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– BULLETIN of ENGINEERING

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CONTENT

Abstract:
The paper is based on acceptance, that if you want to implement the Mass Customization (MC) and Open Innovation (OI) in your business, you have to offer it in a suitable way to the outside environment (OE) and especially your consumers. The innovation is based on challenging existing assumptions and ways of thinking and it is very important to keep informed OE about the possibilities for creative actions, supply them with a suitable environment and provoke them to do that.
There are two sides: one is consumer (customer) expectations and requests, the other is the company competencies and possibilities for the realization of them. The improvement of the tourist services by the development of integrated knowledge management system is discussed.
Potential possibilities for offering of MC and OI in tourism are investigated and analyzed, and a framework of Internet based MC and OI offering system is proposed.

Abstract:
A new asymmetric meshing has been proposed, formed by spur gears with a very small number of teeth where the transverse contact ratio is bigger than one. The meshing in the general case where the gears have different number of teeth has been clarified. The main geometric parameters have been defined. The equations of the tooth profiles have been determined. Analytic dependencies for the geometric dimensions of the gears have been shown. The geometric parameters of the asymmetric gear drive have been found.

Abstract:
Gas meter has been modeled through many different simulation techniques in the recent times, suggesting new solution and giving new ways to minimize the material cost. In this project we will present an advanced simulation of the gas meter components, taking into account the maximum tensile strength and structural integrity. Our design presents a basic gas meter model to predict the behavior of structures while that it can withstand external & internal forces. Those points will be identified which are exceeding the limits of maximum tensile strength of the material. The result will show clear picture of the Von-Mises stresses, Strain, displacement and deformation. There are some inherent problems in simulation like time and memory consumption during analysis is huge. In this paper we shall analyze the gas meter and try to find a suitable solution for the inherent problems.

Abstract:
The KNX intelligent building system is primarily made for lighting control. With the GIRA HomeServer 3 there are more possibilities to make higher level, complex lighting control over the DALI. In this paper, the dimming sequences, the solutions and the background equipments are demonstrated. The operator screen is a web based touch screen.
Using this lighting control it is possible to create more complicated lighting controls, lighting systems. Several lighting circuits can be managed: dimming, switching, organizing in groups etc.
With the HomeServer 3 enables the user to control all lighting from within a particular location as well as from outside that location.

Abstract:
Consciousness among potential housebuyers' regarding crime prevention through the integration of natural surveillance characteristic assist to reduce proportion of crime in our country. Natural surveillance is about crime prevention through environmental design which limits the opportunity for crime by taking steps to increase the perception that people can be seen around the housing area. In the design, natural surveillance involves the placement of physical features such as windows, lighting, and landscaping of the house in such a way as to maximize visibility and foster positive social interaction among legitimate users of the house and its surrounding area. In light of the rising crime rate in this country, the integration of natural surveillance characteristics into the design of houses can only add to the security features of the houses. This study is attempted to investigate the perception and behavioural profiles of the housebuyers towards surveillance characteristics in their houses. The respondents in this study are potential housebuyers attending a property fair in Sungai Petani, Kedah in June 2008. In all, 208 respondents were involved in this research. The results indicated that the respondents have a high tendency towards accepting natural surveillance design as one of the crime prevention efforts.

Abstract:
More than 20 years parallel robots attract the interest of the scientific community and in many applicative domains like, production of motion generators, machine tools, precision positioning devices, medical equipment, pick and place machines, etc., where their potential advantages (high accuracy, rigidity, speed, acceleration and load carrying capability) could be very useful. The objective of this paper is to notify some of the open questions in parallel robotics, which is limitation factor of wider practical application of this type of robots.

Abstract:
The prediction of droplets diameter and velocity distribution in a spray is so difficult since its process and mechanism is not completely known and depends too many parameters. The early stage of the atomization process (Primary Breakup) is clearly deterministic, whereas the final stage of spray formation (Secondary Breakup) is random and stochastic. In the second region, which deals with the stochastic aspect of droplet size and velocity distributions, analysis is done by using the maximum entropy principle (MEP). The MEP predicts atomization process while satisfying constrain equations of mass, momentum and energy. Finally, an experimental investigation is done to verify the theoretical model. For this means, a specific nozzle is designed and manufactured so the breakup length and the droplet size and velocity distributions are measured using high-speed camera and laser based technique (Phase Doppler anemometry).

Abstract:
A prominent problem in manufacturing automation is the accurate and reliable presentation of small parts, in a single specified configuration called preferred orientation, to a work cell. This is often referred to as the "part feeding" problem. Low cost automation is employed to develop the part feeding system for brake liner, a typical asymmetric part. Currently handling of such asymmetric parts is done either manually or by using expensive robot and vision systems. These approaches cumulatively increase the production cost. The proposed low cost part feeder system uses sensor less mechanical devices or barriers such as slot, wiper blade, balcony, edge riser etc. to eliminate or reorient the arbitrary orientation into a preferred orientation which facilitates stacking. A complete set of such mechanical devices is called trap. The orientation with highest probability of occurrence is found using drop test, which is the preferred orientation at the exit of the feeder. A trap is designed to get the preferred orientation at the exit of the feeder. Critical dimensions of the trap were identified and experiments were conducted to optimize them.

Abstract:
The paper explains the basic aspects of designing controllers for an industrial robot control. Industrial robots are basically mechanical devices which, to a certain degree, replicate human motions. They are used whenever there is a need to reduce the danger to a human, provide more strength or accuracy than a human, or when continuous operation is required.
Most industrial robots are stationary, but some move throughout the workplace delivering materials and supplies. While we have the technical ability to produce human robots, industrial robots are actually quite simple devices.
Motions that we take for granted—picking up a something from the table, for instance—are considerably more difficult for a robot. Its mains characteristics of operation, degrees of freedom, etc.
They are solved and the calculations developed to obtain the kinematics and dynamics. The accomplished test to each servomotors and the research about its operation.
Basicaly all industrial robot have a similarly control, because have a similarly actions.

Abstract:
Some researchers have mentioned that temperature creates an important part in the accuracy of positioning of pneumatic artificial muscles (PAMs). However, in literature investigations for measuring temperature inside and outside the PAMs have not been found. This paper presents our robust motion control of these muscle actuators under different temperatures using sliding-mode control.
The layout of this paper is as follows. Section 2 (The study) is devoted to display our test-bed and the LabVIEW programs. Section 3 (Results and discussion) presents several experimental results. Finally, section 4 (Conclusions) gives the investigations we plan.

Abstract:
Power semiconductor devices based on the SiC substrate is coming more and more popular with increasing development of the power electronics. Due to the advantageous qualities discovered at the SiC this material becomes very interesting object for research and development and subsequent using in the all sorts of applications where bigger and bigger exigencies on efficiency, magnitudes, weight and impact on surroundings are set.
This paper presents research motivated by industrial demand for using power semiconductor devices based on SiC (Silicon Carbide). The paper deals with possibility of SiC devices application in traction vehicles. The main attention has been given to the topology of 3-phase voltage-source inverter with free- wheeling SiC schottky diode and 1-phase traction converter with middle frequency converter for auxiliary drives. The theoretical conclusions and simulation results are compared with experimental measurements on laboratory model with rated power of 2kVA.

Abstract:
Currently, the emphasis on improving the effectiveness of automation in industry. One of the base parts for automation is control devices such as different PLC systems and programming environments. This programming environment for PLC system use in laboratory of production system program control. Base for the control of real output per axis manipulator, a schemes is possible in the virtual software followed by simulated and tuning errors. Thus the scheme is then verified recorded in PLC control and prepared to manage the various movements of the manipulator.
The result presents both virtual programming PLC with a feedback simulation and checking the graduates´ skills that would support their preparing for practice and whole-life education.

Abstract:
Union and their development is not controlled by strict quota systems. In Hungary a lot of unique products of excellent quality are produced. Here in this essay we would like to find the answer to the question how the two significant products of the southern part of the Great Hungarian Plain can provide the families with the income that they can live on. We aim at the economical examination of the cucumber grown in Méhkerék and asparagus of Homok. To do this we will apply the so called Standard Gross Margin. The agriculture of the states of the European Union is measured with the help of this method. It can also help us in the future to decide whether the different farms belonging to families are economically viable in Hungary.

Abstract:
Any proposal for a perfect relocation of production lines and the subsequent operation of the production system is still subject to further change. They are caused by innovation of products on the market, qualitative and quantitative requirements of the customer etc.
Resolving of material flows is actual term in present. It brings a lot of problems with layout of particular devices as elements of manufacturing process according to required and defined technology. In present time are suitable software tools for improving of transport, manipulation and storage systems. The simulation of these three systems relation is realized support CA systems to optimal whole technological processes. In this case this problem is solved by simulation software Witness used in Institute of Manufacturing Systems and Applied Mechanics of our faculty.

Abstract:
This paper deals with filter nozzles which are used for water treatment. They are applied in many sectors including drinking water, water demineralization process, urban and industrial waste water treatment, filtration of river or well water for irrigation, water for swimming pools, etc. The filter nozzles are made from the thermoplastic material, with different number and widths of gaps at the head of the nozzles. It is necessary to determine performance curve of filter nozzle before it is installed. The performance curve actually represents the nozzle water gauge head as a function of flow rate. This performance curve has been traditionally determined by measuring of hydrostatic pressure above the nozzle with level meters (graduated scale, ultrasound, capacity etc.). In order to measure a couple of meters water gauge head, a reservoir is necessary. This research is aimed to examine possibility to apply the installation with column and manometer instead of the reservoir, in order to determine filter nozzle performance curve. The water gauge head is measured by manometer and flow rate through the filter nozzle by mass method. Authors are of the opinion that installation with column and manometer could be successfully applied to determine filter nozzle performance curve. In comparison with the reservoir, the installation with column and manometer is more compact and comfortable.

Abstract:
The importance of hydro-cultural growing is significantly increasing. We have been dealing with the hydro-cultural growing of cut flowers at the Department of Ornamental Plant Growing and Maintenance of Gardens at the College Faculty of Horticulture at Kecskemét College since 1988. We started our experiments by growing carnation in growing establishment without soil then we introduced other species of cut flowers and potted ornamental plants into our research work (Lévai et al., 2010/b). Our aim was to examine the effect of Grodan and PU-sponge media on the growth, the yield of flowers, the diameter of the flowers and the length of the stem concerning the species of carnation 'Pink Castellaro'. In case of comparing the species our aim was to examine the effect on the development of the plants, the yield and the characteristics of the flowers: the diameter of the flower and the length of the stem.
The Phytomonitor instrument is placed in the French Filclaire greenhouse and we at the Floriculture and Park Maintaining Department measure rose culture parameters in hydroponics. We measure the following factors: air temperature, leaf temperature, radiation, relative humidity of air, stem diameter and soil moisture (Lévai- Turiné, 2009.) Using Phytomonitor data processing make it possible to use nutriments in an optimal level thus apply a low-cost environmentally friendly technology.

ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING – FASCICULE 3 [JULY – SEPTEMBER]. TOME IV / 2011 *includes original papers submitted to the Editorial Board, directly by authors or by the regional collaborators of the Journal [papers #6-12].*
Also, ***ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING – FASCICULE 3 [JULY – SEPTEMBER]. TOME IV / 2011*** *include original papers presented in the following conferences, in which the Journal was announced communication and logistical support:*

- ***THE 4th INTERNATIONAL CONFERENCE ON MASS CUSTOMIZATION AND PERSONALIZATION IN CENTRAL EUROPE (MCP - CE 2010) – MASS CUSTOMIZATION AND OPEN INNOVATION IN CENTRAL EUROPEAN REGION****, organized in* ***NOVI SAD, SERBIA, 22 – 24 SEPTEMBER 2010*** *[papers #1-5].*
- ***INTERNATIONAL SYMPOSIUM on ADVANCED ENGINEERING & APPLIED MANAGEMENT – 40th ANNIVERSARY in HIGHER EDUCATION (1970-2010) – AE&AM 2010****, organized in* ***HUNEDOARA, ROMANIA, 4 – 5 NOVEMBER, 2010*** *[papers #13-20].*

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Valentina GECEVSKA[1], Zoran ANISIC[2], Paolo CHIABERT[3]

SOLUTIONS OF COLLABORATIVE PRODUCT LIFECYCLE MANAGEMENT

ABSTRACT:
Product Lifecycle Management (PLM) is recognized as one of the most effective approaches for better, fast and cheaper product development and management. Mass customization is one of the key technologies in PLM to provide tailored product to end customers with the cost of mass production. In the modern global economy, companies are facing ever-increasing challenges for short time-to-market to enter into the market early, for reduced time-to-volume to occupy the market quickly, and for decreased time-to-profit to get return from market shortly. Product lifecycle management (PLM) is recognized as one of the key leading technologies to facilitate companies to overcome these challenges, which will offer companies a new way to rapidly plan, organize, manage, measure, and deliver new products or services much faster, better, and cheaper in an integrated way. Following this trend, this study proposes a full scenario of technology solutions for PLM based on the complete analysis of business drivers, industry requirements, limit of current solution, and recent state-of-the-art review in the domain related to PLM. Potential industrial impact of the developed PLM technology solutions is analyzed. It is hoped that the proposed PLM technology solutions will form the frontier basis for further research, development, and application of PLM systems to quickly adapt to the dynamic changing market for industry companies to pursue the most advanced competitiveness.

KEYWORDS:
Product Lifecycle Management, Business processes, Technology requirements

INTRODUCTION

In today's highly competitive environment, business requirements always drive technology solutions. In response to increasing customer demand and dynamic competition, companies are under high pressure to shorten time-to-market by providing tailored products to the customer for the economy of scope, to reduce time-to-volume via mass production for the economy of scale, and to decrease time-to-profit by increasing the efficiency of the entire lifecycle for the economy of service. These business requirements drive technology needs: (1) to speed up product development, (2) to enhance manufacturing and supply capability and capacity and (3) to improve revenue from lifecycle efficiency.

To tackle such challenges, in past decades, with the support of advanced manufacturing technologies, manufacturing industry has shifted from mass production, which takes the advantage of scale of production, to concurrent engineering, which optimizes internal enterprise processes, and virtual enterprise, which leverages intellectual capital via collaborative innovation [1]. In such a virtual enterprise environment, companies need to closely collaborate with customers, manufacturers, and suppliers in a real time manner so as to quickly respond to dynamic market changes.

Accordingly, the business model in the manufacturing industry has shifted from make-to-order, to build-to-order, to engineering-to-order, to configure-to-order, to design-to-order, and in near future to innovate-to-order.

Key technologies to support these business models have changed as well from mass production, to a flexible manufacturing system, to manufacturing knowledge management, to product customization, to product knowledge management, and to product lifecycle management (PLM) [1,2,3,4,5]. As such, PLM is recognized by world's leading universities, institutes, and solution vendors as the next big wave in enterprise application software market.

Product lifecycle includes the processes of portfolio management, product design, process design, supply, production, launch, service, and recycle. Throughout the entire product lifecycle [6], there exist three major objectives, which are:

- *customer benefit such as product quality and serviceability,*
- *company benefit such as product cost and profit,*
- *society benefit such as clean and green environment.*

These benefits become the 'WHY' aspect of product lifecycle. Bearing these benefits in mind, the 'WHAT' aspect of product lifecycle can be created, which is to model product specification, function, behaviour, structure, geometry, topology, machining process, schedule, supply chain, operation service, recycling, and disposal. The next step is 'HOW' to model the product lifecycle, which are lifecycle processes including specification management, conceptual design, detailed design, process design, production, supply, service, and recycle.

To reach customer benefits, mass customization, time-to-innovation, product quality, and reliability are recognized as the key approaches enabled with technologies e.g., product family design, platform based design, modular product design, design process modelling and management, design knowledge management, collaborative design engineering, function/ behaviour/ structure design, etc.

To achieve company benefits, time-to-market, time-to-volume, and time-to-profit are known as the key approaches enabled with technologies, e.g., collaborative product service, product lifecycle process management, product lifecycle information and knowledge management, etc.

To obtain society benefits, design for service, design for reuse, design for recycle are justified as the key approaches enabled with technologies, e.g. product/ service co-design, collaborative early design for lifecycle efficiency, environmentally conscious design, etc.

This article will focus on the discussion of technology solutions to achieve company benefits in product lifecycle, namely, product lifecycle management (PLM), which is also the dominant direction in the current market of enterprise software application. PLM provides customers, developers, manufacturers, and suppliers with the most effective means by collaboratively managing business activities throughout entire product lifecycle [4,6]. PLM supports the capability of collaborative creation, management, dissemination and use of product assets (including data, information and knowledge) in virtual enterprise integrating people, processes, and technology [1,2,3]. PLM systems manage a portfolio of products, processes, and services from initial concept, through design, engineering, to final disposal. As such, PLM offers companies a new way to rapidly plan, organize, manage, measure, and deliver new products or services much faster, better, and cheaper in an integrated way.

Following this trend, in this article, ever-increasing business drivers and industrial requirements are analyzed. PLM is proposed as a new weapon to satisfy modern needs for new business model of innovation-to-order. A recent state-of-the-art review for PLM, including both academe and industry is done.

To effectively manage these product lifecycle processes for competitive advantages via efficient collaboration, technology solutions for PLM are proposed as the future trend. Accordingly, the impacts of PLM technology solutions to industry are analyzed.

CHALLENGES IN PRODUCT LIFECYCLE

Business Driver

The current business environment faces new business challenges for effective management of whole product lifecycle [3], e.g., shorter product lifecycles, increased outsourcing, mass customization demands, more complex products, geographically dispersed design teams, inventories subject to rapid depreciation, and rapid fulfilment needs. In general, these challenges include increased speed, increased demand; increased outsourcing, and the use of Internet.

Industrial Requirement

To effectively tackle the above challenges in a modern collaborative enterprise environment [1,6], new industrial capabilities are required in order to obtain business success in today's Internet economy:

1. *Geographically scattered design teams and supply chain partners need to collaboratively design products on a virtual basis.*
2. *Static designs need to be replaced by mass customization often using predefined modules or building blocks to rapidly configure new product platforms that can be flexibly managed through lifecycle.*
3. *A new approach needs to be created to leverage net centric technology to liberate the inherent value in today's extended business model.*
4. *Such a new approach should enable business to use and leverage information needed by each partner to accelerate and enhance product development predictability.*
5. *That approach should provide a system to exchange and control product information and to perform real-time program/project management.*
6. *A system needs to emerge as the dominant technology for managing inter-enterprise data, information and knowledge.*

To meet these requirements, a new system is imperatively required:

- *to provide an information continuum in order to deliver pervasive, real-time analytics, querying, and reporting throughout the entire product lifecycle,*
- *to provide a collaborative environment bringing together multiple roles, constituents, and stakeholders in threaded discussions beyond four walls of enterprise,*
- *to enable interactive viewing upon product development through multiple devices, channels, and systems involved with the product lifecycle,*
- *to be an open but integrated solution supporting key enterprise value disciplines of product leadership, customer intimacy, and operational excellence.*

Such a new system will provide customers, developers, manufacturers, suppliers, and partners with the following capabilities:

- *product lifecycle collaboration across virtual enterprises,*
- *common product lifecycle processes management,*
- *effective management of product lifecycle activities,*
- *convenient integration with other enterprise systems.*

REVIEW OF PLM APPROACH

PLM Concept

As companies move towards providing better customer-centric products and services quickly to maximally satisfy customer requirements, to improve market share and market size with continuously growing revenue, the efficiency and effectiveness of product lifecycle management becomes much more important in modern enterprise application systems [1,7]. To address these needs, PLM has recently been recognized as a new strategic business approach in support of collaborative creation, management, dissemination, and use of product assets, including data, information, knowledge, etc., across extended enterprise from concept to end of life – integrating people, processes, and technology. PLM systems support the management of a portfolio of products, processes, and services from the initial concept, through the design, engineering, launch, production, and use to final disposal.

They coordinate and collaborate products, project and process information throughout the product value chain among various players, internal and external to enterprise. They also support a product-centric business solution that unifies product lifecycle by enabling online sharing of product knowledge and business applications [2,3,4].

As such, PLM enables manufacturing organizations to obtain the greatest competitive advantages by creating better products in less time, at a lower cost, and with fewer defects than ever before. In summary, PLM not only provides service throughout the entire product lifecycle, but also enables effective collaboration among networked participants in product value chain, which differentiates it from traditional enterprise application systems, such as Enterprise Resource Planning (ERP), Manufacturing Execution System (MES), etc.

Status Survey

This is because, traditional application systems, e.g., computer aided design (CAD)/computer aided manufacturing (CAM) [5], computer aided process planning (CAPP) [6], helped to make the design process more efficient, but they were usually separate from a manufacturing company's mainstream operations.

Design engineers and possibly manufacturing engineers could access these systems, but others, who may have been able to add value to the design, had no systematic process by which to influence or even comment on product design. By the time these other participants provided their input, resulting in high costs or inefficient product design that did not meet customer needs. Even though the modern manufacturing application systems, such as, product data management (PDM), supply chain management (SCM), enterprise resource management (ERP), manufacturing execution system (MES), customer relationship management (CRM), demand chain management (DCM), and so on, have been developed to overcome certain aspects of the above difficulties, they still cannot adequately address the need for collaborative capabilities throughout the product lifecycle because they focus on special activities in an enterprise and are not adequately designed to meet new business requirements [8,9].

A academic state-of-the-art review or the research effort related to PLM is summarized in research given in the references [1,6], where also is summarized the industrial status of PLM solutions from world's leading vendors [10,11]. These solutions from different vendors, particularly the PDM solutions, have been applied in manufacturing industry and have created a beneficial impact on enterprises.

Gap Analysis

However, to get the most competitive advantages in the modern dynamic global manufacturing era, there is still a big gap between increasing demands from industrial companies and available solutions from vendors. The gaps in PLM include:

1. *CAD/CAPP/CAM integration versus collaboration product development and real time design to manufacturing collaboration;*
2. *Product structure and configuration management versus collaborative product family design for mass customization;*
3. *Design for manufacturing versus design for supply chain and lifecycle efficiency;*
4. *Product planning versus product portfolio management;*
5. *Design workflow management versus product lifecycle process management;*
6. *Product and part maintenance versus extended product service.*

Therefore, it is imperatively required that new technology needs to be identified and further developed to enable current commercial PLM solutions to satisfy increasing industrial requirements.

COLLABORATIVE PLM STRATEGY

PLM Strategy

As a business strategy [2,3,4], PLM lets distributed organizations innovate, produce, develop, support, and retire products. It captures best practices creating a storehouse of valuable intellectual capital for systematic and repeatable re-use.

As an information technology strategy, PLM establishes a coherent data structure that enables real-time collaboration and data sharing among geographically distributed teams. PLM lets companies consolidate multiple application systems while leveraging existing legacy investments during their useful lives.

Through adherence to industry standards, PLM minimizes data translation issues while providing users with information access and process visibility at every stage of the product's life.

PLM systems support the management of a portfolio of products, processes and services from initial concept, through design, launch, production and use to final disposal [8]. They coordinate products, project and process information throughout new product introduction, production, service and retirement among the various players, internal and external, who must collaborate to bring the concept to fruition.

The PLM concept gives the strategies to organize and to manage product information the entire life cycle, from concept to re-cycling of the product through:

- *Share the updated product information's within the organization to design, manufacturing, marketing and procurement divisions,*
- *Collaborate internal team with external users, suppliers and customers for iterating new designs,*
- *Maintain a repository of product information for design reuse and to reduce part redundancy,*
- *Systematically gather and analyze customer or market product requirements,*
- *Streamline sourcing team to identify a list of preferred suppliers for purchasing custom and standard parts,*
- *Streamline resource management and analyze the cost-benefits of allocating resources for specific projects.*

Management and distribution of enterprise information by PLM system is realized on different data levels, as:

- *ICT*
  - *Compliance with existing legacy system*
  - *Integration of PLM and ERP/CAD systems*
- *Processes*
  - *Fragmented and unalterable*
  - *Modeling, controlling, improving*
- *Data & Objects*
  - *Different data formats; Standard data representation (IGES, STEP…)*
  - *Preserving data integrity along the time; Supporting data evolution*
- *Methods & Tools*
  - *Specific tools (CAD, CAE)*
  - *New development methodologies (Six Sigma, Axiomatic design…)*
- *People & Organization*
  - *Functional organization promotes incommu-nicability*
  - *Supply chain approach*

Establishing PLM

There are companies that supply software to support the PLM process. That software itself is just a tool and cannot make many contributions if the PLM process is not defined first and understood by its users whom it should contribute to at the end. Setting up PLM within the company is a process and project itself [6].

Select operations that should be managed as a part of the PLM across the company business would be:

- *Customer relationship management (CRM) system for managing customer record,*
- *Enterprise resource planning (ERP) system for managing financial records,*
- *Supply chain management (SCM) system for managing supplier support,*
- *Human resource management (HRM) system to manage the employee record,*
- *Requirement management (RM) system for managing of requirements,*
- *Project management (PM) system for managing capabilities provide project scheduling, tracking, and resource management while the change management is driving the execution of these projects via the process workflows and part/document management capabilities.*
- *Product data Management (PDM) system for managing product data and workflows.*

Fist step in establishing PLM would be understanding and analyzing the company way of work, organizational structure, roles and responsibilities within the organization. Each of the PLM operational systems should be defined to specify who is contributing to the system, how the information is shared and responsible person appointed for each of the systems. It is not necessary that all those operation systems are integrated within one software tool, and usually for small and medium companies they won't be, while on the other side big companies might need to adopt available software and tools to their specific needs.

Application of PLM in medium to large enterprises

In the current economic climate, addressing global business challenges is the top priority of most medium and large enterprises. Whether they want to expand their customer base in new markets, or to leverage more cost competitive resources, conducting their business globally is a necessity [1,7]. To sustain an advantage, they have to overcome the challenges of a dispersed organization, while still empowering individual team members.

PLM concept offers comprehensive solutions to help enterprises address their challenges and create competitive advantage. Five areas where medium and large enterprise should have achieved success include:

- *Managing new product introduction, to create a winning product portfolio.*
- *Achieving concurrent engineering globally, to be faster to market.*
- *Creating platforms for reuse, to reduce cost and speed product customization.*
- *Managing product and manufacturing complexity, to avoid program problems.*
- *Supporting products currently in-service, to ensure they are available for use at minimum cost.*

Application of PLM in small to medium enterprises

Small and medium enterprises have special needs and limited resources. PLM concept brings a complete solutions designed specifically for them; solutions that help them respond better to their customer's needs.

Small businesses need a product lifecycle management solution designed from the ground-up –one that is pre-configured with the industry's best practices, and offers fast and affordable deployment. Fully integrated PLM solutions are designed to provide what small and medium enterprises need to maximize their innovation strategy, and easily scale to meet their needs tomorrow.

One producer of that type of PLM software solutions is Siemens PLM software [8]. It helps mid-sized manufacturing companies to transform their process of innovation by applying preconfigured best practices to everyday engineering tasks and processes. Companies using PLM software benefit from:

- *Securing their corporate design data while facilitating access by authorized personnel*
- *A more successful move from 2D to 3D*
- *Increasing their design reuse, facilitated by a powerful and flexible search capability*
- *Streamlining their engineering process with simple design review and release workflows and effective change management*
- *Error reduction through more effective collaboration between their departments and the elimination of mistake manual handoffs to manufacturing*
- *Rapid deployment of a full-featured product data management (PDM) solution*
- *Low total cost of ownership.*

PLM METRICS DEVELOPMENT PROCESS

The questions often asked in business and commerce are how well do we know we're doing, and how do we know what we're doing is working? There is important to find out the metrics process for measuring what is important and meaningful [3,5,7]. The only way to find out answers to these questions is to measure the processes and outcomes of these processes. As PLM transforms the way companies do business, it is important that companies understand how well they are doing. To determine the effectiveness of PLM implementation within any context, PLM processes and outcomes need to be measured. Measurement of PLM requires the development of metrics that are important and meaningful to the process. It is essential that what is identified as a metric is relevant, appropriate and important, since typically what gets measured gets done.

The objective of the metrics development process is to identify, develop, and articulate PLM metrics that would help companies implementing PLM determine the extent to which their PLM efforts are paying off. The PLM assessment process model shown at the Figure 1, conceptually presents the metrics development process.

The PLM processes, including ideation, design, build, service, disposal, and recycling, on one hand influence the determination the key performance indicators of success on the other hand the execution of the strategies and initiatives depends on them.

The key performance indicators are directly impacted by the organizational strategies and initiatives. In other words, the organizational goals and objectives define what the organizational considers success which should determine the key performance indicators. Key metrics are derived from the performance indicators. The key metrics measure what is relevant and important to the organization as outlined by the organizational strategic plan. Outcomes of the assessment and analysis using the key metrics impact the organizational strategic plan. These metrics are all tied to business objectives related to growth, revenue, and profitability.

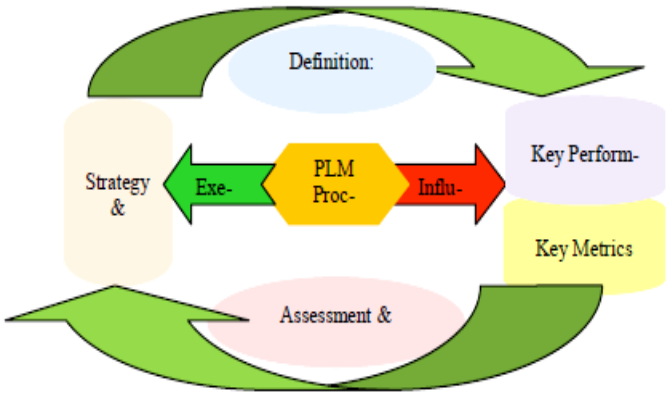

Fig. 1. PLM Assessment Process Model

PLM metrics can be applied at various levels of complexity.

- *At the very basic Level 1 Input metrics are measured. At this level, the question is whether the organization is applying appropriate resources to the PLM process, i.e. investments.*
- *At Level 2, metrics are used to determine if the appropriate PLM processes were implemented, e.g., Requirements Management, Sourcing and procurement, Distribution Quote/order generation.*
- *Level 3 focuses on customers being reached.*
- *Level 4 and 5 metrics examine the efficiency whether the outputs meet the needs of customers are being met (e.g., requirements traceability, visualization, concepts, design capture & accessibility, change control & change capacity, configuration management, commercial cost of risk, product quality) and effectiveness, if desirable results are being achieved (e.g., generation of new business, software integration, cost performance, market share, cost reduction, design reuse).*
- *At the highest Level 6 metrics are used to measure the impact of the implementation of PLM by measuring the extent to which procedures and controls have been integrated and the return on investment. Level 6 metrics are the most complex and difficult to measure. These include waste reduction, innovation/ new products, continuous improvement, and sustainable green manufacturing.*

PLM Business Value

When the enterprise implements the PLM concept in work, than it can move forward strategically while achieving near-term results and can establish a platform for innovation. As the enterprise address specific business issues and builds a solid foundation for future success through PLM platform, it will be able to realize measurable innovation benefits both immediately and over the long term, shown on the Figure 2.

Traditionally, companies brought their products to market in time-consuming serial processes that delayed the participation of downstream contributors, such as suppliers, manufacturing experts and service/maintenance providers. By allowing to the enterprise to execute as many lifecycle tasks as possible in parallel processes, PLM enables to the enterprise to streamline and collapse critical stages in the product lifecycle. PLM delivers aligned, accurate, and highly synchronized product knowledge to multiple disciplines early in product lifecycle – thereby avoiding the cost and scheduling impact that comes when late suggestions and unexpected concerns arise from downstream players. PLM enables to the enterprise to beat the competition to market with innovative product content that carries first to-market advantages and drives early product sales.

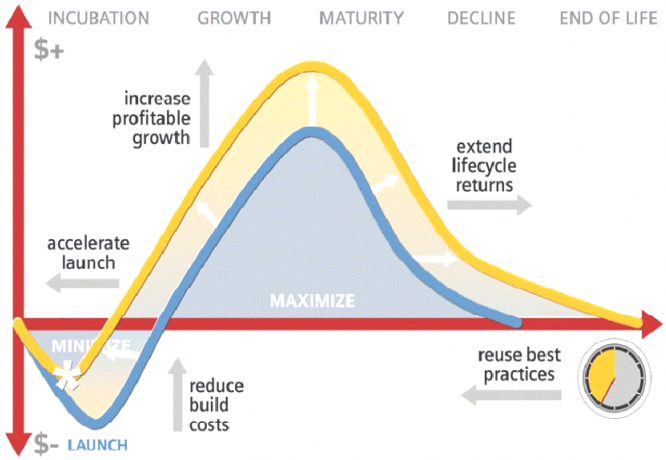

Fig. 2. PLM business value

Increase profitable growth

PLM allows the enterprise to create, capture and share the product-related requirements, expectations and preferences of targeted customers and markets and align these requirements with specific innovative content that customers want for a price they can afford at the time when it is needed. PLM concept gives new product ideas against quickly rising customer requirements and cost effective manufacturability. Global cross-functional teams collaborate in real time on the development process, each contributing their unique experience and perspective. Knowledge and "lessons learned" are captured for potential re-use in a process of continual innovation.

PLM facilitates mass customization by enabling to rapidly and costs effectively deliver customized product offerings that satisfy the needs of individual customers and targeted market segments. PLM combines the advantages of configuration management with option and variant management. These state-of-the-market capabilities allow the enterprise to perform portfolio planning in as flexible and continuous a process as possible.

Reduce build costs

PLM allows the enterprise to reduce cost across all of the stages in the product lifecycle – which in turn, enables to minimize the cost of the product offerings that plan, develop, manufacture, and support.

For example, by leveraging PLM to understand the time and resource impacts of proposed design changes and requirements changes, the enterprise's team can make decisions that minimize lifecycle and product costs. By using PLM to catch design flaws up front in the lifecycle, the team can avoid the cascading rework and cost associated with changing the products during the manufacturing stages of the product lifecycle. Also, the enterprise's team can use PLM to incorporate the concerns of the maintenance and service groups into the product designs and minimize warranty costs. By digitally creating and re-using the manufacturing plans, plant information and manufacturing processes, the enterprise can reduce the overall operational costs. The enterprise can also use PLM to implement virtual prototyping that enables to reduce the validation costs associated with physical prototyping.

Implementation of the PLM concept in the enterprise enables to cost effectively deliver product enhancements, derivatives, niche offerings and add-ons that extend the profitable duration of the product lifecycle. PLM facilitates this objective by enabling to create product platforms that accelerate start up processes, minimize take to market cost and maximize the revenue generated by a product's initial release.

PLM enables the enterprise to maximize the re-use of the best-practice processes, intellectual capital, human resources, product plans, production plans, production facilities and value chains across a continuing set of take-to-market programs and complete set of product and production management capabilities.

Conclusion

Although a quite new method with short history PLM has proven itself to be useful for all management levels within the company in both vertical and horizontal organization. By making relevant historical information structured and available PLM is used both for those who are doing execution and decision makers within the organization answering to the rapid changes in the business environment. A business approach for coordinating design process through the implementation of PLM systems is proposed for improving design coordination in SMEs.

Firstly, this business approach is based on a method for analysing informal collaborative practices and modelling detailed design processes. Secondly, these processes are implemented by using PLM technologies. Multi-level workflows are implemented to control progress of design schedule from project management level to document lifecycle management level.

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REFERENCES

[1.] *Pol, G., Merlo, C., Legardeur, J.: Implementation of collaborative design processes into PLM systems, International Journal of Product Lifecycle Management, Inder-science, Vol.3, No.4 (2008), pp. 279-294.*

[2.] *Saaksvuori A., Immonen A.: Product Lifecycle Management, Springer-Verlag, 2008.*

[3.] *Grieves, M.: PLM: Driving the Next Generation of Lean Thinking, McGraw-Hill, 2009.*

[4.] *Bernard A., Tichkiewitch S.: Design of Sustainable Product Life Cycles, Springer-Verlag, 2008.*

[5.] *Stark, J.: PLM: 21st century Paradigm for Product Realisation, Springer-Verlag, 2004.*

[6.] *X. G. Ming, J. Q. Yan: Technology Solutions for Collaborative Product Lifecycle Management - Status Review and Future Trend, Journal Concurrent Engineering, Vol.13, No.4, 2005, pp.311-321.*

[7.] *Kecojevic S., Lalic B., Maksimovic R., Palcic I.: Product Lifecycle Management of IT Project, Proceedings of the Conference Trend 2010, Serbia, 2010, pp. 221-225.*

[8.] *Szykman, S., Sriram, R.D. and Regli, W.C. (2001). The Role of Knowledge in Next-Generation Product Development Systems, Transactions of the ASME, Journal of Computing and Information Science in Engineering, Vol.1: 3–11.*

[9.] *TEMPUS MAS-PLM project: Master Studies and continuing education network for Product Lifecycle Management with Susstainable Production, Tempus Programme, European Commission, Agreement N0.144959, EC, 2009-2012.*

[10.] *www.siemens.com/plm, Siemens PLM, 2009.*

[11.] *www.sap/plm.com, SAP PLM, 2009*

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REFLEXIVE MODERNIZATION, INDIVIDUALIZATION AND MASS CUSTOMIZATION

ABSTRACT:
In this paper we argue, that individualization in mass customization business model should be seen as part of the reflexive modernization theory, which takes into account uncertainty in solving customer problems. This article is structured in the following way. The first part describes the idea of reflexive modernization and suggests some broad areas where the theory may illuminate activities in the economy. The second part describes individualization in mass customization business models. The third section offers some thoughts, how individualization from the reflexive modernization point of view and from the intercultural point of view can help to improve mass customization business model.

KEYWORDS:
Reflexive Modernization, Individualizati-on, Mass Customization

INTRODUCTION

At the present time, the amount of sociological time analysis is growing increasingly. Present civilization is undergoing fast, basic and international social changes. These fundamental evolutions are explained in more than a few methods. Using extremely diverse terms, sociologist try to recognize the dissimilarity between history and present time trying to grasp in a methodical mode the huge number of social transformations by recognizing fundamental systems.

IDEA OF REFLEXIVE MODERNIZATION

German sociologist Ulrich Beck (1986) has defined time diagnosis in terms of so called reflexive modernization. German sociologist indicates a thoughtful transformation in the character of the modernization process itself. This transformation is typified as a changeover from uncomplicated/ simple/first modernity to reflexive/automatic/late modernity. First modernity represents the progress from a conventional, undeveloped social order to a modern, developed social order. In this period of transformation, reasonableness stays over convention and false notion. Methodical reasonableness functions as a perfect source of authentic and purposeful awareness. The societal group dissimilarity has replaced the previous dissimilarity between the 3 feudal domains. According to Beck, however, this 'classical' modernity is a 'semi-modern condition'.

The manufacturing, developed background intrinsically encloses more than a few anti-modern essentials which stay resistant to additional modernization. It means that the contemporary institutional prototypes of social group and sexual category are reasoning novel social disparities. These contemporary disparities actually substitute the conventional hierarchy. The methodical fascination with development produces significant hazards that are no more controllable.

However, these unmanageable risks stay unseen behind a contemporary frontage of lucid dominance and ideal managing systems. Knowledge and expertise reach therefore a self-disagreement with the as yet uncontrolled increase of dangerous side-effects of their success. Beck argues that industrial civilization threatens itself throughout its imperfect structural design. Through the disagreement with its partially contemporary restrictions, developed civilization becomes the energetic power of its own alteration progression. Reflexive modernization thus represents a transformation of the developed civilization itself. From the wrecks of developed civilization, first-order modernity occurs. This essential transformation breaks through the semi-modern nature of the ordinary contemporary developed period. Away from the charts of developed civilization, it produces a dissimilar and not unavoidably better, institutional form, so called hazard social order full of risks.

This novel institutional circumstance is typified by a basic insight into the critical and repeatedly increasing consequences that are methodically shaped together with the rising accessibility of well-being.

The hazard social order refers to the mixture of stability and instability. While in traditional developed civilization the sense of prosperity creation prevails, transformation does not just mean prosperity increase, but also the methodical creation of increasing and universal hazards like nuclear risks, which can't be understood as simply handy consequences of a smooth transformation progression. On the opposite, they more and more come into view as intrinsic products of additional transformation. Furthermore hazard social order refers to the far-reaching societal transformations that are reasoned by the transformation progression. These split as ordinary characteristic the immanent disagreements flanked by modernity and anti-modernity within developed civilization and indicates the progressions of globalization and individualization, to altering relations among men and women, within the family etc. to progresses in the area of employment, economical development and political affairs.

Consequently, the development of automatic, reflexive transformation and modernization deeply manipulates the social surroundings of persons. The developed dynamism of improvement also challenges the philosophy of social groups and categories, qualified employment, family, sexual category roles, church, manufacturing, political affairs etc. which are extremely entrenched in individual life. Novel, radicalized structures are taking forms alongside the environment of the outstanding but collapsing mature ways of life. In these unfinished and opposing circumstances among history and prospect, person's life obtains some novel attribute appearances as uncertainty, randomness, temporality and doubt linked with the loss of identity. This uncertain based individualism has impacts on the tailored mass customization, which will be explained in the following.

Individualization In Mass Customization Business Models

The idea of mass customization is based on the observation that there is a customer interest in products that are adapted to his/her individual needs and preferences, since the adaptation will increase perceived performance. As the standard of living has increased in the last 50 years, individualization has received increased focus, since customization has come within reach of the average consumer. At the same time there has been a massive development of technologies (Svenson and Jensen 2001, p. 1). In this environment customers have the power to demand individually tailored products that are specifically designed and manufactured to suit their needs.

The required shift in thinking is so great – and the danger of not making the transition is so serious – that the National Research Council commissioned a study to articulate the problem and help prepare american manufacturers to meet the challenge. Their conclusion was that we are in the midst of a fundamental revolution in the nature of business, one that, in their words, "has the potential to alter the manufacturing landscape as dramatically as the industrial revolution" (Taylor 2004, p. 18).The companies that respond properly to these changes are now exploring and beginning to master yet another frontier in business competition, one whose terrain is decidedly different from that of Mass Production. They have found, that customers can no longer lumped together in a huge homogeneous market, bit individuals whose individual wants and needs can be ascertained and fulfilled. Leading companies have created process for low-cost, volume production of great variety, and even for individually customized goods or services. They have discovered the new frontier in business competition: Mass Customization (Pine 1993, pp. 6-7). The concept of mass customization was first identified in "Future shock" by Toffler (1971) and was later described in "Future perfect" by Davis (1987). Stan Davis, who coined the phrase in 1987, refers to mass customization when "the same large number of customers can be reached as in mass markets of the industrial economy, and simultaneously they can be treated individually as in the customized markets of pre-industrial economies" (Davis 1987, p. 169). In order to address the implementation issues of mass customization, Tseng and Jiao (2001) provide a working definition of mass customization that is very useful. The objective of mass customization is "to deliver goods and services that meet individual customers´ needs with near mass production efficiency" (Piller, 2003). Doing so, mass customization is performed on four levels. While the differentiation level of mass customization is based on the additional utility (value) customers gain from a product or service that corresponds better to their needs, the cost level demands that this can be done at total costs that will not lead to such a price increase that the customization process implies a switch of market segments. The information collected in the course of individualization serves to build up a lasting individual relationship with each customer and, thus, to increase customer loyalty (relationship level). While the first three levels have a customer centric perspective, a fourth level takes an internal view and relates to the fulfillment system of a mass customizing firm: Mass customization operations are performed in a fixed solution space that represents (Piller, 2003) "the pre-existing capability and degrees of freedom built into a given manufacturer's production system" (von Hippel, 2001). Customized products might be a differentiator now, but what happens when every company can make customized clothing, customized bags, etc.? What happens when customized products become a commodity? How will you differentiate? Mass customizers need to be at once product-centric and user-focused (Aaronson, 2003). Personalization should therefore be clearly distinguished from customization.

Both customization and personalization are based on the assumption that a homogeneous offering is not sufficient in meeting the customer's needs (…). As defined by the Webster dictionary (2003), personalize means "to make something personal or individual; specifically: to mark as the property of a particular person" (Fung et. al. 2001, p. 2). The definitions of mass customization and of personalization implies that the goal is to detect customers needs and then to fulfill these needs with an efficiency that almost equals that of mass production.A precondition of the business model Mass Customization
is the trend to individualization based on classical modernization theories. Beck et al. (2003) argue, that these theories (first modernity) are interested in deconstruction without reconstruction, second modernity (reflexive modernization) is about deconstruction and reconstruction. Second modernity is therefore different to modernization and postmodernism. Reflexive modernization (Böhle and Weihrich 2009, p.10; Bonß 2009) is based on the idea of a risk society, forced individualization and multidimensional globalization (Beck and Grande 2004, p. 50).

Cultural Dimensions, Societal Changes And Their Influence On The Individualization

The patters of thinking and acting are dominated by the specific environment the individuals and groups living in. Inter cultural analysis supports to find the causes of specific behaviour, based on empirically cultural differentiation and analysis of the national cultural environments. Culture has an understanding role for the affiliates of a group, which share that special culture. Even though all affiliates of a group or the nation might share their specific culture, appearances of consequential, cultural behavior are personalized by the person's character, childhood, educational background and experience to a substantial level. As the jointly arranged outlines of beliefs and the way of acting, individuals and groups have nowadays in the modern world increasingly more liberty to define their way of life as well as their individual decision-making processes autonomously. As argued by Beck and Beck-Gernsheim (1996), the conventionally homogeneous life route has been replaced by so called 'do-it-yourself biography' which persons have to create themselves.
Furthermore authors state that the individualization's concept articulates this procedure of biographic freedom. At an especially basic plane, in addition it creates area for independent structures of individuality creation. The choices individuals and groups have to take in daily life unavoidably have extensive existential effects. In the dialogue about individualization there is often claimed that there are no obvious or correct responds to essential questions in life. As a result, the lately achieved autonomy in life is of a doubtful character.
Liberated options are inescapably hazardous and random choices, whereby individuals and groups are completely liable for incorrect options chosen. Based on these thoughts Fitoussi and Rosanvallon (1996) argue that the individualism can be positive and negative. Some researchers of the modernization processes claim that, individualized society does not exist (cf. Laermans 1991, p. 215) because the conditions for the creation of the personal course of life are different. Even more the individual levels of the welfare are according to author, precondition for the creation of the specific way of individualism. Therefore those who do not have these social and intellectual abilities and real financial potentials experience considerable obstructions to an individualized utilization of own autonomy. This view is very personalized, and do not include the impact of the society on the individuals and groups. It is known from our own experiences that there is society existing which are traditionally more or less individualized or rather collectivistic. Even political systems have an great impact on the degree of the individualization and therefore on the mass customization. This observation doesn't claim the existence of the personalized individualization, but it indicates the existence of the individualized society. Taking into consideration the work of social psychologists as e.g. Hofstede or Schwartz the existence of the individualized society can be specified. As stated by Jewell and Abate (2001, p. 865) individualism has conventionally been recognized as "the habit or principle of being independent and self-reliant…". Hofstede (1980, 1983) among others describes cultural dimensions of individualism compared to collectivism. So called Individualism vs. Collectivism index (IDV) is the level to which persons are included and incorporated into social group. In cultures where come across many nonconformists and individualistic people and where emotional and social links between individuals are informal and limp is expected, that persons in this society look after themselves and their firsthand families. On the other side, in cultures where come across many conformists and collectivistic people and where emotional and social links between individuals are strong and expected, because people in these societies are from birth beyond integrated into well-built, consistent groups and frequently comprehensive families including relatives like cousins, aunts, grandparents and uncles which keep on look after them in substitute for automatic faithfulness and familiar honesty. Hofstede emphasizes that the terms individualism or collectivism have no biased meaning and have no reference to the matters referring the national-state but only to the social groups. Also this dimension is enormously basic one, and concerns all civilizations worldwide. There are several empirical studies which have been carried out to identify the levels societies' individualism and respectively collectivism. The levels of individualization of some national states are presented in the table below.

Table 1: Hofstede's cultural dimenisons

Country	IDV
Germany	67
USA	91
Russia	39

The graduation of the scores is based on the reference, highest score of 100. The more the score of the cultural dimension for the individualism compared to collectivism dimension, the society seems to be more individualistic. Similar consideration has been made by Schwartz (1990,1994) whereby 10 different motivation goals defining 7 polar cultural dimensions. The motivation goals which can be taken in consideration to define the level of the autonomy of the society and the individuals and groups living in, which are open to take the risks for own short- or long-tem goals, and reproducing these decisions on their behavior as consumers, are so called "self-direction", "hedonism" and "stimulation". Self-Direction as an individual value has an motivational goal of the achievement of self-governing act as for instance, selecting, constructing, discovering. Stimulation as an individual value has an motivational goal of the achievement of enthusiasm, innovation, modernism and comfort in life. Hedonism as an individual value has an motivational goal of the achievement of enjoyment or luxurious satisfaction for oneself. Cultural bipolar dimensions reflecting these motivation goals have a high scores of so called "mastery", "intellectual autonomy" and " affective autonomy". Mastery as a polar cultural dimension describes a person and groups as human beings which prefer to manage, master, direct and modify the collective and natural surroundings through self-confident act with the intention of creation of the further individual or group goals. Intellectual Autonomy has a intellectual stress on the interest of persons autonomously following their own thoughts and rational guidelines as for example inquisitiveness, liberalism or originality. Affective Autonomy as a polar cultural dimension describes a person as an autonomous human being which has an intellectual stress to encourage and defend the person's autonomous aspiration of individual affectively optimistic experience as for example like happiness, thrilling and diverse life and so on. Societies with the high scores of these cultural dimensions reflecting the tendency of the person living in this society, to be inclined to consume mass produced goods or services, especially categorized in the scope of the soft customized consume, as for instance service individualization like for instance music programs for passengers with divers airlines; delivery with the catering; telephone disturbance hotline etc. or implicit personalization services, as so called "my-services" like -my ebay, -my yahoo- etc. Within the scope of the hard customization, people from these societies tend to find the satisfaction in the unique products, like personalized products of different kind.

Table 2: Schwartz's cultural values

Country	Intellectual Autonomy	Affective Autonomy	Mastery
Germany	5,26	4,57	4,17
USA	3,95	3,67	3,83
Russia	4,01	3,61	3,88

Looking on the Hofstede's data, it is to be expected that in USA people tend to have very variable and specific taste in order to be satisfy the individualistic personality, which derives from the lesser emotional and social links between individuals in society and the tendency to the informality.
Therefore, in average, we argue that mass customization in the American society is strongly linked with the personalization of the services and the higher flexibility of the individualization within the mass customization. This tendency is gradually falling toward Russian society, followed by Polish and German consumers. Analysis the Schwartz's data indicate that Germans are very profound with the choice of the product, expecting the uniqueness of the goods and services. They express the high curiosity to explore the service or products expecting the repeat of the positive experience in the case of the previous positive experience or creation of the initial emotionally positive experience. Also, high degree of the influence on the customization in Germany is to be expected, as well as the importance for the values such as ambition, success and independence, which means that this cultural area is indeed very products sensitive but compared with the American society not as open to the mass customization, because of the higher expectation to the awesomeness and the enjoyment the product or service have to bring with to the person itself and the society. Germans, compared with Americas more prefer to modify social and personal environment, encouraging more reflexion and creating the increased doubt of the satisfaction with the service or product, questioning it adequacy. Tendency to challenge uniqueness of the product or service is increasingly declining toward Russian society, which correlates with the Hofstede's data. Anyway, the looking deeper on examination of the nature of the scores derived from cross-cultural analyses may indicate some limitation of the statements. Societal dynamism through the global movement of the individuals and information make at some level unable to transcend the inclination to make equal culture with the idea of the nation state. Furthermore, some cultural data to the national states may be too old to be of any contemporary value, mainly with today's fast changing worldwide environments and societal convergence. On the other side, cross cultural psychologists argue that empirically results of the cross-cultural investigation are founded on century of indoctrination, current reproduction of the data indicating the national values and behavior have supported the reality that culture will not revolutionize overnight (cf. Hofstede 1998).

Taking into consideration criticism and praise of cross-cultural analysis we argue that, cultural explanation of the phenomenon the individualism and its connection with the mass customization, can be used as an indicator. Many factors as for example individualistic data to the experience regarding the products and services already used, personal disposition to the decision-making process etc. but have to be included into analysis to explain exactly the mass customization behavior.

CONCLUSION

Social changes are on the one hand reasoned by the occurrence and progression of modernization, which is on the other hand linked with the process of globalization. Modernization process breeds intrinsic disagreements stuck between modernity and anti-modernity within developed society and refer to the progressions of individualization. Individualization is uncertain process, which can have positive and negative consequences on the individual's choices in life. Against the claims of some researches we argue that, level of the societal individualization is ascertainable by using of cross-cultural analysis models, allowing the tendential predictions about the consumer behavior and therefore the openness to the societal mass customization. It is useful for the clarification of the economic activities and the improvement of mass customization business models, allowing more tailored business solutions.

REFERENCES

[1] Aaronson, J. (2003) Personalization, Meet Customization, <Available> http://www.clickz.com/experts/crm/crm_strat/article.php/3091931,21.06.2010
[2] Beck U. (1986) Risikogesellschaft. Auf dem Weg in eine andere Moderne. Frankfurt am Main: Suhrkamp Verlag.
[3] Beck U. and Beck-Gernsheim, E. (1996) "Individualization and 'precarious freedoms: perspectives and controversies of a subject-orientated sociology",in: Paul Heelas, Scott Lash and Paul Morris (eds.): Detradtionalization. Critical Reflections on Authority and Identity. Cambridge, MA/Oxford, UK: Blackwell Publishers, 23-48
[4] Beck, U.; Bonß, W. and Lau, C. (2003) "The Theory of Reflexive Modernization", Theory, Culture & Society, Vol. 20, No. 2, 1-33 (2003)
[5] Beck, U. and Grande, E. (2004): Das kosmopolitische Europa, Frankfurt/Main
[6] Böhle, F.; Weihrich, M. (2009) Ungewissheit, Uneindeutigkeit, Unsicherheit –Braucht die Theorie reflexiver Modernisierung eine neue Handlungstheorie? In: Böhle, F.; Weihrich, M. (Hrsg.): Handeln unter Unsicherheit. VS Verlag für Sozialwissenschaften/ GWV Fachverlage GmbH, Wiesbaden 2009. S. 9-21.
[7] Bonß, W. (2009) Das Subjekt als fiktiver Entscheider? Anmerkungen zur soziologischen Handlungstheorie. In: Böhle, F.; Weihrich, M. (Hrsg.): Handeln unter Unsicherheit. VS Verlag für Sozialwissenschaften/GWV Fachverlage GmbH, Wiesbaden 2009. S. 149-166.
[8] Davis, S. M. (1987) Future perfect, MA, Addison-Wesley publishing company, INC
[9] Elizabeth J. Jewell and Frank R. Abate (2001) The new Oxford American dictionary, Oxford, UK: Oxford University Press.
[10] Fitoussi, Jean-Paul and Pierre Rosanvallon, (1996) Le nouvel âge des inegalités, Paris: Seuil.
[11] Fung, G., Boysen, A. and Chignell, M. (2001) A Model of Personalization. 1st Worldcongress on Mass Customization and Personalization, Hong Kong
[12] Hofstede, Geert (1980) Culture's consequences: International differences in work-related values, Newbury Park, CA: Sage.
[13] Hofstede, Geert (1983) "The Cultural Relativity of Organizational Practices and Theories", Jour-nal of International Business Studies, 14:2, 75-89
[14] Hofstede, Geert (1998). "Attitudes, Values and Organizational Culture: Disentangling the concepts." Organization Studies 19:3, 470-477.
[15] Laermans, Rudi (1991), 'Van collectief bewustzijn naar individuele reflexiviteit: media, consumptie en identiteitsconstructie binnen de 'reflexieve moderniteit", Vrije tijd en samenleving, 9:4, 99-118.
[16] Piller, F. (2003) Mass Customization News, Newsletter on Mass Customization, Personalization and Customer Integration, Vol. 6, No. 1 (May 2003), <Available> http://www.mass-customization.de/ news/news03_01.htm,18.06.2010
[17] Pine, J. P. (1993) Mass Customization, Harvard Business School Press, Boston, MA.
[18] Schwartz, Shalom H. (1990) „Individualism - collectivism: Critique and proposed refinements", Journal of Cross-Cultural Psychology,21:2,139-157.
[19] Schwartz, Shalom H. (1994) "Beyond individualism/collectivism: new cultural dimensions of values", in Kim, U, Triandis, HC, Kagitcibasi, C, Choi, SC, Yoon, G (Eds), Individualism and Collectivism: Theory, Method, and Applications, Sage, Thousand Oaks, CA, 85-119
[20] Svensson, C. and Jensen, T. (2001): The customer at the final frontier of mass customisation, 1st Worldcongress on Mass Customization, Hong Kong
[21] Taylor, D. A. (2004) Supply Chains, Boston
[22] Toffler, A. (1971) Future shock, New York
[23] Tseng, M.M. and Jiao, J. (2001) Mass Customization, in G. Salvendy (Ed.) Handbook of Industrial Engineering, 3rd edition, New York: Wiley, 2001, pp. 684-709.
[24] Von Hippel, E. (2001) "Perspective: User Toolkits for Innovation", The Journal of Product Innovation Management, 18 , pp. 247-257.
[25] Webster Online (2003) Definition "to personalize",<Available>http://www.webster. com /cgi-in/ dictionary? book=Dictionary&va =personal- ize , 15.05.2010

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GOVERNMENT INSTRUMENTS TO SUPPORT OPEN INNOVATION-EXPERIENCES FROM EU COUNTRIES

ABSTRACT:
Open innovation requires cooperation between countries and learning form experiences of others. In this paper closed innovation will be compared with open innovation concept to lay foundation to later discussion. Also organizational vs. government level in open innovation will be considered along with presentation of some existing experiences and government instruments for supporting open innovation in EU countries (Netherlands, Belgium and Estonia). Most suitable instruments of government policies will be discussed.

KEYWORDS:
Open Innovation, Closed Innovation, Government Instruments for Open Innovation

INTRODUCTION

Open innovation, as the most important current trend, call for the transformation of innovation policies of firms and national institutions. It will significantly affect the transformation of many familiar drivers of innovation processes such as intellectual property rights and capital markets, cooperation between universities and companies etc. It will affect to the policy making instruments too. Open innovation requires cooperation between the countries. EU provides many instruments for this activity. After the introduction, the main conceptual issues about the closed vs. open innovation concept are mentioned. In the next part the organizational vs. government level in open innovation research is considered. Some existing experiences and the government instruments to support open innovation in EU countries are presented. How important Open Innovation should be to guide policymaking and which are the most suitable instruments used by the governments for this purpose are discussed in the conclusions.

CLOSED VS. OPEN INNOVATION CONCEPT

Traditional closed innovation model is based on an idea, where innovation takes place within a single company or research group, and protecting the innovation is the key issue. It is based on the idea that research and development is the key to innovations. That concept evaluated to more recent approaches such as the systems, interactive, view of innovation that rests on interdependencies in the innovation process. [1] Today it is increasingly recognized that innovation extends beyond formal research and development activities. The ability of firms to innovate depends on their networks with other firms and actors.

For the most of the twentieth century enterprises [2] were closed enough to their own ideas, to their own manufacturing processes, to their own machines, to their own scientists and workers. They couldn't believe in a network of exchanging information and knowledge among the other companies.

Open innovation has emerged as a model where firms commercialize both external and internal ideas/technologies and use both external and internal resources. [3] The boundary between a firm and its surrounding environment is more porous, enabling innovation to move easily between the two. In an open innovation process, projects can be launched from internal or external sources and new technology can enter at various stages. Projects can also go to market in many ways, [4] such as out-licensing or a spin-off venture in addition to traditional sales channels.

Open innovation stands for opening up the innovation process to external parties. Firms aim to search for innovations and knowledge also from outside. In the closed innovation model firms suspend the ideas that do not fit their particular portfolio, whereas in the open innovation model they aim to sell or license them for others to capitalize while, at the same time, seeking seeds for innovation from the outside of the firm. The term open innovation was mentioned for the first time by Henry Chesbourgh in 2003. He defines open innovation as [5] the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.

Open innovation is described as [6] both a set of practices for profiting from innovation and also a cognitive model for creating, interpreting and researching those practices.
Open innovation are much widely used today then it was when the Chesbrough defined it for the first time. There is still limited number of empirical research about it and there is still lot of questions about open innovation that expect answers. That opens a lot of possibilities for further research and different levels of analyses.

ORGANIZATIONAL VS. GOVERNMENT LEVEL IN OPEN INNOVATION RESEARCH

Open Innovation so far has been mainly discussed at the enterprise level. First reason is that [7] innovation is traditionally conceived as the outcome of deliberate actions of a single firm, and thus research and development competition has also been stylized as an innovation race between two or more firms. Second reason is that [7] the value of a technical invention is realized only through a business model of a firm. However, neither the practice nor research on open innovation is limited to the level of the firm. Innovations are created by individuals or group of individuals, usually within organizations, so the sub firm level of analysis is particularly salient in understanding of sources of innovation. At the same time, firms are embedded in networks, industries and sectors, thus it is essential to consider these level of analyses. Finally, open innovation is practiced within the context of a given set of political and economic institutions, including regulation, intellectual property law, capital markets and industry structure.
Understanding innovation as an open process, in which enterprises seek purposively for inflows and outflows of knowledge, has implications for the design and implementation of any kind of policy to support innovation. In a world of open innovation, policies must be aligned with the behavior of innovating enterprises and the external conditions which motivate enterprises to practice open innovation.

GOVERNMENT INSTRUMENTS TO SUPPORT OPEN INNOVATION IN EU COUNTRIES

The European Innovation Scoreboard shows that [8] Europe is already today the continent with some of the most innovative countries and regions of the world. It can be seen that these countries are usually spending above the average for education, training and lifelong learning, have the highest share of research and development (R&D) spending in GDP and have instruments to support the uptake of new technologies and products in the public and private sectors. [8] Experience also shows that these countries are better prepared to make use of the exchange of best practices and to learn from others. The challenge today is to replicate these success stories through the EU.
The role that public authorities play for innovation is very important. Member State's innovation policies show a tendency to a broadening of the scope of their innovation strategies and a trend towards measures with wider societal goals.
A number of initiatives have been undertaken at the EU Community level with the aim of synergies between policies and instruments at different levels. [8]The coordination of policies to support innovation at regional, national and EU level has to improve significantly and a better governance system is needed, based on the principles of subsidiarity, but better exploiting the added value of setting common objectives, agreeing on common actions and sharing best practices among Member States. Cooperation with third countries and in particular best practice exchange with the US should also be substantially enhanced.
According to the research on stimulation of open innovation in the Netherlands [9] it is identified that mostly used instruments for this purpose are: regulations, public ownership, taxation and subsidies. With these instruments the government tries to influence the needs for open innovation and to stimulate the necessary characteristic of open innovation collaboration.
The use of regulation allows politicians to act and receive credit for action while simultaneously avoiding most of the associated costs. [9] Regulatory instruments include three dimensions. First regulatory instruments exercise a symbolic function, as they are an attribute of legitimate power and draw their strength from their observance of the decision-making procedure that precedes them. Second regulatory instruments have an axiological function; they set out the values and interests protected by the state. Third regulatory instruments fulfill a pragmatic function in directing social behaviors and organizing supervisory systems. policy is aimed. Fourth, regulation has a reactive character.
Concerning the relation to government and public ownership as the other government instruments it might be said that [9] private ownership should generally be preferred to public ownership when the incentives to innovate and to contain costs must be strong. Many of the concerns that private firms fail to address to social goals can be addressed through government contracting and regulating, without resort to government ownership.
Taxation is the instrument used to raise the money that government spends. Taxes are generally unpopular, and the more visible they are, the less popular they appear to be. Examples for the innovation policy are investment allowances, research allowances and allowances for medical expenses.
There are many situations in which a subsidy and a regulatory tax can be considered as alternative instruments to attain the same policy objective. [9] In reality is observed that politicians often prefer subsidies to taxes, because of the attractiveness from an electoral point of view.
A group of researchers within the VISION Era-Net project [10] "Policies for Open Innovation: Theory, Framework and Cases" have identified a list of policy

areas which are influential and need to be addressed related to open innovation. That framework was applied in three Era-Net countries The Netherlands, Flanders (Belgium) and Estonia. The aim of the study was to identify the best practices that could be used for the others from comparison between these countries. The study made inventory of policy measures which are the most relevant for open innovation policy in these countries.

The case studies revealed strengths and weaknesses which were fairly unique for specific countries. [10] Dutch policies for example pay much attention to the migration of knowledge, while in Flanders this topic is only modestly covered. Likewise, the Estonian case shows that relatively many Open Innovation guidelines are not or slightly reflected in the current policy mix , but as a consequence of the still emerging status of its innovation system and specific features of local industries (i.e. many enterprises operating on low value-added basis), the priority of Open Innovation guidelines needs to be regarded as diverse.

Dutch policy measures [10] very well reflect some of the Open Innovation guidelines, e.g. stimulate private research and development, interaction between the actors in the innovation system, entrepreneurship, and higher education in science and technology disciplines.

In Belgium, due to the regional differences the current policies and governance structures are too distinct from one another to apply the Open Innovation policy assessment framework to the whole country. [10] As for the federal government, it has little experience with proactive innovation policies, but it did initiate changes in the fiscal system to stimulate innovation and research and development by means of a series of additional or revised reductions in tax and social security contributions for enterprises and their employees. Although the Belgian education system is performing well, there is evidence for an innovation skills mismatch. There is a challenge to preserve the country's good position to attract and retain innovative enterprises. There is also a need to boost entrepreneurship, especially the rate of creation and growth of high potential knowledge-intensive enterprises.

Estonia, as a transition state, has gone through rapid development of its basic institutions and specific policies. [10] In addition to nation-state policies, the pivotal influence on Estonian policy-making has been the accession process to the EU. Financing possibilities and conditions provided by the EU and its financing schemes had to be considered. Concerning the open innovation policy instruments [10] there are only a few impact assessments and evaluations of the 2004-2006 policies while most 2007-2013 measures are still in their design phase.

The overview of the measures in three countries is presented in the following tables:

Table 1. Inventory of Open innovation policies for Netherlands

	Policy areas/guidelines		Policy areas/guidelines
1	WBSO R&D promotion act	19	Venture capital scheme
2	SBIR – Innovation procurement	20	New Entrepreneurship Action Plan
3	Innovation Performance Contracts	21	Lumpsum research funding
4	Innovation Programs	22	NWO funding
5	IOPLTI – Publicprivate partnering	23	Incidental research funding
6	OCNL Netherlands Patent Office	24	Technological institutes
7	Patent information project	25	STW – Technology foundation
8	NEN Standard Setting Organization	26	Leading Social Institutes
9	Standards Awareness Project	27	Opportunity Zones
10	OASE – Open Source Software	28	Valorization grant
11	Syntens – Intermediaryorganization	29	Technological Sciences Platform
12	ROMs Regional development agencies	30	Lectureships
13	Innovation vouchers	31	Project Learning and Work
14	RAAK – Public privatepartnering	32	Entrepreneurship Education ActionProgram
15	Peaks in the Delta	33	Casimir – Mobility scheme
16	Innovation credit	34	Knowledge Migration Desk
17	Techno Partner	35	NMa Netherlands Competition Authority
18	BBMKB SMEs creditguarantee		

Source: De Jong, J.P.J., W. Vanhaverbeke, T. Kalvet & H. Chesbrough (2008), Policies for Open Innovation: Theory, Framework and Cases, Research project funded by VISION Era-Net, Helsinki: Finland.

Table 2. Inventory of Open innovation policies for Belgium

	Policy areas/guidelines		Policy areas/guidelines
1	Tax exemption for researchers employed by enterprises	18	One off Innovation Premium
2	SME Program	19	Applied Biomedical Research with a Primarily Societal Finality
3	Knowledge transfer instrategic areas	20	Flemish Cooperative Innovation Networks VIS
4	Research mandates	21	University interface services
5	Poles of Excellence/ Centers of Excellence	22	Tax deduction for R&D investments and patents acquisition
6	Strategic Basic Research SBO	23	OPRIDIE Office for Intellectual Property
7	Action Plan for Science Information&Innovation	24	R&D projects of companies
8	Growth subsidy	25	Tax deduction for increase in R&D personnel
9	TETRA Fund	26	Tax deduction for patent income
10	Financial support for industrial estates and science parks	27	R&D Tax Credit
11	VINNOF	28	Mentorship Programs
12	Industrial Research FundIOF	29	Hercules Foundation
13	Entrepreneurship Action Plan	30	Special Research Funds
14	NRC Fund	31	Flemish Young Enterprises VLAJO
15	ARKimedes	32	Methusalem
16	Winwin loan	33	Odysseus
17	Young Innovative Companies	34	Economy Education Bridging Projects

Source: De Jong, J.P.J., W. Vanhaverbeke, T. Kalvet & H. Chesbrough (2008), Policies for Open Innovation: Theory, Framework and Cases, Research project funded by VISION Era-Net, Helsinki: Finland.

Table 3. Inventory of Open innovation policies for Estonia 2004-2006

Policy areas/guidelines		Policy areas/guidelines	
1	R&D Financing Program	12	KredEx credit and guarantee organization
2	Competence Centers Program	13	Export Plan Program
3	Estonian Patent Office	14	Startup Program for Enterprises
4	Enterprise Incubation Program	15	Centers of Excellence Development
5	Estonian Centre for Standardization	16	Research Funding Schemes
6	Spinno Program	17	Archimedes Foundation
7	Inno Awareness	18	Programs Vocational and higher education and R&D institutions
8	Innovation Audit Program	19	INNOVE Lifelong Learning
9	Enterprise Estonia – support organization for enterprises	20	Program for educational system providing labor market flexibility, lifelong learning, access
10	Training Scheme	21	Program for equal labor market opportunities
11	Mentoring/Counseling Program	22	Estonian Competition Authority

Source: De Jong, J.P.J., W. Vanhaverbeke, T. Kalvet & H. Chesbrough (2008), Policies for Open Innovation: Theory, Framework and Cases, Research project funded by VISION Era-Net, Helsinki: Finland.

Table 4. Inventory of Open innovation policies for Estonia 2007-2013

Policy areas/guidelines		Policy areas/guidelines	
1	National Technology Programs	18	Estonian Development Fund
2	Cluster Program	19	KredEx credit and guarantee organization
3	R&D Financing Program	20	Export Support Schemes
4	Investments in New Technology	21	Services for Foreign Investors
5	Competence Centers Program	22	Foreign Representative Offices
6	Estonian Patent Office	23	Mobility Program
7	Enterprise Incubation Program	24	International Cooperation Networks
8	Estonian Centre for Standardization	25	Startup Programs and Loan guarantees
9	Spinno+ Program	26	Centers of Excellence Development
10	Science and Technology Parks	27	Research Funding Scheme
11	Cooperation with Universities	28	Archimedes Foundation
12	Innovation and Entrepreneurship Awareness Program	29	Infrastructure development program for R&D and higher education institutes
13	Enterprise Estonia support organization for enterprises	30	INNOVE –Lifelong Learning
14	Innovation Vouchers	31	Programs to develop R&D human resources
15	Training Program (incl. training services)	32	Lifelong Learning Programs
16	Information Gateway for Entrepreneurs	33	Estonian Competition Authority
17	Mentoring/Counseling Program		

Source: De Jong, J.P.J., W. Vanhaverbeke, T. Kalvet & H. Chesbrough (2008), Policies for Open Innovation: Theory, Framework and Cases, Research project funded by VISION Era-Net, Helsinki: Finland.

CONCLUSION

From the very limited research on open innovation at the state level, it could be seen that current government policies in many EU countries already contain many elements to support it. The Open Innovation model inevitably influences to traditional policy making, but does not completely upset it. Current policies already reflect many aspects of Open Innovation. These are [10] policies to offer financial research and development incentives, to stimulate interaction between actors in the innovation system, to better secure innovating enterprises' access to finance, and to generally stimulate competition. Other guidelines which are frequently found are support for regional clusters and to organize the diffusion of scientific knowledge.

Open Innovation, from the other side, broadens the scope of policymaking. It is influenced by a rather broad set of policy areas outside the traditional domains such as labor markets and education. [10] It will be a challenge for policy makers to develop truly lateral policies and to find out how to effectively influence all policy areas.

Beside the traditional financial instruments to support innovation in general, open innovation ask for the other instruments such as subsidies, grants and guarantee schemes. In open innovation model it would be also necessary to develop alternative policies such as information services and legislation issues that are relatively scarce in current innovation policy. Opportunities for new policies are also present in the areas of [10] user innovation, technology markets, corporate entrepreneurship in incumbent enterprises, balanced (career and work) incentives for scientific researchers, and standard setting processes.

General question is how important Open Innovation should be to guide policymaking. The experiences of EU countries show tendency to a broadening of the scope of their policies towards support the open innovation model. These countries are usually spending above the average for education, training and lifelong learning, have the highest share of research and development spending in GDP and have instruments to support the uptake of new technologies and products in the public and private sectors. At the Community level it is also mentioned the importance of open innovation through many documents. The Business Panel on future EU innovation policy calls [11] to open up innovation to the creativity of broad range of people and ideas and to make a shift from closed processes to power of networks. It is noticed that [11] closed innovation system of laboratories, universities, research institutes, art schools, corporations, public administration, professionals are no longer a viable approach for future innovation. Openness call for collaboration that [11] requires a platform, often including government actors, to specify the rules of engagement to help incentivize an open exchange.

To accelerate this process it is proposed to [11] create, fund and network innovation labs, with localities creating spaces to enable interaction between large and small, low tech and high tech, arts and technology, public and private and not-for profit, supported by recognition and networking at European level. Innovation labs should help to develop, test and scale up solutions to implement the new orientations of EU innovation policy.

Developing countries, from the other side, have other priorities for policymaking due to the relatively under-developed innovation institutions. In such countries have to developed basic innovation and interaction instruments in the first phase. The next step should be more sophisticated instruments such as development of technology markets, stimulation of corporate entrepreneurship, etc.

Although the finance is one of the greatest obstacles by both enterprises and innovation support organizations to innovation in developing countries there are other instruments that government could use, even in the phase of the establishment of innovation system. In addition to measures that require financial resources, reforms in education and training, life long learning, as well as the promotion of entrepreneurial culture and better match between skills and labor market should be the measures that enable a good open innovation environment. Government instruments that facilitate the dissemination of good practice via networks and support to cluster development may also contribute to the process of open innovation without major investment.

Even from the very limited research of experiences in some EU countries could be concluded that open innovation trend will undoubtedly influence the policy making in future. Government instruments to support open innovation vary depending of the level of development of innovation system of the country, but exchange of good practice and experiences is the instrument that should be practiced at any stage and without major financial investment in every country.

REFERENCES

[1.] *Mytelka, L. & Farinelli, F., Local Clusters, Innovation Systems and Sustained Competitiveness, UNU/INTECH Discussion Paper Series, p. 8, 2000*

[2.] *Freund R., Chatzopoulos C., Tsigkas A., Anisic Z, Open Innovation for Entrepreneurs in Central European Region*

[3.] *Chesbourgh, H, Open innovation: the new imperative for creating and profiting form technology. Boston, MA: Harvard Business School Press, 2003*

[4.] *Chesbourgh, H, Open innovation: the new imperative for creating and profiting form technology, MA: Harvard Business School Press, Boston, 2003*

[5.] *Chesbrough, H. W.. New puzzles and new findings, H. W. Chesbrough & W. Vanhaverbeke & J. West (Eds.), Open innovation:Researching a new paradigm: 15-33 Oxford University Press, Oxford, 2006*

[6.] *West J., Vanhaverbeke & Chesbourgh 2006, Open innovtion: Researching a new paradigm: 285-307. Oxford University Press, Oxford, 2006*

[7.] *Chesbourgh, H, Open Innovation: The new imperative for creating and profiting from technology, Harvard Business School Press: Harvard, MA, 2003*

[8.] *European Commission, Communication „Reviewing Community innovation policy in a changing world", COM(2009)442-final http://ec.europa.eu/enterprise/policies/innovation/files/com(2009)442final_en.pdf*

[9.] *Groenveld R., The government as an actor in open innovation, How the Dutch Government stimulate open innovation, University of Twente, Master thesis 2008 http://essay.utwente.nl/59285/1/scriptie_R_Groeneveld.pdf*

[10.] *De Jong, J.P.J., W. Vanhaverbeke, T. Kalvet & H. Chesbrough, Policies for Open Innovation: Theory, Framework and Cases, Research project funded by VISION Era-Net, Helsinki: Finland, 2008*

[11.] *European Commission, The Business Panel on future of EU innovation policy, Reinvent Europe through innovation, From a knowledge society to an innovation society, http://ec.europa.eu/enterprise/policies/innovation/files/panel_report_en.pdf*

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COMPUTER-BASED SOLUTIONS FOR OPEN INNOVATION PROCESSES

ABSTRACT:
Innovation management has significantly changed, especially towards approaches for supporting the innovation process and gathering ideas from outside the organization. In the advent of Web 2.0 these approaches have become increasingly computer-based enabling access to large user communities. This article provides an overview of existing concepts and approaches on computer-based solutions for innovation focusing on creativity support systems relevant for the idea generation phase of the innovation process. Individual as well as group-related aspects are discussed. A case study of an Open Innovation platform showing the results of an interdisciplinary research project exemplifies the practical application of the described concepts.

KEYWORDS:
Computer-Based Solutions, Web 2.0, Creativity Support Systems, Open Innovation

INTRODUCTION

Managing innovations is crucially important in a time when innovation is a necessary survival strategy [6]. But having the right innovations at the right time is not so easy to achieve as it requires effort from the organization – strategy and climate, stable economy, and – most important - the right idea. The right idea at the right time can save a company. Even though the research on the processes and methods to arrive at the right idea is not new, there are many aspects that are left open for further research and development of new fields of discussion. One of the open questions on which, most probably, no one has the right answer is: Which are the most effective idea sources and which methods can provide the best idea generation? However, there are many successful attempts for designing of a method that would at least help the pre-development phase of the innovation process [5], [22], [23] within an organization. When we talk about ideas and innovations it is useless to continue any discussion without thinking on the "fuel" of the process – creativity. Even though there are many definitions of what creativity is, which for the researchers is seen as a problem [17], we accept as a working version the definition given by Sternberg and Lubart [34]. They see creativity as: "The ability to produce work that is both novel (i.e. original, unexpected) and appropriate (i.e. useful, adaptive concerning task constraints)". Creativity has been observed from many different aspects, and many empirical studies, concepts, observations can be found in fields such as arts, social sciences, psychology, business etc. There are many methods designed to support creativity. These methods are of special interest for the business world. For a long time businesses were interested in so called face-to-face methods or traditional methods like brainstorming [25]. Lately companies have a tendency to improve their innovation processes by using computer - based solutions that ease collaboration, knowledge management and idea generation. The focus has fallen on creativity support systems which can help not only the communication and the knowledge sharing but also the idea generation (ideation for product innovation).
In this paper we first give a historical overview of the recognized computer-based systems for groups, primarily designed to foster communication during meetings. Then we describe the background for the development of computer-based solutions for creativity. In the third part we give an example of a web-based Open Innovation platform called Neurovation showing the results of an interdisciplinary research project.

COMPUTER-BASED SOLUTIONS

The trend of computer-based meetings –searching internal ideas

Looking back in the history organizations invested many financial resources on technologies and on implementation of computer-based solutions such as decision support systems, collaboration systems, data flow etc. Unfortunately very few experiments are made with respect to the impact of creativity resulting

from the use of group support solutions including computers and web - based platforms [13].

For more than a quarter of a century research has been conducted on group support systems (GSS) [14]. They are defined as: "A set of techniques, software and technology designed to focus and enhance the communication and decision making of groups" ([24], p.357), and treated as solutions that could overcome the process losses during group meetings. GSS were meant to support a variety of tasks following a similar sequence of events. The early systems from the 80^s were designed to support system analysts and users in the constriction of information systems [6]. Later on they were used as support methods for almost every meeting. At such group support meetings there were a leader and facilitator that developed the agenda for the meeting and selected the group systems tools to be used. The participants on the meeting used their computers to give comments and the results were integrated and displayed on a large screen in the front of the room. In that way the communication between the participants was assumed to be eased.

In the years that followed these meetings were also supported by more internet enabled applications such as Groove, MSN Messenger, Yahoo, Chat, ICQ, Lotus Notes and other Web applications to enable members to communicate [6] and to support meetings with geographically distributed members. On the other side there was a significant interest on decision making and idea sharing accomplished by computer networks [36]. These computers - based tools which supported idea generation were based on the brainstorming face-to-face method [24] and are called Electronic Brainstorming Systems (EBS) [36]. Electronic Brainstorming Systems have received significant attention by researchers. There was an optimistic belief that computer - based brainstorming systems will overcome the problems of inefficiency and low productivity in idea generation group meetings [15], [16].

Facing with the fast changing economy companies started to require and search for computer - based solutions not only for group meetings support but also that could foster their knowledge management activities and collaborations. A new social technologies embedded in the so called "Web 2.0" has appear on the market. These technologies were originally used to describe consumer technologies that enable groups to organize and share information and media [9]. According to Eastwood [9]: "Enterprises quickly caught on the value of these easy to use tools for capturing and sharing ad hoc information that may be otherwise not documented". Having this on mind IT enterprises had to respond to the requirements of their customers with solutions that contain features for collaborative working across regions, knowledge capture, and community and brand building outside the firewall [26]. This led to a creation of new and improved, more holistic tools called Social Enterprise Applications that would enable the "next wave of knowledge worker productivity" (term coined by Oracle company in 2008). The use of the technologies associated with Web 2.0 has implicated the opportunity for companies to literally think outside the "box" by searching for new product ideas outside the organization. By this the Creativity Support Systems have been developed further in order to support the so called Open Innovation approach. Restrictions which previously occurred using internal, closed platforms have been removed by the Web development [11]. It is interesting to mention that most of the computer-based solutions for innovation almost never include all phases of the innovation process but are focused only on one phase where actions from that phase can be separately developed and communicated via given platform. There are several software solutions that can be found under the Stage-Gate Inc. Ready Certified solutions which are based on Cooper's Stage-Gate model [4] which almost support all phases of the innovation process. Other commercial software solutions pay more and more attention to the collaboration segment within the innovation process (CollabNet). Many simple solutions provide the use of (collaborative) mind maps (e.g. Mindmeister.com) and brainstorming features for creative decision support. Some are based on the logic of existing methodologies (e.g.TRIZ) which can be described as systematic innovation methods.

Some tests with computer - based collaboration creativity techniques are identified which resulted in the creation of new solutions for creativity support within groups [11]. As said before only few solutions include the idea generation phase and even fewer are capable for Open Innovation. According to Cooper and Edgett [3] there is a lack of popularity of traditional methods for Open Innovation, but they find that the reason is that some Open Innovation approaches are relatively new. This signifies that there is a lot work to be done in this field.

Background for creating computer-based solutions for creativity support

The roots of the methods for supporting creativity, face-to-face or computer based are based on creativity process models. Even though scientists have been discussing for a long time if the creativity processes are a product of only intelligence [8] unconscious process [28], conscious and problem solving process [38], [17]. There is an obvious consistency about the sequence of two distinctive phases occurring in the creativity processes [37]: a divergent phase, where ideas are generated and collected, followed by a convergent phase, where the ideas are discussed, evaluated and discarded or selected. In more complex process models these pattern can be repeated several times. Tools to support creative process should therefore provide means to support both divergent and convergent phases of the creative process (for the divergent phase there should be means to input and visualize ideas, and for the convergent phase there should be functions that enable the user to organize, discuss, select and rank ideas) [11].

As it was discussed earlier in the text, it can be concluded that most of the creative activities within organisations have been carried out by groups. Understanding the group interactions necessarily pools understanding of the individual behaviour. For example in the literature there are recognized factors that affect creative performance. Rhodes [29] has proposed a categorization into four factors affecting the creative performance also known as 4Ps: person, process, product and press. For every category there is a list of factors that define the creative capability. For the category person the factors are antecedent conditions like the history of the person or personality data [32], [33]; the category "product" focuses on the outcomes and those things that result from the creative person [30], the "process" category involves the mental processes at work in creation (humour, communication, creativity methods); an "press" refers to the relationship of human beings and their work environment including aspects such as leadership or reward.

The conditions for group creativity have been researched from several aspects: group composition, group characteristics, and group process factors. King and Anderson [18] listed leadership, cohesiveness, group longetivity, group composition and group structure as antecedents of group creativity. In examination of the effectiveness of research teams, Payne [27] identified resource availability, leadership, group size, cohesiveness, communication patterns, and group diversity as crucial factors in creative performance.

In the literature on creativity support systems sets for functional requirements creativity computer - based solutions have been defined [19]. Various tests using face-to-face methods have shown that group-related problems occurred more often which initiated researchers to see how group support systems impact for instance efficiency, effectiveness, communication, decision quality, productivity, satisfaction, usability of the solution etc [13]. Group support systems, especially those computer support systems, have shown to reduce many of the problems which are present when face-to face methods are used [11],[13],[14]. These considerations lead to the initiation of the research project "Neurovation" as explained in the following section.

THE OPEN INNOVATION PLATFORM »NEUROVATION«

The Open Innovation platform Neurovation[1] is the result of a research project which started in 2005. The overall aim of the research project was to combine innovation and knowledge management on a psychological and neurophysiologic basis in order to improve the innovative capability of organisations in the long run. Based on the findings obtained in the course of the research project as well as on the insights from existing literature a focus has been made in favour of the first phase of an innovation process so called "fuzzy front end", in particular the idea generation activity. Consequently a set of tools has been developed focusing on different aspects of creativity support and creativity promotion for so called "knowledge workers" within organizations. This initial concept has then been extended and adapted to be suitable for an Open Innovation process involving the integration of external stakeholders such as customers, interest groups or suppliers.

Rationale for developing Neurovation.net

Supporting the very first phases of an innovation process is of relevance to any organisation as the creation of new knowledge constitutes an important part of knowledge work. According to a study conducted in the course of the research project APOSDLE [1] more than 30% of knowledge work is associated with the generation of new knowledge.

Moreover, studies show that in particular the quality of execution of the first phases of an innovation process (i.e also the idea generation phase) significantly influence the success or failure of an innovation process [35].

In the course of the first research activities the Institute of Psychology at the Karl – Franzens - University of Graz conducted an EEG study [12]. In the course of this study the test persons had to generate as many creative ideas as possible to a given challenge within a certain time span. Apart from the control group all participants were interrupted after three minutes by a so called "intervention". The effect of this intervention has been assessed with respect to the development of the idea rate curve. The results showed that positive affect (i.e. humour) and idea sharing have proven to be the best means for preventing the idea rate to go down, i. e. for stimulating persons to generate ideas. The results and conclusions from this study were included in the conception and development of a web-based modular creativity tool named "Idea Generator" targeted at the individual.

In a later phase the prototype of the Idea Generator has been further developed based on a feedback phase including persons from 30 different organisations. In the course of a dissertation the Idea Generator has been empirically evaluated. The aim was to evaluate to which degree the Idea Generator is suited for supporting the creative process and for fostering creative achievement of individuals ([19], [20]). Although the test persons of the Idea Generator considered the tool to be useful and user friendly (as opposed to the control group using paper and pencil), the control group generated more creative ideas. This might be due to the non - familiarity with the Idea Generator and the high degree of novelty of such a tool. However, the so called "humour intervention" evoking positive affect lead to a significantly higher creative achievement [19].

Great potential is seen with respect to idea sharing which has not been integrated as the tool focused on the individual person.

[1] Neurovation is a combination of the terms »NEUROscience« and »InnoVATION«

Therefore the ongoing developments concentrated on supporting idea sharing, the collaborative (asynchronous) generation of ideas and the opening of the idea generation process.

Trends such as Web 2.0 and Open Innovation [2] strongly influenced the research and development works in this later stages of the project. The Open Innovation approach gives stakeholders and relevant communities the opportunity to play an active role in different phases of an innovation process. This integration enables firms to better tailor their innovations in terms of products, services or markets to the needs of the relevant stakeholders and potential customers. Letting these "external" stakeholders become an active part in the innovation process can be facilitated through the use of open Web 2.0 technologies – in particular the possibilities today's Web provides with respect to getting access to large groups of users and communities, user collaboration (harnessing collective intelligence) and user generated content.

From an application point of view, the idea generation phase is not very well supported on the Web. Most of the available tools and applications exclude the idea generation phase. They rather support the process that begins with the enunciated idea and focus on the matching between idea seekers and problem solvers (e.g. Innocentive, Mechanical Turk etc.) [21]. Due to the increasing tendency of idea competitions staged via the Web a great potential can be assumed in supporting the idea generation phase.

The Open Innovation platform Neurovation has been further developed based on the above-mentioned findings and identified trends. In the course of these developments usability designers have been included to simplify and improve the workflow process on the platform, and a system has been developed to enable the community of users to not only develop their ideas via the tools on the platform, but also to submit their ideas to idea competitions.

A case study of an idea competition with offline and online components illustrating the features of the platform Neurovation.net as well as the online activities carried out to promote the offline event are explained in the next section.

Case Study: Open Innovation via the platform Neurovation.net

The basis for the idea competition on Neurovation.net was an offline event called »Braintwister«. This event was supported by an initiative from the Austrian Federal Ministry of Economy, Family and Youth called "Evolve" - the Creative Industries Austria. The aim was to assemble the various creative sectors in Austria, such as design, graphics, media, PR, advertising, multimedia, music, fashion, photography, film, architecture and art.

Braintwister was designed to be the biggest public brainstorming event in Austria. To promote the event and to increase the awareness level of the evolve initiative Web 2.0 functionalities have been actively used. Figure 1 shows the webpage for promoting the Braintwister.

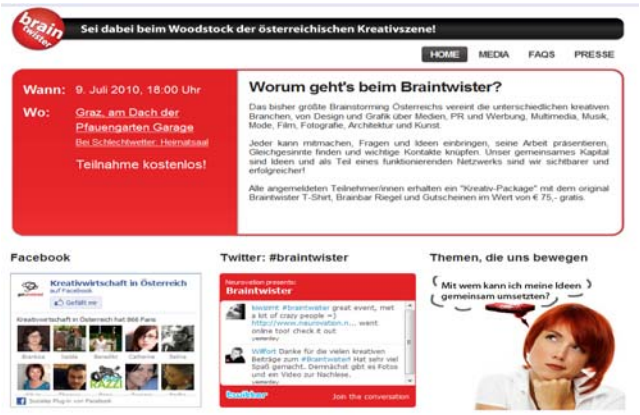

Fig. 1. The Braintwister webpage informing about the offline event preceding the online idea competition using social networking tools such as Twitter and Facebook

In parallel, virtual marketing activities have been staged via Facebook and Twitter. The respective widgets have been integrated into the Braintwister webpage to give interested people a community feeling and to inform them about current activities around the event. For instance, the Facebook group "Creative Industries Austria" which has been founded to promote Braintwister has almost 900 fans. Latest tweets give a first impression on what people think about the event and (after the event) what they experienced there.

More than 300 people finally participated in the offline event which took place in Graz. All generated ideas at the event have then been digitised and published via the Open Innovation platform Neurovation.net. The so called "Idea Pool" (figure 2) shows all public ideas and constitutes an important element for stimulating creative processes of other platform users. By this the effective principle of idea sharing has been realised. Furthermore, users have the possibility to get feedback from the community about their ideas when submitting them to an idea competition.

The online phase for Braintwister is tightly connected to the offline phase, i. e. on the platform Neurovation.net users find an idea competition called "Braintwister" including a detailed description on what the challenge is and what the conditions for participation are (prizes, end of competition, evaluation phase, and legal regulations).

Furthermore, they find the three latest submissions to the competition as a first stimulus for their own creative processes (figure 3).

Therefore detailed users tests have been made regularly at the different project phases (offline via paper prototypes or online in virtual test environments) to permanently improve the existing solutions. To make users feel comfortable and to give them a quick insight on what they can do on Neurovation.net an intro explaining the most important features has been developed (figure 4).

One important part of the Neurovation platform constitute the hands-on creativity tools actively supporting users in their creative processes by providing them with stimuli for new ideas.

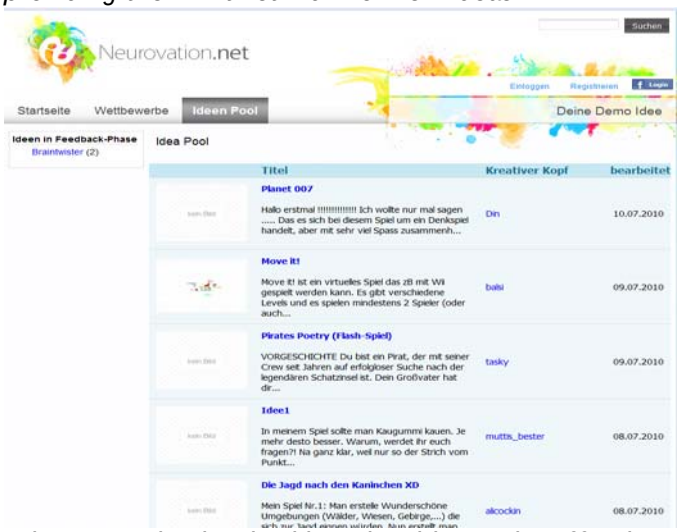

Fig. 2. Getting inspired by other ideas – the effective principle of idea sharing has been realized in Neurovation's "Idea Pool"

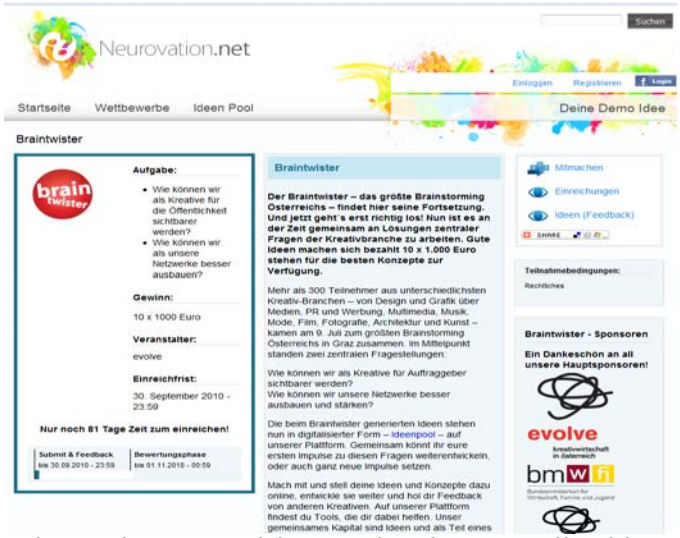

Fig. 3. Idea Competition "Braintwister" - online idea competition following an offline event

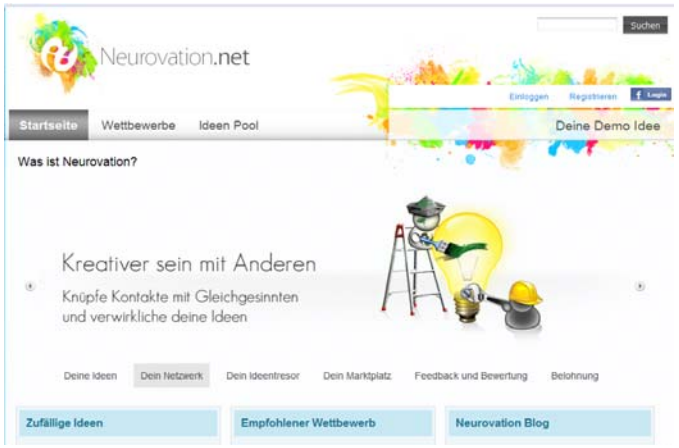

Fig. 4. Intro at the Platform Neurovation – focus on collaboration with others when being creative

In particular the building of associations for linking previously unconnected areas or topics is fostered to provoque highly creative ideas.

The illustration below (figure 5) shows the overview of the three creativity tools on Neurovation.net (these tools are undergoing a redesign at the moment – therefore they are currently not available online).

The tool "MindMonkey" requires the user to enter one word relating to her/his challenge or the topic she/he deals with. The technological background of MindMonkey is an associative index developed at Graz University of Technology. The result – near or far word associations – are visualised in bubbles on which the user can click in order to get associations, i.e. e. the user can swing from one area of bubbles to the next like a monkey swings from tree to tree.

On the contrary, the "SlotMachine" is a tool that does not require any user input. It simply provides the user with impressions (words combined with a picture) to stimulate creative thinking. One mouse click leads the user to the next word-picture-combination.

Fig. 5. The creativity tools on Neurovation.net

The third tool is called "InspirationMachine". Similar to Google Search the user finds an entry field and a button "inspire me!" to start the tool (figure 6 below).

Fig. 6. The input field of InspirationMachine – a meta search engine offering creativity-stimulating results

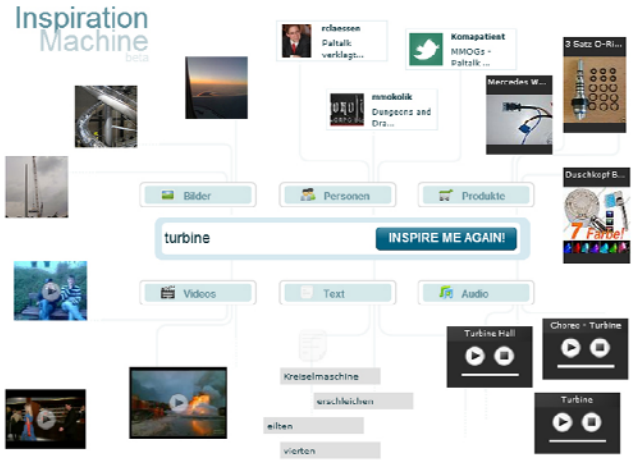

Fig. 7. The results the InspirationMachine shows for the term "turbine"

InspirationMachine is a meta search engine designed to stimulate the user's creativity in many ways by giving her/him a variety of results ranging from pictures to persons, audios, videos and products. The main difference to Google is that InspirationMachine does not show the most relevant results but results that are far from the entered term – again designed to stimulate the building of associations in the user's brain. Figure 7 shows an example for a result. The result changes and new inputs appear as soon as the user clicks onto the button "inspire me again".

After getting inputs and stimuli from the creativity tools the user can go on to describe her/his idea. To do this she/he has the possibility to use the so called »idea board« on the platform. This idea board (shown in figure 8) contains a normal text field but also a drawing board to visualise ideas, to upload photos or to integrate videos.

To create a trusted and supportive environment a point and level system has been introduced on Neurovation.net. Every user can earn points for activity, creativity and trust. Points for activity can be collected by creating own ideas, by evaluating ideas of other users, or by extending one's network. Creativity points are allocated when a user collaborates with others, gives valuable feedback on ideas of other users or when other users like one's own ideas (expressed by a positive rating). Points for trust can be collected by fair behaviour and by supporting other users.

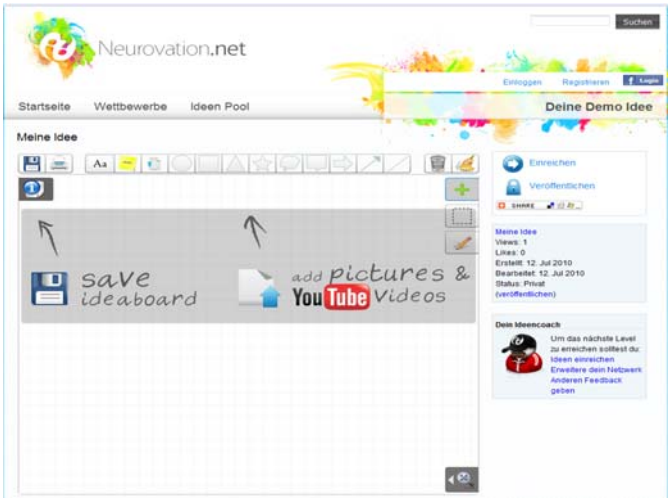

Fig. 8. The idea board on Neurovation.net on which users can draw, design and describe their ideas individually

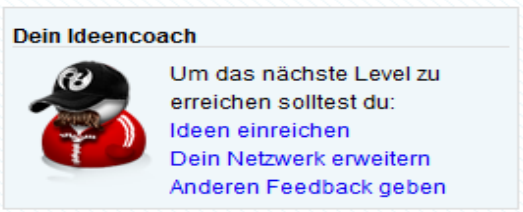

Fig. 9. The user's personal "idea coach" on Neurovation.net.

Depending on the number of points a user can reach the next level which enhances her/his possibilities and voting rights on the platform. A respective level is symbolised by a virtual badge shown with the avatar of the user. This, in turn, influences the user's visibility on the platform with respect to other users or companies looking for creative people. A so called "Idea coach" tells the user what to do for reaching the next level (figure 9).

Ideas are a very personal and sensitive good. Therefore it is important to let users know who will be able to look at their ideas at which stage of the process. This has already been taken care of at the introduction on the platform (figure 10) as this is one of the first things users want to know when working with their ideas in a »public« environment.

Fig. 10. A user can choose by her-/himself who else is able to see his/her idea – symbolized by the idea safe

For a platform provider such as Neurovation, the main goal of an idea competition is to motivate many users to submit their ideas. On Neurovaiton.net the exploitation of ideas is symbolized by the "Market place" where ideas are visible for interested companies. On the other hand, for users it is of interest what they get for submitting their ideas.

Fig. 11. Finally users have the chance to market their ideas via idea competitions

However, in the literature on Open Innovation and interactive value creation there are still differing views on how people are motivated and remunerated (intrinsically, extrinsically, or a combination of both) [31]. Neurovation organises idea contests for organisations and companies which benefit from the platform infrastructure and an existing community of currently about 2,000 creative users. Consequently the community generates ideas on various topics and areas. This variety makes it difficult to motivate users intrinsically, probably due to a missing long-term personal identification with a certain brand, product or service. Therefore the idea competitions on Neurovation.net primarily target extrinsic motivation by allocating prizes for the winning ideas.

CONCLUSION

The idea generation activity plays a crucial role for the success or failure of an innovation process. Computer - based solutions such as: creativity support systems, decision support methods, group support systems and other, have been developed for the use within an organization to facilitate the innovation process. With the advent of Web 2.0 new opportunities evolved for organizations in terms of opening the innovation process, in particular the idea generation phase. Integrating stakeholders (customers, interest groups, suppliers etc.) from outside to contribute their ideas and thoughts is facilitated by Web 2.0 elements such as user-generated content, collaboration and the possibilities to harness collective intelligence. In the course of the research project "Neurovation" a platform has been developed that follows this open innovation approach by focussing on the support of the idea generation phase. The case study described shows how online and offline phases of an open innovation process can be combined.

REFERENCES

[1] APOSDLE Consortium, "Deliverable D02.1 – Workplace Learning Study", retrieved from http://www.aposdle.tugraz.at/content/download/374/1871/file/APOSDLEWorkplace_Learning_Study.pdf, 2006 [access on 2010-07-13].

[2] H. W. Chesbrough, "Open Innovation. The New Imperative for Creating and Profiting from Technology", Harvard Business School Press, Boston, 2003.

[3] R. G. Cooper, S. Edgett, "Ideation for Product Innovation: What are the best methods?", PDMA Visions Magazine, 2008

[4] R. G. Cooper, E. J. Kleinschmidt, "New Products: The Key Factors in Success", American Marketing Association, United States, 1990

[5] R. G. Cooper, E. J. Kleinschmidt, "Determinants of Timeliness in Product Development", Journal of Product Innovation Management, 1994, 11, pp.381-96.

[6] A.R. Dennis, M.L. Williams, "Electronic Brainstorming: Theory, Research and Future Directions", in Paulus, P.B., Nijstad, B.A., 2003 Group Creativity: innovation through collaboration, Oxford University Press, pp. 160-178

[7] P. Drucker, "Innovate or die: Drucker on financial services", The Economist, 1999, September 25.

[8] J.P. Guilford, "The Nature of Human Intelligence", New York: McGraw-Hill, 1967.

[9] M. Eastwood, "Preparing for the 2.0. World: How Enterprises Need to Think About", Emergent Social Technologies, 2009 IDC Analyze the Future white paper

[10] F. Forster, "Distributed Creative Problem Solving over the Web", The Third International Conference on Internet and Web Applications and Services 2008,pp. 283-288 [accessed July 14,2010 at 11:45:20 UTC from IEEE Xplore]

[11] F. Foster, "Improving Creative Thinking Abilities Using a Generic Collaborative Support System", Research, Reflections and Innovations in Integrating ICT in Education, N/A

[12] A. Fink, R. H. Grabner, M. Benedek, G. Reishofer, V. Hauswirth, M. Fally, C. Neuper, F. Ebner, A. C. Neubauer, "The creative brain: Investigation of brain activity during creative problem solving by means of EEG and FMRI", Human Brain Mapping, 2009, Vol. 30, No. 3, pp. 734-748.

[13] J. Fjermestad, "An Analysis of Communication Mode in Group Support Systems Research", Decision Support Systems, 2004,37, pp. 239-263, ELSEVIER

[14] J. Fjermestad, S.R. Hiltz, "Experimental Studies of Group Decision Support Systems: An Assessment of Variables Studied and Methodology", Proceedings of the 30th Hawaii International Conference on System Sciences: Information Systems Track-Collaboration Systems and Technology 1997, 2, p. 45

[15] J.R. Hackman, R.E. Kaplan, "Interventions Into Group Processes: An approach to improving the effectiveness of groups", Decision Science, 1974, 5, pp. 459-480.

[16] Hymowitz, L.R. A Survival Guide to the Office Meeting. The Wall Street J., 1988, 35.

[17] S. G. Isaksen, K. B. Dorval, & D. J. Treffinger, "Toolbox for creative problem solving: Basic tools and resources", Williamsville, NY: Creative Problem Solving Group, Inc, 1998.

[18] N. King, N. Anderson, "Innovation in Working Groups" in West, M. A. & Farr, J. L. (Eds.).Innovation and creativity at work, Chichester, England: Wiley. 1990, pp. 81-100.

[19] A. M. Koeck, "Ein Ansatz zur Steigerung der kreativen Leistung bei der Ideengenerierung mittels eines computerbasierten Kreativitätstools – Integration betriebswirtschaftlicher und psychologischer Erklärungsansätze unter Berücksichtigung des Flow-Konzepts", Dissertation, 2008, Karl-Franzens-University of Graz.

[20] A. M. Koeck, A. Fink, R. Willfort, A. Neubauer, "Creativity @ Work for steady innovation", Paper presented at ECCI X – 10th European Conference on Creativity and Innovation, 14.-17. October 2007, Copenhagen, Denmark.

[21] A. M. Koeck, K. Tochtermann, R. Willfort, "Kreative Geister: Innovationsplattformen im Web", Wissensmanagement – Das Magazin für Führungskräfte, 4/2008, pp. 32-34.

[22] P.J. Koen, et al. "New Concept Development Model: Providing Clarity and a Common Language to the ´Fuzzy Front End´ of Innovation", Research Technology Management, 2001, 44 (2), pp. 46-55

[23] A. Khurana, S. R.Rosenthal, "Towards Holistic "Front Ends", in New Product Development". The

Journal of Product Innovation Management, 1998, 15 (1), pp. 57-74

[24] J.F. Nunmaker, "Future Research in Group Support Systems: needs, some questions and possible directions". International Journal of Human-Computer Studies, 1997, 47, 357-385

[25] A. Osborn, "Applied Imagination", New York: Charles Scribner, 1953

[26] Oracle Company White Paper, "The Social Enterprise: Using Social Enterprise Applications to Enable the Next Wave of Knowledge Worker Productivity" 2008

[27] R. Payne, "The Effectiveness of Research Teams: A review", In M. A. West & J. L. Farr (Eds.), Innovation and creativity at work: 101-122, Chichester, England: Wiley, 1990

[28] H. Poincare, "The Foundations of Incubation: Searching for the elusive", Journal of Creative Behavior, 1913, 13, 9-22

[29] M. Rhodes, "An Analysis of Creativity". Phi Delta Kappan, 1961, 42, 305-310

[30] M.A. Runco, "Creativity" Annual Review of Psychology, 2004, 55, 657-687

[31] R. Reichwald, F. Piller, "Interaktive Wertschöpfung. Open Innovation, Individualisierung und neue Formen der Arbeitsteilung", 2nd edition, Gabler, Wiesbaden, 2009.

[32] D. K. Simonton, "Age and Literary Creativity: A cross-cultural and transhistorical survey", Journal of Cross-Cultural Psychology, 1975, 6: 259-277.

[33] B. Singh, "Role of Personality Versus Biographical Factors in Creativity" Psychological Studies, 1986, 31: 90-92.

[34] R.J. Sternberg, T.I. Lubart, "The Concept of Creativity: Prospects and Paradigms" in Sternberg, R.J. Hadbook of Creativity, Cambridge University Press, 1999, 3-15.

[35] G. Stevens, J. R. Burley, "Divine, "Creativity + Business Discipline = Higher Profits Faster from New Product Development", Journal of Product Innovation Management, Sept. 2003, Vol. 16, No. 5, pp. 455-468.

[36] S.G. Straus, "Getting a Clue: The Effects of Communication Media and Information Distribution on Participation and Performance in Computer – mediated and Face-to –Face groups", Small Group Research, 1996, 27, 115-142

[37] A.B. VanGundy, "Idea Power" AMACOM, 1992.

[38] G. Wallas, "The Art of Thought", New York: Harcourt Brace, 1926.

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INTERNET OFFERING OF MASS CUSTOMIZATION AND OPEN INNOVATION IN TOURISM

ABSTRACT:
The paper is based on acceptance, that if you want to implement the Mass Customization (MC) and Open Innovation (OI) in your business, you have to offer it in a suitable way to the outside environment (OE) and especially your consumers. The innovation is based on challenging existing assumptions and ways of thinking and it is very important to keep informed OE about the possibilities for creative actions, supply them with a suitable environment and provoke them to do that.
There are two sides: one is consumer (customer) expectations and requests, the other is the company competencies and possibilities for the realization of them. The improvement of the tourist services by the development of integrated knowledge management system is discussed.
Potential possibilities for offering of MC and OI in tourism are investigated and analyzed, and a framework of Internet based MC and OI offering system is proposed.

KEYWORDS:
Tourism, Mass Customization and Personalization, Internet, Knowledge Management

INTRODUCTION

Today the companies have to adopt strategies like Mass Customization (MC), because they are being forced to react to the growing individualization of demand, yet, at the same time, increasing competitive pressure dictates that costs must also continue to decrease. The concept of MC has been discussed in the literature for more than a decade (e.g. Davis, 1987; Kotler, 1989; Pine; 1993; in fact, Toffler, 1970 described the basic idea), but increased practical implementation of this strategy can been found in business only in the last few years. The objective of MC is to deliver goods and services which meet individual consumer's needs with near mass production efficiency (Tseng and Jiao,1996) [1].
MC and Open Innovation (OI) are closely related. Henry Chesbrough promoted the term OI in his book "Open Innovation: The new imperative for creating and profiting from technology" [2]. He give the following definition of OI: "Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model". In a world of widely distributed knowledge the boundaries between a firm and its environment have become more permeable and innovations can easily transfer inward and outward.
For tourism Internet offers the potential to make information and booking facilities available to large numbers of tourists at relatively low costs and provides a tool for communication between tourism suppliers and tourists (consumers).
The information technologies are the main enabler for practical implementation of MC and OI. But they are just an enabler. Their influence in the realm of tourism is the subject of much research, but the problems of MC and OI have not been solved rationally yet.
In this work we propose an improvement of the tourist services by the development of integrated knowledge management system: potential possibilities for offering of MC and OI in tourism are investigated and analyzed, and a framework of Internet based MC and OI offering system is discussed.

MC AND OI – CURRENT SITUATION

According to [3] MC is a "vision… to perform company's processes in a truly customer-centric manner… resulting in products corresponding to needs of individual customer… without surpluses associated with customization". MC current situation is described in the [3] conclusions as:

- *the MC concept has not yet taken off despite its immense potential;*
- *it have to be payed attention to the gap between research in the MC field and its practical implementation;*
- *the bulk of the MC focus has been on product design and configuration;*
- *the supply and logistics aspect which also forms a vital component of MC needs more focus too.*

OI contemporary situation is clearly represented in [4]. The finding of a study conducted by Grant Thornton International is that alongside its managers, researchers, and development engineers, a company's most important source of ideas is its own customers. "Almost half of all respondents in the Asia Pacific region said customers were an important source of innovation, compared to 40 % in Western Europe, and 35 % in the U.S. Moreover, a significant proportion of respondents worldwide identified open innovation as successful and a strategy that they will continue to adopt. At 35 %, agreement with this claim was highest in Western Europe, compared to 30 % in North America, the original home of open innovation". The results of this study about the origins of the best ideas and companies opinion about the OI are represented on Table 1 and 2.

NONAKA'S KNOWLEDGE CREATION FRAMEWORK

According to Professor Ikujiro Nonaka [5], knowledge creation is a spiraling process of interactions between explicit (codified knowledge that can be transmitted in formal, systematic language) and tacit knowledge (it is highly personal and hard to formalize; it contains subjective insights, intuitions and hunches; it is deeply rooted in and individuals' actions and experience as well as in the ideals, values, or emotions he or she embraces). The differences between these two types of knowledge are shown in Table 3 [6]. The interactions between the explicit and tacit knowledge lead to the creation of new knowledge. Nonaka's SECI knowledge creation model [5] is shown on Fig.1 (SECI come from Socialization, Externalization, Combination, Internalization).

Table 1. Origins of the Best Ideas

By region: percentage of companies surveyed	Worldwide	Asia /Pacific	North America	Western Europe
Consumers	41	48	35	40
Heads of business units	35	43	35	28
Employees	33	31	33	34
In-house R&D team	33	30	34	34
CEO	27	24	28	28
Business partners and suppliers	26	31	21	28
Sales	17	17	13	22

Table 2. Companies' Opinions of Open Innovation

By region: percentage of companies surveyed	Worldwide	Asia/ Pacific	North America	Western Europe
We have successfully applied the concept and will continue to do so.	33	34	30	35
Have never heard of it.	16	15	19	14
Never considered it - our own intellectual property is too valuable to share.	14	11	14	16
Explored the concept but can't benefit from it.	13	11	14	14
Open innovation is too complicated or expensive for us to adopt.	11	13	9	10
Appointed internal specialists to work on open innovation strategy.	8	8	8	8
Applied it in the past without success and will not consider again.	6	8	5	4

Table 3. Two types of knowledge

Explicit Knowledge (objective)	Tacit Knowledge (subjective)
Knowledge of rationality (mind)	Knowledge of experiences (body)
Sequential Knowledge (there and then)	Simultaneous Knowledge (here and now)
Digital Knowledge (theory)	Analog Knowledge (practice)

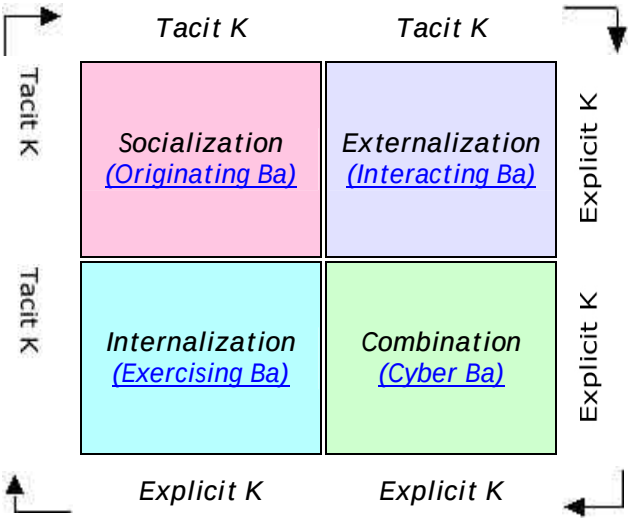

Fig. 1. Nonaka's SECI Model

Knowledge creating process consists of 3 elements:

A. SECI
B. Ba
C. Knowledge assets

The knowledge assets (C) are mobilized and shared in 'Ba' (B) whereas the tacit knowledge held by individuals is converted and amplified by the spiral of knowledge

through: Socialization, Externalization, Combination and Internalization (A).

The four modes of knowledge conversion interact in the spiral of knowledge creation (A):

A.1. Socialization.

Sharing tacit knowledge through face-to-face communication or shared experience. Without written or verbal instructions, the tacit knowledge is exchanged through join activities – such as being together, spending time and living in the same environment. An example is an apprenticeship.

A.2. Externalization.

Externalization requires the expression of tacit knowledge and its translation into comprehensible forms that can be understood by others. It is related to the development of concepts, which embed the combined tacit knowledge and which enable its communication.

A.3. Combination.

Combination involves the conversion of explicit knowledge into more complex sets of explicit knowledge. Building a prototype is an example about the combination of various elements of explicit knowledge.

A.4. Internalization.

Closely linked to learning by doing, the explicit knowledge becomes part of the individual's knowledge base (e.g. mental model). This requires the individual to identify the knowledge relevant for one's self within the organizational knowledge. Learning by doing, training and exercises allow the individual to access the knowledge realm of the group and the entire organization.

'Ba' (there is no exact translation of the word) is difficult concept and can be defined as a shared context in which knowledge is shared, created and utilized through interaction. Various types of Ba are given on the Fig.1 in Italic and within brackets:

B.1. Originating Ba.

It is the world where individuals share feelings, emotions, experiences and mental model. Physical and face to face experiences are the key to conversion and transfer of tacit knowledge. Example of the Originating Ba is the shop floor, it enables people to interact with each other and with customers.

However, without physical contact or any socialization, knowledge can be created by using the advanced technology nowadays (for example, the virtual world like Internet with its facilities). The advanced technology nowadays aids to provide easier real time communication.

B.2. Interacting Ba.

Through dialogue, individual's mental models and skills are converted into common terms and concepts. This is the place where tacit knowledge is made explicit, thus it represents the externalization process. Dialogue is key for such conversions. If we use the example with the shop as for originating Ba, interacting Ba can be explained with the usage of tacit knowledge of local employees for creation of sales forecasts, in dialogue with each other.

B.3. Cyber Ba.

It is a place of interaction in a virtual world instead of real space and time. It represents the combination phase.

Here, the combining of new explicit knowledge with existing information and knowledge generates and systematizes explicit knowledge. The combination of explicit knowledge is most efficiently supported in collaborative environments utilising information technology. And as example about Cyber Ba (again a shop related example): the forecasts of sales are tested against the sales results and are fed back to the local stores.

B.4. Exercising Ba.

This Ba is more of learning process in each individual. Thus, it is important from the knowledge creation in own individual. Exercising Ba supports the internalisation phase. It facilitates the conversion of explicit knowledge to tacit knowledge. Focused training with senior mentors and colleagues consists primarily of continued exercises that stress certain patterns and working out of such pattern. Thus the internalisation of knowledge is continuously enhanced by the use of formal knowledge (explicit) in the real life or in the simulated applications.

The SECI model that correspond to Exercising Ba is Internalization

Example: by using of explicit information, and comparing it to reality, staff of the shop improve their skills and ability to make the forecasts.

Knowledge assets (C) are company-specific resources that are indispensable to create values for the firm. They are the inputs, outputs, and moderating factors, of the knowledge-creating process.

TOURISM – SIMULATION AND MODELING

Useful information about the contemporary technology tools for tourism and community planning are represented on [7]. Google Maps, Earth, and SketchUp are a very appropriate examples about the contemporary development of such technologies tools.

Google has recently released the latest and greatest version of their free popular geographic information package. This version bring a whole host of new features, including the ability to make 3D building models for Google Earth, to look at historical imagery, underwater viewing and etc.

Just for testing their possibilities we downloaded Google Earth [8] and about 30 minits after installing it we already had own experimental own mini tour of Sofia city. By using the feature "record a tour" option, which lets you track a session (including zooming and panning) while recording commentary we created a .kmz format file, which can be shared via email, posted on a website or blog, or distributed to anyone else for viewing in Google Earth. On Fig.2 a) and b) below are shown screens parts from the created tour.

This feature assures a very neat way to create your own tours and could be used in all sorts of social media tourism advertising content. We can imagine tourists, operators, and locals all creating their rich narratives of a location using such kind of functions and tools.

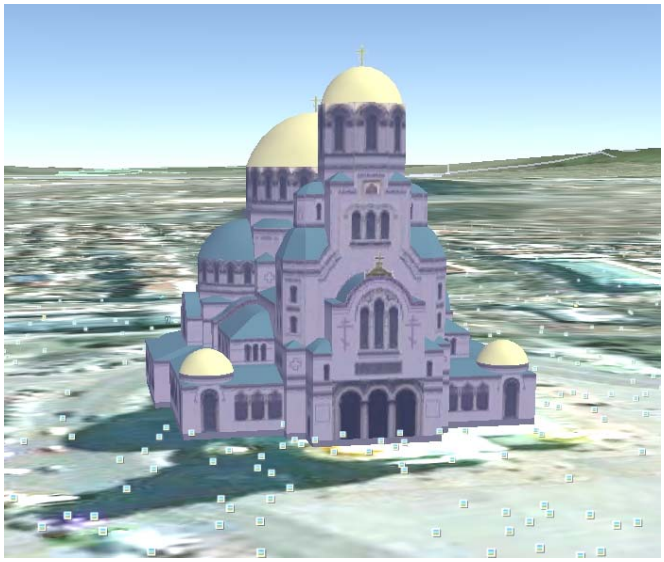

Fig. 2. a) Alexander Nevsky Cathedral

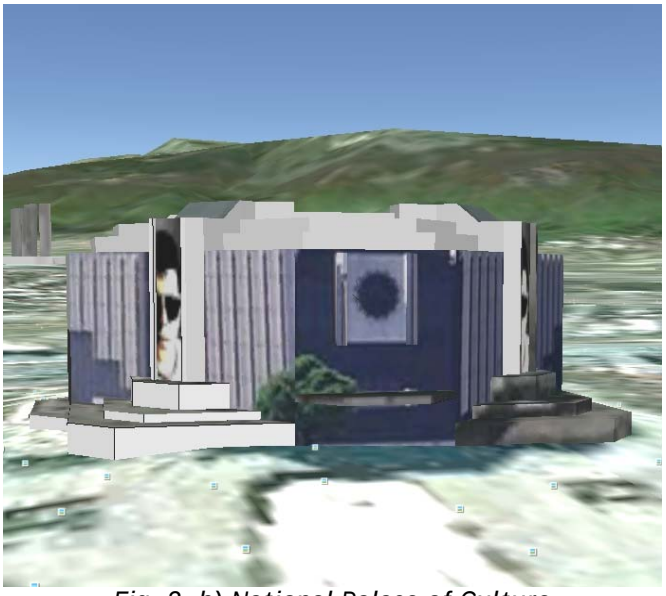

Fig. 2. b) National Palace of Culture
Fig. 2. a), b) Google Earth tour of Sofia city

Our experiment is an example and it shows that nowadays technologies related to tourism give enough facilities for easy preparation of web-based presentations with good quality. It is very easy to put together a tour of your favorite touristic spots. You really need to pick a location with nicely rendered 3-D buildings (like the examples shown on Fig. 2) to be able to communicate much with the tour. So, the development of information technologies is significant and it is very easy to use them for modeling and simulation, but here we have to underline that their integration with other systems and modules is not still rationally realized.

INTERNET OFFERING OF MC AND OI IN TOURISM AND WEB-BASED KNOWLEDGE STRUCTURING

Our work aims to improve the tourist services by the development of integrated knowledge management system (with the integration of MC, OI, Simulation and Modeling, calculation and other tools).

Potential possibilities for offering of MC and OI in tourism are investigated and analyzed, and a framework of Internet based MC and OI offering system is proposed.
With our proposal we aim to provoke the creativity of the users (firm's members, consumers, business partners and suppliers) by assuring all necessary Internet technologies for discussions with voting, sending and storing of many kinds of information: video, audio, text, models of products and services and etc. Users have to be informed that the things are not so strongly defined and they have the freedom to propose something different.
We believe that breaking the boundaries between routine and innovative area can be caused easily by collecting and structuring information of any kind of what awaits us after crossing the border (see Fig.3.).

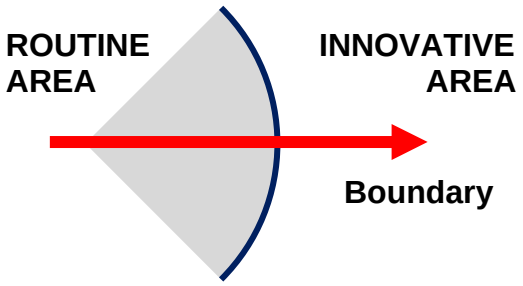

Fig. 3. Innovative action

We also have the objective of creating greater opportunity for the emergence of the barrier following events by implementing the organizational unit of the system to deal with different combinations and flexible management.
The ability to create, transfer, assemble, integrate, protect and exploit knowledge assets is a main factor for the existence and successful work of the companies. The knowledge base of the firm includes its competences, its knowledge of consumer needs and supplier (and/or partners) capabilities [9]. Our work aims to combine the advantages of MC, OI, Nonaka's knowledge creation model and contemporary Web based means for the development of integrated knowledge management system for tourism.
To effectively manage knowledge creation and exploitation, a company has to 'map' its inventory of knowledge assets. Cataloguing is however not enough: knowledge assets are dynamic; new knowledge assets can be created from existing knowledge assets.
Two important constraints in the tourism business are geographical location (place) and time related to the concrete touristic schedule (relative time). They play basic role in the proposed here framework. Inovative proposals or just partial information related to the diferent geographical locations can be captured through Internet. The firm members, consumers, suppliers and partners can add new information or discuss already published one by the proposed web based system on suitable manner for SECI knowledge creation model. A framework of our proposal is shown on Fig. 4.

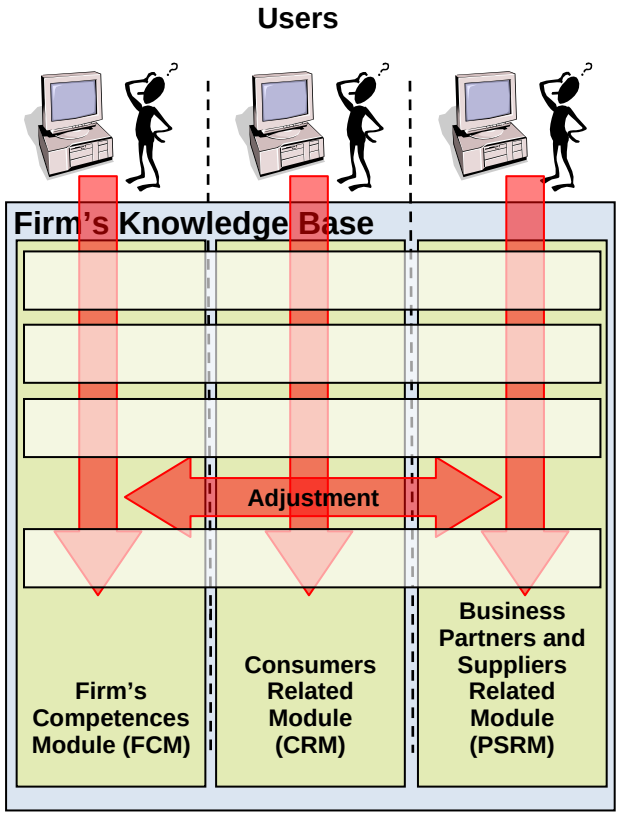

Fig. 4. Knowledge base of firm – a framework of Web based knowledge structuring for Tourism

The realization of such a system, shown on Fig. 4, will provide structured information corresponding to the location and user, which information subsequently can be relatively easily used for calculation of costs, resources and adjustments on time schedule. The innovative proposal (for example new attraction, destination and etc.) can be initiated by every one user and became the real touristic service after users discussion and approval. Following the initiation of an innovative proposal it is necessary to specify the information as it is used to add knowledge until the moment when the proposal become the recipe of routine area.

CONCLUSION

Involvement of users in the open inovation process in touristic business by a web-based knowledge structuring integrated environment represents a perspective solution for increase the efficiency of touristic firms in today's competitive global economy. We can conclude by pointing following expected results related to proposed framework for Web-based knowledge structuring:

- *our proposal aims to combine the advantages of contemporary information technologies, MC and OI, and knowledge management theories;*
- *it saves time and costs, reduces the effort in respect to the solving remotely MC and OI problems and improves the quality of touristic services;*
- *our proposal aims to assure the overcoming of the negative effects of the communicational fragmentation of the usage of different tools by the development of an integrated environment;*
- *users' knowledge and direct participation in the MC and OI brings different users' attitudes towards buying decision making.*

REFERENCES

[1.] *F. Piller, K. Möslein, "From Economies of Scale towards Economies of Customer Interaction: Value Creation in Mass Customization Based Electronic Commerce", Proceedings of the 15th Bled Electronic Commerce Conference eReality: Constructing the eEconomy, Bled, Slovenia, June 17 - 19, 2002, pp.214-228.(in english)*

[2.] *H. Chesbrough, "Open Innovation: The New Imperative for Creating And Profiting from Technology", Harvard Business School Press, Boston, 2003.(in english)*

[3.] *A. Nambiar, "Mass Customization: Where do we go from here?", Proceedings of the World Congress on Engineering 2009 Vol I WCE 2009, London, U.K., July 1 - 3, 2009, pp. 687-693.(in english)*

[4.] *N. Wohllaib, "Open Innovation/Facts and Forecasts", Pictures of the Future (The Magazine for Research and Innovation), Siemens, Spring 2010, pp.99.(in english)*

[5.] *http://www.cyberartsweb.org/cpace/ht//thonglipfei/nonaka_seci.html, "Nonaka's Knowledge Creation Framework", accessed July 2010.(in english)*

[6.] *R. Abdullah, K. Zamli, M. Selamat, "Collaborative Knowledge Management System for Eco-Tourism", International Journal of Computer Science and Network Security, VOL.9 No.2, February 2009, Seoul, Korea, 2009, pp. 409-416.(in english)*

[7.] *http://toursim.wordpress.com,"Tourism Simulation and Modeling - Technology tools for tourism and community planning", accessed July 2010.(in english)*

[8.] *http://earth.google.com/download-earth.html, "Download Google Earth", accessed July 2010.(in english)*

[9.] *D. Teece, "Managing Intellectual Capital (Organi-zational, Strategic, and Policy Dimensions)", Oxford University Press, New York, 2002.(in english)*

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SPUR GEAR DRIVES WITH ASYMMETRIC INVOLUTE–LANTERN MESHING

ABSTRACT:
A new asymmetric meshing has been proposed, formed by spur gears with a very small number of teeth where the transverse contact ratio is bigger than one. The meshing in the general case where the gears have different number of teeth has been clarified. The main geometric parameters have been defined. The equations of the tooth profiles have been determined. Analytic dependencies for the geometric dimensions of the gears have been shown. The geometric parameters of the asymmetric gear drive have been found.

KEYWORDS:
Spur gear, Asymmetric teeth, Involute – lantern meshing, Pressure angle, Protruding profile, Concave profile

INTRODUCTION

The use of spur involute gears for continuous transmission of rotary motion is limited in cases where teeth number z of the pinion (the small gear) is very small (z = 4,3,2,1). Then the transverse contact ratio ε_α is smaller than one and after a specified gear pair goes out of meshing the next gear pair still has not meshed. Due to the small contact ratio the movement in the gear is interrupted. In practice this means that using the traditional involute meshing it is not possible to realize continuous transmission of motion from the one gear to the other one if gears have a very small teeth number.

If the gear meshing is involute and symmetric, in [Alipiev et al., 2009] it is proved that at $\varepsilon_\alpha > 1$ the smallest equal teeth number of the gears is e $z_1 = z_2 = 5$. This result, got in different ways, is well-known also by the publications of [Kotelnikov, 1973], [Bulgakov, 1995] and [Kapelevich et al., 2002]. When the asymmetric involute meshing is used [Alipiev, 2008] for the smallest equal teeth number of the gears, synthesized using the "method of the realized potential" [Alipiev, 2009] it is got $z_1 = z_2 = 4$. In this case the opposite lateral teeth profiles are drawn by different involute curves. Then the transverse contact ratio for the driving direction of movement is $\varepsilon_\alpha > 1$, and for the non-driving direction - $\varepsilon_\alpha^{\wedge} < 1$.

Gears of a small teeth number find practical application mainly in gear pumps, gear compressors, kinematic transmissions, realizing large tooth ratios, some types of elevating mechanisms etc. Under equal other conditions (dimensions, weight, width of gears), the small teeth number leads to an increase of the volume of tooth spaces and an increase of the efficiency of the gear pump. Besides, by decreasing the teeth number of the pinion and keeping the tooth space of the gear, its tooth ratio increases.

An object of survey in the present paper is the geometry of a new type of asymmetric meshing where the continuous transmission of motion ($\varepsilon_\alpha > 1$) in the driving direction is realized by gears, having a very small teeth number.

GENERAL DATA FOR THE MESHING

The transverse contact ration in the driving direction of motion could be increased if an asymmetric meshing shown on Figure 1 [Alipiev, 2010] is used. In this case the asymmetric teeth of the meshed gears have a protruding and concave sides. Despite the geometric shape of each tooth of the generally different gears 1 and 2 is simply defined by three successively connected curves. The first curve, shaping the protruding (driving) tooth side is the involute curve ME ($M'E'$). It is got as a trajectory of point K on the straight line AB, when this straight line rolls on the respective base circle of a radius r_{b1} or r_{b2}. The beginning of the first curve begins from the base circle, and its end ends in the point E (E'). Using the second curve is shaped the tooth crest in the area from point E (E') to point N (N'). This curve is an arc of a circle (called lantern one) of a radius r_{p1} (r_{p2}), of a center C_1 (C_2) at a distance of r_{c1} (r_{c2}) from the gear center O_1 (O_2).

Despite the center C_1 (C_2) lies on the tangent to the base circle of the respective gear, descended from the end point E (E') of the involute curve.

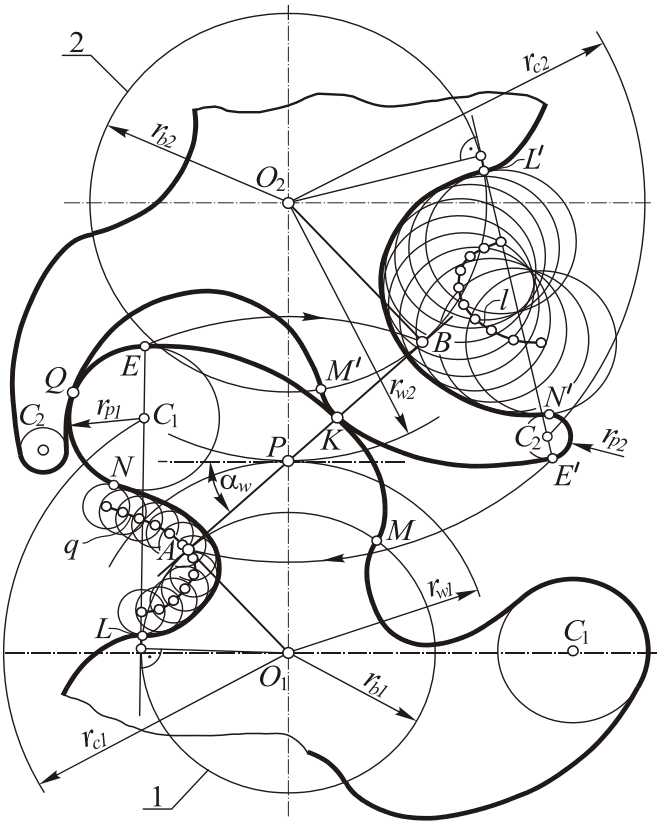

Figure 1. Formation of involute-lantern meshing

The third curve NL ($N'L'$) shapes the concave side of the asymmetric tooth. At gear 1 this curve NL is got as a wrapping curve of the relative places which the tooth crest gets (the lantern circle of a radius r_{p2}) from gear 2 in the plane of gear 1. Analogously the curve $N'L'$ of the tooth of gear 2 is got as a wrapping curve of the lantern circle of a radius r_{p1} of gear 1. The end point L (L') of the third curve lies on the respective base circle r_{b1} (r_{b2}) and appears as an initial point for the involute profile of the next neighbouring tooth.

The provision of maximum overlap by meshing of the involute profiles is got due to their contact along the whole line of action AB. For this purpose the areas of the involute teeth profiles are chosen in this way that the кръговите trajectories EB and $E'A$ of their end points E and E' cross the end points B and A of the action line, and their initial points M and M' lie on the corresponding base circles.

The proposed gear meshing is called an „involute-lantern meshing", because in the driving direction of motion the conjugate profilers are the meshed involute curves ME and $M'E'$, and in the opposite direction mesh the arc EN ($E'N'$, respectively) of the lantern circle of the one gear of the concave profile $L'N'$ (LN, respectively) of the asymmetric tooth of the other gear. In other words, in the one direction of movement the meshing is involute and in the other one - lantern. Hence the lantern meshing is corrected since the centers C_1 and C_2 of the lanterns do not lie on the respective centroids of the gears when realizing the gear meshing, defined as pitch circles of radii r_{w1} and r_{w2}. In contrast to the traditional lantern meshing where the tooth profile of the one gear is a circle and of the other one - an equidistant curve of a epicycloid, in the proposed meshing the non-involute teeth profile is a combination of two connected curves (concave profile and an arc of a circle).

EQUATION OF THE TEETH PROFILES

The geometry of asymmetric gear profiles is fully determined if the following independent values (Figure 1) are specified: teeth number z_1 and z_2 of both gears; the radii of the pitch circles r_{w1} and r_{w1}; the radii of the lantern circles r_{p1} and r_{p1}; the radii r_{c1} and r_{c1}, on which are placed the centers of the lanterns; the pressure angle of the involute meshing α_w.

In order to provide expression in scale of all geometric dimensions, coming from the experience in the theory of the traditional involute meshing, eit is more rational to use another set of independent values, including: the gearing module m; teeth number z_1 and z_2; the coefficients r_{p1}^* and r_{p2}^* of the radii of the lantern circles, the coefficients λ_1 and λ_2 of the shape of the concave teeth profiles; the angle of involute meshing α_w. In this set of parameters, z_1, z_2, r_{p1}^*, r_{p2}^*, λ_1 and λ_2 cre dimensionless values, and the module m is a scale factor. The relation between the real linear dimensions and the corresponding dimensionless values from the above mentioned two sets is defined by the following equations:

$$r_{w1} = m\,z_1/2\,, \qquad r_{w2} = m\,z_2/2\,, \tag{1}$$

$$r_{p1} = m\,r_{p1}^*\,, \qquad r_{p2} = m\,r_{p2}^*\,, \tag{2}$$

$$r_{c1} = \lambda_1 r_{w1} = m\,\lambda_1 z_1/2\,, \qquad r_{c2} = \lambda_2 r_{w2} = m\,\lambda_2 z_2/2\,. \tag{3}$$

In the proposed meshing, as it was already mentioned, the opposite lateral teeth profiles are drawn by two different curves. Hence by the curves, shaping the protruding teeth side, a continuous motion in the driving direction of motion is being transmitted, and by the other curves if being shaped the concave teeth side.

- Protruded profiles. For their drawing an involute curve is being used. In the co-ordinate system XOY (Figure 2) the parametric equation of the involute ME is of the type

$$\left.\begin{aligned} X_i &= -r_i \sin\delta_i \\ Y_i &= r_i \cos\delta_i \end{aligned}\right\} \tag{4}$$

where r_i is the polar radius of the current point i of the curve, and δ_i - its polar angle.

From the theory of involute meshing [Litvin, 1968] it is known that

$$r_i = \frac{r_b}{\cos\alpha_i}\ , \qquad (5)$$

$$r_b = 0{,}5 m z \cos\alpha_w\ . \qquad (6)$$

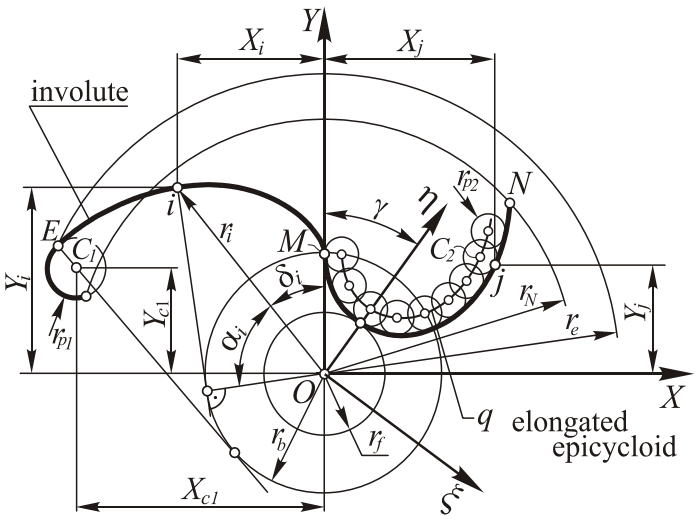

Figure 2. Geometry of teeth profiles

Taking into consideration equations (5) and (6) for the parametric equations of the involute curve finally is got and α_i *is the angular para-*

$$\left.\begin{aligned} X_i &= -0{,}5\, m\, z \cos\alpha_w \sin\delta_i / \cos\alpha_i = X_i(\alpha_i) \\ Y_i &= 0{,}5\, m\, z \cos\alpha_w \cos\delta_i / \cos\alpha_i = Y_i(\alpha_i) \end{aligned}\right\} \quad (7)$$

where $\delta_i = \mathrm{inv}\,\alpha_i = \tan\alpha_i - \alpha_i$,

meter of the curve. At $z = z_1$ *with equations (7) are got the coordinates of the profile points* ME *of the gear 1, and at* $z = z_2$ *- the profile* $M'E'$ *(Figure 1) of the gear 2.*

- Concave profiles. The concave profile of the asymmetric teeth is got in the following way. To the plane of the circle r_{w2} *of gear 2 (Figure 1) the point* C_2 *is immovably connected. When this circle rolls without friction on the circle* r_{w1} *point* C_2 *draws the curve* q *in the plane of gear 1. Analogously the point* C_1 *of the plane of the circle* r_{w1} *draws the curve* l *in the plane of gear 2.*

By formation of the lantern meshing as theoretical teeth profiles could be assumed:

a) point C_2 *of gear 2, b) the curve* q *of gear 1. The equations of the curve* q *in the coordinate system* $\xi O \eta$ *shown in Figure 2 are written in the following way:*

$$\left.\begin{aligned} \xi_{qj} &= \frac{m}{2}\left[(z_1+z_2)\sin\varphi_j - \lambda_2 z_2 \sin\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right)\right] \\ \eta_{qj} &= \frac{m}{2}\left[(z_1+z_2)\cos\varphi_j - \lambda_2 z_2 \cos\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right)\right] \end{aligned}\right\} \quad (8)$$

As by drawing the curve q *the rolling circles* r_{w1} *and* r_{w2} *(Figure 1) contact externally, and the drawing point* C_2 *lies outside the circle* r_{w1}, *the got curve* q *is an elongated epicycloid.*

In fact with gearings instead of the theoretical profiles are used their equidistant curves (equally spaced curves on the profile normals): a) the circle of a radius r_{p2} *for gear 2, b) the curve* MN *for gear 1. The equation of the curve* MN *in the same coordinate system* $\xi O \eta$ *in this case is written as follows:*

$$\left.\begin{aligned} \xi_j &= \frac{m}{2}\left\{(z_1+z_2)\sin\varphi_j - \lambda_2 z_2 \sin\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right) - \right. \\ &\left. - \frac{2r^*_{p2}\left[\lambda_2 \sin\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right) - \sin\varphi_j\right]}{\sqrt{1 - 2\lambda_2 \cos\frac{z_1}{z_2}\varphi_j + \lambda_2^2}}\right\} \\ \eta_j &= \frac{m}{2}\left\{(z_1+z_2)\cos\varphi_j - \lambda_2 z_2 \cos\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right) - \right. \\ &\left. - \frac{2r^*_{p2}\left[\lambda_2 \cos\left(\frac{z_1}{z_2}\varphi_j + \varphi_j\right) - \cos\varphi_j\right]}{\sqrt{1 - 2\lambda_2 \cos\frac{z_1}{z_2}\varphi_j + \lambda_2^2}}\right\} \end{aligned}\right\} \quad (9)$$

Out of the way of formation of the concave profile MN *of the tooth of gear 1 it follows that equations (9) are equations of an equidistant curve of an elongated epicycloid.*

Analogously are found the equations of the concave profile of gear 2. In this case the equations are got directly from equations (9), after replacing z_1 *with* z_2, z_2 *with* z_1, λ_2 *with* λ_1 *and* r^*_{p2} *with* r^*_{p1}.

In order to find the coordinates of the concave profile in the same coordinate system, in which the protruded profile is specified, it is necessary that the curve MN *rotates at an angle* γ. *Then after the respective transformation between the coordinate systems* $\xi O \eta$ *and* XOY *finally the following equations for* MN *in* XOY *are got*

$$\left.\begin{aligned} X_j &= \xi_j \cos\gamma + \eta_j \sin\gamma = X_j(\varphi_j) \\ Y_j &= -\xi_j \sin\gamma + \eta_j \cos\gamma = Y_j(\varphi_j) \end{aligned}\right\} \quad (10)$$

In which the coordinates ξ_j *and* η_j *are preliminary defined from equations (9). The value of the angle* γ *is found in a numerical way. For the purpose from equation*

$$\xi_j^2 + \eta_j^2 = r_b^2\ . \qquad (11)$$

Taking into consideration equations (6) and (9), the parameter φ_j *for the coordinates of point* M *is defined, afterwards from equation*

$$\gamma = \mathrm{arctg}(\xi_j / \eta_j) \qquad (12)$$

the angle γ *is got.*

BASIC GEOMETRICAL DEPENDENCES

The basic geometrical dimensions of gears and the parameters of the involute gearing are defined using Figure 3. In the same figure are shown also the lines of action, got as a geometric place of the contact points of asymmetric gear profiles in the still plane.

The straight line AB, as it was mentioned, is the line of action between the involute profiles. Its slope is defined by the pressure angle α_w, and its end points A and B coincide with the contact points of the straight line $N-N$ and the base circles r_{b1} and r_{b2}. In the proposed gearing the actual line AB of the involute meshing coincides with the theoretical line of action, by reason of that it has a maximum length. The contact of the concave profiles with the teeth crests (engaged in the lantern meshing) is realized over two lines of action - AQ and BR. The line of action AQ corresponds to the contact points between the concave tooth profile of gear 1 and the lantern circle (of a radius r_{p2}) of gear 2. Analogously, along the line of action BR contact the concave profile of gear 2 with the lantern circle (of a radius r_{p1}) of gear 1. The end points Q and R of the lines of lantern action are defined from the place of the boundary points N_1 and N_2.

- Pitch circles. By realizing the gear meshing the pitch circles, as centroids in the gearing, roll one over another without sliding. The diameters d_{w1} and d_{w2} of these circlesa are defined by the equations

$$d_{w1}=2r_{w1}=m\,z_1\,,\qquad d_{w2}=2r_{w2}=m\,z_2\,. \quad (13)$$

- Line of involute meshing. Its length l_{AB} is equal to the straight line AB. Taking into consideration the rectangular triangles PAO_1, PBO_2 and equations (13), for the straight line of action the following formula is got

$$l_{AB}=l_{AP}+l_{BP}=0{,}5m(z_1+z_2)\sin\alpha_w\,. \quad (14)$$

- Pressure angles in the end points of the involute curves. As it was already mentioned the place of the end points e_1 and e_2 of the involute profiles are defined so that the circles of radii r_{e1} and r_{e2} should cross the end points B and A of the line of lantern action. In this case from Figure 3 it is directly seen that $\overline{AB}=\overline{e_1b_1}=\overline{e_2b_2}$. Then from the rectangular triangles $e_1b_1O_1$, $e_2b_2O_2$ and equations (14) and (6) for the pressure angles α_{e1} and α_{e2} of the end involute points the following formulas are got

$$\mathrm{tg}\alpha_{e1}=\frac{l_{AB}}{r_{b1}}=\frac{z_1+z_2}{z_1}\mathrm{tg}\alpha_w\,,\ \mathrm{tg}\alpha_{e2}=\frac{l_{AB}}{r_{b2}}=\frac{z_1+z_2}{z_2}\mathrm{tg}\alpha_w\,. \quad (15)$$

- Radii of the end points of the involutes. From the triangles $e_1b_1O_1$, $e_2b_2O_2$ it follows that

$$r_{e1}=\sqrt{r_{b1}^2+l_{AB}^2}\,,\qquad r_{e2}=\sqrt{r_{b2}^2+l_{AB}^2}\,. \quad (16)$$

- Radii of the centers of the lantern circles. The centers C_1 and C_2 of the lantern circles lie on the normal of the involute curves, dropped from their end points e_1 and e_2. In order to define their position it is necessary preliminary to find the radii of the lantern circles. The calculation of r_{p1} and r_{p2} is done by numerical method, providing the simultaneous of the lantern circle with the concave and protruded tooth profile.

The value of the radii r_{c1} and r_{c2} to the centers of the lantern circles are defined by triangles $C_1b_1O_1$ and $C_2b_2O_2$, whence

$$r_{c1}=\sqrt{r_{b1}^2+(l_{AB}-r_{p1})^2}\,,\ r_{c2}=\sqrt{r_{b2}^2+(l_{AB}-r_{p2})^2}\,. \quad (17)$$

- Addendum circles. They are defined as distances from the center of the corresponding gear to its most distant tooth point. In the discussed case the radii r_{a1} and r_{a2} of the addendum circles are equal to the corresponding straight lines O_1a_1 and O_2a_2, i.e.

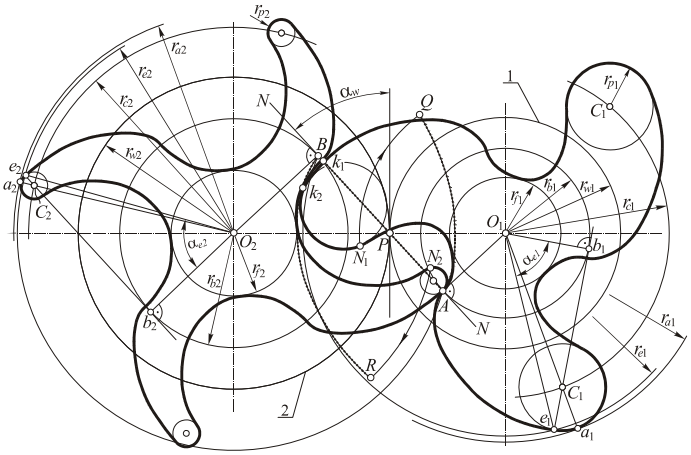

Figure 3. Asymmetric involute-lantern meshing $z_1=3$, $z_2=4$

$$r_{a1}=r_{c1}+r_{p1}\,,\qquad r_{a2}=r_{c2}+r_{p2}\,. \quad (18)$$

- Internal circles. They are defined by the formulas

$$r_{f1}=a_w-r_{a2}\,,\qquad r_{f2}=a_w-r_{a1}\,, \quad (19)$$

where $a_w=r_{w1}+r_{w2}=0{,}5m(z_1+z_2)$ is the centre distance of the gearing.

- Transverse contact ratio for the involute meshing. As the contact between the involute profiles is realized along the whole line of action, for the transverse contact ratio the following formula is effective

$$\varepsilon_\alpha=(z_1+z_2)\,\mathrm{tg}\,\alpha_w/2\pi\,. \quad (20)$$

CONCLUSION

With the proposed asymmetric meshing is overcome the shortcoming of the involute meshing, related to the impossibility the meshed gears to have a small teeth number.

In the present paper is shown that in case asymmetric involute-lantern meshing is used, with elongated involute profiles, there appears the possibility to provide continuous transmission of the motion in the driving direction by a very small teeth number.

REFERENCES

[1.] *Alipiev O.: Spur gearing with internal gearing. Patent application 110302 /06.01.2009. Bulgaria*

[2.] *Alipiev O.: Geometric design of involute spur gear drives with symmetric and asymmetric teeth using the Realized Potential Method , Mechanism and Machine Theory, "Elsevier", Vol. 46, № 1, 2011, p. 10-32,* http://www.sciencedirect.com/science/journal/0094114X

[3.] *Alipiev O.: Geometric calculation of involute spur gears defined with generalized basic rack. Theory of Mechanisms and Machines, 6 (2008) 2, Russia, pp.60-70,* http://tmm.spbstu.ru/12/alipiyev_12.pdf

[4.] *Vulgakov E.: Theory of involute gears. Mashinostroyenie, Moscow,1995, p.320*

[5.] *Kotelnikov V.: The smallest number of spur external teeth, cut with a non-standard rack-type cutter. Works of universities - Mashinostroyenie, 6, (1973), Russia p. 52-56*

[6.] *F.L. Litvin, A. Fuentes, Gear geometry and applied theory, Cambridge University Press, Cambridge, 2004, p.782*

[7.] *Alipiev O., S. Antonov, T. Grozeva, D. Zafi-rov. Minimum numbers of teeth in symmetric and asymmetric involute spur gearings of a teeth ratio equal to one. 3rd International conference "Power transmissions'09", Kallithea - Greece, 2009, p. 51-58*

[8.] *Kapelevich A., Kleiss R. Direct Gear Design for Spur and Helical Gears, Gear Technology, 10/11 (2002) p. 29-35*

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ADVANCED SIMULATION OF GAS METER COMPONENTS

ABSTRACT:
Gas meter has been modeled through many different simulation techniques in the recent times, suggesting new solution and giving new ways to minimize the material cost. In this project we will present an advanced simulation of the gas meter components, taking into account the maximum tensile strength and structural integrity. Our design presents a basic gas meter model to predict the behavior of structures while that it can withstand external & internal forces. Those points will be identified which are exceeding the limits of maximum tensile strength of the material. The result will show clear picture of the Von-Mises stresses, Strain, displacement and deformation. There are some inherent problems in simulation like time and memory consumption during analysis is huge. In this paper we shall analyze the gas meter and try to find a suitable solution for the inherent problems.

KEYWORDS:
Simulation, Boundary Conditions, Von Mises Stresses, Structural Integrity, Strain, Deformation

INTRODUCTION

A gas meter is used to measure the volume of fuel gases such as natural gas and propane. Gas meters are used at residential, commercial, and industrial buildings that consume fuel gas supplied by a gas utility. Gases are more difficult to measure than liquids, as measured volumes are highly affected by temperature and pressure. Gas meters measure a defined volume, regardless of the pressurized quantity or quality of the gas flowing through the meter. There are different types of gas meter used, Diaphragm meters, Rotary meters, Turbine meters, orifice meters and ultrasonic Flow meters. We will discuss and perform our simulation on the Diaphragm type only. The countermeasure of permanent deformation of Gas meter demands for detailed knowledge of its structural integrity and the properties of the material. For this reason, the combination of numerical and experimental simulation is a very promising way.

Simulation is the imitation of some real thing, state of affairs, or process. The act of simulating something generally involves representing certain key characteristics or behaviors of a selected physical or abstract system (Davis and Eisenhardt, 2007). Simulation is used in many contexts, including the modeling of natural systems or human systems in order to gain insight into their functioning. Other contexts include simulation of technology for performance optimization, safety engineering, testing, training and education. Simulation can be used to show the eventual real effects of alternative conditions and courses of action. In the future, CAE systems will be major providers of information to help support design teams in decision making (Carrol and Harrison, 1998).

EXPERIMENTAL WORK.

Structural Analysis of Measuring Unit

Structural analysis comprises the set of physical laws and mathematics required to study and predicts the behavior of structures. The subjects of structural analysis are engineering artifacts whose integrity is judged largely based upon their ability to withstand loads; they commonly include buildings, bridges, aircraft, and ships (Fakhir and Muzzaffar, 2009). Structural analysis incorporates the fields of mechanics and dynamics as well as many failure theories. From a theoretical perspective the primary goal of structural analysis is the computation of deformations, internal forces, and stresses. In practice, structural analysis can be viewed more abstractly as a method to drive the engineering design process or prove the soundness of a design without a dependence on directly testing it (Hartmann 1996).

Gas meter consist of three major components, Upper case, Lower case and measuring unit. Measuring unit is a part from where gas flows and the reading is measured. Figure 1 shows the outer surface of measuring unit on which we will do analysis so that it can withstand high external and internal forces.

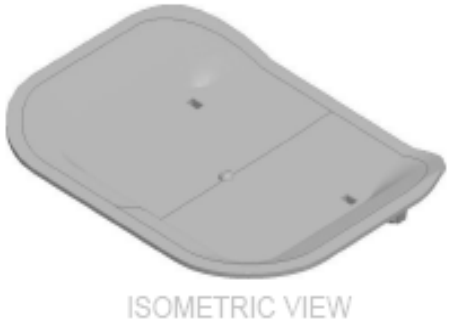

Figure 1. Isometric view of shell

Pre-Processing

Now to analyze the part on ANSYS Multiphysics 11.0, it is necessary to create a Mesh. Meshing means discretization of the whole part into number of elements. The finite element mesh subdivides the geometry into elements, upon which are found nodes. We need now to define the Material Properties and to apply the Boundary Conditions; we selected SOLID 92 as material type because it has a quadratic displacement behavior and is well suited to model irregular meshes. The element also has plasticity, creep, swelling, stress stiffening, large deflection, and large strain capabilities.

The material of the measuring unit is Acetal Copolymer F-20-02 and the properties are;

Tensile Modulus (Elastic Modulus) = 28,900 "Kg/cm^2"= 2832.2 "N/mm^2 "

Poisson's Ratio = 0.35

Material properties were then assigned to the model.

Applying Boundary Conditions

Boundary Conditions are the loads and constraints that represent the effect of the surrounding environment on the model. Loads can be forces, moments, pressures, temperatures, accelerations etc. Constraints resist the deformations induced by the loads (Law and Kelton, 1991). In our case, the load is applied on the two extrusions of the Shell through which the Measuring Unit is supported on the Lower Case. In figure 2 those areas are highlighted which are experiencing impact force due to direct contact with the lower case of the gas meter.

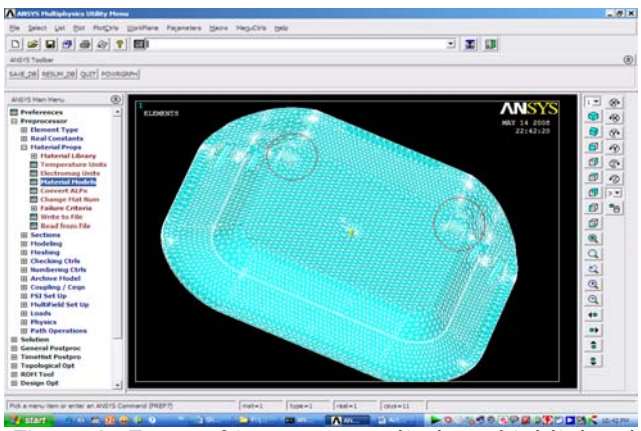

Figure 2. Force of impact is applied are highlighted

The impact pressure was than calculated from the laboratory by direct testing and it was found to be 15.6 "N/mm2". It should be noted here that since the extrusion are on the supports at half of their lengths, so the pressure applied at half of the area. Figure 3 shows the pressure applied on half of the extrusion of the model.

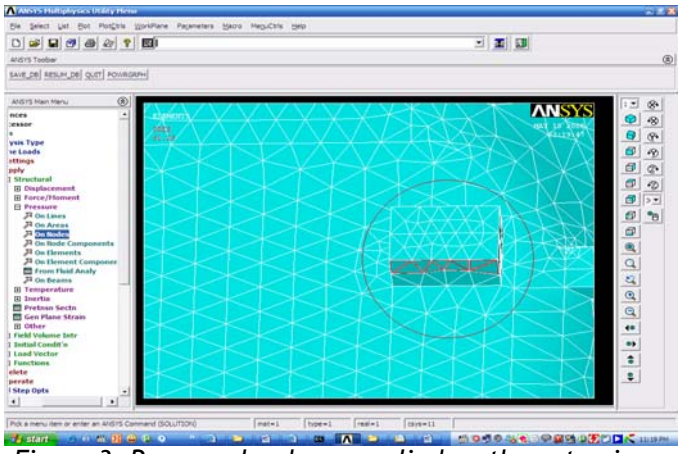

Figure 3. Pressure has been applied on the extrusion

Now, since the Shell is ultrasonically welded with the rest of the Measuring Unit, so the Degree of Freedom constraints were applied on the edges of the part as shown in Figure 4.

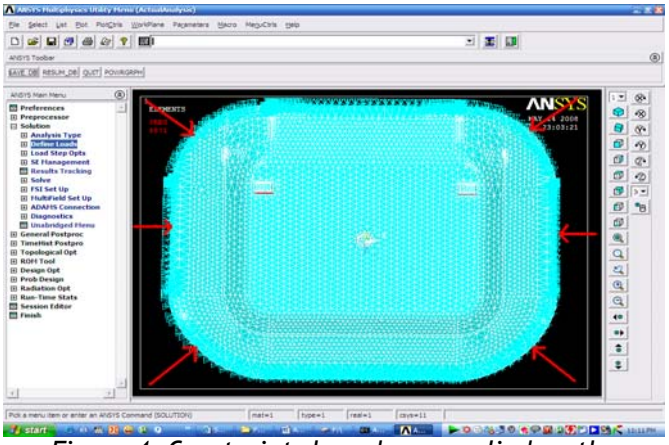

Figure 4. Constraints have been applied on the boundaries

SOLUTION

The solution is often a batch process, and is demanding of computer resource. The governing equations are assembled into matrix form and are solved numerically. The assembly process depends not only on the type of analysis (e.g. static or dynamic), but also on the model's element types and properties, material properties and boundary conditions (Repenning, 2002).

POST-PROCESSING

After a finite element model has been prepared and checked, boundary conditions have been applied, and the model has been solved, it is time to investigate the results of the analysis. This activity is known as the post-processing phase of the finite element method (Gani and Pistikopoulos, 2002).From Figure 5 it can be analyzed that the maximum deformation occurs at the two extrusions which are actually acting as the supports through which the Measuring Unit is mounted on the Lower Case.

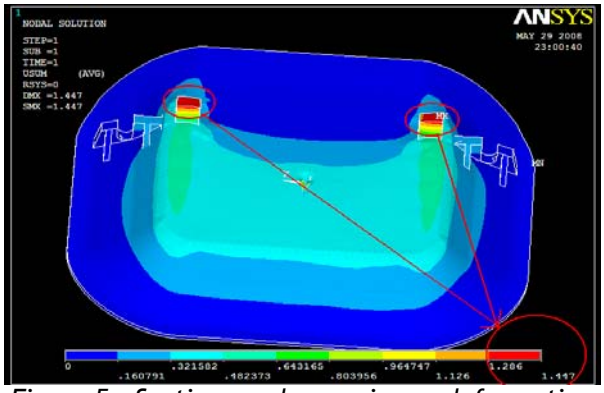

Figure 5. Sections under maximum deformation

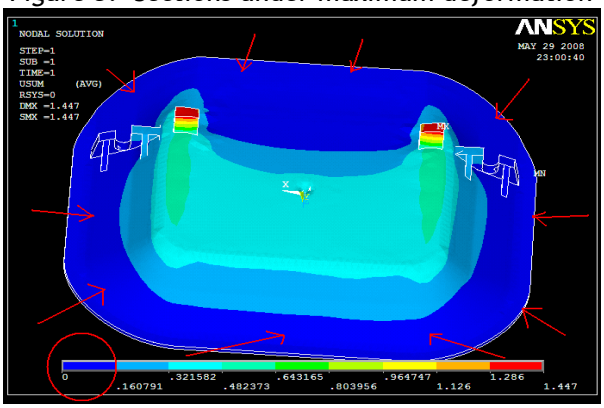

Figure 6. Edges experiencing no deformation

It is also worth noted that since the extrusions were subjected to direct force at half of their lengths, so only half of the length is under maximum deformation. It is observed during analysis that after the application of sudden load, both extruded entities are deformed up to major extent, causing the areas below them to deform, which resulted in the deformation in the middle-portion of the part. The complex contours besides the extrusion entities can be find minimizing and limiting the extent of Deformation.

Now since the corners of the Shell are Ultrasonically Welded with the Measuring Unit, Figure 6 shows that the corners and boundaries did not experience any deformation.

STRESSES

The result of key concern in this case was the stresses generated in the part, after the application of Impact force because these stresses were responsible for the cracks than fracture of the Shell.

From Figure 7, it can be observed that stresses are maximum near the base of extruded part and from then they propagates along the sharp geometry to the upper corner of the part. Now according the Material Specifications from the data sheet, the Tensile Strength of the Acetal Copolymer F20-02 is;

Tensile Strength = 61.25 "N/mm2".

Comparing the Tensile Strength with the stress bands, it can be noted that the stresses in the 'Red' band (SEQV = 55.549 "N/mm2"- 62.492 "N/mm2") are greater than the Tensile Strength of the material (UTS = 61.25 "N/mm2") so the fracture is certain here.

Red band is preceded by the bands in 'Orange' (SEQV = 48.605 "N/mm2"- 55.549 "N/mm2") and 'Yellow' (SEQV = 41.662 "N/mm2"- 48.605 "N/mm2"). The magnitude of these stresses is also enough to generate cracks.

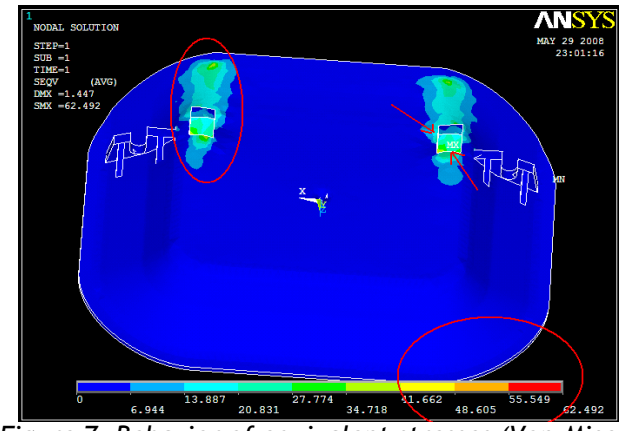

Figure 7: Behavior of equivalent stresses (Von-Mises) after the impact force has been applied

SOLUTIONS FOR THE PROBLEM

The problem of part fracture due to high forces can be solved from different alternative solutions, while modifying the design, we have to keep the modifications as simple as possible, so that the mold may require least amendments and the design changes may be implemented in shortest possible span of time. One solution is to increase the width of the extrusion but this need major changes in the design of the mold which require redesigning of the mold in the software, next step is to analyze the resigned mold on a software to justify the changes, all these steps consume much resources.

Another solution can be increasing the thickness of the extrusion which again requires amendments in the mold and the design changes may lead to the increase in cost and time. The third solution can be to support the extrusion by ribs which require great concentration in the design work because after seeing the current design of the Gas meter it is very difficult to design a rib but research has been done on ribs. So, assistance can be taken from previous research regarding the design of ribs on a complicated mold.

The fourth solution can be to fill the hole of the extruded part completely; this countermeasure needs to just machine the mold from the surface of the extrusion which will just need the cost of designing and machining. As computers become faster and computationally more powerful, the range of application for computer simulation and modeling has also expanded. These benefits should be utilized in the solution of the current problem.

CONCLUSION AND FUTURE WORK

We presented here a basic model of Gas meter and simulation results with Ansys Multiphysics. The problem with the current model is that it can not bear high external and internal forces.

The actual model was then physically tested in laboratory using Tensile Testing machine, the readings was than taken and utilized as input parameters on Ansys Multiphysics. Naturally the accuracy of computer simulation greatly depends on the quality of the input parameters, so laboratory testing was the important phase of the project. The results clearly show that the stresses (62.492 "N/mm^2") generate on the measuring unit was greater than its tensile stress (61.25 "N/mm^2"). Summarizing the four solutions presented, the last solution, to fill the hole of the extruded part completely is less cheap and achievable as it consumes less resources. In the future the reader can analyze the four designs presented or present his own design which should be efficient to design and implement.

The future is very bright for Simulation as it includes more efficient utilization of resource and cost saving from its increased efficiency. Indeed, in many fields, computer simulation is integral and therefore essential to business and research. Computer simulation provides the capability to enter fields that are inaccessible to traditional experimentation. It uses mathematical models and numerical solution techniques and using computers to analyze and solve scientific and engineering problems. By using the advanced simulation techniques in the future we can be able to design aircraft which has light weight, no need to build tunnel for physical testing of the wings of airplane. It can assist Fluid mechanics and heat transfer problems, the flow of material inside a mold can easily be controlled. This paper can also assist other engineering fields.

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REFERENCES

[1.] Carroll, G., & Harrison, J. R. 1998. Organizational Demography and Culture: Insights from a Formal Model and Simulation. Administrative Science Quarterly, 43: 637-667

[2.] Davis, J.P., Eisenhardt, K.M. & Bingham, C.B. 2007. Developing Theory with Simulation Methods. Academy of Management Review, 32(2), 580-599

[3.] Dr. Fakhir Hasani and Dr. Muzzaffar Mahmood, (2009). "Computational Fluid Dynamics Modeling in Narrow Obstructed Channels of Membrane Modules". 4th International Mechanical Engineering Congress, pp. 03.

[4.] Gani R., Pistikopoulos E.N., "Property Modeling and Simulation for Product and Process Design", Fluid Phase Equilib., 194-197, 43-59, 2002.

[5.] Law, A. M., & Kelton, D. W. 1991. Simulation Modeling and Analysis (2nd ed.). New York, NY: McGraw-Hill.

[6.] Repenning, N. 2002. A Simulation-Based Approach to Understanding the Dynamics of Innovation Implementation. Organization Science, 13(2): 109-127

[7.] S. Hartmann, The World as a Process: Simulations in the Natural and Social Sciences, in: R. Hegselmann et al. (eds.), Modelling and Simulation in the Social Sciences from the Philosophy of Science Point of View, Theory and Decision Library. Dordrecht: Kluwer 1996, 77-100

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KNX CONTROLLED LIGHTING OVER THE DALI NETWORK

ABSTRACT:
The KNX intelligent building system is primarily made for lighting control. With the GIRA HomeServer 3 there are more possibilities to make higher level, complex lighting control over the DALI. In this paper, the dimming sequences, the solutions and the background equipments are demonstrated. The operator screen is a web based touch screen.

KEYWORDS:
KNX intelligent building system, lighting control, DALI (Digital Addressable Lighting Interface)

INTRODUCTION TO THE DALI

DALI stands for Digital Addressable Lighting Interface. It is an International Standard (IEC 62386) lighting control system providing a single interface for all Electronic Control Gears (light sources) and Electronic Control Devices (lighting controllers)
The DALI Standard enables dimmable ballasts, transformers, relay modules, emergency fittings and controllers from different manufacturers to be mixed and matched into a single control system. A DALI system provides designers, installers, building owners, facility managers and end-users a powerful and flexible digital lighting system with security of supply from many sources.
The DALI Standard is overseen by the AG-DALI activity group comprising engineers, manufacturers and institutions working in the field of digital lamp/luminaire control. DALI is effectively an enhancement on DSI control with the added advantages it has interoperability, status feedback and advanced control.

THE DALI LINE

A DALI Line is a network of up to 64 DALI light sources (ballasts, transformers, emergency fittings etc.), addressed from 0 to 63. DALI ballasts are controlled by commands that can be sent to individual ballasts, to groups of ballasts or broadcast to all ballasts on the line.
DALI ballast is an intelligent device that can be configured to remember its power-on level, maximum level, minimum level, system failure level, fade rate and fade time. Ballast can belong to up to 16 groups and store up to 16 preset scene levels.
A true DALI lighting system can report the level of every ballast and the status of every ballast and lamp. It can automatically test emergency fittings and report their status. True DALI systems also enable controllers from multiple vendors to be used on the DALI Line.

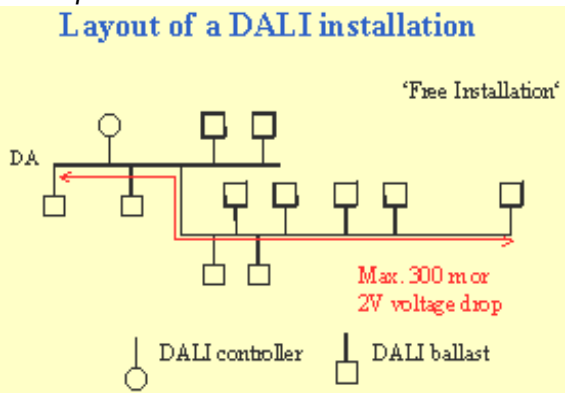

Figure 1. The DALI installation

A DALI Line consists of the following components:

- *One or more DALI Power Supplies to a maximum current of 250mA*
- *From one to sixty-four DALI ECGs ie. ballasts, transformers, inverters, relay modules, EXIT signs etc.*
- *One or more DALI ECDs ie. Line controller, group controller, sensor, switchplate etc.*

THE DALI SYSTEM

DALI Control lighting systems can be scaled from single rooms to complete buildings and campuses.
A simple system could consist of a few light fittings and a switch connected to a DALI group controller. The switch provides on/off control and up/down dimming of the fittings. Minimal configuration is required and ballasts do not need to be individually addressed.
A grouped system consists of multiple ballasts individually addressed on a DALI Line. Addressing of the ballasts takes approximately 15 minutes for random addressing and 30 minutes for sequential addressing. Inputs on a Line Controller or a group controller can be

configured to provide switching and dimming as required. The functionality of the inputs depend on the controller's capabilities however typical examples include switches, pushbuttons, occupancy sensors and light level sensors.

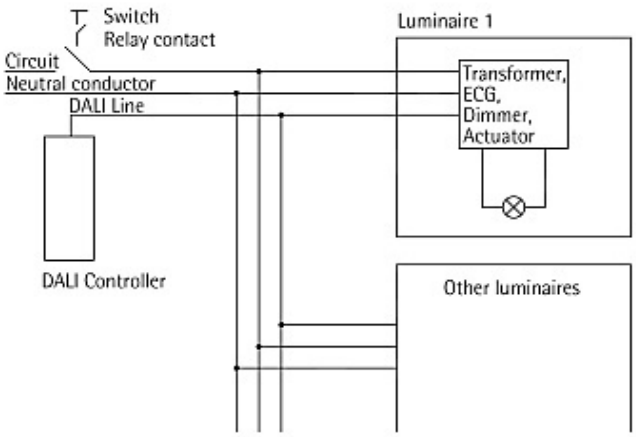

Figure 2. The DALI system

Multiple DALI Lines can be linked together with DCBM DALI Line Controllers that combine DALI Lines onto an Ethernet backbone.

ADVANTAGES OF DALI

- *For lighting designers and consultants*
- *Distributed intelligence for flexible and reliable control*
- *Control of individual lights, groups and DALI Lines*
- *Easy configuration & reconfiguration for changing circumstances*
- *Simple interface with building management systems*
- *Logarithmic dimming behavior matching the human eye*
- *Increased energy savings*
- *Options for emergency lighting*
- *For installers and electrical contractors*
- *Simple 5-core wiring, no special control cable, no polarity, no termination and no segregation required*
- *Easy base-building commissioning*
- *Easy commissioning for tenancies*
- *Building lighting and emergency lighting on the one system*
- *No need to switch the mains voltage (handled internally by the ballasts)*
- *For facilities managers & maintenance contractors*
- *Status reporting of lamps and ballasts*
- *Simple modification - no need to rewire for changing tenancies*
- *Lower maintenance costs*
- *Increased energy savings due to dimming and control capabilities*
- *For building occupants & tenants*
- *Customized lighting preferences*
- *More comfortable lighting*
- *Individual control*
- *Easy modification*

THE INSTABUS EIB KNX SYSTEM

At the end of the 1980s years five manufacturers developed the intelligent building system, called instabus. This system is based on bus communication, which bus system has equal participants. These participants usually are sensors and actuators. The sensors receives the events from outside world (for example: pressing a button, motion, raining, twilight etc.) and sends a telegram to a bus. The actuators receive telegrams from the sensors and perform the physically act of switching, dimming, valve moving etc. The bus topology is tree. All participants have their own, individual physical addresses, which identify the device. The telegram contains the physical address of the sender, the group address, routing counter, flags, parity, and the sending data. Those participants receive the telegrams, which contains that particular group address denoted in the telegram. Using the group addresses means that creating logical wires between the devices. At the beginning of the 1990s years several manufacturers joined to this building standard, and the name of the standard was changed to EIB (European Installation Bus), and has been developed the EIBA (EIB Association) in Brussels. At the end of the 1990s years, EIB became KNX, because three more building standards EHS and BatiBUS to joined the EIB. The programming, designing and installing the KNX system is made possible by ETS (Engineering Tool Software).

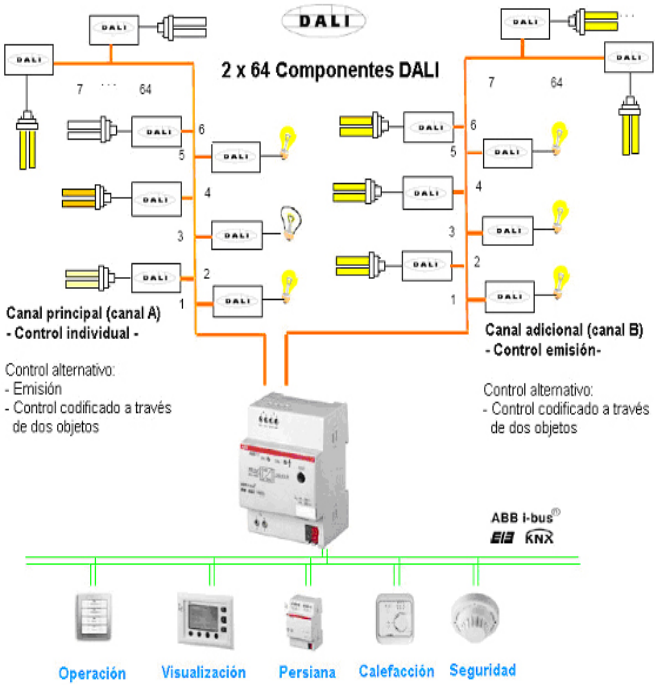

Figure 3.T he KNX and DALI network

THE GIRA HOMESERVER 3

The Gira company developed a server, which operates 24 hours in a day. This server is made to control the KNX systems on the high level. The HomeServer is a management over the KNX systems. It is possible to connect to the LAN, to the ISDN and to the KNX system. The connection of LAN or ISDN makes the chance to control a building from all over the world.

Web based visualizations, alarming, archives, SMS alarming, e-mail alarming, dial alarming are the main possibilities. Logical modules can program, scenes, sequences, timers etc.

USAGE THE LIGHTING CONTROL THROUGH A TOUCH SCREEN

The usage of the lighting control is possible through a touch screen, which is a screen of a simple personal computer, or it is an industrial PC. There are several colored buttons, which have to be pressed and pressing those causes state modifications in the KNX system and in the GIRA's HomeServer 3. Pressing the light bulb button, the HomeServer 3 dims the light by 100%, at a rate of 10% a second. (The speed of the dimming is 10%/second.) Then, the light's brightness is at the maximum.

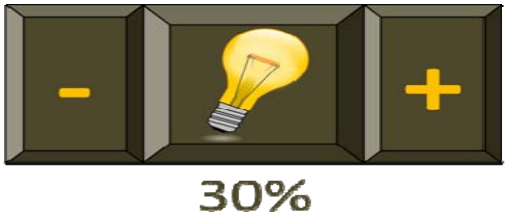

Figure 4. The light bulb button

Pressing the light bulb button again, the light is dimmed to 0%, at a rate of 10% a second. Pressing the plus button, the brightness of the light is raised to 10%. Each time the plus button is pressed the brightness is increased by 10%. If the minus button is pressed, it is decreases by 10%. When the last press of the plus button is followed by a press of the light bulb button, the HomeServer 3 gives a dimming command to the maximum, 100% brightness. If the last press was the minus button and then light bulb button, the dimming value is decreased to 0%. The dimming value is shown below the light bulb button.

CREATING THE KNX PROJECT IN THE ETS 3 FOR THE DIMMING

The first step to create the project in the ETS 3, is to find a sufficient KNX based DALI controller and a sufficient ECG. The sufficient ECG depends on the lamp's load capacity pretension and on the voltage. The choice is the SIEMENS DALI controller.

Figure 5. The Siemens DALI controller

In the ETS 3, the product's application data must be imported, and parameterized. In this project the used communication object is the "circuit set value" which is 1 Byte object. The dimmer gets the dimming value on the KNX bus, to this object, and controls the requested value. For example: if the dimmers communication object gets 50%, then the lamps brightness will be half of the maximum brightness. The communication object "circuit set value" has to be linked to a group address. In this case, the group address is: 0/0/1 and called: "DIMM1". This group address has to be exported to the specific file (lighting_control.esf), and the file has to be imported into the GIRA's HomeServer 3 Experte 2.3 software.

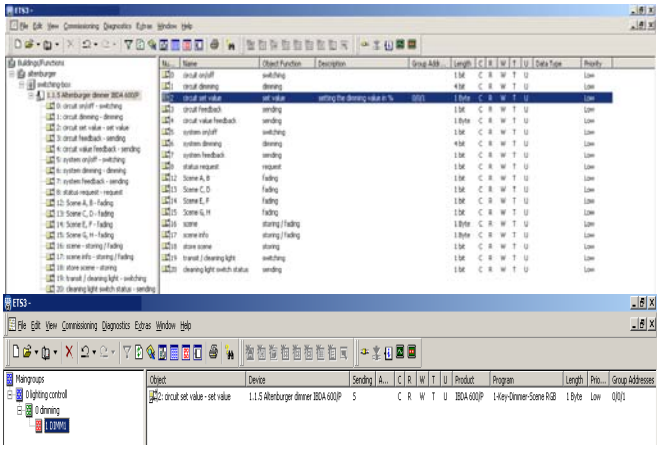

Figure 6. GIRA's HomeServer 3 Experte 2.3 software

PROGRAMMING THE LIGHTING CONTROL IN THE GIRA'S HOMESERVER 3 EXPERTE 2.3

After the importing the group addresses from the ETS 3 to Experte 2.3, it is necessary to create logical modules with logical gates are necessary. These logical modules make the control of the lighting, depending on the input group addresses. It is necessary to create internal group addresses, which are not part of the KNX system, only part of the HomeServer 3 program. When the icon light bulb is pressed, the internal group address "pressing_the_light_bulb_DIMM1"'s state is 1, which is the one input of the logical module. By the command "state_DIMM1" the Dimmi's state changes, depending on the previous state. If the "state_DIMM1"s (internal group address) previous state was 1, then after the changing become 0, and reverse. In the logical module, there is an AND gate (ID:940), which has 2 inputs. The one input is the "state_DIMM1", and the other input is the "pressing_the_light_bulb_DIMM1". After pressing the light bulb and if the "state_DIMM1" has changed to 1, on the AND gate's output it will be 1, because it gets 1 at (to) each input.

The AND gate's output is linked to the command, which is activated when it turns to 1. The command is the dimming down. The AND gate's output is 1 only when there is a change on the output. If the AND gate's output was 1 before, and based on the new inputs, the output should be 1 again, that will not be 1 again, only if it was 0 before. There is another AND gate (ID:941), which operates like the ID:940, it means that the inputs are the same, except that the "state_DIMM1" is

inverted. Therefore, if the "state_DIMM1" is 0, this AND gate's output is 1, and the command - which is linked to the output - is the dimming up. After this process (dimming up or down), the "pressing_the_light_bulb_DIMM1"'s state returns to 0. There is a binary trigger (ID:937) which detects the "pressing_the_light_bulb_DIMM1"'s 1 state and after a time delay the binary triggers output (which is 1) is sent to the command, which changes "pressing_the_light_bulb_DIMM1"'s state to 0. The time delays (ID:936 and ID:939) used in this module to avoid the hazardous operation, and to wait previous process to take effect, and arrive to the end. If the "DIMM1[0/0/1]" group address - which is part of the KNX system - becomes 100%, the state of "state_DIMM1" becomes 0. The logical gate "Equal To" (ID:952) compares the value of "DIMM1 [0/0/1]" and if the value becomes 100, the command is that the "state_DIMM1" becomes 0. If, the "DIMM1[0/0/1]" becomes 0, the "state_DIMM1" becomes 1. This operation, is because the "DIMM1 [0/0/1]"'s value reaches the 100% dimming level, and the light bulb is pressed after it, the dimming should go down. The output of the "Equal To" is 1 if the previous state was 0, and reverse.

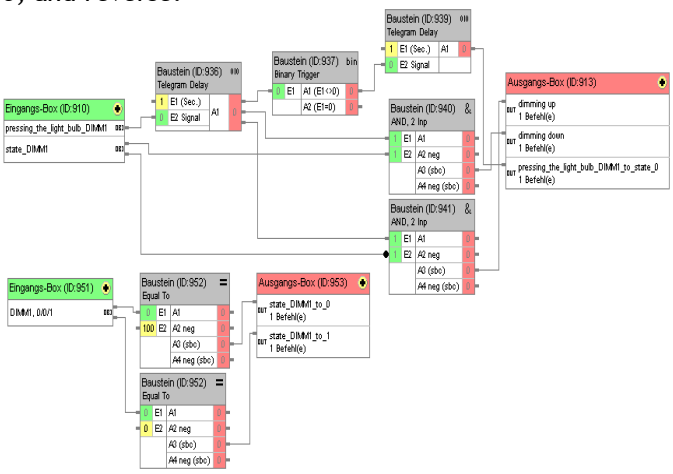

Figure 7. Logical modules with logical gates

If the plus symbol was pressed, the HomeServer 3 increases the dimming value by 10%. Then the commands are: add 10% value to the group address "DIMM1 [0/0/1]" and "state_DIMM1"'s state become 1. If the "state_DIMM1"'s state is 1, and the light bulb is pressed, the dimming up command is activated. If the minus symbol was pressed, the dimming value is decreases by 10%, and the "state_DIMM1"'s state become 0. After it, if the light bulb is pressed, the dimming down command is activated.

CREATING THE DIMMING SEQUENCE IN THE GIRA'S HOMESERVER 3 EXPERTE 2.3

In the logical module the main outputs are the "dimming up" and the "dimming down". These outputs are the parts of the HomeServer 3 Experte 2.3's sequence module. The "dimming up" sequence means, that the HomeServer sends brightness values to the dimmer's "brightness value" communication object in every seconds with higher value by 10% through the group address "DIMM1". In the sequence every 10 commands are "Schritt+" or "Schritt-" which means increase or decrease.

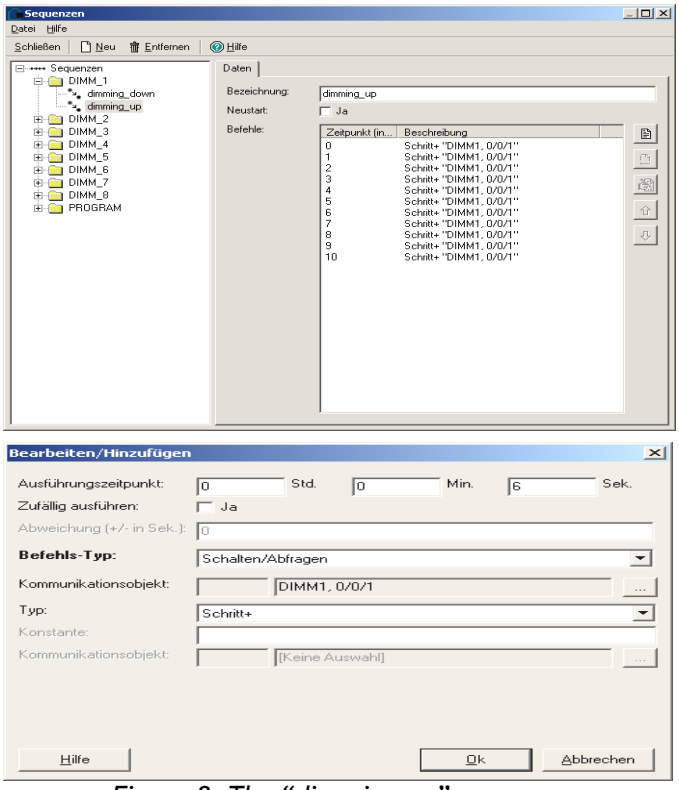

Figure 8. The "dimming up" sequence

The step size is set up in the group address's setup:

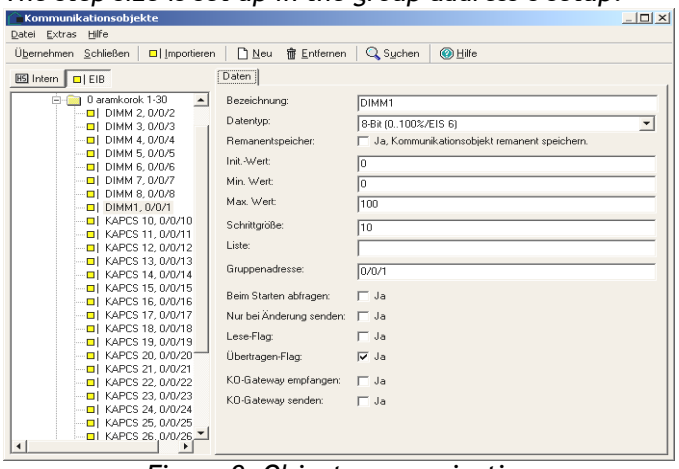

Figure 9. Object communication

Also set up the type of the group address which must be 8 bits, EIS 6 (the value range is 0% to 100%), the default value (Init.), minimum value (Min.) and maximum value (Max.).

DEVELOPING POSSIBILITIES

Using this lighting control it is possible to create more complicated lighting controls, lighting systems. Several lighting circuits can be managed: dimming, switching, organizing in groups etc. Where can such advanced lighting circuits are implemented?
Their application is wide-spread, including in large buildings, for example: theatres, cinemas, conference halls, show rooms, concert-halls, auditoriums, congress halls, hotels, restaurants, cafés, salons, and so on.

With the HomeServer 3 enables the user to control all lighting from within a particular location as well as from outside that location.
The HomeServer 3 allows a maximum of 200 users to be logged in, therefore the authorities can be separated to several sections. Each user can manage that part of the building which was assigned to them.
The HomeServer 3 has Ethernet port, it means that it can connect to the Internet. Users can log in through the Internet and to manage their job from any place, either from a personal computer or from a mobile phone it is all the same.
The HomeServer 3 offers alarm functions, which are very beneficial. The server can notify the user about anomalous behavior. The anomalous states can be bad illuminators (this function can be programmed, if the dimmer actuator or switching actuator offers the observation of the prefect consumption), forgotten lamps, low bus voltage, low electrical voltage, disabled UPS etc.
In the HomeServer 3, there are archives, in which users can register actions, measured values, reasons of alarms, and so on. A (big) significant amount of lighting scenes, lighting sequences, event-based lighting behaviors can program in this server and perform high level control over the KNX systems.

REFERENCES

[1] http://www.clipsal.com/dalicontrol/about_dali/what_is_dali
[2] Gira HomeServer 3 Comissioning manual, Giersiepen GmbH & CO. KG, Radevormwald
[3] Dr. Kovács Károly, Az instabus EIB épületüzemeltetési és felügyeleti rendszer, EIB felhasználói Club, Budapest, 1998
[4] Handbuch Gebäudesystemtechnik, ZVEI, Frankfurt AM, 1997
[5] Rainer Scherg, EIB planen und installieren, Vogel Buchverlag, Würzburg, 1995
[6] Balogh Zoltán, KNX beavatkozó elemek – aktorok, Villanyszerelők Lapja, Budapest, 2009
[7] KNX/EIB oktatási anyag, Siemens Hungary
[8] EIB: User's View, 1999
[9] M. Mevenkamp, M. Mayer: "Energy efficiency in educational buildings using KNX/EIB", KONNEX Scientific Conference, Pisa, 09/2005
[10] J-C Juang, H-C Wang, C-L Lu, W-M Chen, C-W Hsu, "A Touch-Dim Network for the Dimming Control of Lighting System", 2010 International Conference on Computational Aspects of Social Networks
[11] Yuan Ma; Wobschall, D.; "A Sensor Network for Buildings Based on the DALI Bus", Sensors Applications Symposium, 2007. SAS '07. IEEE
[12] S-C Wang; Y-H Liu; Y-L Chen; J-Y Che; "Development of DALI-based electronic ballast with energy saving control for ultraviolet lamps", Industrial Informatics (INDIN), 2010 8th IEEE International Conference on
[13] H Li; M Wu; Y Zhong; "Development and research of lighting system based on DALI", Industrial Electronics and Applications, 2008. ICIEA 2008. 3rd IEEE Conference
[14] E. Matijevics, "KNX based lighting control solutions with GIRA HomeServer 3", SISY'09, 2009. 7th International Symposium on, pp.263 - 266.
[15] Contenti, C.; "Digitally addressable DALI dimming ballast", Applied Power Electronics Conference and Exposition, 2002. APEC 2002. Seventeenth Annual IEEE
[16] Gyula Mester, "Distance Learning in Robotics", Proceedings of The Third International Conference on Informatics, Educational Technology and New Media in Education, pp. 249-245, Sombor, Serbia, 2006
[17] Gyula Mester: "Converting Traditional Courses to E-learning", Proceedings of the Informatika a Felsőoktatásban, pp. 1212-1216, Debrecen, Hungary, 2002

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CRIME PREVENTION THROUGH THE INTEGRATION OF NATURAL SURVEILLANCE CHARACTERISTICS IN HOUSE DESIGN: PERCEPTION OF POTENTIAL HOUSEBUYERS'

ABSTRACT:
Consciousness among potential housebuyers' regarding crime prevention through the integration of natural surveillance characteristic assist to reduce proportion of crime in our country. Natural surveillance is about crime prevention through environmental design which limits the opportunity for crime by taking steps to increase the perception that people can be seen around the housing area. In the design, natural surveillance involves the placement of physical features such as windows, lighting, and landscaping of the house in such a way as to maximize visibility and foster positive social interaction among legitimate users of the house and its surrounding area. In light of the rising crime rate in this country, the integration of natural surveillance characteristics into the design of houses can only add to the security features of the houses. This study is attempted to investigate the perception and behavioural profiles of the housebuyers towards surveillance characteristics in their houses. The respondents in this study are potential housebuyers attending a property fair in Sungai Petani, Kedah in June 2008. In all, 208 respondents were involved in this research. The results indicated that the respondents have a high tendency towards accepting natural surveillance design as one of the crime prevention efforts.

KEYWORDS:
Home security, natural surveillance, crime prevention

INTRODUCTION

Proportion of crime in Malaysia housing was increased and so does the number of legal and illegal foreigner workers. According to Utusan Malaysia (2008), statistics showed that compared to 33, 599 houses burgled in 2007, was increase 4,727 compare with 2006 total cases 28,872. In the first fourth quarters 2008, the police predicted that house crimes will increase. House crime cases will increase every year because total number of residents also increased. The government and the police are concerned about this issue; they are interested to find solutions on how to solve it. However, cooperation from the public to prevent house crimes is needed. Napier (1998) found that safety and security are often the first priority of the urban poor in both developed and developing countries. Cozens (2002) noted that in consideration of the apparently extensive crime and deprivation experienced in certain existing housing estates, the criminogenic potential of new-build housing developments is of paramount importance. Many cases showed that burglars enter to the house through the same way namely doors and windows. Table 1 shows that the point of entry to the house for burglary has happened before. Entry though rear window was the highest (29%) and entry through rear door was the second highest (15%). From point of view show that rear window and door the main entry to burglary enter because occupant seldom used it. Desyllas et al., (2003) noted that some of the supposed relationships are obvious such as the level of `target hardening' in the design of doors and window locks to make access to properties more difficult.

Table 1: Homes Point of burglars entry

Point of Entry	Percentage of cases in which point of entry was used
Rear Window	29%
Rear Door	15%
Front Door	10%
Patio Door	2%

Source: Armitage (2000)

Ellsworth (2002) stated that while research and experience repeatedly demonstrates that crime prevention is the most effective and efficient means of reducing crime. Crime prevention continues to lag behind reactionary approaches to crime reduction. Desyllas et al., (2003) stated that a key distinction is who is considered to be the agent of surveillance and what is the object of surveillance. Broadly, previous writers have suggested two types: the surveillance

provided by occupants of buildings and the surveillance provided by members of the public on the street. The research looks into the natural surveillance characteristics and compare with profile of Sungai Petani housebuyers and also look to how far respondents in this issues. It will basically be focused on answering the following objectives which are as follows: (i) to identify the house buyers' needs of natural surveillance for their housing area; (ii) to identify the house buyers' agreeability to practice of natural surveillance design in their homes; and (iii) to look of criteria of house buyers, who want to practice natural surveillance?

PRINCIPAL OF CRIME PROBLEMS

Poyner (2006) suggests that the process of incorporating crime prevention into the design of residential areas is not a single strand of thought but is rather recognition of the need to develop strategies against four principal crime problems:

i. *Burglary – a strategy is needed to discourage people from trying to break into houses;*
ii. *Car crime – a strategy for providing a safe place to park cars;*
iii. *Theft around the home – a strategy for protecting the front of the house, and items in gardens, sheds and garages;*
iv. *Criminal damage – a strategy to minimise malicious damage to property*

The principal of crime problems need developer to know how they can apply in design of housing development. Crimes happened because some affect from poor design. Schneider and Kitchen (2007) noted that in order to make natural surveillance effective, there is a need to improve street lighting because it makes people see the surroundings clearly. Targets (people or property) that encounter crimes in the normal, everyday course of their lives become part of templates, Schneider and Kitchen (2007). The proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime and an improvement in the quality of life (Crowe, 2000). Cozens (2002) mentioned that activity support can be enhanced by physical design whereby encouraging legitimate activity in public space can help to discourage crime. Activities which involve the community can be organized in specific locations in order to define and promote the preferred use. For example, a basketball court in a public park may provide recreational space for the young while also making strangers more obvious by increasing natural surveillance and a sense of ownership.

DEFINITION OF NATURAL SURVEILLANCE

Cozens (2002) defined natural surveillance as a crucial dimension since criminals do not generally wish to be observed, much less apprehended. The configuration of physical features, activities and people, in ways that maximise opportunities for surveillance can act to discourage crime. Desyllas and Connoly (2003) also defined natural surveillance as the overlooking of public space by members of the public in the course of their day-to-day lives. In the case of burglary, for example, such cues might include the perceived ease of entry based on the sturdiness of the door frame, or the risk of being spotted based on the likelihood that neighbours can see from their own windows or yard to the target entry point (natural surveillance), (Schneider and Kitchen, 2007). Many types of crime prevention procedures have been done to ensure housing safety always. Natural surveillance was practised in Crime Prevention through Environmental Design (CPTED), Secured by Design (SBD) and Defensible Space (DS). Natural surveillance is very important in our housing scheme, detail about natural surveillance. Cozens (2002) demonstrated in the UK, Secured By Design (SBD) is an initiative developed in 1989 by the Association of Chief Police Officers (ACPO) and supported by the Home Office Crime Prevention Unit whereby new-build housing developments utilise 'defensible space' and CPTED ideas to reduce opportunities for criminality.

DEFINITION OF CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN

"The proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime, and improvement in the quality of life" National Crime Prevention Institute (NCPI) 1986. The growing Crime Prevention through Environmental Design' movement (International CPTED Association, 2003) is based on the idea that the design and layout of communities can themselves influence crime risk (Desyllas and Connoly, 2003).

CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED) STRATEGIES

CPTED strategies to make surrounding safe during the day and public will know what was happen in housing area. Crowe (2000) notes that element into space design and management:

- *Natural access control. Space should give some natural indication of where people are allowed and are not allowed. Don't depend just on locks and guards, but make security part of the layout.*
- *Natural surveillance. Again, traditional factors like good lighting are important, but don't overlook a natural factor such as a strategically placed window or the placement of an employee work station.*
- *Territorial reinforcement. This is an umbrella concept, embodying all natural surveillance and access control principles. It emphasizes the enhancement of ownership and proprietary behaviours.*

Natural surveillance by Crowe (2000) also stated that what need to follow to make sure housing area and house in safe every time. In the bellow show the elements should follow:

i. *Provide magnet for watches, or gatekeepers, by increased outdoor use of space (e.g., porches, yard assignment, and gardening).*
ii. *Reduce light pollution on bedroom windows to influence residents to leave curtains and blind*

open or partially open to create the reality and perception of surveillance.

iii. *Install windows in dead walls on the sides of buildings.*

iv. *Install automatically controlled porch lights to create a sea of light at the human scale to allow for better visual identification of faces, and intensity of overhead mast-mounted lights.*

v. *Place car parking in line-of-sight of units, or preferably, immediately in front.*

vi. *Install central HVAC to eliminate the use of window units that block natural surveillance and audio monitoring of outdoor activities; this also significantly improves the quality of life.*

vii. *Remove walls and hedgerows that produce impediments to natural surveillance; replace dumpster enclosures and perimeter fencing with transparent materials.*

Type Agent of surveillance Object of surveillance Mechanism of surveillance by Desyllas and Connoly (2003):

- *Building occupants public space users and building occupants see public local properties space and other properties from windows and building entrances; and*
- *Public space users other public space users passing members of public and local properties provide `virtual' community and see access points to buildings.*

SECURED BY DESIGN

Armitage (2000) noted that SBD estates are designed to achieve maximum natural surveillance without compromising the need for privacy. The informal social control which emerges from the design of SBD estates is accentuated through ensuring that each estate contains a mix of dwellings designed for the needs of a variety of resident types. In doing so, the likelihood that at least one neighbour will be at home throughout the day and night is increased.

DEFINITION OF DEFENSIBLE SPACE

Newman (1973) claims that 'Defensible Space' is "a means for restructuring the residential environments of our cities so they can again become livable and controlled not by police, but by a community of people sharing a common terrain" cited by Desyllas and Connoly (2003). Brunson et al. (2001) defined Defensible Space (DS) interventions involve making physical changes to the areas around residences to make them less vulnerable to crime and more supportive of the development of community among residents. Brunson et al., (2001) said one factor that DS theory posits may be important in the success of defensible spaces is the extent to which residents defend and in other ways appropriate near-home space. If residents intervene when inappropriate or unsafe behaviours occur in near-home space, if they spend time there, if they interact with neighbours and participate in caretaking activities, DS theory asserts that community life should flourish, and safety should be maintained. If these types of physical, social, and territorial appropriation are inhibited, DS theory predicts that community life may be disrupted and that neighbourhoods will become unsafe.

CONSUMER BEHAVIOR

In this study look to relationship between demographic of housebuyers with the integration of natural surveillance characteristics in house design for crime prevention. Donelly (1988) indicates that among American samples, age is positively related to fear of crime. Income is, however, inversely related to fear of crime even when race, age, and gender are held constant (Sundeen & Mathieu, 1976), probably because high-income earners live in presumably safe neighbourhoods (Skogan & Maxfield, 1981). Cozens (2002) said multiple dwelling units (flats) were consistently perceived to be more criminogenic and associated with fear and also to be less 'defensible' than the single dwelling units (SDUs). However, the socio-economic associations relating to the residents and the level of maintenance were also crucial determinants in the perception of each design.

RESEARCH METHOD

A survey was conducted during the property fair held from 5th June 2008 until 8th June 2008 in Central Square shopping complex at Sungai Petani which is located in Kedah State. Structured questionnaires were administered face-to-face to potential house buyers attending the property fair. Total questionnaires was distributed are 500 and the questionnaires was divided two part. Questions for part A focus on respondents demographic and part B more focus on natural surveillance characteristic. In all, 208 questionnaires were answered by the respondents and analyzed by using the crosstab analysis.

RESULTS ANALYSIS

Results in this study show that all house buyers in Sungai Petani agree about the need of natural surveillance in their homes. The results showed that natural surveillance is very important to them. Figure 1 shows a comparison between age and the need of natural surveillance among house buyers.

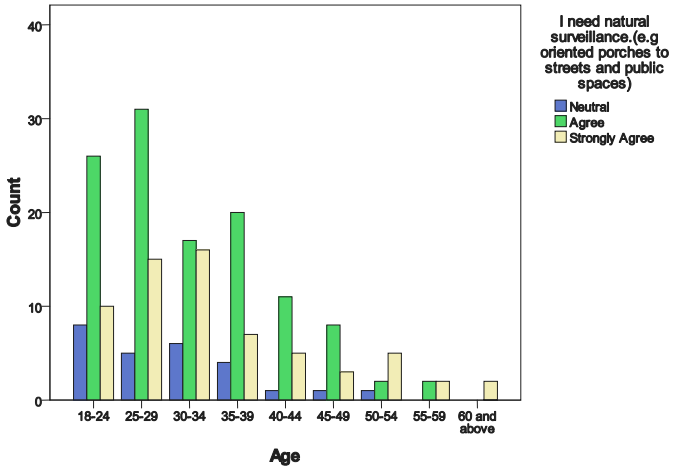

Figure 1: Comparison between age and the need of natural surveillance in the housing among housebuyers

The highest respondents involved in this study were aged between 25-29. Around 2% of them were neutral in their opinions about natural surveillance, 15% agreed, and 7% strongly agreed to have natural surveillance in their homes. For age above 60 years old 1% from total of respondents said strongly agreed to have natural surveillance in their homes.

Figure 2 shows that respondents monthly income, the highest monthly income involved in this survey is RM 1,501-RM 2,500 around 25% follow by monthly income below RM 1,500 around 23% from total respondents. Around 88% respondents agreed and (10%) strongly agreed to have natural surveillance in their houses and other 12% neutral regarding this issues.

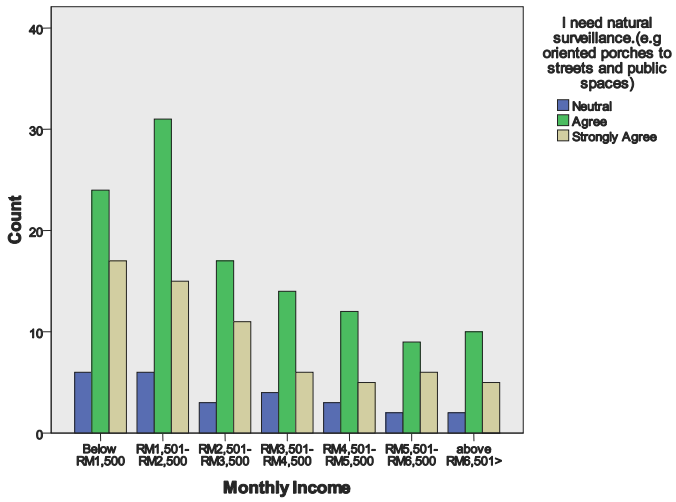

Figure 2: Comparison between monthly income and the need of natural surveillance in the housing among housebuyers

Figure 3 shows that the highest respondents involved this study live in single storey terraced houses, 40% of them agreed and strongly agreed to have natural surveillance and other than that 6% Most of types of houses agreed and strongly agreed to have natural surveillance and balance from them neutral.

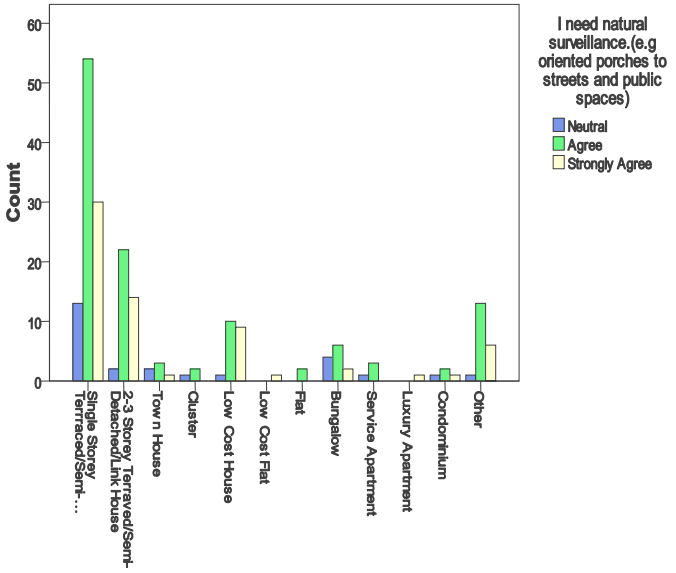

Figure 3: Comparison between house type and the need of natural surveillance in the house among housebuyers in Sungai Petani

DISCUSSION

Based on the findings showed that age, monthly income and house types are related positive fear to crime and its look true that was present on the literature. Many type of natural surveillance that can be apply in house design and that parallel to consciousness of potential housebuyers which can practices to their homes.

CONCLUSION

The results indicate that the respondents have a high tendency towards accepting natural surveillance design as one of the crime prevention efforts. This study showed that housebuyers in Sungai Petani (88%) agreed and strongly agreed to have natural surveillance in their homes and others 12% neutral for these issues because some of them did not know clearly about the natural surveillance and how to it is practiced in housing scheme. Young housebuyers age between 25-29, monthly income range between RM1,501-RM2,500 and single storey terraced houses are the highest range involved in this study and also agree to have natural surveillance. The literature review said people fear and think seriously about safety but in this study, it can be shown that all categories of respondents are happy to have natural surveillance in their homes because of security and safety matters. Developers need to know that house buyers in Sungai Petani like to have natural surveillance in their homes because it can be made their housing more attractive to house buyers. Further investigations are needed to look more into what kind of natural surveillance should be practices in housing design.

REFERENCES

[1.] *Armitage, R. (2000). An Evaluation Of Secured By Design Housing Within West Yorkshire Home Office Building A safe and Tolerant Society, Briefing Note 7/00.*

[2.] *Brunson, L., Kuo, F.E. and Sullivan, W.C. (2001). Resident Appropriation of Defensible Space In Public Housing Implications For Safety And Community Environment and Behaviour, 33 (5), 626-652.*

[3.] *Cozens, P. M. (2002). Sustainable Urban Development and Crime Prevention Through Environmental Design for the British City. Towards an Effective Urban Environmentalism for the 21st Century.*

[4.] *Crowe, T. (2000). Crime Prevention through Environmental Design: Applications of Architectural Design and Space Management Concepts, 2nd ed., Butterworth-Heinemann, Oxford.*

[5.] *Desyllas, J., Connoly, P., and Hebbert, F. (2003). Modelling natural surveillance. Environment and Planning **B**: Planning and Design 2003, 30, 643 – 655.*

[6.] *Donnelly, P.G. (1988). Individual and neighbourhood influences on fear of crime. Sociological Focus, 22(1), 69-85.*

[7.] *Ellsworth, J. (2002). "Embedding prevention in policy and practice", Report on the National Crime Prevention Council's Conference of State Partners, Phoenix, AZ, April, 14-16.*
[8.] *Napier, M., Plessis, C.D., Liebermann, S., Kruger, T., Shaw, M., Louw, A. and Oppler, S. (1998). Environmental Design for Safer Communities in South Africa, Volume 1 and 2, Council for Scientific and Industrial Research, Pretoria.*
[9.] *National Crime Prevention Institute (1986). Understanding Crime Prevention, Stoneham, MA: Butterworth publishers.*
[10.] *Newman, O. (1973). Defensible Space People and Design in the Violent City, Architectural Press, London.*
[11.] *Poyner, B. (2006). Crime-Free Housing in the 21st Century, UCL Jill Dando Institute of Crime Science, London.*
[12.] *Schneider, R.H. and Kitchen, T. (2007). Crime Prevention and the Built Environment.*
[13.] *Skogan, W.G., & Maxfield, M.G. (1980). Coping with crime: Victimization, fear and reactions to crime in three American cities. Beverly Hills, CA: Sage.*
[14.] *Sundeen, R.A. (1984). Explaining the fear of crime among international students from developing countries: A revised model. Criminal Justice Review, 2, 7-13.*
[15.] *Utusan Malaysia (2004). Make sure your home leave in safely, Issues: Malaysia Security Force, Section: Malaysian Weekly News.*

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SEVERAL OPEN PROBLEMS IN PARALLEL ROBOTICS

ABSTRACT:
More than 20 years parallel robots attract the interest of the scientific community and in many applicative domains like, production of motion generators, machine tools, precision positioning devices, medical equipment, pick and place machines, etc., where their potential advantages (high accuracy, rigidity, speed, acceleration and load carrying capability) could be very useful. The objective of this paper is to notify some of the open questions in parallel robotics, which is limitation factor of wider practical application of this type of robots.

KEYWORDS:
parallel robots, open problems, research

INTRODUCTION

A parallel robot is composed of two or more closed-loop kinematic chains in which the end-effector (mobile platform) is connected to the base (fixed platform) by at least two independent kinematic chains. Between the base and end-effector platforms are serial chains (called limbs or legs) [90] (fig.1).
Parallel robot could be named as hexapod, a Stewart platform, Gough platform, Stewart-Gough platform, a parallel kinematic machine (PKM) or a parallel manipulator. Theoretical work on parallel mechanisms dates back to as early as 1645 by Christopher Wren, then in 1813 by Cauchy and in 1867 by Lebesgue. Variable-length-strut hexapods, as those used in motion simulators [31,84] have existed almost 50 years.
Parallel mechanisms are stronger than serial because the load is distributed among all legs, but also because, for some architectures, the legs are only subjected to axial loads. Also, parallel robots theoretically should be more precise since they are more rigid, and since the errors in the legs are averaged instead of accumulated. Finally, these robots are faster since they usually have their heavy motors mounted on the base (fig.1)
On the other hand, parallel robots have a more limited and complex-shaped workspace. Moreover, the rotation and position capabilities (if both present) of parallel mechanisms are highly coupled which makes their control and calibration extremely complex. Furthermore, parallel mechanisms generally have singularities within their workspace and computing the resulting end-effector position for a given set of actuator inputs is, in general, a very difficult and complex problem allowing up to 40 solutions.

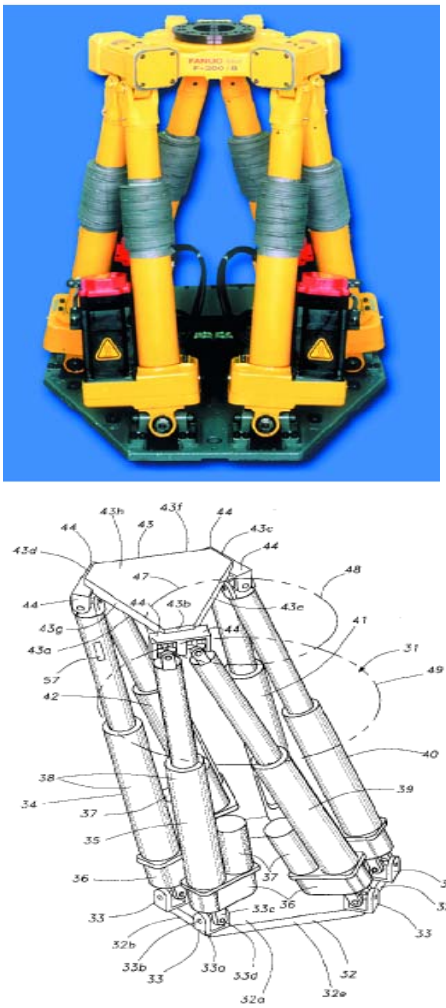

FIGURE 1. A FANUC parallel robot [94] (US patent No. 5987726) [93]

General overview of the main characteristics of the parallel robots are given in the table below:

Table 1.

Feature	Parallel robot
Workspace	Small and complex
Solving forward kinematics	Very difficult
Solving inverse kinematic	Easy
Position error	Averages
Force error	Accumulates
Maximum force	Summation of all actuator forces
Stiffness	High
Dynamics characteristics	Very high
Modelling and solving dynamics	Very complex
Inertia	Small
Areas of application	Currently limited, especially in industry
Payload/weight ratio	High
Speed and acceleration	High
Accuracy	High
Uniformity of components	High
Calibration	Complicated
Workspace/robot size ratio	Low

In the past two decades parallel robots very much attracted the interest in the robotics community. Great interest for parallel robots come from the potentially interesting features of parallel mechanisms: high accuracy, rigidity, speed and large load carrying capability, which in a very large number of cases may overcome the drawbacks of the more complex kinematics, dynamics and smaller workspace. The great interest could be exemplified by a large number of papers published on this subject together with the application of parallel robots in very different domains such as fine positioning devices, simulators, motion generators (platforms), ultra-fast pick and place robots, machine-tools, medical applications, haptic devices, entertainment, force sensors, micro-robots, etc.

But in fact all these advantages of parallel robots are only potential. Any real parallel robot will present in practice impressing performances only if all its components (either hardware or software) present a high level of performance. However in many cases unexpected difficulties in the design and control of such complex system have led to performances which, although still better than conventional serial mechanical architectures, were fare below what was expected. In some cases, for example, the machine tools, performances were even the worst [89].

In the following we will give some examples of some open problems in parallel robotics, which makes limitation of wider practical application of this type of robots.

OPEN QUESTIONS IN PARALLEL ROBOTICS

Mechanical design

A lot of different mechanical architectures of parallel robots, more than 100 according [60] with 2 to 6 DOF have already been proposed and it is probable that not all of them have been discovered. Analysis of the literature shows that more than 80% of the parallel robots are with 3 DOF and 6 DOF. The rest are parallel robots with 5 DOF, 4 DOF, and 2DOF. Unfortunately there are not so many proposed architecture that have only 4 or 5 DOF, while many applications require such number of DOF. For example 4-DOF is sufficient for most pick-and place applications, and 5-DOF is adequate for every machine tool application.

There is a recent trend is to propose parallel robots with 4 and 5 DOF: [19, 69, 16, 18, 26, 50, 99, 21, 98, 104, 10].

It is really an interesting research area but many questions arise with this type of robots:

- *the proposed structures have in theory only 4 or 5 DOF and rely on geometrical constraints to obtain this reduced number of DOF. In practice however these constraints will never been perfectly fulfilled and hence these robots will exhibit parasitic motions. Open problems are to determine what will be the maximal amplitude of these parasitic motion, produced by given manufacturing tolerances, [11, 33] and the dual problem of determining the amplitude of the manufacturing tolerances so that the maximal amplitude of the parasitic motion will not exceed a given limits.*
- *having less actuators and sensors may sound economically interesting, but it is unclear, if classical parallel robots with 6 DOF which are redundant with respect to the task, are more appropriated. First of all their kinematic chains are identical (which is not the case for the most of 4 and 5 DOF robots). That will reduce the maintenance costs. Then by using the redundancy it is possible to optimize the performances of the robot for a given task*

Redundancy is also an interesting and open research area. In the field of parallel robots redundancy has been used to increase the workspace of the robot (such as in the Eclipse parallel robot [45]) and to deal with singularities [65]. The main unsolved problem for redundant parallel robot is to determine how to use the redundancy for an optimal use of the robot.

Joints

Parallel robots require higher kinematic pairs with relatively large amplitude of motion and, in some cases, relatively high load. Current available joints (either ball-and-socket or U-joints) are not completely satisfactory from this view point, although recent products like the INA joints have been developed especially for parallel robots [25]. Hence the development of higher kinematic pairs with 2 to 4 DOF is a key issue [4, 81]. As for any mechanical joints these joints must have a low friction, no hysteresis and must have a very reduced backlash. But in addition these joints must be designed so that it is possible to add sensors to measure partly or totally the amplitude of the motion of the joints, which is important for the forward kinematics.

Compliant joints are also an interesting field of research, especially for micro-robots [62].

Forward kinematics

The biggest kinematics problem is parallel robotics is the forward kinematics, which consists in finding the possible position of the platform for given joint coordinates. The forward kinematics is a more complex problem than its dual inverse kinematics counterpart for serial robots. The need of the forward kinematics is a controversial question. It may be thought that forward kinematics is an academic question that may be useful only for off-line simulation purposes and a parallel robot will be position controlled using inverse kinematics only. Pure position control is very difficult for parallel robots, especially when there are constraints on both the trajectory and the velocity of the robot (for example when the robot is used as a machine tool). In that case velocity control, which implies solving the forward kinematics, will be much more appropriate.

Although there is much mechanical architecture of parallel robots the forward kinematics problem for most of them may be reduced to solve the forward kinematics problem for a few key architectures. For example solving the forward kinematics for the Gough platform [64] allows to solve the forward kinematics of the Hexa [68] or the Hexaglide [37, 17, 36] although the mechanical architectures of these robots are quite different.

It is now well known that the forward kinematics of the Stewart-Gough platform may have up to 40 solutions and that all these 40 solutions may be real. Numerous works have provided a deep understanding of the problem which in turn has led to efficient algorithms for determining all the solutions of the forward kinematics using elimination, Gröebner basis or interval analysis. Although impressing progress has been made these algorithms are not yet real-time and furthermore it cannot be said that forward kinematics is a fully solved problem. The research continues with the works [58, 100, 40, 30, 79], etc.

The true forward kinematics problem is to determine the current position of the platform being given the joint coordinates. The algorithms provide all the solutions and hence it is necessary to sort the solutions to determine the current position. In fact the true unsolved forward kinematics problem is combination of the current algorithms with a sorting algorithm that will reject solutions that cannot be realized physically because of the presence of singularity or of the possible interferences on the trajectory. Also it is unclear if this will be sufficient to eliminate all solutions, or only one.

Another approach to solve the forward kinematics is to add extra sensors to the robot. Each extra sensor will provide an additional equation, leading to an over-constrained system which hopefully will have a unique solution. The problem is here to determine the minimal number of sensors and their location in order to have a unique solution with the simplest analytic form and quite robust with respect to the sensor errors. Some of these problems have been analyzed in [8, 45, 29] but this issue is far from being solved. Adding extra sensors may play also an important role in the robot calibration.

Singularity analysis

There are various ways to introduce the concept of singularities but the most spectacular one is to consider the static behaviour of the robot. Let F be the wrench applied on the platform of the robot and τ the set of joint forces. These quantities are linearly related by

$$F = J^{-T}(X)\tau \qquad (1)$$

where J^{-T} is the transpose of the inverse Jacobian matrix of the robot that is position dependent. Each component of the joint forces vector τ_i may be obtained as a ratio:

$$\tau_i = \frac{A}{\left|J^{-T}\right|} \qquad (2)$$

where A is the minor associated to τ_i. Hence, if A is not 0, the joint force τ_i will go to infinity at any position, called singular position, where the determinant of J^{-T} is 0, causing a breakdown of the robot (in fact the breakdown will occur before reaching the singularity).

Although the condition $\left|J^{-T}\right|$ seems to be a simple condition as the matrix J^{-T} has an analytical form, the full calculation of this determinant leads to a complex expression with a large number of terms (especially if the robot has 6 DOF).

This remains an important topic of study although many progress have been made in this field, for example the geometrical classification of the singularities or algorithms for detecting singularities in a given workspace [59]. We should also mention the works of other authors dealing with singularities for different types of parallel robot manipulators like [44, 13, 2, 3, 83, 95, 96, 47, 102, 103, 51, 41].

Singularities for different configurations of parallel robots still remains open field for research.

Another open question is global analysis of singularity in relation with the workspace and trajectory planning. In that field we should mentioned the work of [24].

Workspace

One of the main drawbacks of parallel robots are their reduced workspace. Furthermore computing this workspace is not an easy task. Opposite of classical serial robots, here the translational and orientation workspace are coupled. Classically a first approach to solve this problem is to fix the values of some DOF until only 3 DOF are free. This is usually done by fixing either the orientation of the platform or the location of its centre. In the first case the geometrical approach that determine geometrically the possible motion of the centre of the platform for each kinematic chains leads usually to the best result as it provides exact calculation with a compact storage and easy representation.

Orientation workspace is more difficult to deal with as there is no universal way to represent this workspace. Here we could mention the works [7] and [70].

Another approach is to calculate an approximation either of the border or of the whole workspace using a numerical method. Some of these approaches have the advantage to be able to deal also with limits on the motion of the passive joints and to allow for workspace verification (i.e. to check if a desired workspace is included in the workspace of the robot). They may also calculate various types of workspace.

Analysis of the workspace for different types of parallel robots is given in [20, 6, 54, 96, 24, 49, 71, 72].

Workspace analysis for different configurations of parallel robots still remains open research field.

Other unsolved problems are:

- *a fast algorithm to compute the maximal motion of the platform*
- *an algorithm that allows to check for links interference. This is a much more complex problem than may be thought in the first moment. It is necessary to determine all the hyper-surfaces in the workspace for which a pair of kinematic chain intersects in order to split the workspace in interference-free regions and then to determine in which region the initial assembly modes is located to obtain the interference-free workspace of the robot. This is a difficult task even for robot with very simple kinematic chains [15].*

Motion (trajectory) planning

Motion planning is a classical problem for serial robots. But in the case of parallel robots the problem is somewhat different. For serial robot obstacle avoidance is the main reason for motion planning, but for parallel robot is the workspace. Possible problems are:

- *verification if a given trajectory lie completely within the workspace of the robot*
- *determine if two positions may be reached by a singularity free and interference free trajectory that lie completely within the workspace of the robot*

Problem 1 can be solved for almost any arbitrary time-function trajectory using interval analysis [59], while problem 2 has some particular solutions [22, 24, 82, 85]. A lot of work has to be done in this area.

Calibration

Although this problem has been solved for serial robots, this is not the case for parallel robots. Indeed, for a serial robot, small errors in the geometric parameters of the robot lead, in general, to a large difference between the real position of the end-effector and the expected one. This difference may be evaluated by measuring the position of the end-effector and then be used in an optimization procedure which will determine values of the parameters decreasing the positioning errors. Applied to parallel robot this method leads to calibration result that are in general disastrous. One of the advantages of parallel robot is that large errors in geometric parameters may lead to quite small errors in the position of the end-effector. Furthermore the measurement noise has a large influence on the results of the calibration process.

There are two types of calibration methods:

- *external: an external measurement device is used to determine (completely or partially) what is the real position of the platform for different desired configurations of the platform. The differences between the measured position and the desired position give an error signal that is used for the calibration [92, 105, 27, 86, 73, 74, 75, 76, 42, 23, 80, 87].*
- *self-calibration: the platform has extra sensors (for example sensors that are used for the FK) and only the robot measurements are used for the calibration [63, 101, 27, 38].*

The first method is difficult and tedious to use in practice but usually gives good results. The second method is less accurate, but is easy to use and has also the advantages that it can be fully automated.

An interesting theoretical problem is to determine what are the measurement configurations of the platform that will lead to the best calibration. Of course there is an open problem to put the calibration in use in a real, industrial environment.

Dynamics

Another advantage of parallel robots is that they can reach a high acceleration and velocity, due to low mass of the moving elements [37,17].

A first problem here is to determine appropriate dynamic model of the robot. Various formulations may be used [56, 43, 97, 61, 48, 28], although some simplifying assumption have to be made.

A second problem is implementation of control algorithms, so that the use of the parallel robot dynamic model, will really improve the motion control of the robot, compared to more classical control laws [17, 37, 36, 32, 91, 14, 39, 78, 46, 88, 5, 77].

Computing the dynamic model of a parallel robot is time consuming (and involves also solving the forward kinematic problem). An important problem here is to determine what should be the computation time of the calculation of the dynamic model, so that its use in a control loop will really leads to an improvement of the performances of the robot. This is a very complex issue especially if it is considered that the control algorithm is not continuous.

Synthesis and optimal design

It is well known that the performances that will be reached by any mechanism depends upon:

- *the topology of the mechanism*
- *the dimensions of the components of the mechanism*

This is especially true for closed-loop, parallel, mechanisms that are highly sensitive to both factors. When we design a parallel mechanism so that its performances should best fit to the list of requirements, both aspects must be take into consideration:

- *topological synthesis i.e. finding the general arrangements of joints, links that will describe the general kinematics of the structure.*
- *dimensional synthesis i.e. finding the appropriate dimensioning of the mechanism.*

Synthesis of parallel robot is an open field (there are very limited number of papers dealing with this problem) [1, 9, 26, 57] and the main task for the development of parallel robots in practice.

The problems caused by using parallel structures in the field of machine-tool has shown that designers which have a deep understanding of open-loop mechanisms but, have not experience in closed-loop are focused only on the development of the basic mechanical components of their machine and have almost completely neglected the analysis part.

Topology synthesis is a very complex problem for parallel mechanisms at the opposite of open-loop mechanisms for which the number of possible kinematic combinations is relatively reduced. Currently topological synthesis for parallel robots is restricted to find a mechanism with a given number of DOF without considering other performance criterion(s)

Parallel mechanisms, robots, are highly sensitive to dimensioning. One classical example given by [59] is that by changing the radius of the platform of Stewart-Gough platform by 10% we may change the minimal stiffness of the robot over its workspace by 700% .

According, [59] none of existing dimensional synthesis methods are appropriate for parallel robots which have usually a large number of design parameters. Furthermore these methods lead to a unique solution: in the case of parallel robots usually will not be a single solution to a design problem and providing only one design solution is not realistic. The main difficulty comes from the criterions which have to be considered: some of them are antagonistic (workspace and accuracy-a very accurate robot will usually have a small workspace and vice-versa), or not continuous (no singularity within the workspace), etc.

Therefore a design methodology should provide not only one single solution but, if possible, all the possible design solutions, or, at least, an approximation of the set of all design solutions.

With the optimal design (also includes topological synthesis and dimensional synthesis) which is crucial issue for development efficient parallel robots, several interesting problems could be solved, like optimization of:

- *robot kinematics (workspace, accuracy, maximal motion of the passive joints, dexterity, accessibility, motion pattern, kinematic error)*
- *robot dynamic (robot max acceleration, robot max speed, inertia, centre of mass)*
- *robot flexibility (robot stiffness and robot natural frequencies).*

Optimal design is open and actual problem. Very few papers could be find in this area [66, 67, 52, 53, 12, 34].

Controller

Parallel robot will be effective system only if the robot controller allows dealing with the specific characteristics of parallel robots. Unfortunately the current trend, especially in the field of machine tools, is adaptation of existing hardware for the purpose of controlling parallel robots.

If may be, this trend could be justified at the beginning of parallel robotics, long term this will have very bad effect on the robot performances.

Analysis in the machine-tool field have shown that more of the 70% errors on the fabricated parts are induced by controller, CAD system is responsible of approximately 20% of the errors, and the Stewart-Gough platform (if optimally designed) less than 10% [59]. Hence research should be focused mostly on the controller. The hardware of the controller should support:

- *the possibility of using appropriate control laws capable to deal with inherent non-linearities of parallel robots,*
- *parallel computation (that will drastically improve the sampling time)*
- *specialized integrated circuits that will be devoted to basic computation tasks such as inverse and forward kinematics*

CONCLUSION

In this paper we notified some open questions in parallel robotics. Some of the problems are long term, but others should be solved as soon as possible in order to enable wider application of parallel robots in practice.

Serial and parallel robots probably will live parallel a long years. If we compare about 20 years research in parallel mechanisms and more than 200 years in research to reach the current level of knowledge for serial mechanisms, it is easy to conclude that this process of solving problems in parallel robotics will be long term.

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REFERENCES

[1] *ANGELES J., 2002, The Qualitative Synthesis of Parallel Manipulators, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators October 3–4, 2002, Quebec City, Quebec, Canada pp.160-168*

[2] *ANGELES J., YANG G., CHEN I. M., 2001, Singularity Analysis of Three-Legged, Six-DOF Platform Manipulators with RRRS Legs, 2001 IEEE/ASME International Conference on Advanced Intelligent Mechatronics Proceedings, 8-12 July 2001, Como, Italy, pp.32-36*

[3] *ANGELES J., YANG G., CHEN I. M., 2003, Singularity Analysis of Three-Legged, Six-DOF Platform Manipulators With URS Legs, IEEE/ASME TRANSACTIONS ON MECHATRONICS, VOL. 8, NO. 4, DECEMBER 2003, pp.469-475*

[4] *ANNACONDIA, E., APILE, E., DOTTA, A., BOËR, C. R., 2002, An Expierience in Design and Development of Joints for Parallel Kinematics Machines, The 3rd Chemnitz Parallel Kinematics Seminar PKS 2002, Chemnitz, Germany, pp.243-261*

[5] BELDA K., 2004, Various utilization of predictive control, in parallel machine tools, 5th International PhD Workshop on Systems and Control a Young Generation Viewpoint September 8-11, 2004 Balatonfüred, Hungary

[6] BONEV A. I., RYU J., 1999, Workspace Analysis Of 6-Prrs Parallel Manipulators Based On The Vertex Space Concept, Proceedings of the 1999 ASME Design Engineering Technical Conferences September 12-15, 1999, Las Vegas, Nevada, DETC99/DAC-8647

[7] BONEV A. I., RYU J., 2003, A new approach to orientation workspace analysis of 6-DOF parallel manipulators, Mechanism and Machine Theory 36 (2001) pp.15-28

[8] BONEV A. I., RYU J., KIM S. G. AND LEE S. K., 2001, A Closed-Form Solution to the Direct Kinematics of Nearly General Parallel Manipulators with Optimally Located Three Linear Extra Sensors, TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 17, NO. 2, APRIL 2001, pp.148-156

[9] BROGARDH T., 2002, PKM Research - Important Issues, as seen from a Product Development Perspective at ABB Robotics, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators October 3–4, 2002, Quebec City, Quebec, Canada, pp.68-82

[10] BRUZZONE L. , MOLFINO R.M., AND ZOPPI M., 2004, Kinematic modelling and simulation of a novel interconnected-chains PKM, Int. Conf. Modelling, Identification and Control MIC2004, Grindelwald, Switzerland, February 23-25 2004. ISBN 0-88986-387-3.

[11] CASTELLI P. V. AND DI GREGORIO R., 2000, Influence of manufacturing errors on the kinematic performance of the 3-UPU parallel mechanism, 2nd Chemnitzer Parallelkinematik Seminar, pages 85-99, Chemnitz, Germany, 2000.

[12] CECCARELLI M., CARBONE G. AND OTTAVIANO E., 2005, Multi criteria optimum design of manipulators, BULLETIN of the POLISH ACADEMY of SCIENCES, TECHNICAL SCIENCES, Volume 53, Issue 1, March 2005, pp 9 - 18

[13] CHEN S.-L. AND YOU I.-T., 2000, Kinematic and Singularity Analyses of a Six DOF 6-3-3 Parallel Link Machine Tool, Int J Adv Manuf Technol (2000) 16:835–842

[14] CHUANG H. Y. AND CHANG Y. C., 2001, Evaluation of an Adaptive Weighting Cross-Coupled Controller for a 3-PRPS Platform, JSME International Journal Series C, Vol. 44 (2001) , No. 1, pp. 164-170

[15] CHUCKPAIWONG I., NEWMAN S. W., 2001, Reflexive collision avoidance for a Novell parallel Mnaipulator, Proceedings of the 2001 IEEE/RSJ, International Conference on Intelligent Robots and systems, Maui, Hawai, USA, Oct. 29-Nov.03, 2001, pp.1293-1298.

[16] CLAVEL R., THURNEYSEN M., GIOVANOLA J., SCHNYDER M., JEANNERAT D., 2002, HITA-STT A new 5 dof parallel kinematics for production applications, Proceedings of the 33rd ISR (International Symposium on Robotics) October 7 – 11, 2002

[17] CODOUREY A., HONEGGER M., BURDET E., 1997, A Body-oriented Method for Dynamic Modeling and Adaptive Control of Fully Parallel Robots, SYROCO'97, Nantes, France, September 1997

[18] COMPANY O., KRUT S. AND PIERROT F., 2002, Modeling and Preliminary Design Issues of a 4-Axis Parallel Machine for Heavy Parts Handling, IMechE Journal of Multibody Dynamics, Vol. 216, Special Issue, Part K, pp. 1-11, January 2002.

[19] COMPANY O., PIERROT F., 1999, A new 3R-1T parallel robot, 9th International Conference on Advanced Robotics, Tokyo, Japan, 25-27 October 1999, pp. 557-562.

[20] CONTI J.P., CLINTON C.M., ZHANG G., WAVERING A.J, 1998, Workspace Variation of a Hexapod Machine Tool, Published: NISTIR 6135, National Institute of Standards and Technology, Gaithersburg, MD, March 1998

[21] CORRADINI C., FAUROUX J.-C., KRUT S. AND COMPANY O., 2003, Evaluation of a 4-Degree of Freedom Parallel Manipulator Stiffness, 11th World Congress in Mechanism and Machine Science, Tianjin, China, August 2003.

[22] CORTÉS J. AND SIMÉON T., 2003, Probabilistic Motion Planning for Parallel Mechanisms, Proc. of the IEEE International Conference on Robotics and Automation, 2003.

[23] DANEY D., PAPEGAY Y., NEUMAIER A., 2004, Interval Methods for Certification of the Kinematic Calibration of Parallel Robots, Proceedings of the 2004 IEEE International Conference on Robotics & Automation, New Orleans, LA • April 2004 pp.1913-1918

[24] DASH, A.K., CHEN, I.-M., YEO, S.H., YANG, G.L., 2002, Workspace Analysis and Singularity-free Path Planning of Parallel Manipulators, Int'l Conf. Mechatronics Technology, Fukuoka, Japan, pp. 457-462, 2002.

[25] DÜRSCHMIED, F., HESTERMANN, J.-O., 2002, Achieving Technical and Economic Potential with INA Components, The 3rd Chemnitz Parallel Kinematics Seminar PKS 2002, Chemnitz, Germany, pp.263-275

[26] FANG Y., TSAI L.-W., 2002, Structure Synthesis of a Class of 4-DoF and 5-DoF Parallel Manipulators with Identical Limb Structures, THE INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH , September 2002, pp.799-810

[27] FASSI I., LEGNANI G., 2002, Automatic Identification of a Minimum, Complete and Parametrically Continuos Model for the Geometrical Calibration of Parallel Robots, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators October 3–4, 2002, Quebec City, Quebec, Canada, pp.204-214

[28] GALLARDO J., RICO J.M., FRISOLI A. , CHECCACCI D., BERGAMASCO M., 2003, Dynamics of parallel manipulators by means of screw theory, Mechanism and Machine Theory 38 (2003) pp. 1113–1131

[29] GAO J., WEBB. P AND GINDY N., 2003, Error reduction for an inertial-sensor-based dynamic parallel kinematic machine positioning system, INSTITUTE OF PHYSICS PUBLISHING MEASUREMENT SCIENCE AND TECHNOLOGY, Meas. Sci. Technol. 14 (2003) pp.543–550

[30] GAO X.-S., LEI D., LIAO Q., ZHANG G.-F., 2005, Generalized Stewart–Gough Platforms and Their Direct Kinematics, IEEE TRANSACTIONS ON ROBOTICS, VOL. 21, NO. 2, APRIL 2005, pp.141-150

[31] GOUGH V. E., WITEHALL S. G., 1962, Universal Tire Test Machine, Proceedings of the 9th International Automobile Technical Congress FISITA, London (UK), ImechE (pp. 117 – 137) 1962.

[32] GRAF R., VIERLING R., DILLMANN R., 1998, A flexible controller for a Stewart platform, 2nd Int. Conf. on knowledge-based intelligent electronic Systems, Adelaide, 21-23 April 1998, pp. 52-59

[33] GREGORIO D, R., CASTELLI P. V., 2002, Geometric Error Effects on the Performances of a Parallel Wrist, The 3rd Chemnitz Parallel Kinematics Seminar PKS 2002, pp, 1011-1024

[34] HAO F., MERLET J.-P. , 2005, Multi-criteria optimal design of parallel manipulators based on interval analysis, Mechanism and Machine Theory 40 (2005) 157–171

[35] HAYES M. J. D., MURRAY P. J. Z., CHEN C., 2004, Unified Kinematic Analysis of General Planar Parallel Manipulators, Journal of Mechanical Design 2004 by ASME, September 2004, Vol. 126 , pp.1-10

[36] HONEGGER M., 1998, Nonlinear adaptive control of a 6-DOF. parallel manipulator, MOVIC '98, Zurich, Switzerland,. August 25-28, vol. 3, pp. 961-966, 1998

[37] HONEGGER M., CODOUREY A., BURDET E., 1997, Adaptive Control of the Hexaglide, a 6 dof Parallel Manipulator, IEEE International Conference on Robotics and Automation, Albuquerque, USA, April 1997

[38] HSU W.-Y., CHEN J.-S., 2004, Error analysis and auto-calibration for a Cartesian-guided tripod machine tool, Int J Adv Manuf Technol (2004) 24: pp. 899–909

[39] HUBERT H., 2003, Model Based Control of a Parallel Robot – A Comparison of Control Algorithms, PAMM · Proc. Appl. Math. Mech. 2, (2003), pp.124–127

[40] JAKOBOVIC D., BUDIN L., 2002, Forward Kinematics of a Stewart Platform Mechanism, INES 2002, 6th International Conference on Intelligent Engineering Systems 2002, Opatija, Croatia

[41] JIN Y., CHEN I-M., YANG G., 2004, Structure synthesis and singularity analysis of a parallel manipulator based on selective actuation, Proceedings of IEEE Int. Conf. on

Robotics and Automation, pages 4533-4538, New Orleans, 28-30 April 2004
[42] JOSHI, S., SURIANARAYAN, A., 2003, Calibration of a 6-DOF Cable Robot Using Two Inclinometers, Performance Metrics for Intelligent Systems, PerMIS '03, NIST Special Publication 1014, September 16 - 18, 2003
[43] KHALIL W., GUEGAN S., 2001, A New Method for the Dynamic Formulation of Parallel Manipulators, Journées Franco-Mexicaines d'automatique appliquée, 12-14 Septembre, 2001
[44] KIM D. AND CHUNG, W., 1999, Analytic Singularity Equation and Analysis of Six-DOF Parallel Manipulators Using Local Structurization Method, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 15, NO. 4, AUGUST 1999, pp.612-622
[45] KIM J., PARK F. C., RYU S. J., KIM J., HWANG J. C., PARK C., AND IURASCU C. C., 2001, Design and Analysis of a Redundantly Actuated Parallel Mechanism for Rapid Machining, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 17, NO. 4, AUGUST 2001, pp.423-434
[46] KOHN N., KOLBUS M., REISINGER T., DIETHERS K., STEINER J., THOMAS U., 2004, PROSA - A Generic Control Architecture for Parallel Robots, Proceedings of the Mechatronics & Robotics, Aachen, September 2004
[47] KONG X., GOSSELIN C. M., 2002, Kinematics and Singularity Analysis of a Novel Type of 3-CRR 3-DOF Translational Parallel Manipulator, The International Journal of Robotics Research, Vol. 21, No. 9, September 2002, pp. 791-798,
[48] KOVECSES J., PIEDBOEUF J.-C., LANGE C., 2002, Methods for Dynamic Models of Parallel Robots and Mechanisms, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators October 3–4, 2002, Quebec City, Quebec, Canada, pp.339-347
[49] LIN C., TANG X., SHI J., DUAN G., 2003, Workspace analysis of reconfigurable parallel machine tool based on setting-angle of spherical joint Systems, Man and Cybernetics, 2003, IEEE International Conference on Volume 5, 5-8 Oct. 2003 Page(s): pp. 4945 - 4950 vol.5
[50] LIU X.-J., KIM J., WANG J., 2002, Two Novel Parallel Mechanisms with Less than Six DoFs and the Applications, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators, October 3–4, 2002, Quebec City, Quebec, Canada, pp.172-178
[51] LIU G., LOU Y., AND LI, Z. 2003, Singularities of Parallel Manipulators: A Geometric Treatment, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 19, NO. 4, AUGUST 2003 pp.579-594
[52] LOU Y. ET AL., 2004, A general approach for optimal kinematic design of parallel manipulators, Proceedings of the IEEE Int. Conf. on Robotics and Automation, pp. 3659-3664, New Orleans, 28-30 April 2004
[53] LOU Y.J., LIU G.F., AND LI Z.X., 2005, A General Approach for Optimal Design of Parallel Manipulators, SUBMIT TO IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING, VOL. X, NO. X, XX 2005
[54] MAJID M. Z. A., HUANG Z. AND YAO Y. L., 2000, Workspace Analysis of a Six-Degrees of Freedom, Three-Prismatic-Prismatic-Spheric-Revolute Parallel Manipulator, Int J Adv Manuf Technol (2000) 16: pp. 441–449
[55] MARQUET F., COMPANY O., KRUT S. AND PIERROT F., 2002, Enhancing Parallel Robots Accuracy with Redundant Sensors, IEEE ICRA: Int. Conf. on Robotics and Automation, , Washington, DC, USA, Mai 11-15, 2002, pp. 4114-4119
[56] MCAREE P. R., SELIG J. M., 1999, Constrained Robot Dynamics II: Parallel Machines, Journal of Robotic Systems 16(9), 487-498 (1999)
[57] MENG J., LIU G., LI Z., 2005, A Geometric Theory for Synthesis and Analysis of Sub-6 DoF Parallel Manipulators, International Conference on Robotics and Automation, April18-2005, Barcelona, Spain
[58] MERLET J-P., 1999, Forward kinematics of parallel robots, Proceedings of IMACS Conf. on Applications of Computer Algebra, El Escorial, 24-27 June 1999
[59] MERLET J. P., 2000, Parallel robots, Kluwer, 2000
[60] MERLET J.-P., 2002, An initiative for the kinematics study of parallel manipulators, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators, October 3–4, 2002, Quebec City, Quebec, Canada, pp.1-9
[61] MILLER K., 2001, Dynamics of the New UWA Robot, ACRA 2001,Australian Conference on Robotics and Automation, Sydney, 14 - 15 November 2001, pp.1-6
[62] MOON Y.-M., KOTA S., 2002, Design Of Compliant Parallel Kinematic Machines, Proceedings of DETC 02, ASME 2002 Design Engineering Technical Conferences and Computer and Information in Engineering Conference Montreal, Canada, September 29-October 2, 2002
[63] NAHVI A., HOLLERBACH J.M., HAYWARD V. ,1994, Calibration of a parallel robot using multiple kinematics closed loops, Proceedings of the IEEE Int. Conf. on Robotics and Automation, San Diego, 8-13 May 1994, pp. 407-412,
[64] NANUA P., WALDRON K.J., 1989, Direct kinematic solution of a Stewart platform, Proceedings of the IEEE Int. Conf. on Robotics and Automation, Scottsdale, 14-19 May 1989, pp. 431-437
[65] O'BRIEN J., WEN J. T. , 1999, Redundant Actuation for Improving Kinematic Manipulability, 1999 IEEE International Conference on Robotics and Automation, May 10-15, 1999, Marriott Hotel, Renaissance Center, Detroit, Michigan, Proceedings. IEEE Robotics and Automation Society 1999, Volume, 2 pp. 1520-1525
[66] OTTAVIANO E. AND CECCARELLI M., 2001, Optimal Design of CaPaMan (Cassino Parallel Manipulator) With Prescribed Position and Orientation Workspace, Proceedings of the IEEE 9th Mediterranean Conference on Control and Automation, June 27-29, 2001, Dubrovnik, Croatia
[67] OTTAVIANO E. AND CECCARELLI M., 2002, Optimum Design of Parallel Manipulators for Workspace and Singularity Performances, Proceedings of the WORKSHOP on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators, 2002, Quebec City, Quebec, Canada, pp.98-105
[68] PIERROT F., DAUCHEZ P., AND FOURNIER A., 1991, Hexa: a fast six-dof fully parallel robot, Proceedings of ICAR conference, 1991, pp. 1159-1163.
[69] PIERROT F., MARQUET F., COMPANY O., GIL T., 2001, H4 parallel robot: modelling, design and preliminary experiments, IEEE Int. Conf. On Robotics and Automation, Seoul, Korea, May 2001
[70] POTT A., FRANITZA D., HILLER M., 2004, Orientation workspace verification for parallel kinematic machines with constant leg length, Proceedings of Conference Mechatronics and Robotics, MechRob 2004, Aachen, 2004
[71] PUSEY J., FATTAH A., AGRAWAL S., MESSINA E. AND JACOFF A., 2003, Design and Workspace Analysis of a 6-6 Cable-Suspended Parallel Robot, Proceedings of the 2003 IEEE/RSJ Intl. Conference on Intelligent Robots and Systems Las Vegas, Nevada · October 2003, pp.2090-2095
[72] PUSEY J., FATTAH A., AGRAWAL S., MESSINA E., 2004, Design and workspace analysis of a 6–6 cable-suspended parallel robot, Mechanism and Machine Theory 39 (2004) 761–778
[73] RENAUD P., ANDREFF N., GOGU G., 2003-1, On Vision-based Kinematic Calibration of a Stewart-Gough Platform, Proceedings of the 11th World Congress in Mechanism and Machine Science, August 18.21, 2003, Tianjin, China
[74] RENAUD P., ANDREFF N., GOGU G., DHOME M., 2003-2, Optimal pose selection for vision-based kinematic calibration of parallel mechanisms, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'2003), pp. 2223-2228, vol. 3, Las Vegas, USA, October 2003,
[75] RENAUD P., ANDREFF N., MARQUET F., MARTINET P., 2003-3, Vision-based Kinematic Calibration of a H4 parallel mechanism, 2003 IEEE International Conference on Robotics and Automation, pp. 1191-1196, Taipei, Taiwan, September 2003,

[76] RENAUD P., ANDREFF N., KRUT S., GOGU G., 2004, Kinematic calibration of linear-actuated parallel mechanisms from leg observation, 35th International Symposium on Robotics, April 2004, Paris, France.
[77] RIDGEWAY, S., AND CRANE, C., 2004, Control Considerations in the Design of a Parallel Kinematic Machine with Separate Actuation and Metrology Mechanisms, Proceedings of the 12th Mediterranean Conference on Control and Automation (MED '04), Kusadasi, Turkey, June 2004.
[78] SABATER, J.M., AZORIN, JM, GARCIA, N., ARACIL, R, SALTAREN, R., 2003, Kinematics control of a 6 URS parallel platform working as an impedance display, 2003 IEEE Conference on Control Aplications
[79] SADJADIAN H., TAGHIRAD H.D., FATEHI A., 2005, Neural Networks Approaches for Computing the Forward Kinematics of a Redundant Parallel Manipulator, International Journal of Computational Intelligence Volume 2 Number 1 2005, PP.40-47
[80] SATO O., SHIMOJIMA K., OLEA G., FURUTANI R., TAKAMASU K., 2004, Full Parameter Calibration of Parallel Mechanism, 4th International Conference of the European Society for Precision Engineering and Nanotechnology (euspen2004, Glasgow, UK, May 31 - June 2), 2004, 396-39
[81] SCHNYDER, M.; GIOVANOLA, J.; CLAVEL, R.; THURNEYSEN, M.; JEANNERAT, D., 2004, Spherical Joints with 3 and 4 Degrees of Freedom for 5-Axis Parallel Kinematics Machine Tool, The 4 Chemnitz Parallel Kinematics Seminar PKS2004, Chemnitz, Germany, April 20-21, 2004, pp.487-502
[82] SHAW D. AND CHEN Y.-S., 2001, Cutting path generation of the Stewart-Platform-Based Milling Machine using an end-mill, Int. J. Prod. Res., 2001, vol. 39, no. 7, pp.1367-1383
[83] SIMAAN N. AND SHOHAM M., 2001, Singularity Analysis of a Class of Composite Serial In-Parallel Robots, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 17, NO. 3, JUNE 2001 pp. 301-311
[84] STEWART, D., 1965, A Platform with Six Degrees of Freedom, Proc. Inst. Mech. Eng. London, Vol 180, 1965, pp. 371-386.
[85] SU H., DIETMAIER P., MCCARTHY J. M., 2003, Trajectory Planning for Constrained Parallel Manipulators, ASME Journal of Mechanical Design, March 2003
[86] TAKAMASU K., MURUI I., SATO O., OLEA G. AND FURUTANI R., 2002, Calibration of Three Dimensional Mechanism - Novel Calibration Method for 3DOF Parallel Mechanism, Proccedings of IEEE ICIT'02 (Bankok, December), 2002, pp. 394-398
[87] TANG X., WANG J. , GAO M., 2004, Kinematic calibration of gantry hybrid machine tool based on estimation error and local measurement information, Int J Adv Manuf Technol (2004) Published online: 24 November 2004
[88] TING Y., CHEN Y.-S., AND JAR H.-C., 2004, Modeling and Control for a Gough–Stewart Platform CNC Machine, Journal of Robotic Systems 21(11), (2004), pp. 609–623
[89] TLUSTY J., ZIEGERT J., RIDGEWAY S., 1999, Fundamental comparison of the use of serial and parallel kinematics for machine tools authors, Annals of CIRP, 48/1/1999, pp. 351-356
[90] TSAI L. W., 1999, Robot Analysis: The Mechanics of Serial and Parallel Manipulators, New York: John Wiley & Sons, Inc., 1999.
[91] WALKER I.D., AND BENNETT J.K., 1998, Parallel robot control using speculative computation. Journal of Robotics and Automation, 13(4), 101-112, Dec, 1998. DL Hamilton,
[92] WU J., ZHANG L., LI S., 2001, Posture Measurement And Structural Parameters Calibration On Parallel 6 Dof Platform, Fifth International Conference On Fluid Power Transmission And Control (ICFP2001) 3-5 April, 2001, Hangzhou, China
[93] www.delphion.com
[94] www.fanucrobotics.com
[95] YANG G., CHEN I.-M., LIN W. AND ANGELES J., 2001, Singularity Analysis of Three-Legged Parallel Robots Based on Passive-Joint Velocities, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 17, NO. 4, AUGUST 2001, pp. 413-422
[96] YIU Y.K., AND LI Z.X., 2001-1, Modeling Configuration Space and Singularities of Parallel Mechanisms, International Conference on Mechatronics Technology, 6 - 8 June 2001, Singapore pp. 298-303
[97] YIU Y.K., AND LI Z.X., 2001-2, Dynamics of a Planar 2-dof Redundant Parallel Robot, International Conference on Mechatronics Technology, 6 - 8 June 2001, Singapore, pp.339-344
[98] ZHANG D. AND LANG, S. Y. T., 2003, On Conceptual Design of 5-axis Parallel Kinematic Machines using kinetostatic modelling approach, 2nd International Conference on Reconfigurable Manufacturing d International Conference on Reconfigurable Manufacturing 2003
[99] ZHAO T. S., DAI J. S. AND HUANG Z., 2002, Geometric Analysis of Overconstrained Parallel Manipulators with Three and Four Degrees of Freedom, JSME International Journal Series C, Vol. 45 (2002) , No. 3, pp.730-740
[100] ZHAO X., PENG S., 2000, Direct Displacement Analysis of Parallel Manipulators, Journal of Robotic Systems 17(6), (2000), pp.341-345
[101] ZHUANG H., 1997, Self-Calibration of Parallel Mechanisms with a Case Study on Stewart Platforms, IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 13, NO. 3, JUNE 1997, pp.387-397
[102] ZLATANOV, D., BONEV, I.A., GOSSELIN, C.M., 2002, Constraint Singularities as C-Space Singularities, 8th International Symposium on Advances in Robot Kinematics (ARK 2002), Caldes de Malavella, Spain, 24–28 June, 2002.
[103] ZOPPI M., BUZZONE L. E., MOLFINO R. M., NICHELINI R. C., 2003, Constraint Singularities of Force Transmission in Nonredundant Parallel Robots With Less Than Six Degrees of Freedom, Journal of Mechanical Design 2003 SEPTEMBER 2003, Vol. 125, pp. 557-563
[104] ZOPPI M., BRUZZONE L., MOLFINO R.M., 2004, A novel 5-DoF Interconnected-Chains PKM for manufacturing of revolute surfaces, The 4 Chemnitz Parallel Kinematics Seminar PKS2004, April 20-21, 2004, Chemnitz, Germany, pp.437-448
[105] ZOU H., NOTASH L., 2001, Discussions on the Camera-Aided Calibration of Parallel Manipulators, 2001 CCToMM Symposium on Mechanisms, Machines, and Mechatronics 2001 CCToMM SM, June 1, 2001, the Canadian Space Agency, Saint-Hubert (Montréal), Québec, Canada

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PREDICTION OF DROPLET SIZE AND VELOCITY DISTRIBUTION IN SPRAY USING MAXIMUM ENTROPY METHOD

ABSTRACT:
The prediction of droplets diameter and velocity distribution in a spray is so difficult since its process and mechanism is not completely known and depends too many parameters. The early stage of the atomization process (Primary Breakup) is clearly deterministic, whereas the final stage of spray formation (Secondary Breakup) is random and stochastic. In the second region, which deals with the stochastic aspect of droplet size and velocity distributions, analysis is done by using the maximum entropy principle (MEP). The MEP predicts atomization process while satisfying constrain equations of mass, momentum and energy. Finally, an experimental investigation is done to verify the theoretical model. For this means, a specific nozzle is designed and manufactured so the breakup length and the droplet size and velocity distributions are measured using high-speed camera and laser based technique (Phase Doppler anemometry).

KEYWORDS:
Spray, Maximum Entropy, Modeling, Distribution, Velocity, Diameter

INTRODUCTION

In the past years, numerous investigations are concentrated on making appropriate model to describe jet fracture and droplet formation.
Classic model to predict diameter distribution and velocity of the droplets are derived mainly from experimental data. In this procedure, a curve is fitted on different data obtaining from various conditions of nozzle operations. This procedure is the main basis for distributions like Rosin & Rambler, Nukiyama-tanasawa, log-kornel and root-kornel and Log hyperbolic.
In an alternative method of empirical procedures, an analytical model using entropy maximization procedure (MEP) is developed for computing the size distribution of droplets in the past two decades.
At the end of 1980, maximum entropy principle is observed for calculating size and velocity distribution of the droplets in the sprays. This viewpoint predicts the distribution using a set of rules and principles implying general information related to the system.
This approach assumes that in addition to conservation of mass, momentum and energy, the droplet size distribution function satisfy a maximum entropy principle.
This approach suggests the most plausible size distribution in which conservation equations are satisfied and system entropy is maximized. Using MEF model and the initial value for average diameter, it is possible to acquire size distribution and droplet velocity in a spray or probability density function (PDF).
This approach are presented, at the first, by Sellens and Brzustowski in 1986 [5,6] and then developed by Tankin and Li in 1987 [9] in which initial conservation and energy of partial surface equations are used.
Then, Ahmadi and Sellense [4] could estimate droplet size distribution independent from their velocity distribution. In 1996, Cousin [2] observed the correct application of entropy maximization principle and announced that this formulation can predict any distributing in the spray. He used different average diameter and concluded that the relation between diameter and volume of particle should be considered in the formulation in order to obtain a suitable volume distribution.
In 2003, X. Li & M. Li [8] proposed an innovative model for estimation of droplet size distribution based on maximization of entropy during the spray process. This idea forecasts the distributions by implementing a set of rules and principles implying general information related to the system. Entropy maximization principle for modeling the size and velocity of droplet is applicable only for the adiabatic system in which thermodynamics equilibrium is prevailed.

MATHEMATICAL MODEL AND GOVERNING EQUATIONS

To extract governing equations and determine size and velocity distribution for particles, a control volume on the outlet of injector is assumed. Control volume is considered in such a way that the inlet is coincident with outlet of injector and the outlet is continued to the droplet formation location. Figure 1 shows the control volume considered in a conical spay of an injector. According to the figure, a droplet, which is formed separated from its neighborhood fluid, is assumed to be out of the control volume and hence the interaction of a droplet with surrounding is out of the control volume.

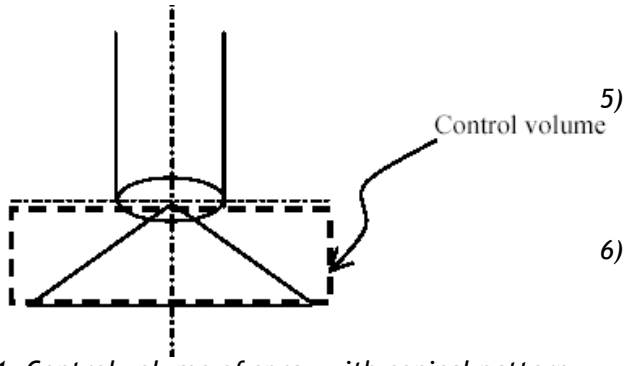


Figure1. Control volume of spray with conical pattern

Droplet formation process in the control volume can be considered as a transformation from one to another equilibrium state. According to the thermodynamics laws, during changing in state mass, momentum and energy is conserved as well as entropy maximization occurs. Therefore, the basis in mathematical modeling of spray systems is the consideration and derivation of appropriate mass, momentum and energy conservation equations for analyzing the spray systems. Regarding to the formulation of entropy maximization, conservation equation can be stated in terms of probability density function. P_{ij}, which is the probability of finding a droplet with volume v_j and velocity u_i. Hence, the mass, momentum and energy conservation equation can be restated as:

1) Mass balance:

$$\sum_i \sum_j p_{i,j} V_i \rho \dot{n} = \dot{m}_o + s_m$$

2) Momentum balance:

$$\sum_i \sum_j p_{i,j} V_i \rho \dot{n} u_j = \dot{J}_o + s_{mu}$$

3) Energy balance:

$$\sum_i \sum_j p_{i,j} \dot{n} (V_i \rho u^2{}_j + 2\sigma A_i) = \dot{E}_o + s_e$$

In these equations, $\dot{n}$ is the droplet generation rate in the spray. $\dot{m}_o$, $\dot{J}_O$, $\dot{E}_O$ are mass flow rate, momentum and energy which get into the control volume from injector outlet. S_m, S_{mu} and S_e are the source terms for mass, momentum and energy equations respectively which are used to compensate the existence of additional parameter waived in the equations.

In addition to the kinetic energy, a droplet has a surface energy, which is necessary for its formation. Therefore, $2\sigma A_i$ terms are considered in the energy equation. To obtain a more proper form of equations, it is possible to normalize the equation with $\dot{m}_o$, $\dot{J}_O$, $\dot{E}_O$. Regarding to the definition of momentum average velocity and droplet average volume in spay, mass, momentum and energy equations can be rewritten as follow:

4) Mass balance:

$$\sum_i \sum_j p_{ij} \left(\frac{V_i}{V_m}\right) = 1 + \frac{s_m}{\dot{m}_o}$$

5) Momentum balance:

$$\sum_i \sum_j p_{ij} \left(\frac{V_i}{V_m}\right)\left(\frac{u_j}{\bar{u}_o}\right) = 1 + \frac{s_{mu}}{\dot{J}_o}$$

6) Energy balance:

$$\sum_i \sum_j p_{ij} \left(\frac{V_i}{V_m}\right) \frac{1}{H}\left[\left(\frac{u_j}{\bar{u}_o}\right)^2 + B' k_i\right] = 1 + \frac{s_e}{\dot{E}_o}$$

In these equations, k_i is the division of area to volume of a droplet which belongs to the group size $k_i = \frac{A_i}{V_i}$, $B' = \frac{2\sigma}{\rho \bar{u}_o^2}$. H is the shape factor for velocity profile and can be defined as:

$$H = \frac{\left(\frac{\dot{E}_O}{\dot{m}_o}\right)}{\dot{u}_o^2} = \frac{\left(\frac{\dot{E}_O}{\dot{m}_o}\right)}{\left(\frac{\dot{J}_O}{\dot{m}_o}\right)^2} \qquad (7)$$

When outlet velocity profile is uniform, the shape factor (H) is equal to 1 and volume, velocity and dimensionless source terms can be described as:

$$\bar{V}_i = \frac{V_i}{V_m} \;,\; \bar{u}_j = \frac{u_j}{\bar{u}_o} \;,\; \bar{s}_m = \frac{s_m}{\dot{m}_o} \;,$$

$$\bar{s}_{mu} = \frac{s_{mu}}{\dot{J}_O} \;,\; \bar{s}_e = \frac{s_e}{\dot{E}_O}$$

In addition to the three above mentioned equations, according to the probability concept, total summation of probabilities should be equal to unity:

$$\sum_i \sum_j p_{ij} = 1 \qquad (8)$$

As it is mentioned before, there are infinite probability distributions P_{ij} to satisfy the equations 4 through 8, therefore the most appropriate distribution is the one in which Shannon entropy is maximized.

$$S = -k \sum_i \sum_j p_{ij} Lnp_{ij} \qquad (9)$$

Using Lagrange coefficient procedure, the probability distribution in which entropy is maximized is presented as follow:

$$p_{ij} = \exp[-\lambda_0 - \lambda_1 \bar{V}_i - \lambda_2 \bar{V}_i \bar{u}_j - \lambda_3 (\frac{\bar{V}_i \bar{u}_j^2}{H} + \frac{B' k_i \bar{V}_i}{H})] \quad (10)$$

To obtain coefficient λ_i, equations 4 to 8 and 10 should be solved simultaneously. Probability of finding the droplets which their volumes are between $\bar{V}_{n-1}$ and $\bar{V}_n$ and their velocities are between $\bar{u}_{m-1}$ and $\bar{u}_m$ is presented as follow:

$$_{n-1} \le \bar{u} \le \bar{u}_m \} = \sum_{V_{n-1}} \sum_{u_{m-1}} p_{ij} =$$

$$\lambda_1 \bar{V}_i - \lambda_2 \bar{V}_i \bar{u}_j - \lambda_3 (\frac{\bar{V}_i \bar{u}_j^2}{H} + \frac{B' k_i \bar{V}_i}{H})] \quad (11)$$

Generally, in the spraying problems, the size and velocity of droplets are varied continuously. Therefore, it is possible to uniformly descriptive the analytical domain and instead of using $\sum$; the equations can be stated in the integral form over size and velocity of droplets. It is also feasible to convert analytical domain from volume and velocity of droplets to their diameter and velocity. Hence, Probability of finding droplets which their diameters are between $\bar{D}_{n-1}$ and $\bar{D}_n$ and their velocities are between $\bar{u}_{m-1}$ and $\bar{u}_m$ is presented as follow:

$$p\{\bar{V}_{n-1} \le \bar{V} \le \bar{V}_n, \bar{u}_{m-1} \le \bar{u} \le \bar{u}_m\} = \sum_{V_{n-1}} \sum_{u_{m-1}} p_{ij} =$$

$$= \sum_{\bar{V}_{n-1}}^{\bar{V}_n} \sum_{\bar{u}_{m-1}}^{\bar{u}_m} \exp[-\lambda_0 - \lambda_1 \bar{V}_i - \lambda_2 \bar{V}_i \bar{u}_j - \lambda_3 (\frac{\bar{V}_i \bar{u}_j^2}{H} + \frac{B' k_i \bar{V}_i}{H})] \quad (12)$$

In these equations, $\bar{D}_{n-1}$ and $\bar{D}_n$ are the droplet diameters related to the volumes $\bar{V}_{n-1}$ and $\bar{V}_n$ and f is the probability density function for size and velocity of a droplet (PDF).

$$f = 3\bar{D}^2 \exp[-\lambda_0 - \lambda_1 \bar{D}^3 - \lambda_2 \bar{D}^3 \bar{u} - \lambda_3 (\frac{\bar{D}^3 \bar{u}^2}{H} + \frac{B\bar{D}^2}{H})]$$

$$we = \frac{\rho \bar{u}_o^2 D_{30}}{\sigma}, B = \frac{12}{we} \quad (13)$$

The relative velocity of liquid and gas is near liquid velocity in the analytical domains (location of droplet formation). Droplet generated from spraying is relatively small and usually their shape is considered to be spherical due to the surface tension effects.

Equations 4 to 8 can be restated in integral forms and in analytical domains of velocity and diameter of the droplet. Hence, regarding above mentioned statement, to obtain Lagrange coefficient (λ_i) in PDF (f), it is necessary to solve the following sets of equations.

$$\begin{cases} \int_{\bar{D}_{\min}}^{\bar{D}_{\max}} \int_{\bar{u}_{\min}}^{\bar{u}_{\max}} f\bar{D}^3 d\bar{u} d\bar{D} = 1 + \bar{s}_m \\ \int_{\bar{D}_{\min}}^{\bar{D}_{\max}} \int_{\bar{u}_{\min}}^{\bar{u}_{\max}} f\bar{D}^3 \bar{u} d\bar{u} d\bar{D} = 1 + \bar{s}_{mu} \\ \int_{\bar{D}_{\min}}^{\bar{D}_{\max}} \int_{\bar{u}_{\min}}^{\bar{u}_{\max}} f(\frac{\bar{D}^3 \bar{u}^2}{H} + \frac{B\bar{D}^2}{H}) d\bar{u} d\bar{D} = 1 + \bar{s}_e \\ \int_{\bar{D}_{\min}}^{\bar{D}_{\max}} \int_{\bar{u}_{\min}}^{\bar{u}_{\max}} f d\bar{u} d\bar{D} = 1 \\ f = 3\bar{D}^2 \exp[-\lambda_0 - \lambda_1 \bar{D}^3 - \lambda_2 \bar{D}^3 \bar{u} - \lambda_3 (\frac{\bar{D}^3 \bar{u}^2}{H} + \frac{B\bar{D}^2}{H}) \end{cases} \quad (14)$$

As it can be seen from the equations, the analytical domain is changed from $\bar{D}_{\min}$ to $\bar{D}_{\max}$ and from $\bar{u}_{\min}$ to $\bar{u}_{\max}$. The variations of $\bar{D}$ and $\bar{u}$ in the domain are independent that is, the probability of existence for every droplet (with arbitrary velocity $\bar{u}$ and diameter($\bar{D}$) is considered

SOURCE TERMS

Not considering the flow which enter from the nozzle of control volume and droplets which after formation depart the control volume, if there is any inlet or outlet of mass flow rate, it should be considered in a source terms. As an example, the evaporation and distillation of liquid during spraying process should be considered in a source term. If within the control volume, there is a momentum exchange between the flow and continuous phase, this momentum transformation should be considered as a source term. For instance, the effects of drag force on liquid body can be stated. The drag force is proportional to the relative velocity between liquid and gas.

In the present formulation of entropy maximization, all the sources and sinks of energy (source and sinks of kinematics energy, surface energy, turbulence energy etc will be accumulated in the energy source term (Se). If there is any energy conversion whiting the control volume, it is not considered as a source term. Therefore, the entire energy, entering and exiting from control volume and not considered in the equations is computed as a source or sink term. As an example, the energy conversion from heat and the energy exchange from evaporation and distillation can be pointed out.

When the liquid enter from the nozzle to the gas environment, some of its kinetic energy is consumed by free surface formation and consequently droplet constitution. This energy which is called surface energy is a state of energy conversion within the control volume and hence, is not computed in the source terms.

NUMERICAL ANALYSIS

To obtain this function, it is imperative to determine Lagrange coefficient λ_i in equations 13 which can be computed from solving the equations set of 14 simultaneously. In this paper, to solve this set of equations, Newton-Raphson method is used. At first, some initial value for the $\lambda_0, \lambda_1, \lambda_2, \lambda_3$ is assumed. Then, using this values and Newton-Raphson procedure, new value for λ_0 and then $\lambda_1, \lambda_2, \lambda_3$ is obtained and this procedure is continued until final answer is computed.

To solve these equations, it is noted that, function G_i and their derivatives are integral functions. Therefore, to compute their value, double integrals function should be solved numerically in all iterations. Another important point is that G_i functions and their derivatives are integral functions and the terms in these integrals are exponential, hence if the selection of an initial guessed of λ_i turns out to be close to the answer, the value starts to diverge away from the answer immediately.

MODELING

To assess maximum entropy principle for determination of PDF, the procedure is evaluated for a special operating condition. Therefore, a spray resulting from a conical hollow nozzle is modeled. The prescribed condition is the one which was previously used by Li and Tankin [7, 8] in their research.

In this condition, a fluid (water at 20^0C) is sprayed to a stationary continuous environment (air at 20^0C and 1atm pressure). The injector characteristics are presented in table 1.

If the velocity profile at the injector outlet is assumed uniform, the shape factor of velocity profile (H) will be unity. But if the outlet flow from the injector is assumed to be fully developed and turbulent, this factor will be equal to 1.01647 if the fluid is relatively developed, the shape factor will be between 1 and 1.01647 [8]. Regarding the fact that Li and Tankin, in their investigation, assumed a uniform velocity profile at the injector outlet, in this research shape factor of velocity profile is considered unity. According to the supposed value in table 1, table 2 parameter can be computed.

Table1. Spray characteristic [7]

Fluid characteristic	Density	998.2 (Kg/m^3)
	Surface Tension	0.0736 (N/m)
Ambient air characteristic	Density	1.22 (Kg/m^3)
	Absolute viscosity	$1.915*10^{-5}$ (N/m.s)
Injector specification	Output Diameter	0.002 (m)
	Gap thickness	$1.097*10^{-5}$ (m)
Injection condition	flow	$2.809*10^{-3}$ (Kg/s)
	Average Velocity	40.8 (m/s)
	Initial rotation velocity	0
	Initial angular injection	24.4
	Average mass diameter	$1.37*10^{-5}$ (m)
	Coefficient of figure	1

Table2. Momentum and energy flow rate into the control volume

Weber Number	We	311
Control volume flow rate	$\dot{J}_O$	0.1147 (N)
Control volume energy rate	$\dot{E}_O$	4.684 (Nm/s)

To solve the governing equation, analytical domain is considered as follow:

$$\overline{D}_{\min} = 0 \quad , \quad \overline{D}_{\max} = 3$$
$$\overline{u}_{\min} = 0 \quad , \quad \overline{u}_{\max} = 3$$

The source term of all the conservation equations except momentum equation are assumed zero because by considering zero source term for momentum equation, this equation and kinetic energy behaves in such a way that the velocity variation approach zero which contradict the reality. Besides, in the present simulation, the effects of evaporation, collision and merging of droplets are not considered. To evaluate the air effects on the droplets, all of them are supposed to have spherical shape.

One of the occasion in which momentum exchange between liquid and continuous phase occurs is the influence of drag force on the droplet body. To evaluate drag force, conical layer from outlet of the nozzle to the fracture inception of the fluid layer is opened and estimated as a triangular shape. As an approximation, it is considered that this layer is a flat and stationary layer on which the air is passed with a relative velocity of liquid gas. Considering a laminar boundary layer flow passing on a flat plate, it is possible to compute C_f so the momentum source term can be evaluated as shown in table 3. The Reynolds number in calculation of the source term is based on the jet velocity at the outlet of injector [7].

Table3- Computed source term for momentum equations

Air Velocity	Drag Force	Non dimensional number of terms sources
Corrected average velocity	$1.953*10^{-3}$ (N)	-0.01702

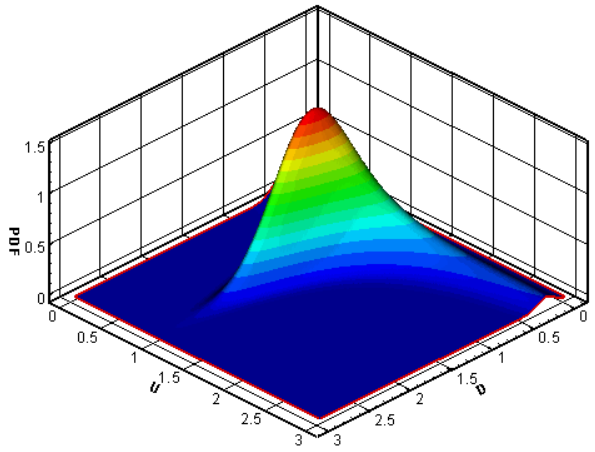
Air velocity also considered as an average of minimum film velocity (velocity at the outlet of injector) and film velocity at the location of friction force calculation. In this procedure, an integral of average velocity is computed to some extent.

NUMERICAL RESULTS

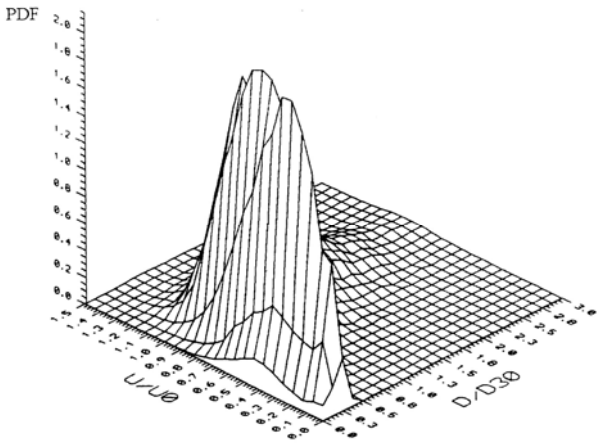
The three dimensional probability distribution for size-velocity and measurements are demonstrated in figures 2. Computations are shown in figure 2-a while experimental data of Li and Tankin results [7] are presented in figure 2-b.

The calculated probability contour and measurements are also exhibited in figure 3. The difference between contours distributions is affected by measurement accuracy for the momentum source term which is also affected by the drag forces exerted on the droplet after jet fracture because, as it is mentioned, in the present spray, the fracture of conical jet occurs at 7

cm apart from the nozzle, while the region which velocity and size of droplets are measured at the distance of 10 cm apart and during this interval, the droplets are generated from the fluid jet and drag forces exerted on the droplet are not consisted in computation of momentum source term.



2-a: The computed velocity-size probability distribution



2-b: The measured velocity-size probability distribution [7]

Figure 2. Comparison of theoretical and experimental velocity-size probability

In figure 4, the measured and computed probability distributions of size are demonstrated. This function is acquired from the integration of velocity-size probability distribution function over the velocity interval. As it is apparent from the figure, there is a satisfactory agreement between theoretical and experimental results.

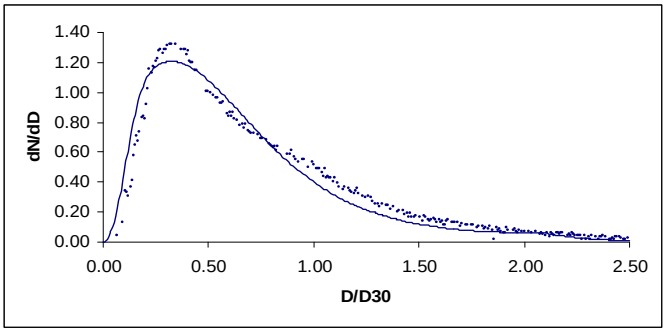
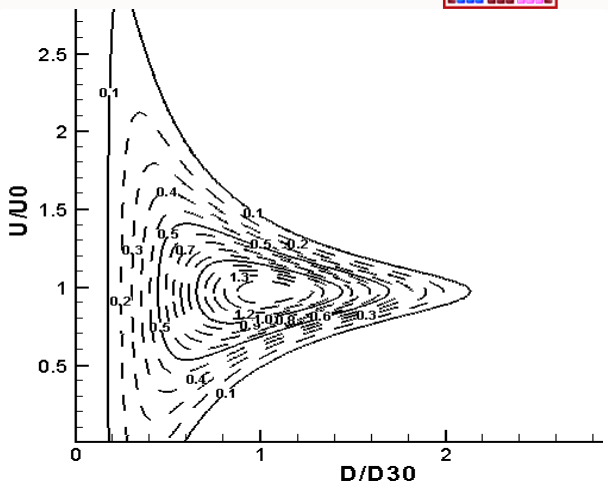
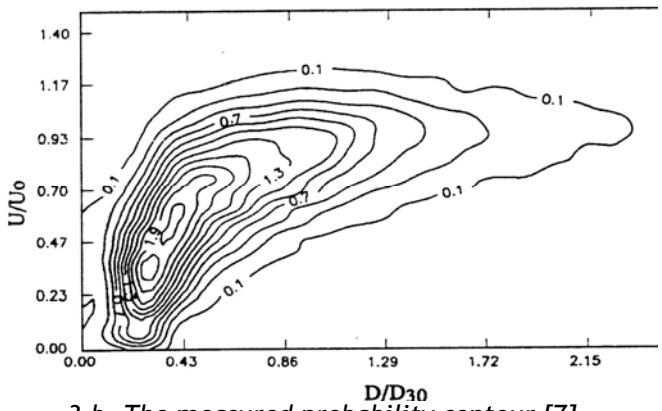


Figure 4. Comparison of theoretical and experimental droplet size distribution



3-a. The predicted probability contour



3-b. The measured probability contour [7]

Figure 3. Comparison of theoretical and experimental contour

WEBER NUMBER EFFECT

In this section, the influence of increasing Weber number on the velocity and size distribution of droplets, in a spray, are investigated. Rising Weber number always results in increasing instability of the fluid jet. It is also leads to the earlier formation of droplets and jet fracture. In figures 5 and 6 the diameter and velocity distributions of droplets at the distance of 10cm from the nozzle and after jet fracture inception and droplet generations versus Weber number are shown. According to the figure 7, by increasing the Weber number, the curves of droplet size distribution become more flat and its maximum decreases hence, droplet size distribution become uniform. However, after Weber number reaches to a specific number, the variations of distribution curves decreases even its trend can be reversed. This point can be seen more clearly in the droplet velocity distribution in next figure. In figure 8, by increasing the Weber number, from a small value to a specific value, the velocity distribution curves shrinks and expands. As a result, the peak of velocity distribution curves becomes greater.

By Increasing Weber, number beyond the critical point, the trends reversed and the velocity distribution of droplets expand and their maximum decrease. Therefore, the velocity distribution becomes uniform.

Therefore, as it can be seen, there is a critical Weber number, which has influence in the velocity distribution; for the prescribed conditions, its value is obtained 200 approximately.

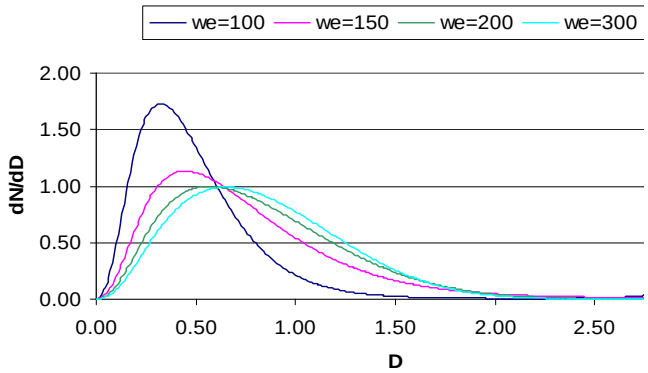


Figure 5: Curves of the dimensionless size of the sprayed droplets at the distance of 10cm from the nozzle versus Weber number

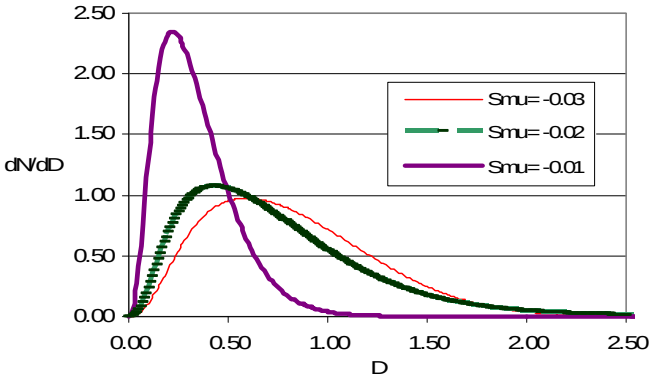


Figure 6- Curves of the dimensionless diameter of the sprayed droplets at the distance of 10cm from the nozzle versus momentum source term

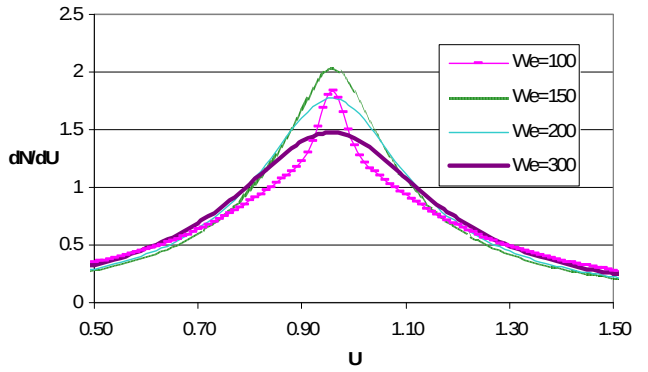


Figure 7- Curves of the dimensionless velocity distribution of the sprayed droplets versus Weber number

ENERGY SOURCE TERM EFFECTS

All the sources and sinks of energy (like kinematics sources and sinks, surface energy, turbulence energy) are collected in the energy source term (S_e). The inlet and outlet energy of the control volume are assumed as the energy source or sink. However, the energy conversion within the control volume is not computed in the source terms. In the turbulence flows, the velocity fluctuations produce additional kinematics energy within the control volume, which is not considered in the equations.

This turbulence energy, which can be consumed for the jet deterioration and droplet formation, is an energy source term and should be considered in the energy source term to increase accuracy [1].

Hence, it is expected that by increasing the magnitude of energy source term, the quality of atomization increases which leads to generating more uniform velocity and diameter distributions of the droplets. This effect is demonstrated in the figure 9 and 10, in which the velocity and diameter distribution of the droplets is plotted.

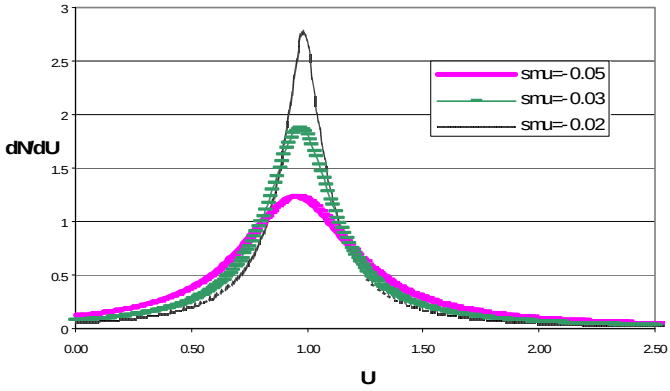


Figure 8- curves of the dimensionless velocity of the sprayed droplets at the distance of 10cm from the nozzle versus momentum source term

CONCLUSION

In the present paper, the random process of distributing diameter and velocity of the droplets is modeled implementing maximum entropy principle (MEP) after jet fracture and droplets formation.

This approach is applicable for predicting the size and velocity distribution of droplets in the systems which thermodynamics equilibrium prevails. However, the process of spray formation is irreversible and no adiabatic and there is always interaction between atomized liquid and surrounding gas. Therefore, establishing a harmony between the results of modeling using MEP and experimental data is a difficult achievement. Although, simplified assumptions used to solve the equations, the results demonstrated a satisfactory conformity with the experiments, which revealed the model ability to account the effects of processes occurs in the spray control volume. Since the functions and their derivatives in the governing equations are in the integral form and function in the integral are exponentials, the solution is sensitive to the initial guess λ_i and by using a wrong initial value, and the solution diverged immediately.

A precise estimation of the source terms is very important so that to acquire exact results the relative velocity variation between liquid and gas in estimating the drag forced should be considered. It is also crucial to observe the drag forced exerted on the droplet after fracture inception. For computation of turbulence effect, at the outlet of the nozzle and heat transformation between two phases, energy source term should be calculated.

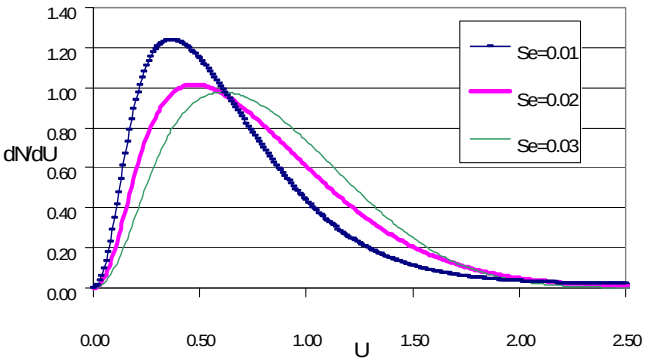


Figure 9 - Curves of the dimensionless diameter distribution of the sprayed droplets at the distance of 10cm from the nozzle versus momentum source term

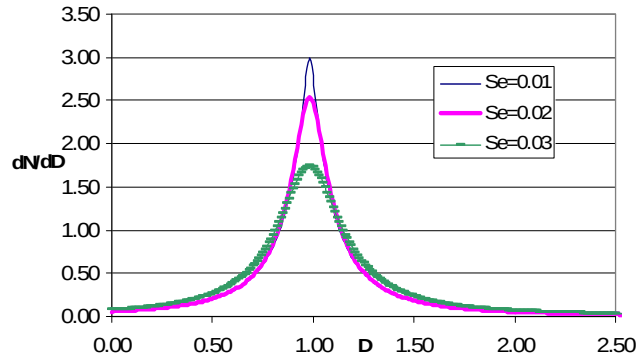


Figure 10 - Curves of the dimensionless velocity distribution of the sprayed droplets at the distance of 10 cm from the nozzle versus momentum source term

REFERENCES

[1.] *H. P. Trinh, Modeling of turbulence effect on liquid jet atomization, A Thesis Submitted for the Degree of Doctor of Philosophy in mechanical engineering, The University of Alabama, 2004.*

[2.] *J. Cousin, SJ. Yoon, C. Dumouchel, Coupling of classical Linear Theory and Maximum Entropy Formalism for Prediction of Drop Size Distribution in sprays. Atom Sprays, 1996, 6:601-22.*

[3.] *L. Huimin, Science and Engineering of Droplets, Chapter 3, William Andrew Publishing, 2000, New York U.S.A*

[4.] *M. Ahmadi, R. W. Sellens, A Simplified Maximum Entropy Based Drop Size Distribution, Atomization and Spray 3, 1993, 291-310.*

[5.] *R.W. Sellence, T.A. Brzustowski, A Simplified Prediction of Droplet Velocity Distribution in a Spray, Combustion and Flame 65, 1986, p.273-279.*

[6.] *R.W. Sellence, T. A.Brzustowski, A Prediction of Drop Size Distribution in a Spray from Principle, Atomization and Spray Technology 1, 1985, p.89-102.*

[7.] *X. Li, L.P. Chin, R. S. Tankin, Comparison between Experiments and Predictions Based on Maximum Entropy, Combustion and Flame 86, p.73-89*

[8.] *X. Li, M. Li, Droplet size distribution in sprays based on maximization of entropy generation, Entropy, 5, 1991, 417-431.*

[9.] *X. Li, R.S. Tankin, Droplet size distribution: A Deviation of a Nukiyama-Tanasawa Type distribution function, Combustion Science and Tech. 1987, 56, 65-76.*

[10.] *Y. Ohyama, "The Effects of Fuel Injection System in Spark Ignition Engine on Exhaust Emissions and Fuel Economy", SAE Technical Paper, 1995, №.95A6022.*

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MANUFACTURING AUTOMATION FOR HANDLING ASYMMETRIC COMPONENTS

ABSTRACT:
A prominent problem in manufacturing automation is the accurate and reliable presentation of small parts, in a single specified configuration called preferred orientation, to a work cell. This is often referred to as the "part feeding" problem. Low cost automation is employed to develop the part feeding system for brake liner, a typical asymmetric part. Currently handling of such asymmetric parts is done either manually or by using expensive robot and vision systems. These approaches cumulatively increase the production cost. The proposed low cost part feeder system uses sensor less mechanical devices or barriers such as slot, wiper blade, balcony, edge riser etc. to eliminate or reorient the arbitrary orientation into a preferred orientation which facilitates stacking. A complete set of such mechanical devices is called trap. The orientation with highest probability of occurrence is found using drop test, which is the preferred orientation at the exit of the feeder. A trap is designed to get the preferred orientation at the exit of the feeder. Critical dimensions of the trap were identified and experiments were conducted to optimize them.

KEYWORDS:
Part feeders, linear vibratory feeders, traps, brake liners

INTRODUCTION

Automation is generally employed in the field of material handling and orienting in a manufacturing environment. An accepted definition of materials handling is the art and science of moving, positioning, packing and storing substances in any form. The material handling devices are normally designed around standard production machinery and integrated with specially made feeders. Such feeders replace human effort by supplying the material-to-be-worked at the work station. Machinery designers undertake the design of special elements based on the material-to-be-handled, range available in the market, affordability etc. Asymmetric components in the form of circular/cylindrical sectors are few areas unchartered. In the present work, brake liner, a typical asymmetric component has been considered and a feeding system is developed to feed and orient them. With our manufacturing sectors requiring large volume of such a product, automation based processes become essential. In the field of research, automation is not new and there has been substantial amount of literature published in this area. However, the published work is mostly limited to cylindrical and regular prismatic components. The sector shaped parts like brake liners, half bearings have more number of stable poses, which makes the processes of feeding and orienting, complex. Hence, a specialized feeding system has to be designed. Boothroyd [1] has done seminal work on characterizing industrial part feeders. An excellent introduction to mechanical parts feeders can be found in Boothroyd's book .With Poli and Murch[2], he developed taxonomy of industrial parts and feeders for orienting such small industrial parts.Goldberg and Gordon smith [3] discussed a class of mechanical filters that can be described by removing polygonal sections from the track of the feeder; they refer to this class of filters as traps, which eliminate or reorient the parts until they reach the final preffered orientation . These traps do not employ any sensor based devices. Robert-Paul Berretty et al [4]has discussed about design of traps for vibratory bowl feeders . B.K.A.Ngoi et al [5] has analyzed the natural resting aspects of parts in vibratory bowl feeders using 'Drop Test'. The works of Dina R. Berkowitz et al [6] concentrated on a tool based on dynamic simulation for Markov model building of part feeders . This Markov model was used to evaluate the performance of the feeder. Edmondson et al [7] has developed a flexible parts feeding system using flex feeders, pattern matching sensors and PLC. Wee et al [8] developed a flexible belt parts feeder to separate cylindrical parts. Patrick S.K. Chua et al [9]

developed an active feeder for handling cylindrical parts having grooves at one end. Omno C Goemans et al [10] discussed about blades for feeding 3D parts on vibratory tracks. He had considered L-type and T-type components for his experiments. In the present paper, an attempt is made to design a simple inexpensive trap to make the asymmetric component (brake liner) fall in the preffered orientation on a moving conveyor without the aid of robots and sensors. The conventional manufacturing of brakeliners segment parts involve the following processes as shown in Table 1 The granules are mixed with chemicals and are preformed into a brakeliner sheet. The brakeliner sheet is cut into samll brakeliner pieces in a slitting machine. The brakeliners are then sent for internal grinding, external grinding, chamfering and final inspection.

Table 1. Manufacturing of brakeliners

Operation No	Process
1	Mixing of granules with chemicals
2	Preforming / hot molding
3	Slitting/ cutting to size
4	Internal grinding / finishing
5	Outer grinding/ finishing
6	Chamfering/ edge nosing
7	Inspection of size/ shape

During each stage of operations 3 to 6 (Figure 1), the components have to be segregated and stacked for further processing. In the absence of an appropriate part feeding system, the segregation and stacking between each stages are to be done manually., which consumes more labour time. If a part feeding system is developed for handling these parts, then productivity can be increased by reducing the labour time.

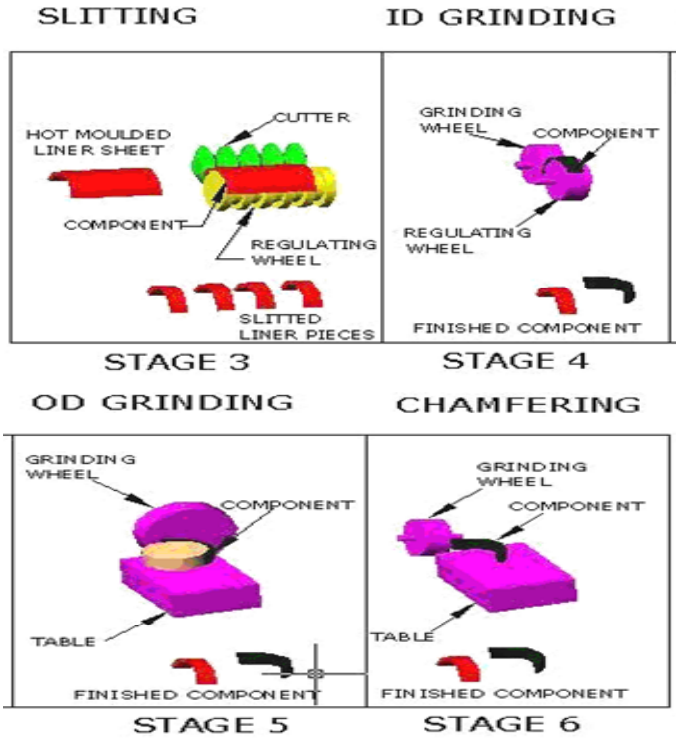

Figure 1. Machining stages of brake liners

OBJECTIVES

The following objectives are addressed to fulfill the above requirements:

- To study the different resting orientations of sector shaped parts and determine the most probable occurring orientation
- To develop a part feeder system using traps to handle sector shaped parts.
- To determine the critical dimensions of the trap.

METHODOLOGY

The methodology of the work is listed below:

- Study of resting orientations of the identified sector part (brake liner) and identification of the most favorable orientation by drop test.
- Design of a part feeding system (trap) for the favorable orientation of the brake liner, without sensors.
- Determination of critical dimensions of the trap, experimentally.

NATURAL RESTING ORIENTATION OF THE BRAKE LINER

The brakeliner considered for the experiments is shown in Figure 2. This brake liner is sector shaped, asymmetric in nature and has less weight of about 8.829 g.

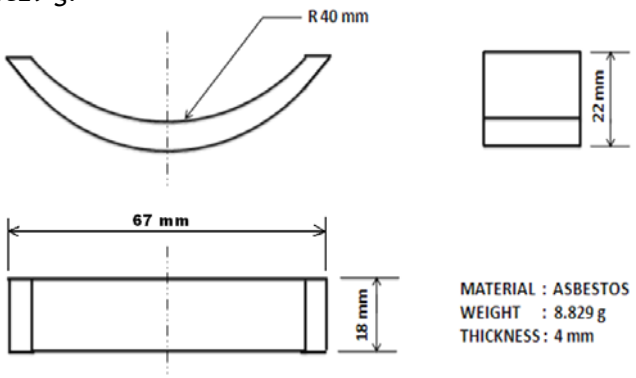

Figure 2. Brake liner

The brakeliner has eight possible resting orientations which are numbered as 1 to 8 as shown in Figure 3.

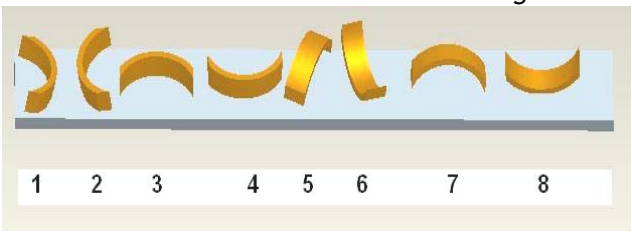

Figure 3. Resting orientations of brakeliner

Out of the eight orientations, the neighboring orientations are clubbed into same family and are named as orientations 'a', 'b' and 'c' as shown in Figure 4. The orientations 1,2 3 and 4 which rest on the sector shaped sides are grouped as orientation 'a'. The orientations 6 and 8 which have their open side facing towards sky are grouped as orientation 'b'. The orientations 5 and 7 which have their open side facing towards ground are grouped as orientation 'c'. The orientations a, b and c were considered only for drop tests and for design of traps, orientations 1 to 8 were considered.

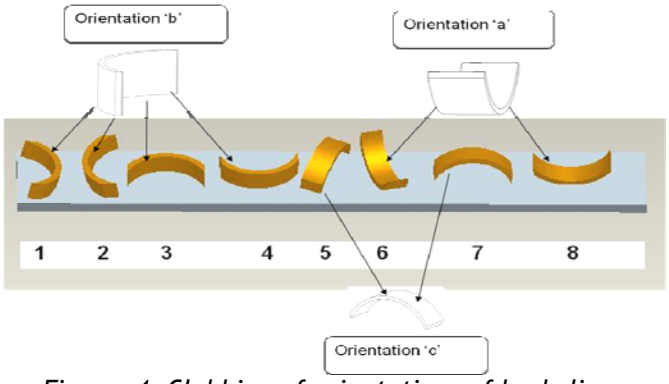

Figure 4. Clubbing of orientations of brakeliner

DROP TEST

In order to determine the most occurring natural resting orientation of parts, drop test was conducted. The following steps were involved in the drop test [5]

- *A sample size of 30 parts was taken.*
- *Parts were dropped one at a time from a height into a hopper.*
- *When the part came to rest, the orientation was noted.*
- *Steps 1 to 3 were repeated by varying the initial orientation from a, b and c with the height fixed.*
- *Steps 1 to 4 were repeated for varying heights of 10, 12, 14, 16, 18, 20, 22, 24 and 26 cm. (When the part is dropped at any height greater than of 26cm, the part jumps out of the hopper).*
- *The orientation which occurs the most was considered the natural resting orientation or the favorable orientation of that part.*

Figure 5(A) to Figure 5(I) show the result of drop test conducted at different heights (10 cm to 26 cm) with initial orientations as a, b and c.

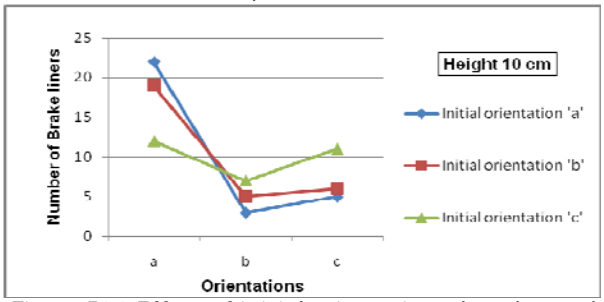

Figure 5(a) Effect of initial orientation when dropped from 10 cm height

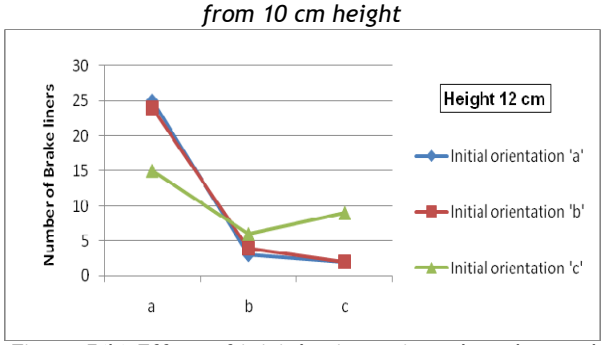

Figure 5(b) Effect of initial orientation when dropped from 12 cm height

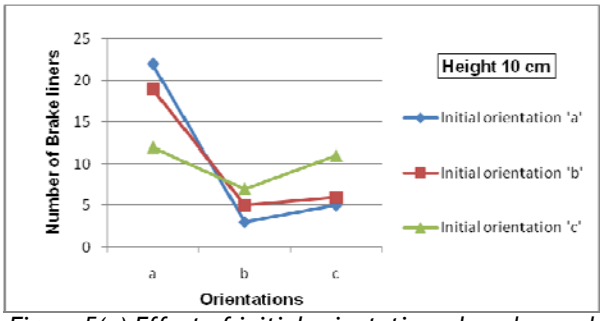

Figure 5(a) Effect of initial orientation when dropped from 10 cm height

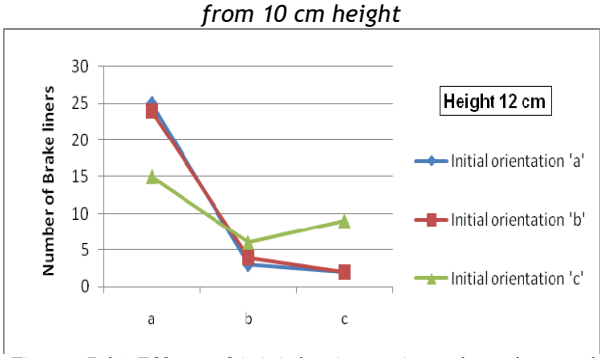

Figure 5(b) Effect of initial orientation when dropped from 12 cm height

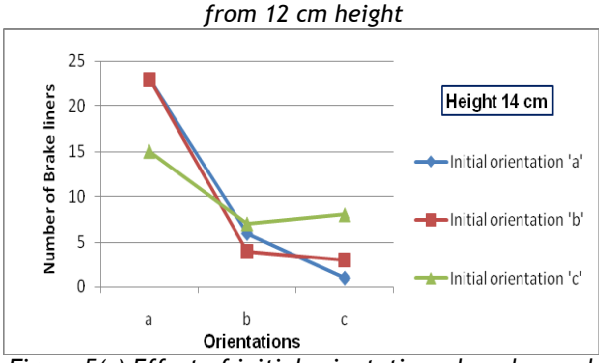

Figure 5(c) Effect of initial orientation when dropped from 14 cm height

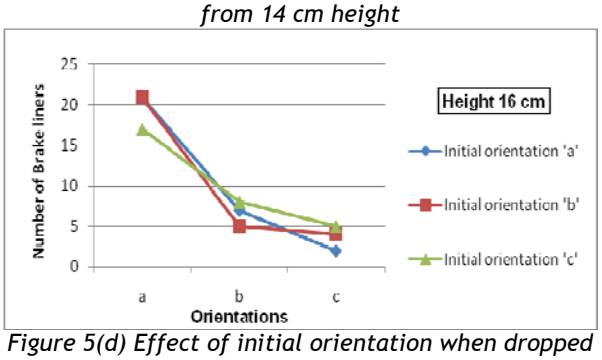

Figure 5(d) Effect of initial orientation when dropped from 16 cm height

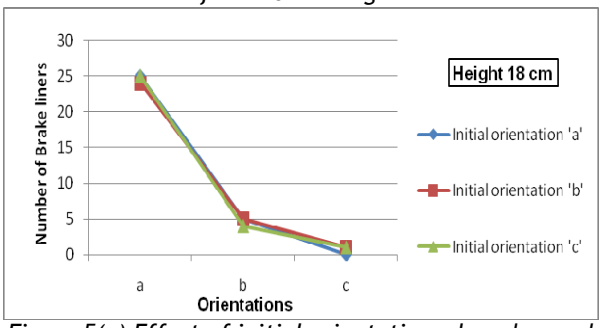

Figure 5(e) Effect of initial orientation when dropped from 18 cm height

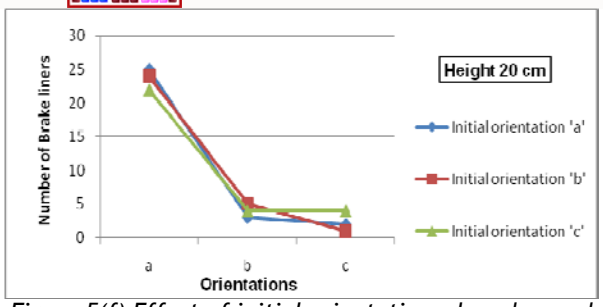

Figure 5(f) Effect of initial orientation when dropped from 20 cm height

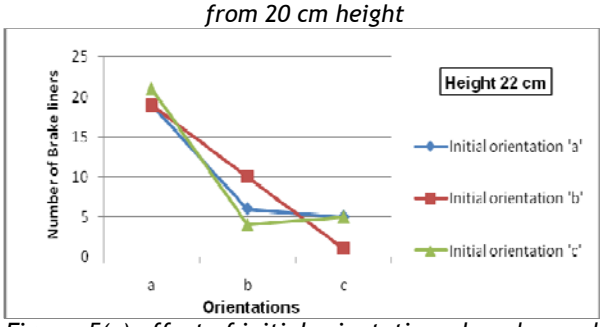

Figure 5(g) effect of initial orientation when dropped from 22 cm height

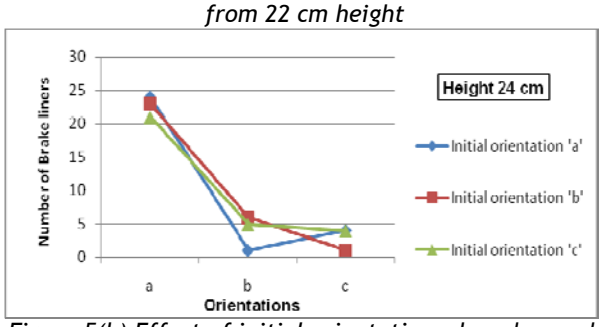

Figure 5(h) Effect of initial orientation when dropped from 24 cm height

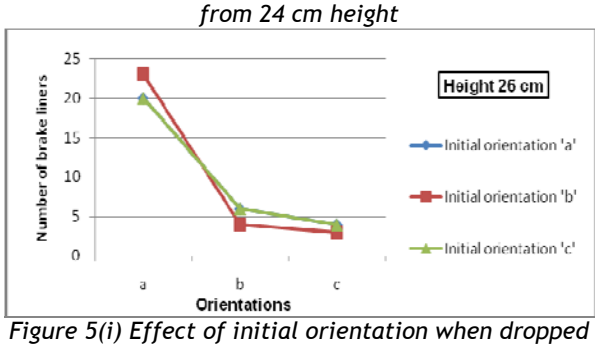

Figure 5(i) Effect of initial orientation when dropped from 26 cm height

It can be observed from the above drop test data that, orientation 'a' was obtained mostly, irrespective of which initial orientation the part was dropped as shown in Figure 5(a) to Figure 5(i). So the trap has to be designed in such a way that output is always orientation 'a', i.e. orientation 6 or 8 as shown in Figure 3. The height was observed to be a factor that changed the probability of occurrence of natural resting orientations due to its impact on potential energy of the part. Thus a proper height has to be maintained to obtain the most probable resting orientation. Initial orientation has no significant effect on the probability of occurrence of natural resting orientations when sector shaped parts were dropped from a height of 18 cm and 20 cm because only at those heights the potential energy was sufficient to facilitate a change in orientation.

DESIGN CONSIDERATION FOR TRAPS

Goldberg and Gordon smith[3] discussed a class of mechanical filters that can be described by removing polygonal sections from the track of the feeder; they refer to this class of filters as traps, which eliminate or reorient the parts until they reach the final preffered orientation. Mechanical traps are proposed to get a single orientation of parts to facilitate stacking. These traps having various combinations of gates (such as slot, balcony, guiding block, edge riser, gap etc), will either reorient or eliminate the disoriented component. Some of the important gates of the trap are discussed in the following sections.

Types of Gates

The mechanical barriers are classified into two categories, based on their function (i) reorient or (ii) eliminate the disoriented component.

Active Gates

These are the gates which reorient the component to preferred orientation without disturbing the preferred orientation.

Passive Gates

These are the gates which eliminate the unfavorable orientation without disturbing the preferred orientation.

Slot

A slot is a rectangular interruption of the supporting area of the trap.

Wiper Blade

A wiper blade is a mechanical barrier, which converges towards the outlet of the trap and ends with a narrow critical path.

Gap

A gap is an interruption of the supporting area that spans the entire width of the track. Both of its boundaries are perpendicular to the vertical surface of trap. The shape of a gap can thus be characterized solely by the distance between these two parallel boundaries. This distance is referred as the gap length.

Guiding Block

The guiding block is a rectangular interruption which could be characterized by the track width it allowed.

Edge Riser

Edge riser is an inclined plane mounted on the track of the feeder which is used to reorient the parts.

Design of Trap I

The model of a trap I (made of cardboard) developed in this work is shown in Figure 6.The wiper blade was introduced at the entry of the trap to reorient the incoming parts with orientations 1,2,5 and 6 to orientations 3,4,7 and 8 . A slot was introduced in the vertical surface to eliminate parts with orientation 4 and a gap in the horizontal surface to eliminate parts with orientation 7. A balcony was provided to ensure that orientations 1, 2 5 and 6 were eliminated. To ensure that the parts were always in contact with vertical surface, the horizontal surface was slightly inclined.

Markov model for Trap I

Markov model was used to compute the probability that a part in a particular initial orientation will end

up in the preferred final orientation. The probability for each pre- and post-orientation, that the gate will convert, was computed. Once Markov model for each gate was obtained, the gate models were chained together to get a model for the entire feeder. Orientations 3 and 8 were the output of the trap I as shown in Figure 6. From Markov model as shown in Figure 7, the efficiency of the trap I was estimated as 54%. Also, it can be seen that the preferred orientation 8 came out with the undesired orientation 3. It has to be eliminated or reoriented to get preferred orientation 8 as the only output.

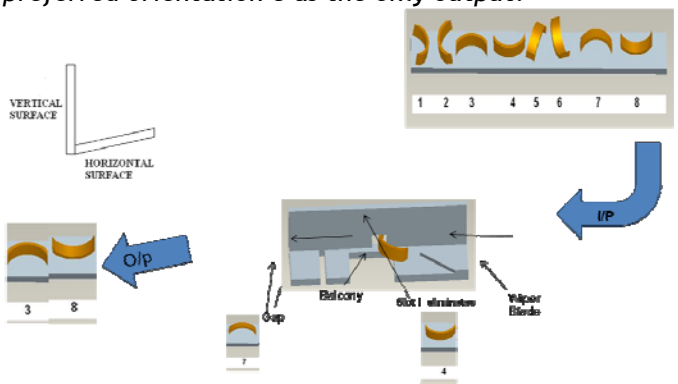

Figure 6. Model of trap I

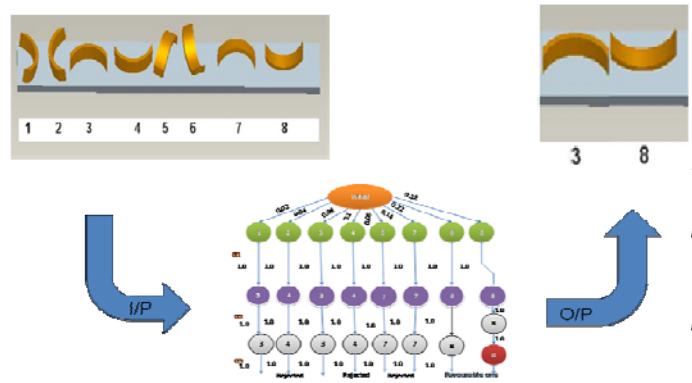

Figure 7. Markov model for trap I (Probability for Preffered orientation = 0.54)

Design of Trap II

The need for trap II was to reject or reorient the orientation 3, without disturbing the preferred orientation 8. An edge riser, an active tool with a guiding block was used to exactly reorient the part in orientation 3 into orientation 8 and allow only orientation 8 without any disturbance, as shown in Figure 8.

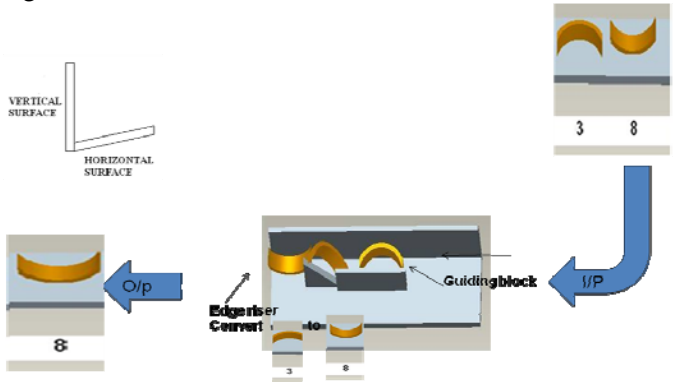

Figure 8. Model of trap II

The guiding block guide the part in orientation 3 to send it to the next gate, edge riser . The part in orientation 8 was unaffected by the edge riser. As the part moves over the edge riser, change of momentum takes place. Because of this change of momentum the part is decelerated. At a particular height, the centre of mass of the part falls out of the projected area of the part, and hence the parts topple and get converted to orientation 8.

Markov model for Trap II

In trap II, the orientation 3 was converted in to orientation 8 which was 10% of the total in coming parts. This provided an advantage of increase in efficiency by 10%. Finally the probability of success for the preffered orientation at the exit of the feeder was found as 64% from Markov model as shown in Figure 9.

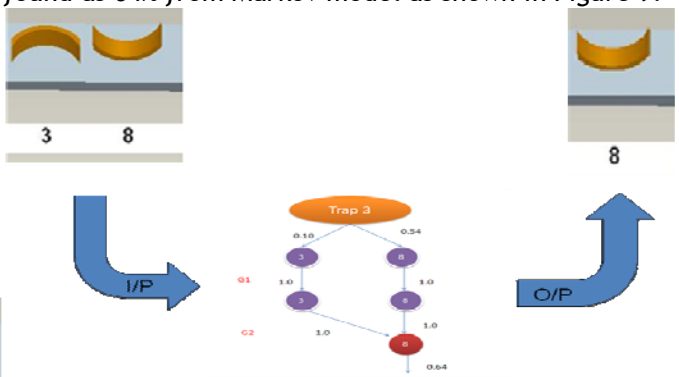

Figure 9. Markov model for trap II (Probability for Preffered orientation = 0.64)

Design of Trap III

The efficeincy of trap II was 0.64 as discussed in the previous section and the feasibility of increasing the efficiency is discussed in this section. The gates are reordered as shown in Figure 10 to obtain maximum probability of success.

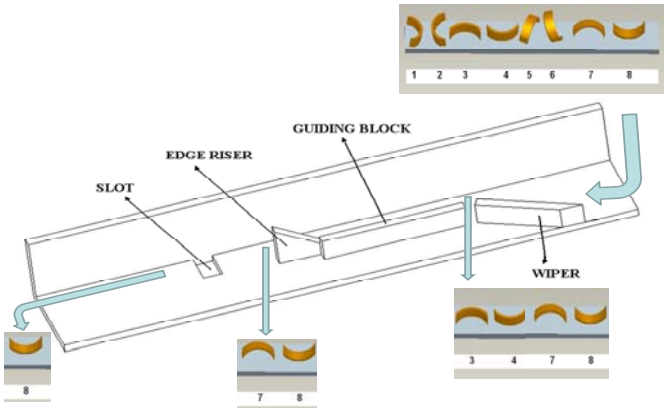

Figure 10. Model of trap III

The wiper blade was introduced at the entry of the trap to reorient the incoming parts with orientations 1,2,5 and 6 to orientations 3,4,7 and 8 . At guiding block and edge riser, parts of orientation 3 and 4 get reoriented to orientations 8 and 7 respectively. Orientation 7 was removed through the slot, but fell down as orientation 8. So, a conveyor was placed below the slot so that the part of orientation 8 was transported along with the parts at the exit of the trap. Hence, the efficiency of the trap increased to 100%.

DETERMINING THE CRITICAL DIMENSIONS OF THE TRAP

The dimensions of the trap were obtained through trial and error method. The critical dimensions are the wiper blade angle (Ø) with the vertical surface of trap and the trap inclination angle (θ) with the horizontal surface as shown in Figure 11 and Figure 12 respectively. The trap was made of cardboard to determine the critical dimensions.

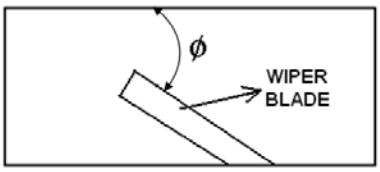

Figure 11. Wiper blade angle

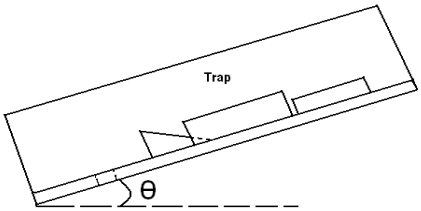

Figure 12. Trap inclination angle

Determining the orientation of wiper blade

The wiper blade angle (Ø) was varied from 20° to 40°. This range was fixed because, for wiper blade angle less than 20° the parts tend to nest (cluster), since the path was too narrow for the parts to pass through it. For wiper blade angle greater than 40°, some parts passed without getting in contact with the wiper blade and hence reorientation did not occur and the parts tend to nest at the entry of guiding block. So, the wiper blade angle range was fixed as 20° to 40°.

In order to determine the appropriate wiper blade angle the following steps were followed,

- *A sample size of 30 parts was taken.*
- *The wiper blade angle was fixed to particular angle (Ø).*
- *Parts were dropped at random orientations at the entry of the wiper blade.*
- *The number of parts that have successfully exited the wiper blade with or without reorientation was noted.*
- *Steps 1 to 5 were repeated 5 times (5 trials) so that the results are reliable.*
- *Steps 1 to 6 were repeated by varying the wiper blade angle (Ø) from 20° to 40°.*

From Figure 13, it can be clearly seen that for angles between 25° to 35° almost all parts were re-oriented to preferred orientation. Hence, wiper blade angle was set between 25° to 35°.

Determining the trap inclination angle

The trap inclination angle (θ) was varied from 20° to 40°. This range was fixed because, for inclination angle (θ) less than 15° the parts do not slide on the track, since the excitation force could not overcome the frictional force. For angle greater than 30° the parts slide very fast and then tumble. So, the trap inclination angle was varied between 15° to 30°.

In order to determine the trap inclination angle the following steps were followed,

- *A sample size of 30 parts was taken.*
- *The trap inclination angle was fixed to particular angle (θ).*
- *Parts were dropped at random orientations at the entry of the trap.*
- *The number of parts that have successfully exited the trap with or without reorientation was noted.*
- *Steps 1 to 5 were repeated 5 times (5 trials) so that the results are reliable.*
- *Steps 1 to 6 were repeated by varying the trap inclination angle (θ) from 15° to 35°.*

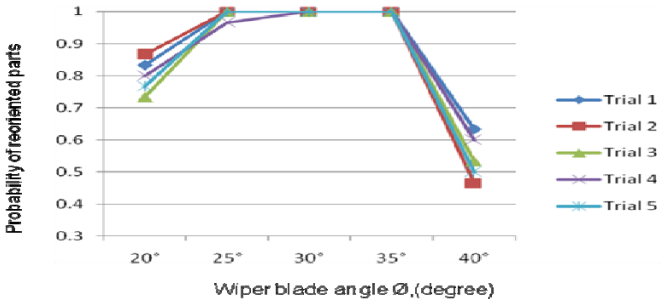

Figure 13. Effect of wiper blade angle on successful orientation of parts

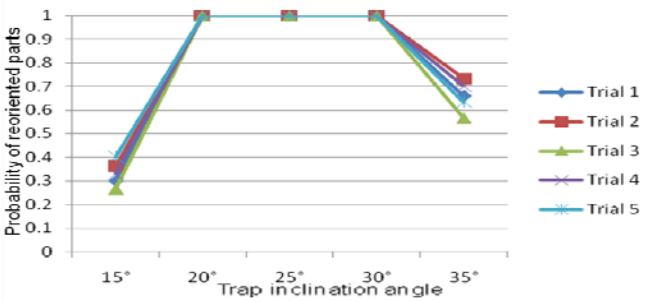

Figure 14. Effect of trap inclination angle on successful orientation of parts

From Figure 14, it can be clearly seen that for angles between 20° to 30° almost all parts pass through the trap and re-orient themselves without nesting. Hence, Trap inclination angle is set between 20° to 30°.

Fabrication of trap

The trap was fabricated (Figure 15) using acrylic plastic. Acrylic plastic was chosen as it has a fairly low coefficient of friction when compared to other materials, ease of fabrication, low cost and bulk availability.

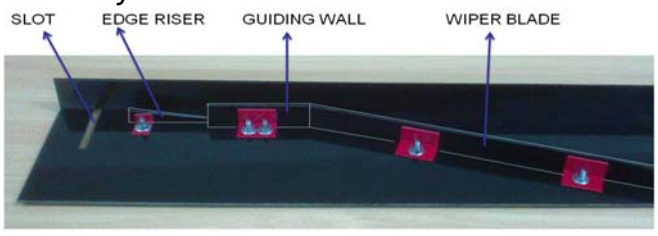

Figure 15. Fabricated trap

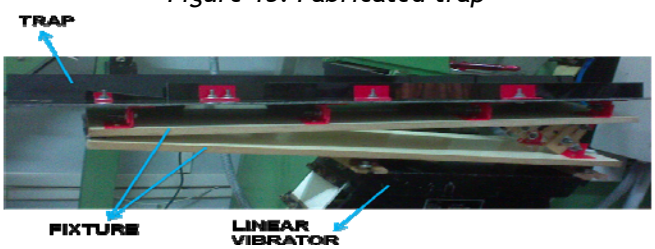

Figure 16. Experimental set-up

The above discussed experiments were repeated using the acrylic plastic trap and the appropriate wiper blade angle range was found to be between 25° to 35°. Similarly, the appropriate trap inclination angle was found to be between 9^0 and 11^0.

Optimization Of Parameters For Maximum Conveying Velocity

The frequency, amplitude of vibration and the trap inclination angle play a critical role in determining the conveying velocity of the trap assembly. ANOVA (Analysis of Variance) technique was adapted to find the effect of these three factors on conveying velocity of the trap. Figure 16 shows the experimental set-up, i.e. trap mounted on a linear vibratory feeder. Levels are the limits within which the factors can vary during the experiment. The level was chosen as three. The outcome of these (Factors and Levels) combinations gave 27 experiments (Levels ^{Factors} = 3^3 = 27). Table 2 shows the factors and levels chosen.

Table 2. Chosen factors and levels

Factors \ Levels	1	2	3
Vibration amplitude, a (% of supply voltage)	61	63	65
Excitation frequency, f (Hz)	68	69	70
Trap inclination angle, Θ (degree)	9°	10°	11°

Experiments were conducted with a sample size of 30 parts per experiment. The parts were dropped at random orientations on the trap. The parts travel a fixed length of 60 cm on the trap. The time taken to cover this distance is observed. Finally the velocity is calculated with the distance and time.

Full factorial array

Orthogonal array gives the possible combinations with minimum number of experiments but, since the number of experiments was low, Full Factorial array was used as shown in Table 3.

Table 3. Full factorial array

Factors / Exp.	Vibration amplitude, a (% of input voltage) (a)	Excitation frequency, f (Hz)	Trap angle, Θ (theta)	Response (average velocity, x 10^{-2} m/s)
1	A_1	F_1	T_1	2.30
2	A_1	F_1	T_2	3.28
3	A_1	F_1	T_3	4.95
4	A_1	F_2	T_1	3.14
5	A_1	F_2	T_2	3.97
6	A_1	F_2	T_3	5.98
7	A_1	F_3	T_1	4.19
8	A_1	F_3	T_2	4.82
9	A_1	F_3	T_3	6.87
10	A_2	F_1	T_1	2.68
11	A_2	F_1	T_2	3.47
12	A_2	F_1	T_3	5.41
13	A_2	F_2	T_1	3.39
14	A_2	F_2	T_2	4.43
15	A_2	F_2	T_3	6.34
16	A_2	F_3	T_1	4.33
17	A_2	F_3	T_2	5.05
18	A_2	F_3	T_3	7.18
19	A_3	F_1	T_1	3.20
20	A_3	F_1	T_2	3.74
21	A_3	F_1	T_3	6.17
22	A_3	F_2	T_1	3.79
23	A_3	F_2	T_2	4.78
24	A_3	F_2	T_3	7.10
25	A_3	F_3	T_1	4.33
26	A_3	F_3	T_2	5.73
27	A_3	F_3	T_3	7.86

Legend: $_{1,2}$ and $_3$ → Levels.

The table also shows the average velocity of the parts. From Table 3, it is clearly seen that experiment - 27 (A3:F3:T3) with vibration amplitude=65(% of input voltage), excitation frequency=70(Hz) and trap inclination angle = 11° gave the highest conveying velocity of 7.86x10^{-2}m/s. The response considered was the conveying velocity which was preferred to be high. So, the Quality loss function considered was of Larger the Better type. The optimal level of amplitude, frequency and trap inclination angle was found by considering the maximum value of Mean of Means.

Regression Analysis

It is a statistical measure that attempts to determine the strength of the relationship between one dependent variable and a series of other changing variables (known as independent variables). The two basic types of regression are linear regression and multiple linear regression. Multiple linear regression model was attempted in this work since three independent variables (vibration amplitude, excitation frequency and trap inclination angle) were considered to predict one output (conveying velocity, m/s). The regression model was trained using the statistical software Minitab 15 from the results obtained experimentally. Regression equation was developed for the conveying velocity using the statistical software.

The regression equation for the conveying velocity is given by the following relation

$$\text{Velocity} \times 10^{-2}\ (m/s) = -80.7 + 0.200\ a\ (\%\ \text{of input voltage}) + 0.842\ f\ (Hz) + 1.47\ \Theta\ (deg) \quad (1)$$

with R^2 = 95.2 %

R Square (R^2) is the square of the measure of correlation between the observed value and the predicted value and indicates the proportion of the variance in the dependent variable. The regression equation gives fairly good result when compared with the experimental result (Table 3) within the range of the input parameter as shown in Table 4.

Table 4. Comparison of regression results with experimental results

S.No	Vibration amplitude, a (% of supply voltage)	Excitation frequency, f (Hz)	Trap inclination angle (Θ) (degree)
1	61	69	11
2	61	70	11
3	63	69	9
4	65	69	9
5	65	69	11

S.No	Conveying velocityx10^{-2} (m/ s)		Error %
	Experimental results	Regression model results	
1	5.98	5.768	3.55
2	6.87	6.61	3.78
3	3.39	3.228	4.78
4	3.79	3.628	4.27
5	7.1	6.568	7.49

ANOVA

From the results of ANOVA, it was observed that for variation in the response, amplitude has contributed upto 5.11%, frequency has contributed upto 22.29% and trap inclination angle has contributed upto 71.58%. This shows that they had statistical significance on the

conveying velocity obtained, especially the trap inclination angle. It is also seen that the error associated to the ANOVA for conveying velocity is approximately 1.02%.

CONCLUSIONS

The salient conclusions of the work are listed below:

- By drop test at different heights, it was found that orientation 'a' (i.e. orientations 6 and 8) has the highest probability of occurrence. Hence, orientation 'a' is considered as the natural resting orientation of this part and the part feeder is designed such that orientation 'a' is the only output.
- The part feeding system using traps for the favorable orientation of the brake liner was designed and fabricated.
- For wiper blade angles between 25° to 35° almost all parts were re-oriented to desired orientation. Hence, wiper blade angle can be set between 25° to 35° for both cardboard & acrylic traps.
- For trap inclination angles between 20° to 30°, all parts passed through the trap and reorient themselves without nesting in case of cardboard traps and 9^0 to 11^0 in case of acrylic traps.
- The optimum level for vibration amplitude is 65(% of input voltage), for excitation frequency is 70(Hz) and for trap inclination angle is 11^0 for which the trap gave the maximum conveying velocity of 7.86 cm/s, which was determined experimentally.
- An expression relating the conveying velocity as a function of vibration amplitude, excitation frequency of vibration and trap inclination angle was obtained through regression analysis. The expression had good correlation with experimental results.
- By ANOVA, the trap inclination angle was found to be the most influencing factor with contribution of 71.58%.

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REFERENCES

[1.] Geoffrey Boothroyd, Assembly Automation and Product Design. Marcel Dekker, Inc., New York, 1992.
[2.] Geoffrey Boothroyd, Corrado R. Poli, and Laurence E. Murch, Hand Book of Feeding and Orienting Techniques for Small Parts. Department of Mechanical Engineering, University of Massachusetts, Amherst, MA, 2001.
[3.] Ken Goldberg and Gorden Smith, Trap Design for Vibratory Bowl Feeders. Proc. of the IEEE International Conference on Robotics and Automation, Detroit, Michigan, 1999.
[4.] Robert-Paul Berretty, Ken Goldberg, Mark H. Overmars, A. Frank van der Stappen, Trap Design for Vibratory Bowl Feeders. The International Journal of Advanced Manufacturing Technology: 1-26, 1996.
[5.] B.K.A.Ngoi, L.E.N.Lim and J.T.Ee, Analysis of Natural Resting aspects of Parts in Vibratory Bowl Feeder-Validation of Drop Test. The International Journal of Advanced Manufacturing Technology 13: 300-310, 1997.
[6.] Berkowitz DR, Canny J, Designing parts feeders using dynamic simulation. Proceedings of IEEE International Conference on Robotics and Automation: 1127 – 1132, 1996.
[7.] Edmondson N F, Red ford A H, Flexible parts feeding for flexible assembly. Int J Prod Res 39(11): 2279-2294, 2001.
[8.] Wee C, Patrick S K Chua, Tan F L, Modeling of parts feeding for a flexible belt parts feeder. Journal of the Institution of Engineers Singapore 45(3), 2005.
[9.] Patrick S K Chua, Novel design & Development of an active feeder. Assembly Automation 27/1: 31-37,2007.
[10.] Omno C Goemans, Ken Goldberg, Frank Van der Stappen A, Blades for feeding 3D parts on vibratory tracks. Assembly Automation 26(3):221-226, 2006.
[11.] Goemans OC, Antony Levandowski, Ken Goldberg, Van der Stappen A F, On the design of guillotine traps for vibratory bowl feeders. Proceedings of the IEEE International Conference on Automation Science and Engineeering : 79-86, 2005.
[12.] Okabe S, Yokoyama Y, Boothroyd G, Analysis of vibratory feeding where the track has directional friction characteristics. The International Journal of Advanced Manufacturing Technology 3(4):73-85, 1988.
[13.] Onno C Goemans, Ken Goldberg, Frank Van der Stappen A, Blades: A New Class of Geometric Primitives for Feeding 3D Parts on Vibratory Tracks. Proceedings of IEEE International Conference on Robotics and Automation: 1730 – 1736, 2005.
[14.] Mark Moll, Michael A Erdmann, Manipulation of Pose Distributions. International Journal of Robotics Research 21(3):277–292, 2002.
[15.] Robert-Paul Berretty, Ken Goldberg, Mark H Overmars, Frank van der Stappen A, Computing fence designs for orienting parts. Computational Geometry 10(4): 249-262, 1998

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THE BASICS OF DESIGNING CONTROLLERS FOR INDUSTRIAL ROBOTS (EG. ROBOTS ABB IRB 2000)

ABSTRACT:
The paper explains the basic aspects of designing controllers for an industrial robot control. Industrial robots are basically mechanical devices which, to a certain degree, replicate human motions. They are used whenever there is a need to reduce the danger to a human, provide more strength or accuracy than a human, or when continuous operation is required.
Most industrial robots are stationary, but some move throughout the workplace delivering materials and supplies. While we have the technical ability to produce human robots, industrial robots are actually quite simple devices.
Motions that we take for granted—picking up a something from the table, for instance—are considerably more difficult for a robot. Its mains characteristics of operation, degrees of freedom, etc.
They are solved and the calculations developed to obtain the kinematics and dynamics. The accomplished test to each servomotors and the research about its operation.
Basicaly all industrial robot have a similarly control, because have a similarly actions.

KEYWORDS:
industrial robot control, designing controllers, basic aspects

INTRODUCTION

Robotics is a new field of modern technology that crosses traditional engineering boundaries. Understanding the robots and their applications requires knowledge of many areas of engineering, informatics, mechanic and mathematics. We need to know the dynamics, kinematics to control of the robot manipulator. Is the basic to the understanding of the robot operation?
An official definition of such a robot comes the Robot Institute of America (RIA): A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.
In the Laboratory of Intelligent Systems in Faculty of Mechanical Engineering in Banja Luka we have a robot IRB 2000. This robot was starting for this study of design controller.
IRB 2000 is a six-axis robot with a large work volume and is primarily intended for arc welding and glueing/sealing.
The IRB 2000 is also suitable for applications such as assembly, water jet cutting, laser cutting, material handling and stud welding.
The handling capacity is 10 kg and the very quick movements of the wrist axis are other important features for the intended applications. The S3 control system makes use of established features like soft keys, joystick and the robot language ARLA for simple and fast programming. The IRb 2000 is in its basic form equipped with an absolute measuring servo system. Another important factor is the interface capacity. The S3 controller has the ability to perform a communication in several different ways. These are digital or analogue I/Os and the serial computer link.

THE STUDY

A robot is the main component of a flexible production system (FPS). Other components of this system are machine tools, transport machines, control devices, and different auxiliary elements. A flexible production system is an automatically operating production system that can be easily reprogrammed and adapted to manufacture different products.
Robot centered modules of FPS, called robot modules or robot systems are intended for specified technological operations like welding, surface coating, packaging, etc. The robot module includes one or more robots (with manipulators and control devices), pallets for details or products, auxiliary positioning, transport devices, etc.
Therefore, robot control means control of a complete robot module and a certain part of the production

process. The control system has the whole electronic of the system and allows the external communications with peripheral equipment.
Fig. 1 shows main hardware and software components of the IRB2000 robot from ABB.

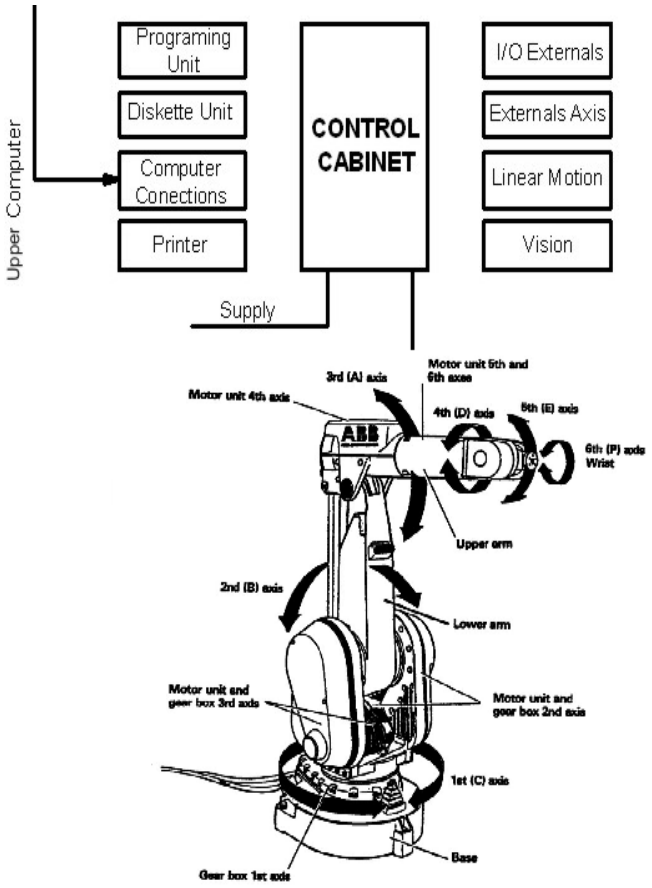

Fig. 1 main ABB IRB 2000 hardware and software components

The mechanical robot is provided with servomotors controlled, in each axes, the servo system have:

- *Speedometer for the speed control.*
- *Resolver for the position control.*
- *Resolver for the absolute measurement system*

The robot is equipped with brakes in each axes, is automatically brake in the emergency stops, power supply fails, or when the motors are disconnected of power supply.
The robot is equipped with brakes in each axes, is automatically brake in the emergency stops, power supply fails, or when the motors are disconnected of power supply. This brakes setting in stand by mode or totally disconnected. While the robot is running and still static the brakes activate automatically after three seconds (automatic operation) or after five seconds. The brakes can turn off manually one by one through of switches in the side of the robot.

ANALISES, DISCUSIONS, APPROACHES AND INTERPRETATIONS

Industrial robots are all-purpose mechanical arms with a number of axes. Regarding movement cycle, route and angle its movements are programmable without mechanical intervention and where required also sensor guided. The mechanical arms are equipped with grippers, other tools and they achieve handling tasks and assembly works.
The path between the positions of robot can be executed in three different coordinate systems: rectangular coordinates, robot coordinates and modified rectangular coordinates.
Each one of the coordinate systems will produce a different path and are used according to the needs of speed, precision and direction. All can be activated through instructions in a robot program.

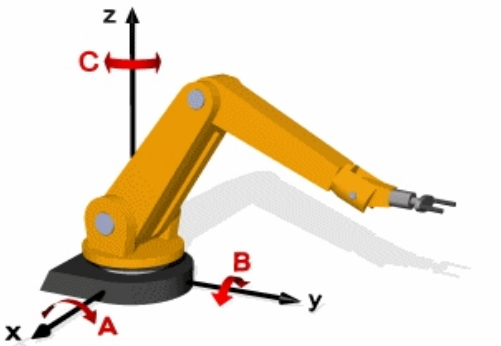

Figure 2. Space coordinates

Figure 3. Joint coordinates

Figure 4. Gripper coordinates

Figure 5. Workpiece coordinates

All the positions of the robot are expressed through the coordinates system that which describe the positions of the robot in the space. This system is setting to the base of the robot with plane X - Y in floor and the axis Z noting upward and concentric to the first rotation shaft.
The point of origin of the space coordinate system usually is located at the first axis of universal robots. In linear robots the point of origin is located at the intersection point of the three linear axes.
The angle and length description of the particular robot axes describe the orientation of the TCP explicitly. A polar insertion of the coordinates is best.
Gripper coordinates describe the orientation and position of the effector in space.
The zero point of the coordinate systems is located at the Tool-Center-Point (TCP) of the effector.
If a workpiece has to be processed in different positions, one can site a workpiece coordinate system into one corner of the workpiece.
IRB 2000 manipulates charges in a wide work area, with great rapidity and precision. This robot is particularly adapted for arc welding, application of adhesives and manipulation of materials, because its speed, wide work area and the inherent flexibility of the design of their 6 shafts. The admissible maximum load is of 10 Kg and depends on the distance to the center on the wrist.
The set of points in the space that they can be reached by the extreme of the wrist of the robot constitute its workspace. Remain limited by the maximum angle or linear displacement that permits the joints and the length of the arms.
The movements and degrees of freedom of the robot IRB 2000 are described in table below:

Table 1: Scopes of the robot's axis IRB 2000

Motion	Workspace	Max. Speed
Axis 1: Rotation	+180° -180°	115°/sec
Axis 2: Arm	+100° -100°	115°/sec
Axis 3: Arm	+60° -60°	115°/sec
Axis 4: Wrist	+200° -200°	280°/sec
Axis 5: Lurching	+120° -120°	300°/sec
Axis 6: Draft	+200° -200°	300°/sec

The robot connections for tools and grippers have been designed as a modular system to achieve the best flexibility when accessories are selected. Component can be selected in various ways without limiting the robot working area. Compressed air as well as electrical signals is supplied to the tools via well integrated cablings. Tool exchange can be performed automatically. The exchanger provides a tool fixing plate free from play which allows supply of compressed air and electrical signals fro the tools. Main components in the system are:

- *Connection unit*
- *Swivel with cabling carrier*
- *Tool exchanger*
- *Slip ring*
- *Tool attachment*
- *Dual grippers*

The modular design enables the unit to be offered in many variants.
Computer board contains four microprocessors.

- *Main computer – for overall control*
- *Servo computer – for control of servo functions and robot movements*
- *Axis computer – for individual control of robot axes*
- *I/O computer – for control of communication with operators unit, peripheral equipment, host computer and floppy or cd disk*

Safety board contains circuits for the personal safety functions

- *Emergency stop*
- *Work hold*
- *Safety hold*

Digital I/O boards have digital process communication up to 128 inputs and 128 outputs
Analogue I/O board has analogue process communication up to 4 inputs and 4 outputs
Combined I/O board has digital and analogue communication up to 16 digital inputs and 16 outputs + 2 analogue outputs
Control Board for external axes also we have communication via RS 232 interface with computer.

CONCLUSIONS

The control panel must to provide full communication with robot system. The emergency stop button and button for resetting the emergency stop function is salient buttons for reasons of safety. The control panel is designed for a demanding industrial environment.
The control panel must include functions for:

- *Selection of operation modes for the robot system, STANDBY (electronics powered, motor de-energized) and RUN (the entire robot system powered)*
- *Synchronization of the robot system*
- *Loading of programs from floppy disk or CD*
- *Start and stop of programmed operation*
- *Emergency stop and re-setting of emergency stop function*
- *Locking by key of the programming unit*
- *Separate LEDs or LCD for indicating emergency stop and fault status*
- *Remote control with joystick*

The robot system can be controlled by sensors mounted on the robot or on the object. The robot system can store signal data from sensors, and used then for program. The robot system can receive digital, analog and asyncronics signal with RS232 or other interfaces from the outside computer.
Programming method is point to point method by:

- *Interactive dialogue*
- *Manual running with joystick*
- *Off-line via terminal*
- *Connected with computer*

REFERENCES

[1.] Konukseven, E. L. & Abidi, A. (2004). Developmen of man machine interface software for an industrial robot. Proc. of 2004 IEEE Symposium on Virtual Environment, Human-Computer Interfaces and Measurement Systems, (VECIMS), pp. 49-53.
[2.] Pires, Norberto: Industrial Robot Programming, Building Applications for the Factories of the Future. New York; Springer, 2006., 282 str.
[3.] Litzenberger, Gudrun: World Robotics 2007 survey. Frankfurt; IFR Statistcal Department, 2007., URL: http://www.worldrobotics.org/downloads/20071023_Pressinfo_charts.pdf. (05.04.2008.).
[4.] Lundqvist, Rasmus; Söreling, Tobias: New Interface for Rapid Feedback Control on ABB-Robots. Linköping; Linköping University, 2005., URL: http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-2762. (20.03.2008.).
[5.] Mihali, Raul C., Sobh, Tarek M., "The Formula One Tire Changing Robot (F1-T.C.R.)", accepted for publication in the Journal of Intelligent and Robotic Systems, April 1999
[6.] Mark W. Spong, M. Vidysagar, "Robot dynamics and control"
[7.] Dr.-ing. Gabriel Hernández López "El origen de la robótica industrial y su desarrollo" in InTech México Automatización pp. 16-22 Octubre-Diciembre 2008
[8.] Reference Manual, ABB Robotics Products, 1993.
[9.] Craig, J.J., "Introduction to Robotics, Mechanics and Control", 2 ^ Edition, Addison-Wesley, 1989.
[10.] Sciavicco, L., and Siciliano, B., "Modeling and Control of Robot Manipulators"-2'"* Edition, McGraw-Hill, 1996

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József SÁROSI[1.]

INVESTIGATION OF POSITIONING OF FLUID MUSCLE ACTUATOR UNDER VARIABLE TEMPERATURE

ABSTRACT:
Some researchers have mentioned that temperature creates an important part in the accuracy of positioning of pneumatic artificial muscles (PAMs). However, in literature investigations for measuring temperature inside and outside the PAMs have not been found. This paper presents our robust motion control of these muscle actuators under different temperatures using sliding-mode control.
The layout of this paper is as follows. Section 2 (The study) is devoted to display our test-bed and the LabVIEW programs. Section 3 (Results and discussion) presents several experimental results. Finally, section 4 (Conclusions) gives the investigations we plan.
Fluid Muscles DMSP-10-250N-RM-RM (with inner diameter of 10 mm and initial length of 250 mm) produced by Festo company were selected for our newest study.

KEYWORDS:
muscle actuators, variable temperature

INTRODUCTION

The working principle of the pneumatic artificial muscles is well described in literature ([1], [2], [3], [4], [5] and [6]).
There are a lot of advantages of these muscles like the high strength, good power-weight ratio, low price, little maintenance needed, great compliance, compactness, inherent safety and usage in rough environments. However, problems with the control of the highly nonlinear pneumatic systems have prevented their widespread use [7]. For this, a fast and robust control necessary to achieve the desired motion. Several control ways have been applied to control different humanoid or robot arms, manipulators, prosthetic and therapy devices driven by pneumatic artificial muscles. The early control methods were based on classical linear controllers and then some modern control strategies have been developed (e. g. adaptive controller, sliding-mode controller, fuzzy controller, neural network controller and others) [8].
The layout of this paper is as follows. Section 2 (The study) is devoted to display our test-bed and the LabVIEW programs. Section 3 (Results and discussion) presents several experimental results. Finally, section 4 (Conclusions) gives the investigations we plan.
Fluid Muscles DMSP-10-250N-RM-RM (with inner diameter of 10 mm and initial length of 250 mm) produced by Festo company were selected for our newest study.

THE STUDY

A good background of our test bed and former experimental results of positioning can be found in [9] and [10].
The PAMs were installed horizontally and can be controlled by MPYE-5-M5-010-B type proportional valve made by Festo. Our robust position control method based on sliding-mode control. The linear displacement of the actuator was measured using a LINIMIK MSA 320 type linear incremental encoder with 0,01 mm resolution.
To measure temperature inside and outside the muscle the test-bed was completed two thermocouples type K (Figure 1). Figure 2 shows the block diagram of this positioning system with proportional valve.

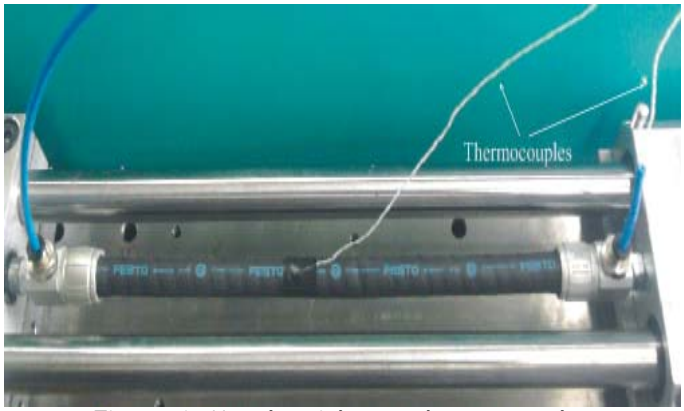

Figure 1. Muscle with two thermocouples

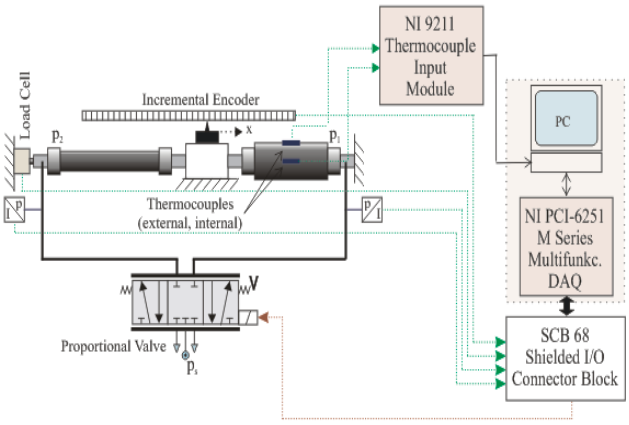

Figure 2. Block diagram of positioning system with proportional valve

The Figure 3 shows data acquisition and positioning that can be achieved in LabVIEW environment. Aside from the desired position the number of samples and the sampling time can also be set. The data can be saved into a text file.

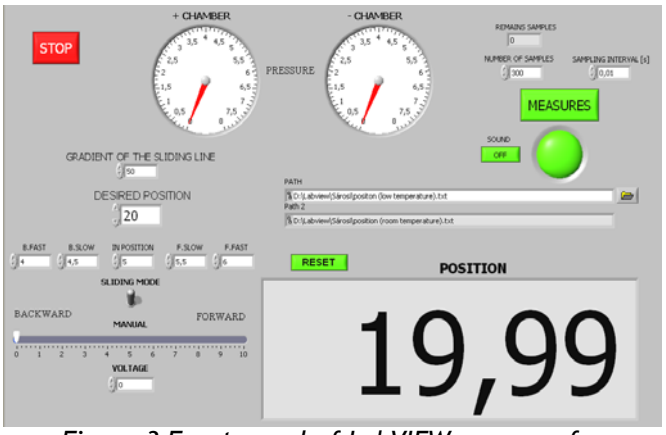

Figure 3 Front panel of LabVIEW program for positioning

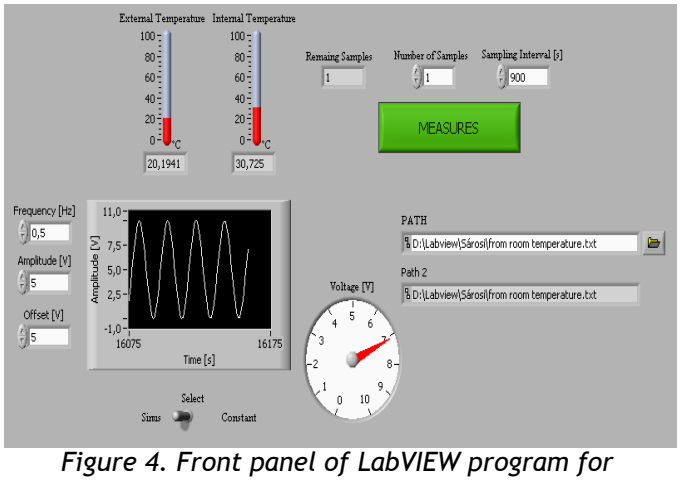

Figure 4. Front panel of LabVIEW program for measuring temperature

The Figure 4 shows the front panel of the LabVIEW program created for temperature measurement. Here the number of samples and sampling time can also be set. During the periodic and automatic working of the muscles the contraction and rate of release can be adjusted with the frequency of the sine wave.

The temperature inside and on the surface of the muscle can be read on the indicators on the screen also it is shown as a number. The measured results are saved in a text file for later processing.

RESULTS AND DISCUSSION

Positioning was first done in room temperature on the pressure of 6 bar. The desired positioning was set to 20 mm, the number of samples was set to 300, while the sampling rate was set to 10 ms, and thus the measurement took 3 s.

Figure 5 shows the positioning as a function of time. It took about 1,85 s for the position to reach the set value. To show the accuracy of positioning the area around the desired position has been magnified (Figure 6). This Figure shows the accuracy of positioning is within 0,01 mm.

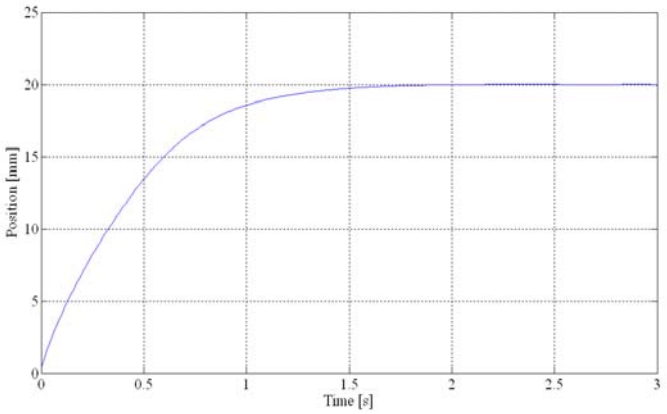

Figure 5. Position as a function of time

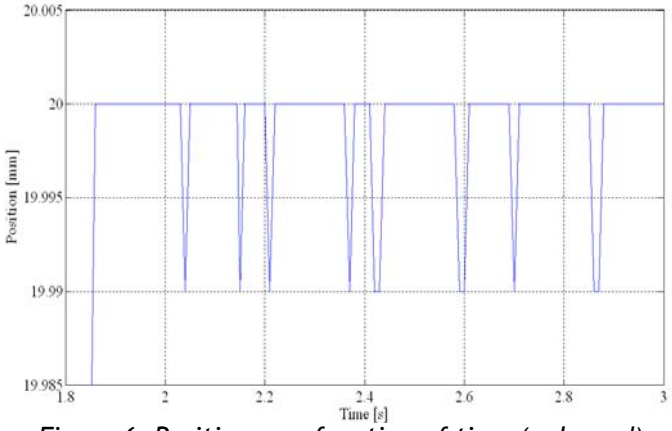

Figure 6. Position as a function of time (enlarged)

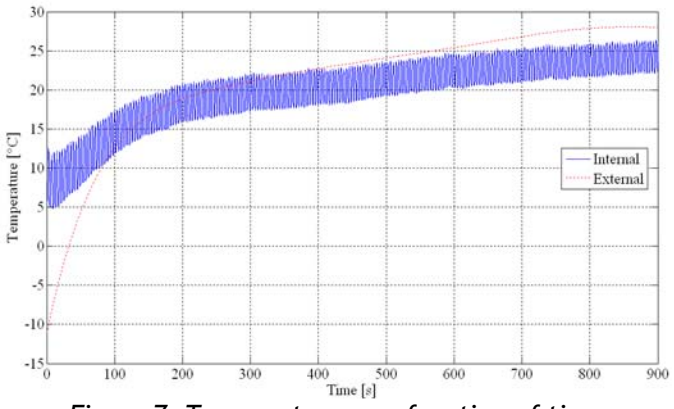

Figure 7. Temperature as a function of time

The periodic working of the muscles was achieved with a 0,5 Hz frequency sine wave. The measurement took 900 s during which the sampling time was 0,25 s, the acquired data is shown in Figure 7. While the surface temperature reached about 28°C, the internal temperature oscillated a lot during contraction and release, for this reason a spline approximation was used for the internal temperature (Figure 8).

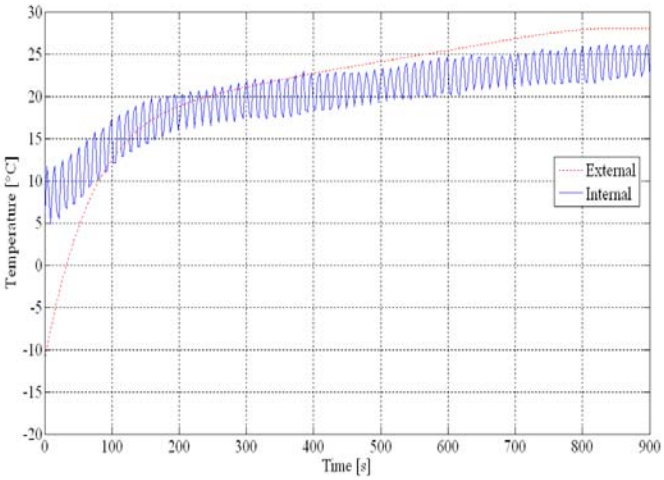

Figure 8. Temperature as a function of time with spline interpolation for internal temperature

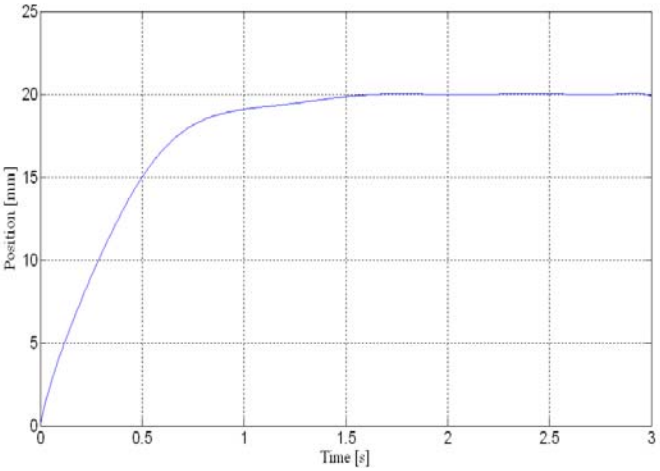

Figure 9. Position as a function of time after work cycle

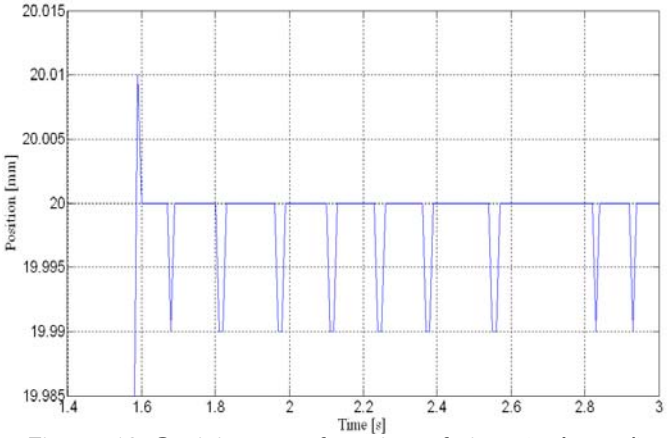

Figure 10. Position as a function of time (enlarged) after work cycle

After a constant temperature was reached positioning was measured on the pressure of 6 bar, too. The result of it is shown in Figure 9. It shows the desired position was reached within 1,6 s. To show the accuracy of positioning the area around the desired position has been magnified (Figure 10.). The accuracy of positioning remained within 0,01 mm.

CONCLUSIONS

From these measurements the conclusion is that the sliding-mode control is rather robust for accurate positioning and the accuracy and time of positioning is more favorable at higher temperature. We plan these investigations will be repeated with different muscles.

REFERENCES

[1.] Daerden, F. (1999): Conception and realization of pleated artificial muscles and their use as compliant actuation elements, PhD Dissertation, Vrije Universiteit Brussel, Faculteit Toegepaste Wetenschappen Vakgroep Werktuigkunde, pp. 5-33.

[2.] Daerden, F. and Lefeber, D. (2002): Pneumatic artificial muscles: actuator for robotics and automation, European Journal of Mechanical and Environmental Engineering, Volume 47, pp. 10-21.

[3.] Caldwell, D. G., Razak, A. and Goodwin, M. J. (1993): Braided pneumatic muscle actuators, Proceedings of the IFAC Conference on Intelligent Autonomous Vehicles, Southampton, United Kingdom, 18-21 April, 1993, pp. 507-512.

[4.] Balara, M. and Petík, A. (2004): The properties of the actuators with pneumatic artificial muscles, Journal of Cybernetics and Informatics, Volume 4, pp. 1-15.

[5.] Chou, C. P. and Hannaford, B. (1996): Measurement and modeling of McKibben pneumatic artificial muscles, IEEE Transactions on Robotics and Automation, Volume 12 (1), pp. 90-102.

[6.] Tondu, B. and Lopez, P. (2000): Modeling and control of McKibben artificial muscle robot actuator, IEEE Control System Magazine, Volume 20, pp. 15-38.

[7.] Caldwell, D. G., Medrano-Cerda, G. A. and Goodwin M. (1995): Control of pneumatic muscle actuators, IEEE Control System Magazine, Volume 15 (1), pp. 40-48.

[8.] Situm, Z. and Herceg, Z. (2008): Design and control of a manipulator arm driven by pneumatic muscle actuators, 16th Mediterranean Conference on Control and Automation, Ajaccio, France, 25-27 June, 2008, pp. 926-931.

[9.] Sárosi J., Gyeviki J., Szabó G. and Szendrő P. (2010): Laboratory Investigations of Fluid Muscles, International Journal of Engineering, Annals of Faculty of Engineering Hunedoara, 2010, Volume 8 (1), pp. 137-142.

[10.] Sárosi J., Gyeviki J., Véha A. and Toman P. (2009): Accurate Position Control of PAM Actuator in LabVIEW Environment IEEE, 7th International Symposium on Intelligent Systems and Informatics, Subotica, Serbia, 25-26 September, 2009, pp. 301-305

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APPLICATION OF THE SILICON CARBIDE COMPONENTS IN POWER ELECTRONICS

ABSTRACT:
This paper presents research motivated by industrial demand for using power semiconductor devices based on SiC (Silicon Carbide). The paper deals with possibility of SiC devices application in traction vehicles. The main attention has been given to the topology of 3-phase voltage-source inverter with free- wheeling SiC schottky diode and 1-phase traction converter with middle frequency converter for auxiliary drives. The theoretical conclusions and simulation results are compared with experimental measurements on laboratory model with rated power of 2kVA.

KEYWORDS:
Silicon Carbide, Traction application, Power semiconductor device, Hybrid power integration, Electric vehicle

INTRODUCTION

Power semiconductor devices based on the SiC substrate is coming more and more popular with increasing development of the power electronics. Due to the advantageous qualities discovered at the SiC this material becomes very interesting object for research and development and subsequent using in the all sorts of applications where bigger and bigger exigencies on efficiency, magnitudes, weight and impact on surroundings are set.

SiC PROPERTIES

Crystals of SiC have analogical crystalline structure as diamond and therefore they belong among the hardest known materials, in the Moh's scale of the hardness they reach levels 9-10. Primarily SiC finds use as material called "Carborundum" and it used to exploit for grinding and polishing. Later it was used in the fire-resistant fireclay brickworks and heating shells for industry furnaces or in the composite materials.
With development of the electrotechnics the semiconductor features of SiC were detected and it started to add to the semiconductor substrate of blue shining LED diodes, later in the high shining diodes and in the last few years it has also started to assert in the field of the power electronics.

COMPARISON OF THE SIC WITH OTHER MATERIALS

SiC has several unique properties, which make SiC very interesting object for research and development, mainly in the area of high voltage applications. Fig.1 shows these features in comparison with commonly used semiconductor materials (Gallium Arsenide and Silicon).

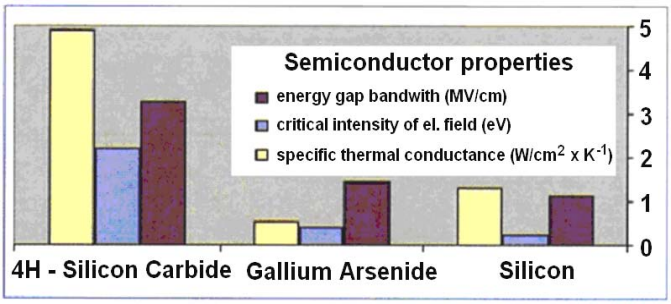

Figure 1. Comparison of individual semiconductor features [3]

PRACTICAL USING OF THE SiC

Meantime SiC diodes are the most used devices based on the Silicon Carbide. They are used in many applications. Blocking (freewheeling) diodes in the PFC applications has been the first example of using and it is still frequently used. Rectifying and freewheeling diodes in the switching sources and freewheeling diodes in voltage inverters or active switching rectifiers are the next using of SiC. Further we will discuss possibility of other devices based on the SiC:
At the first we will compare two version of classical 3-phase VSI (see Fig. 2).
The first version of VSI is mounted by classical silicon IGBTs as shown in Fig.3 in left part. The "hybrid" combination of silicon IGBTs and SiC Schottky freewheeling diodes present the second version of VSI (Fig. 3 in right part).

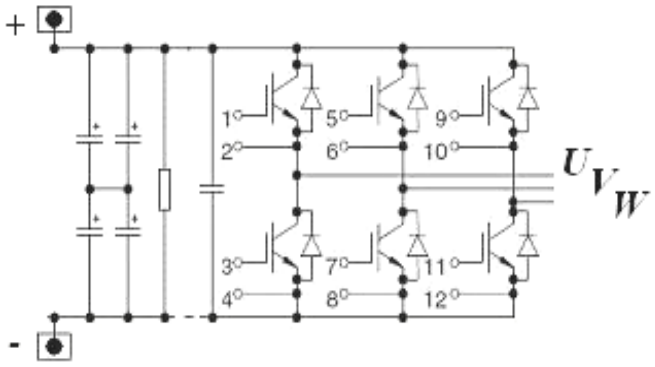

Figure 2. Topology of VSI

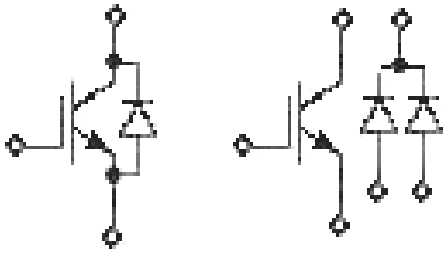

Figure 3. Detailed scheme of used semiconductor devices for VSI

The main advantage of SiC presents following figures 4 and 5 and it is coming-out from Schottky diode properties. The current waveform of silicon diode in the first version of VSI is shown in Fig. 4 and you can clearly see the classical recovering current area.

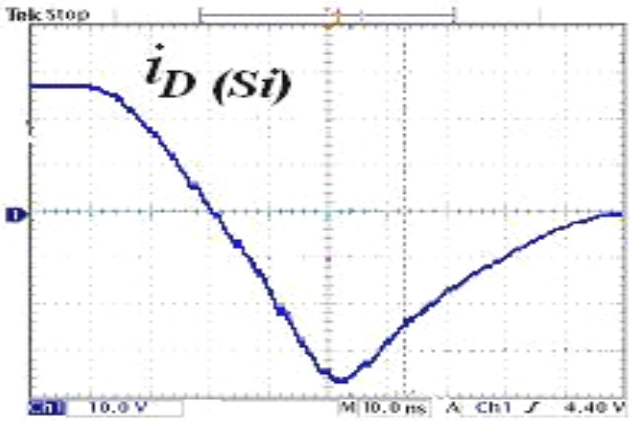

Figure 4. Current waveform of the ultrafast soft recovery epitaxial silicon diode

Against this fact the SiC Schottky diode has very positive waveform of recovering current area (Fig. 5) which is diametrically lower than at Si diode. This is advantage of Schottky structure and SiC material are able produce high voltage Schottky diodes and that is reason of such wave. The double SiC diode module from CREE is used.

Experimental example of star up of the hybrid VSI version presents Fig. 6. It is evident that using of SiC freewheeling diode has positive influence on current overshoot of collector current of IGBT tranzistor.

The testing has been provided under lower supply voltage 200V according to the used devices of 600V range (available free samples).

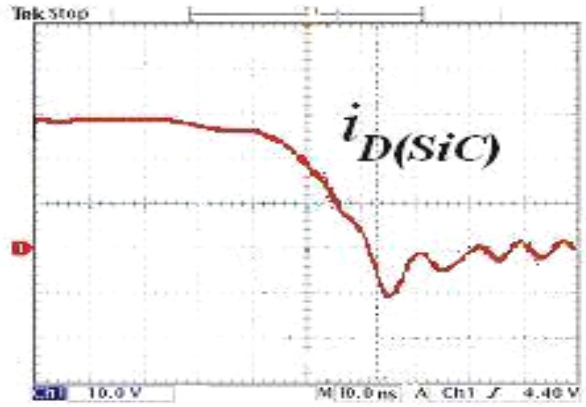

Figure 5. Current waveform of the SiC Schottky diode (produced by CREE as shown in Fig.9)

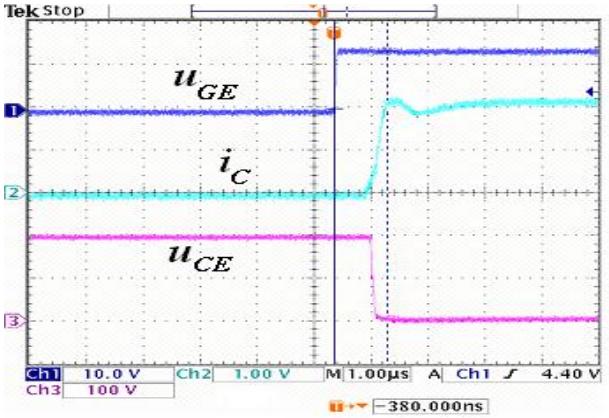

Figure 6. Start up of the hybrid VSI version

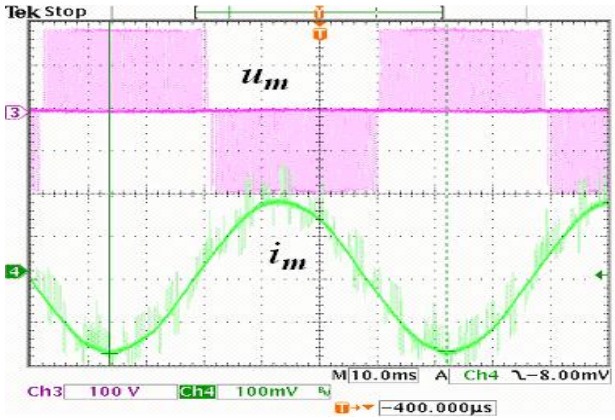

Figure 7. Principal scheme of device J-FET (cascade)

Typical output waveforms of VSI (line to line voltage UM and phase current IM) are shown in Fig. 7.

Fig. 8 – Fig. 11 present photos of experimental ptotypes of VSI with classical Si IGBTs and hybrid version with Si IGHTS and SiC Schottky diodes.

The hybrid version enables use 5-time higher switching frequency under the same conditions as standard topology with silicon IGBT transistors. It is done by expressively lower losses of SiC schottky diodes (Fig.5).

For comparison of the appropriate running condition and losses we have used measuring of circuits values and steady-state temperature of the heat sink.

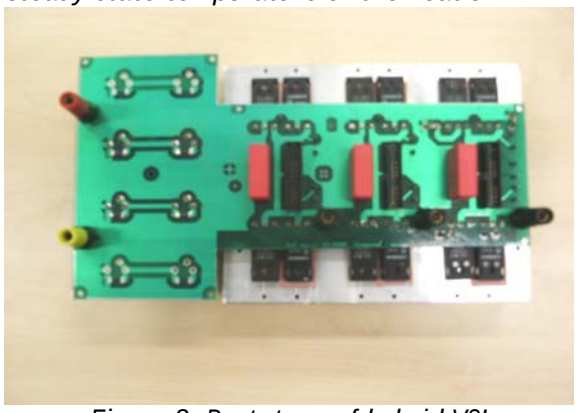

Figure 8. Prototype of hybrid VSI

Figure 9. Detail of hybrid VSI devices

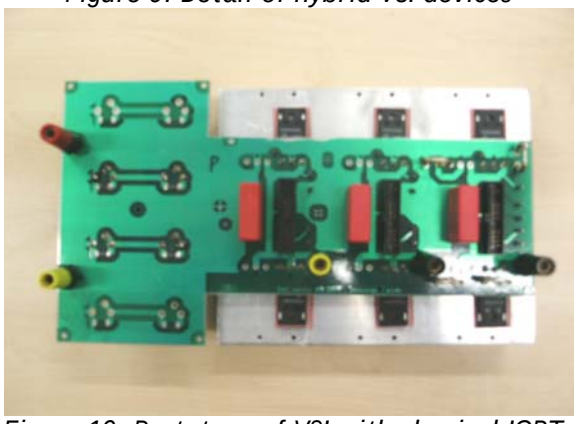

Figure 10. Prototype of VSI with classical IGBTs

Figure 11. Detail of VSI with classical device

The single phase traction converter for auxiliary drives is the second presented application of SiC (Fig. 12). The auxiliary drive converter presents galvanic insulation VSI for auxiliary drives. The input part is directly connected to the DC bus line of main traction converter, it means 1500 V or 3000 V according to the traction vehicle topology. Due to the voltage level the number of serial connections of input 1f VSI has to be placed. Input 1f VSIs fed the middle-frequency transformer (MFT) and the standard diode bride rectifier with SiC is connected on the MFT output. The key is in the using of high switching frequency up to 100 kHz to decrease of weight of auxiliary drive transformer. Output diode rectifier supply DC bus line where several of VSI + auxiliary drives are connected.

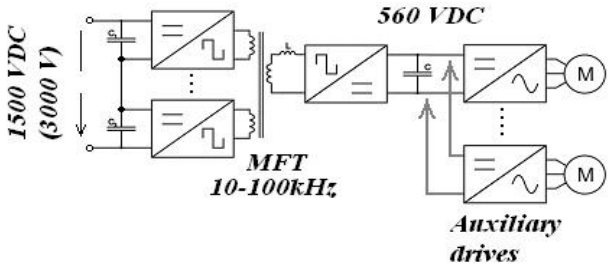

Figure 12. Principal scheme of auxiliary drives traction converter

Fig. 13 presents experimental results of stead state waveforms of MFT voltage and current (output values of input VSI as well). It is evident from the picture that the switching frequency is only 10kHz. This is fact of VSI design with IGBTs and control circuit based on the DSP TEXAS 2812, both aspects limited available switching frequency with reasonable rated power (DSP: A-D converters limited monitoring of analog values, IGBTs limited ratio between switching frequency and reasonable rated power).

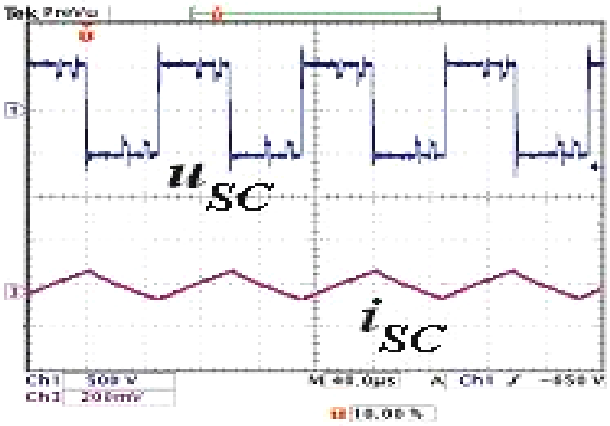

Figure 13. Steady state of voltage and current of MFT, rated power 2kVA

The next step is in a new design of the input single phase VSI based on power MOSFETs (to increase switching frequency with reasonable rated power) and mainly using of superior control system based on on analog circuits (analog operational amplifiers) to achieve 100kHz switching frequency.

CONCLUSION

This paper presents research motivated by industrial demand for using power semiconductor devices based on SiC. The main attention has been given to the topology of 3-phase voltage-source inverter with free-wheeling SiC schottky diode and comparing with topology with classical Si IGBTs. The 5-times increasing of switching frequency with the same loses is the main advantage of this hybrid structure. The second mentioned structure is 1-phase traction converter with middle frequency converter for auxiliary drives. Using SiC diodes in the secondary bridge rectifier brings opportunity to use high switching frequency approximately 50-100 kHz. Proposed converter runs at 10 kHz according to used devices and control system based on DSP Texas 2812 (problem with conversion speed of standard A-D converters).

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REFERENCES

[1] Dahlquist, F. - Frank, W. and Deboy, G. SiC diodes improve boost converter. vyd. Infineon technologies, 2004, 3s, SiC Diodes Improve Boost Converters (PEE 4-04).pdf

[2] Richmond, J. – Hodge, S. and Palmour. J, Silicon karbide power application and roadmap. Publ. Cree inc, 2004, 4s, SiC Power Appl. and Devices Roadmap (PEE 7-04).pdf

[3] Friedrichs, P. – Rupp, R. Silicon Carbide Power Devices - Current Developments and Potential Applications. EPE 2005. ISBN : 90-75815-08-5.

[4] Hruška, M. Application of Silicon Carbide in the power electronics. Publ. in UWB in Pilsen, 2006, 21s.

[5] Kapels, H et. al. A revolutionary step towards energy saving power Electronic systems. vyd. Infineon technologies AG, 2001, 5s, SIC- PFC Inf. - SiC Schottky Diode - Revolutionary Step to Energy Saving.pdf

[6] Technical documentation, CoolMOS Power transistor – SPW35N60C3. publ. Infineon technologies, 2005, 11s, SPW35N60C3_Rev.2.4.pdf

[7] Technical documentation, SiC diode – SDT12S60. publ. Infineon technologies, 2002, 8s, 1-SDT12S60.pdf

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PLC PROGRAMMING IN LABORATORY OF PRODUCTION SYSTEM PROGRAM CONTROL

ABSTRACT:
Currently, the emphasis on improving the effectiveness of automation in industry. One of the base parts for automation is control devices such as different PLC systems and programming environments. This programming environment for PLC system use in laboratory of production system program control. Base for the control of real output per axis manipulator, a schemes is possible in the virtual software followed by simulated and tuning errors. Thus the scheme is then verified recorded in PLC control and prepared to manage the various movements of the manipulator.

KEYWORDS:
PLC systems, manipulator, automation, sensor, virtual laboratory

INTRODUCTION

Within the solution of KEGA grant task, which is being solved at the Institute of Production systems and Applied Mechanics STU Bratislava in years 2009-2011, there is an opportunity to develop the abilities and skills that employers usually expect from the graduates of technical universities. The main goal of this project is to create a virtual laboratory of manufacturing devices programming control and build a suitable system of teaching that will support the creation and consolidation of professional key competences. The result presents both virtual programming PLC with a feedback simulation and checking the graduates´ skills that would support their preparing for practice and whole-life education. The demands on graduates´ skills and their job market preparedness are deeply analyzed.

PRINCIPLE OF PROGRAMMABLE LOGIC CONTROLLER OPERATION

Operation of PLC - the program stored in memory periodically evaluates input signals and set the output.
Using PLC - PLC is used in machine tools, material handling, automated assembly, and in many other industrial applications.
Preparation of PLC and its structure, types of input and output units
The basic structure of the PLC:
Compact (Fixed Hardware Style)
This copy is cheap and is used more for simpler applications. Configuration variability is low with it. Usually have a limited number of digital inputs, digital outputs or analog input or output. Some compact PLCs also have the option to extend the variability of configurations using additional modules.
Modular (Modular Hardware Style)
It is suitable for demanding applications. This allows much more variable configuration. The basis of the frame (rack, chassis), which in its left is the resource. The rear frame is driven internal bus on which the connector module. Frame length varies according to the number of slots for insertion module (unit). As the first module from the right source plug-in CPU (processor) and then followed by further input / output modules (I / O modules).
Function parts PLC:
CPU - central processing unit
- *control all operations in the PLC,*
- *performs programmed sequence of instructions stored in memory,*
- *CPU can be implemented as a separate module that can add input and output circuits (ie, other modules).*

Memory - into PLC memory is stored
- *technology program management process,*
- *titles and operating system PLC.*

Input and output circuits
- *connecting PLC to sensors and actuators, where the galvanic separation of signals,*
- *A / C and C / A conversion of continuous variables (current, voltage, resistance),*
- *each input and output PLC has a (unique) address through which they can access it (write to it or read it).*

Programming the device

- *configuration and PLC programming [1].*

Programmable logic controller PLC is a digital computer consisting of a programmable memory for internal instructions saving. It performs different specific functions such as logical, sequential, timing and start-stop functions by means of digital or analogue input and output modules. More simplified, PLC can be characterized as an industrial digital computer designed especially for controlling in the field of industry [2].

Type of PLC depends on the complexity of controlled technology. Choice of PLC type depends on the application in service. Small PLC is sufficient for plants with simple technological cycle. For automated production and assembly halls it is suitable to use big PLC mainly because of the possibility to extend it by input or output modules and communication interface integration.

Nano PLC and Micro PLC are used as substitutions for switching relay. They control devices like parking automata, manipulators, and machine tools. Their size is very similar to a relay. Small PLC, sometimes called SLC (small logic control), is suitable for plants where PLC performs independently. PLC usually contains an integrated pushbuttons package and an internal LCD display.

FUNDAMENTAL STRUCTURE OF PLC SYSTEMS

Fundamental structure of PLC systems is identical for any PLC (fig.1). Differences are mainly in other options of its expansion. PLC structure is composed of the following parts:

- *power supply,*
- *control processor,*
- *inputs and outputs (binary, analogue),*
- *program memory, memory for variables,*
- *connector interface for program loading,*
- *other peripherals (floating battery, memory card, RTC, communication conductor bar).*

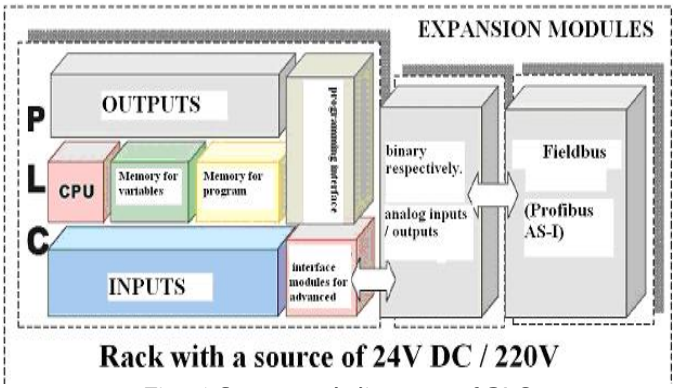

Fig. 1 Structural diagram of PLC

PLC Programming Alpha used in the laboratory of manufacturing devices programming control is performed by assembling functional blocks of logic with the help of members [3].

PROGRAMMING METHOD

Controlling and programming of these devices is a very important field of study. For particular manipulator (Fig.2), we used PLC Alpha Controller for cycle automation.

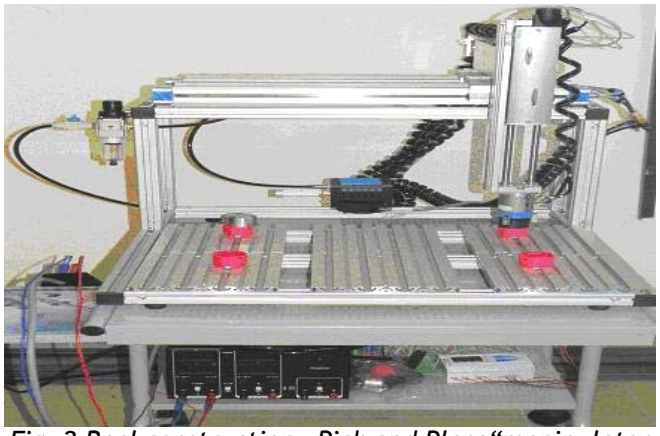

Fig. 2 Real construction „Pick and Place“manipulator controlled by PLC

The workplace of one purpose manipulator “Pick & Place”

The one purpose manipulator consists from pneumatics actuators and components and the main frame is realized out of aluminum profiles [4].

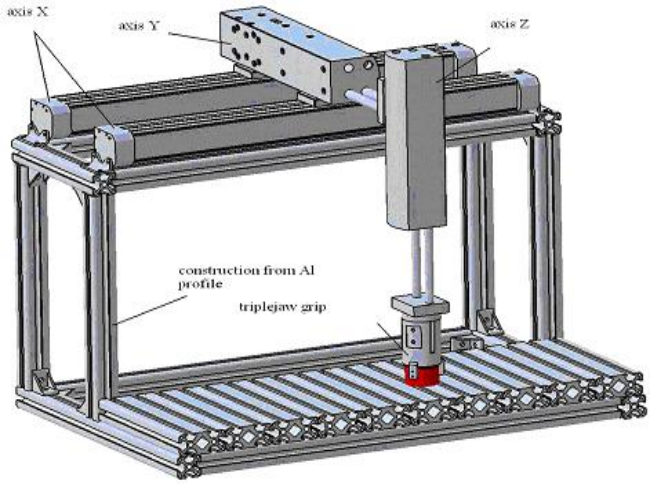

Fig. 3 Three-axis pneumatic „Pick and Place“ workstation design

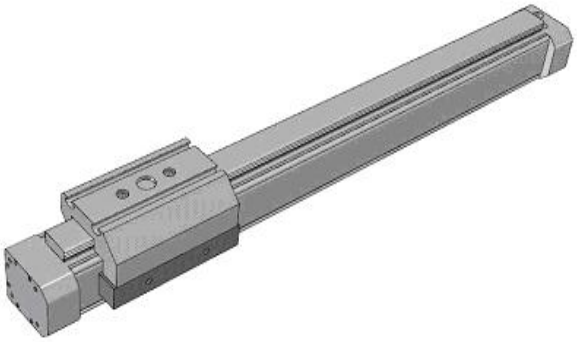

Fig. 4 The X - axis drive (direct pneumatic driver DGPL-25-350-PPV-A-GF-B)

The X - axis drive

The X-axis drive is marked as DGPL-25-350-PPV-A-GF-B. It is linear pneumatic actuator with plain bearing. .

- *DGPL – linear actuator,*
- *25 – piston diameter [mm],*
- *350 – stroke [mm],*
- *PPV – adjustable pneumatic absorbing of end positions,*
- *A – magnetic proximity switch possibility,*
- *GF – bead fixation,*
- *B – actuator generation B*

Supplementary data:

- *Synchronization principle by shape connection,*
- *Position detection,*
- *Work pressure (2 – 8 bar),*
- *Double acting motion,*
- *Work medium – filtered, oiled or no-oiled compressed air.*

The Y - axis drive

The Y-axis drive is marked as HMPL-20-200-AI-VP-2A3. This actuator is one of type category of pneumatic actuated linear axes for assembly and manipulation equipment and devices. It is possible directly to combine between actuators and loads into axis systems and thereafter to complete into manipulators units "Pick & Place". The category HMPL is included into modular technique for assembly and manipulation HMT. It is supplemented this category by it in its construction size and utility mass to down direction. The horizontal axis with vertical axis HMPL creates system "Pick & Place". It is optimized to stiffness, dynamics and function.

Fig. 5: The Y- axis driver (linear pneumatic driver HMPL-20-200-AI-VP-2A3)

The main characteristics of this actuator are:

- *HMPL – pneumatic linear axis,*
- *20 – piston diameter [mm],*
- *200 – stroke [mm],*
- *AI – absorbing of position,*
- *VP – armature plate desk,*
- *2A3 –proximity switch position.*

Supplementary data:

- *Assembly position,*
- *Ball bearing,*
- *Work pressure – (4 - 8 bar),*
- *Double acting motion.*

The Z - axis drive

The z-axis drive is marked as HMPL-16-160-AI-VP-2A3.

- *HMPL – pneumatic linear axis,*
- *16 – piston diameter [mm],*
- *160 – stroke [mm]*
- *AI – absorbing of position,*

The actuator axis Z is one of type category as actuator axis Y. the different is only in piston diameter and stroke.

This PLC (Fig. 6) is able to process binary or analogue electric signals.

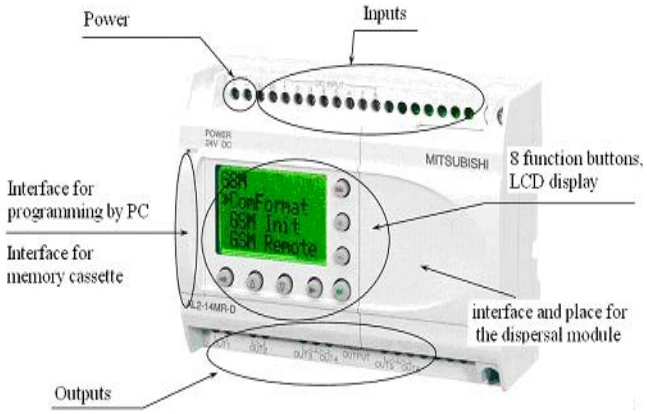

Fig. 6 Programming machine Mishubishi Alpha

Programming can be realized either with using the buttons on the front panel or by PC (software Alpha-PCS-WIN-E). By reason of user accessibility, we use the programming language FBD (functional block diagram) for programming. Then we load the following into PLC Alpha by the real output implementation from the created program in given software. Pick and Place manipulator performs single moves on the ground of sensors which are installed on it [5].

It is possible to program in two ways: direct programming or flexible programming. When we use direct programming, it is possible to programmed simplified commands with the help of pushbuttons. All performed changes will be shown on the display. Direct programming is mainly used for controlling and maintenance, eventually a small program change. Flexible programming is performed by interconnection of the functional blocks so they complete the automation task. It is possible to use up-to 200 functional blocks in one program and the individual functions can repeat arbitrarily often.

Functional blocks are available for:

- *simple and complex logical connections,*
- *attributes (parameters) setting,*
- *timers,*
- *visual display of notifications,*
- *analogue processing parameter settings (offset / gain).*

Functional blocks – a program is created by joining of main components. They enable us to process the information gained from inputs, or other source, and on their ground (according to dependency of a given stored program) switch the corresponding outputs.

It is possible to use 22 different functional blocks when compiling a program. These blocks are pre-programmed for performing of specific tasks and they can have different parameters (Fig. 7). Parameters can be changed where necessary [6].

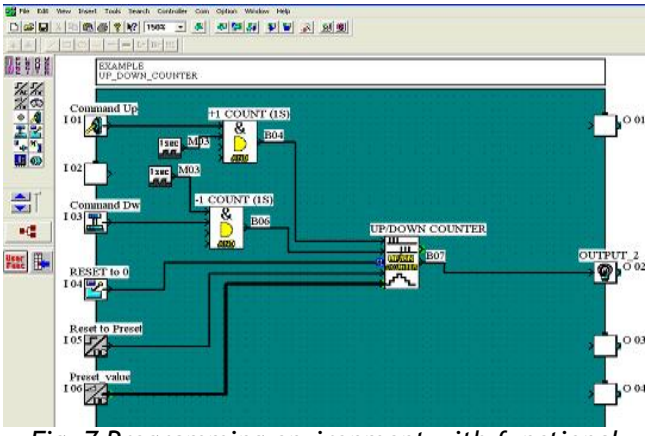

Fig. 7 Programming environment with functional blocks

FBD layout - place for positioning programming features (inputs, outputs, functional blocks, memory cells, or keys) during the programming process.
Binary value - variable type (input, output, and memory cell) can have only two states - 0 (Off) or 1 (On).
Analogue quantity - variable type has numeric value.
Program variables of different types can be edited or read by an open protocol. PC communication, utility panels communication or other PA is possible with the help of communication cable RS-232C. Created programs can be password protected. This type of security answers the purpose of programmer's copyright protection because so protected program cannot be copied any more

CONCLUSION

At present it is very important to know the flexibility to enter into the controlling process at every moment of the automatic cycle manipulation, or technology operations. Therefore, we in our laboratory program of controlling manufacturing systems to teach students to interact. Whether it is the creation of a virtual program by PLC, but also a change in real time the parameters of input and output units.

ACKNOWLEDGMENT

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REFERENCES

[1] ŽIDEK, K., MAXIM, V., Kurz programovateľných automatov - PLC. I. INTERNETOVÝ ČASOPIS, 2009, Vol. 1, č. 1, Bratislava: , 2009, www.oktagon.sk

[2] VARGA G., DUDAS, I.: Intelligent Manufacturing System for Production of Helicoid Surfaces, Gep, Vol.: LI. No.: 09, 2000, pp.: 44-46

[3] DRSTVENŠEK, I., PAHOLE, I., KOVAČIČ, M., BALIČ, J. Intelligent interface in a flexible production environment. J. mater. process. technol.. [Print ed.], 15. maj 2005, vol. 164-165,pp.1309-1316. http://dx.doi.org/10.1016/j.jmatprotec.2005.02.074

[4] HORVÁTH, ŠTEFAN - RUŽAROVSKÝ, ROMAN - VELÍŠEK, KAROL: Flexible assembly system generation by CAD and PPS systems. In: Machine Design. - ISSN 1821-1259. - 2010 (2010), s. 269-272

[5] DANIŠOVÁ, N., VELÍŠEK, K., KOŠŤÁL, P.,: Automated tool changing system in the intelligent manufacturing and assembly cell. In: ISCCC 2009: Proceedings of the 2009 International Symposium on Computing, Communication and Control, October 9-11, 2009, Singapore. - Singapore : International Association of Computer Science and Information Technology Press, 2009. - ISBN 978-9-8108-3815-7. - S. 1-8

[6] JAVOROVÁ, A., HRUŠKOVÁ, E., MATÚŠOVÁ, M.: Automated design of assembly system with computer aided system help. In: MMA 2009. Flexible Technologies: Proceedings. 10th international scientific conference. - Novi Sad, 9.-10.10. 2009. – Novi Sad: Faculty of Technical Sciences, 2009. - ISBN 978-86-7892-223-7. - S. 206-209

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ROLE OF RURAL DEVELOPMENT IN THE PRODUCTION OF THE HUNGARIAN TRADITIONAL HORTICULTURAL PRODUCTS

ABSTRACT:
Union and their development is not controlled by strict quota systems. In Hungary a lot of unique products of excellent quality are produced. Here in this essay we would like to find the answer to the question how the two significant products of the southern part of the Great Hungarian Plain can provide the families with the income that they can live on. We aim at the economical examination of the cucumber grown in Méhkerék and asparagus of Homok. To do this we will apply the so called Standard Gross Margin. The agriculture of the states of the European Union is measured with the help of this method. It can also help us in the future to decide whether the different farms belonging to families are economically viable in Hungary.

KEYWORDS:
unique products, SGM of cucumber and asparagus

INTRODUCTION

We would like to find the answer to the question how some significant products of Hungary can provide the families with the income that they can live on. I aim at the economical examination of the asparagus, the cucumber. To do this I will apply the so called Standard Gross Margin. The agriculture of the states of the European Union is measured with the help of this method. It can also help us in the future to decide whether the different farms belonging to families are economically viable in Hungary. I make suggestions regarding the sizes of the area, which would be required to provide a livelihood for a Hungarian family. Agriculture has been and probably will be a significant branch in the south part of the Great Plain in the future as well. Besides the mass products and in many cases instead of them when forming the agricultural structure, this region has to pay more attention to the branches that were important in the past (Berde, 2000). Hungarian experts who are famous in foreign countries as well deal with these branches and they provide excellent products (Juhász et al., 2006). The rules referring to these products are more liberal in the market places of the European Union and their development is not controlled by strict quota systems.

MATERIAL AND METHOD

The standard gross margin (SGM)

Our calculations were carried out with the help of a method worked out and applied in the European Union. In the European Union the agricultural enterprises have been regularly assessed (since 1966) and comparative data have been given to the decision-making organisations of the Union. Because of the number and the variations of the enterprises more than one form of measuring was applied such as the territory of the factory, the number of the employees, the number of the animals bred and the price of the products sold. As it was experienced the achievement of the agriculture in a state could not have been defined by these forms of measuring and by the combination of them. Similar to this they were not sufficient to determine the economic size of an enterprise and to compare the different factories from economic aspect (Kovács, 2001). The unified classification system (the economy typology) was accepted in 1978 that pays attention to two aspects, the type of farming (the structure of production) and the size of the economy. In order to define the economic size the Standard Gross Margin (SGM) was worked out (Kovács et.al., 1999). The natural data referring to the structure of the factory cannot say anything about the achievement of the agriculture of a country and they are not good for economic comparing. The size of the factory is defined the best of all by the potential profitable capacity which equals with the total standard gross margin (SGM) of the particular factory -which is the same as the added value (Agriculture in the European Union 2001, European Commission).

The calculation of the Standard Gross Margin

According to the regulations of the European Union, in cultivation of plants the costs of the seeds, the propagation, the artificial fertilizers, the insecticides, the heating, the irrigation, the processing, the classification, the packing, the insurance and other variable costs that are connected with the particular production activity have to be taken into consideration among the direct variable expenses. The indirect variable costs are also defined. The variable expenses in connection with the machines belonging to the factory (such as fuel, lubricants, repairing costs) are listed here. These two groups together mean the variable costs of the economy (Hajduné et.al., 2008). It does not include the costs of amortization and the rent of the agricultural land. This method takes into consideration every wages and their complementary costs as constant expenses without paying attention to whether they were paid to the owner of the farm or to a family member or to an employee. The amortization costs of the tangible assets, the rent of the agricultural land and the general costs are referred to as constant expenses.

The SGM1 and SGM2 index numbers can be calculated on the basis of the relations mentioned above.

SGM1 = sales - direct variable cost (direct material costs)

SGM2 = sales - direct variable cost - indirect variable cost (the direct material costs and the direct costs of machine work are deducted from the sales).

The SGM2 index number is in fact the gross income.

The necessity of live labour

The basis of the economy producing unique Hungarian products is to deal with growing plants that assure the costs of living for a long time; can be easily produced in the south of the Great Hungarian Plain, can be easily sold in the market and can be produced by own live labour.

The necessity of live labour has to be determined especially in the harvesting and the selling period. It can be calculated on the basis of detailed producing technology. In this essay we determine the area that a family can cultivate on its own - without employing workers seasonally. If we take a family with four members we calculate with three manpower units. In our earlier research the working days and working hours in cultivation of plants were defined. These data are essential to calculate the necessity of live labour especially when we plan the working peak. In the harvest phase we calculate with 7-10 working hours per manpower units a day. The family can perform 200-250 hours every ten days.

RESULTS AND DISCUSSION

The economic assessment of the cucumber grown

The training system for growing cucumber assures bigger quantities and better quality comparing to the plough-land cultivation. The cost of it is 3600-4400 euro per hectare that does not include the farmer's labour.

This system can be planned for ten years and can be applied when growing tomatoes as well. A particularity of growing cucumbers intensively is that the size of the desired product is in inverse relation to its yield and average price. The yield is lower if we pick cucumbers every day which are 1cm-3cm, 2cm-5cm and 3cm-6cm big and their price is higher. In the model we plan to pick 3cm-6cm and 6cm-9cm big cucumbers every two days.

From among the direct variable expenses the costs of artificial and organic fertilizers, pesticides, plants, irrigation and other variable costs were calculated in our project. The direct variable cost of the cucumbers grown on family farms with the help of training system and irrigation is 600 euro per hectare. In our technology 800 euro per hectare variable cost was calculated taking into consideration the running and the repairing costs of the machines of own property. The total variable cost in a year (1.400 euro) was compared to the probable income. The yield can reach 80 tons per hectare in the south of the Great Hungarian Plain if irrigation is applied. The 0,24 euro/kg average price could assure the farm a 19.200 euro income. We must not forget about the fact that such an intensive planting culture requires 800 euro costs per hectare at the beginning taking only an average data. This cost cannot be taken into consideration among the expenses (according to the terminology of the European Nations). Similarly to this the salary cannot be deducted although the application of live labour is the highest in case of growing plants in the fields. SGM1 = 19.200 euro income - 600 euro direct variable cost = 18.600 euro/year/hectare. SGM2 = 19.200 euro income - 600 euro direct variable cost - 800 euro indirect variable cost = 17.800 euro / year / hectare. The need for live labour is the greatest first when planting starts. If own labour is used, the work can be finished in time. The next peak of work appears during harvest when 540 working hours of live labour per hectares are needed. Taking into consideration the number of the working hours, one family can manage 0.51-hectare-post system area without employing working seasonally. The area that can be cultivated by the family on average assures only 9.076 euro SGM.

The economic assessment of the asparagus

The basis of the production is the asparagus plantation, which has a good effect on the farming. After planting there are three or four years without harvest but the field must be cultivated although there is no income and no other plants can be grown meanwhile to utilize the area. The cost of plantation and cultivation is 8.0000 euro in the proportion of 85+5+5+5 every year. Besides this 1600 working hours are needed. The factor cost of one hectare is 10.400 - 12.000 euro. The length of the period when there is harvest is 6-8 years. The accountable depreciation is 15% a year. During this period the quantity of the yield is not the same: in the first two or three years it is growing, then it is stagnating for two or three years and after that it is decreasing. In this model we

calculate with the yield of a stagnating year. The variable cost of the enterprise is encumbered with almost 220 euro per hectare. This includes the costs of the materials, the artificial and organic fertilizers, the pesticides, the packing and the processing. The indirect variable cost of the farm - according to our survey - is 170 which give a result of a total 400 euro variable cost. In the south of the Great Hungarian Plain - taking into consideration the areas not abounding in nutrients - we can calculate with a five-tonne average yield per hectare.
The distribution must be calculated with care with a 16 euro/kg - average price. The income is 8.000 euro per hectare. The biggest peak of work appears during the harvest. Taking into consideration the number of working hours 0.97 hectare of asparagus plantation ripening at the same time can be accomplished without employing workers for this season.
SGM1 = 8.000 euro income - 220 euro direct variable cost = 7.780 euro / year / hectare
SGM2 = 8.000 euro income - 220 euro direct variable cost - 170 euro indirect variable cost = 7.610 euro / hectare/ year.
The SGM2 for a 0.97 hectare is 7.390 euro.

CONCLUSIONS

The bread winning capacity of the cucumber in Hungary
In order to get the income expected the cucumber should be grown with the help of post system on a 0.72 hectare big area. On such a big area other workers have to be employed during the harvest period for 540 working hours. The cost of it is 780 euro.
This kind of cucumber growing makes it possible for the family to make ends meet. On the basis of the significant export, the market for the cucumber can be said to be steady. The income depends on the Hungarian sale ring and the processing. The cost of introducing the post system is high but the income of the first year can cover this cost on a successful farm.
The bread winning capacity of the asparagus grown in Hungary
In order to get the income expected the pale asparagus should be grown on a 1.66 hectare big area. On such a big area other workers have to be employed during the harvest period for 469 working hours. The cost of it is 680 euro. The kinds of the asparagus make it possible for the family to make ends meet. On the basis of the significant export, the market for the asparagus can be said to be steady. The income depends on the Hungarian sale ring. Because of the frost in late spring it is not recommended to base the whole income of the farm on the asparagus. Other recommended products can be the ones the harvesting time of which not the beginning of April is or the middle of June.

REFERENCES

[1.] Agriculture in the European Union 2001, European Commission.
[2.] Berde, Cs (2000): Changes of Approaches to Management Functions in Agriculture. Zbornik, Vedekych Prac, Nitra p. 217-222.
[3.] Juhász, Cs.-Berde, Cs. (2006): Synchronisational problems in organisational motivation in agriculture. Studies in Agricultural Economics. No. 104. p. 129-142.
[4.] Hajdu I-né- Nótári M. (2008): Fogyasztói attitűdök vizsgálata a hungarikum jellegű kertészeti- és élelmiszeripari termékek piacán. Acta Oeconomica Kaposvariensis 2008. No.1. p. 25-32.
[5.] Kovács G.-Keszthelyi Sz.(1999): A tesztüzemek 1998.évi gazdálkodásának eredményei, AKII Füzetek,1.
[6.] Kovács G. (2001). Mérethatárok és lefedettség, Magyar Mezőgazdaság XII. p. 12.

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MATERIAL FLOW STRATEGY BY SOFTWARE WITNESS

ABSTRACT:
Any proposal for a perfect relocation of production lines and the subsequent operation of the production system is still subject to further change. They are caused by innovation of products on the market, qualitative and quantitative requirements of the customer etc.
Resolving of material flows is actual term in present. It brings a lot of problems with layout of particular devices as elements of manufacturing process according to required and defined technology. In present time are suitable software tools for improving of transport, manipulation and storage systems. The simulation of these three systems relation is realized support CA systems to optimal whole technological processes. In this case this problem is solved by simulation software Witness used in Institute of Manufacturing Systems and Applied Mechanics of our faculty.

KEYWORDS:
production system, manufacturing, material flow, layout optimizing

INTRODUCTION

Predictive simulation technology is attracted of specialists in many fields. Competitiveness retention and raising the level of services required by organizations constantly change.
It is necessary to verify the possibility of planned systems and find successful solutions under conditions of strict monitoring costs. Requirements to change technology or business processes, however, entail some risk.

INTRODUCTION

The simulation model is a dynamic model in which there are phenomena of the same order as the system modeling. Simulation methods obtain solutions to some transformation of values that have been learned from observing the model run (run program). The simulation model provides results based on information collected from the changes in the model over time.
Contribution of simulation methods in the field of operational research is particularly in facilitating the work of dynamic and complicated probability ties. As far as the achievement of the goal to create an analytically solvable model, it is necessary to prioritize. Such a model adequately reflects the essential reality site.
This model is usually more general (simulation methods provide results only in numerical form) and to construct and less expensive solutions. In addition, simulation methods are appropriate for assessing the number option than to solve problems that lie in finding optimal solutions to large sets or even an infinite number of elements. With the growing complexity of systems that need to be rationally designed and managed will need to increase the use of simulation methods.

SIMULATION MODELS AS TOOL TO OPTIMIZE THE MATERIAL FLOW

There are mostly used in practice following types of simulation:

- *dynamic simulation and physical systems (differential equations, finite element method, etc.)*
- *discrete event simulation systems (network theory front, etc.)*
- *simulation aimed at training people (air simulators and trainers, simulators and other operator).*

Using simulation to solve the various proposals for optimization of production lines and several systems in different industries to track:

- *verification of the new designed production line operations, a comparison of the old organization to the proposed production control system based on KANBAN,*
- *the design of optimal production batch subject to a lot of clock and production of products,*
- *the optimization of the number of workers in the system, the allocation of operations jobs.*

PROCESS SIMULATION SOFTWARE

WITNESS - is successful program to simulate the production, maintenance and logistics processes. It is used for interactive model creation, creation of modular structures, interactive experimentation, working with CAD / CAM applications and information systems, creating a single optimization module, 3D visualization - virtual reality module. Other administration routes of the Witness:

- *modern methods implementation of production management,*
- *the identification and removal of bottlenecks,*
- *optimal allocation of production and logistics units, material flow analysis,*
- *the prediction of the operational interventions consequences.*

Application Witness simulation program can be realized in the order:

- *the choice of components,*
- *manufacturing process technology,*
- *the choice of machines,*
- *making production variations,*
- *comparison of the designed variations,*
- *selecting of an acceptable variant.*

Technological process of production

In the technological process of product manufacture is necessary to ensure selection of appropriate means of production, namely:

- *products production and production volume,*
- *determination of the technological processing structures and methods,*
- *technology and organizational structure of production, especially mass, production specified, degree of automation and flexibility,*
- *technology equipment - machines and devices, tools and products,*
- *handling equipment,*
- *control equipment. [3]*

The choice of machine

The most important factor in machines classification is a kind of manufacturing plant production. This classification determined the concept of machine technology and automation. [2]

Classification systems of production machines recognize:

- *universal production machines,*
- *specialized production machinery,*
- *special-purpose ,*
- *numerically controlled machine,*
- *numerically controlled manufacturing centers,*
- *numerically controlled machines for automated manufacturing systems.[1, 4]*

Development of production variants

At this stage, to shape the overall concept of technology production. Detail degree of technology depends on whether the choice of production facilities does:

- *for the compilation of the existing technological process in production,*
- *technological solutions to project a new or upgraded, respectively modernized production,*
- *reconstruction of production facilities.*

It is possible to proceed in various ways to create proposals for production. One is the analysis of material flow in production. In Fig. 1 shows the analysis of material flow through production line graphical display.

Symbol	classification activities
	technological operation
	control
	transport, handling of material
	break, downtime sorting
	storage
	loading, unloading
	weighing
	packaging

Fig. 1 Symbols illustrated activities

Different variants of the production lines can be designed using the following symbols, depending on the technological process of manufacturing the product.

Comparison of original and newly proposed material flow in production:

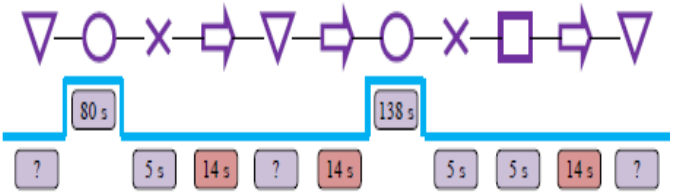

Fig.2 Production line variant by symbols

GRAPHICAL SIMULATION OUTPUT OF MACHINERY AND DEVICES

The simulation software generates statistics on the performance of machines and devices after a simulation of the production line. In this case, the witness was used.

Based on the above chart it is possible to achieve productivity gains and to address the increasing efficiency of machines. The solution is to reduce downtime and streamlining manufacturing process technology for finishing. It is necessary to increase the number of inspectors who would ensure the continuity of material flow in quality control. This eliminates the accumulation of technology stocks.

SIMULATION OF THE VARIANTS

Simulation of material flow production lines is shown in Fig. 3.

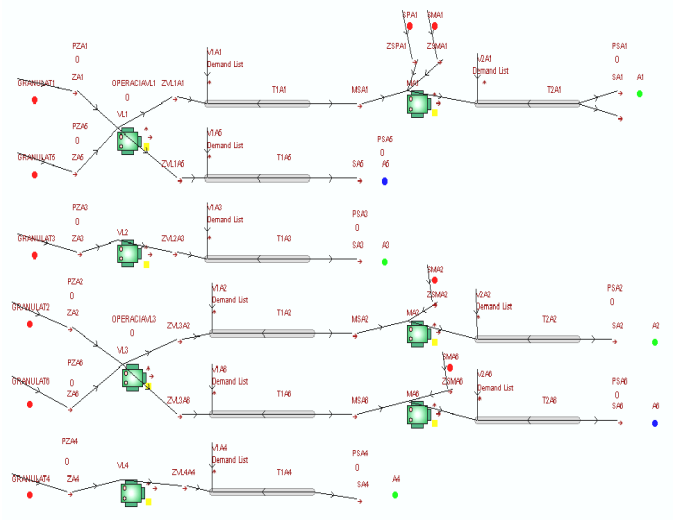

Fig. 3 Example of production lines simulation

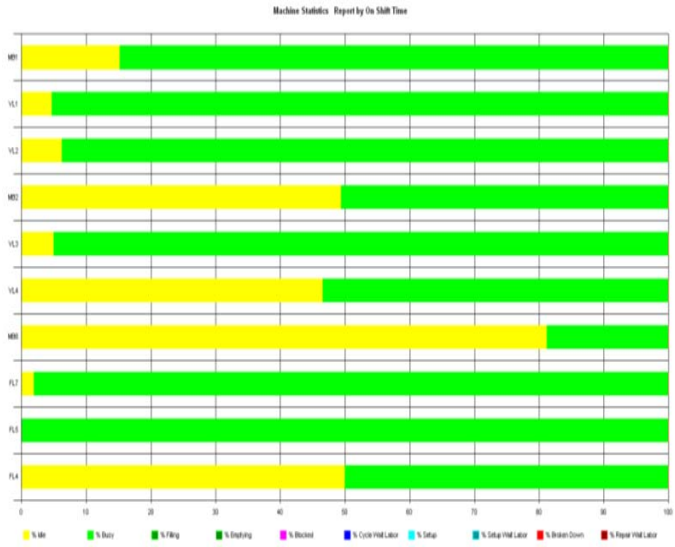

Fig. 4 Graph operation of machines and devices during the simulation

CONCLUSION

Any proposal for a perfect relocation of production lines and the subsequent operation of the production system is still subject to further change. They are caused by innovation of products on the market, qualitative and quantitative requirements of the customer etc. Therefore, the production system in operation there may be changes in the parameters of the production system, which, depending on time may decrease, unchanged, or rise. Simulation of the production system is a tool to select from a large number of possible solutions. The simulation is to select the optimal variant. By choosing this option should be to optimize the production system. An appropriate choice of the optimal solution and the result of a rationalization of the project are dependent primarily on a thorough analysis of the production system and production program.

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The main aim of cooperated project is increasing of manufacture technical level and of control effectiveness in the field of plastics component production with three specific project aims:

- *Building of laboratory for construction and tool simulation for processing of plastics components,*
- *Material flow and production planning optimalization,*
- *Mechanisation and automation as a tooling for elimination of bad human factor influence to the manufacture quality.*

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REFERENCES

[1] *Danišová, N., Zvolenský, R.: Intelligent manipulating and transport systems. In: International Doctoral Seminar 2007: Proceeding. 13-16 May, 2007, Smolenice. - Trnava : AlumniPress, 2007. - ISBN 978-80-8096-011-7. - pg. 34-38*

[2] *Horváth, Štefan - Danišová, Nina: Power elements of flexible manufacturing and assembling systems. In: International Doctoral Seminar 2008 : Proceedings. Smolenice, May 18-20, 2008. - Trnava : AlumniPress, 2008. - ISBN 978-80-8096-058-2. - pg. 130-136*

[3] *Horváth, Štefan - Javorová, Angela: Planning and design production system organizational structures and procedures. In: Annals of Faculty of Engineering Hunedoara - Journal of Engineering. - ISSN 1584-2673. - Tom VIII, Fasc 3 (2010), s. 331-335*

[4] *Javorová, Angela - Matúšová, Miriam: Automated assembly system design with help of computer aided system. In: Annals of The Faculty of Engineering Hunedoara. - ISSN 1584-2665. - Tom VII, Fasc. 2 (2009), s. 43-48*

[5] Mudriková, Andrea - Hrušková, Erika - Velíšek, Karol: Logistics of material flow in flexible manufacturing and assembly cell. - registered in ISI Proceedings. In: Annals of DAAAM and Proceedings of DAAAM Symposium. - ISSN 1726-9679. - Vol. 19, No.1. Annals of DAAAM for 2008 & Proceedings of the 19th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on Next Generation of Intelligent Systems and Solutions", 22-25th October 2008, Trnava, Slovakia. - Viedeň : DAAAM International Vienna, 2008. - ISBN 978-3-901509-68-1, s. 0919-0920

[6] Mudriková, Andrea - Košťál, Peter - Velíšek, Karol: Material and information flow in flexible manufacturing cell. - registered in ISI Proceedings. In: Annals of DAAAM and Proceedings of DAAAM Symposium. - ISSN 1726-9679. - Vol. 18, No.1. Annals of DAAAM for 2007 & Proceedings of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on Creativity, Responsibility, and Ethics of Engineers" : Croatia, Zadar 24-27th October 2007 (2007). - Viedeň : DAAAM International Vienna. - ISBN 3-901509-58-5, s. 485-486

[7] Pecháček, František - Charbulová, Marcela: Stavebnicové upínacie systémy. Modular fixture systems. In: Strojárstvo - Strojírenství. - ISSN 1335-2938. - Roč. 12, č. 9 (2008), 191/5-192/5

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FILTER NOZZLE TESTING BY THE INSTALATION WITH COLUMN AND MANOMETER

ABSTRACT:
This paper deals with filter nozzles which are used for water treatment. They are applied in many sectors including drinking water, water demineralization process, urban and industrial waste water treatment, filtration of river or well water for irrigation, water for swimming pools, etc. The filter nozzles are made from the thermoplastic material, with different number and widths of gaps at the head of the nozzles. It is necessary to determine performance curve of filter nozzle before it is installed. The performance curve actually represents the nozzle water gauge head as a function of flow rate. This performance curve has been traditionally determined by measuring of hydrostatic pressure above the nozzle with level meters (graduated scale, ultrasound, capacity etc.). In order to measure a couple of meters water gauge head, a reservoir is necessary. This research is aimed to examine possibility to apply the installation with column and manometer instead of the reservoir, in order to determine filter nozzle performance curve. The water gauge head is measured by manometer and flow rate through the filter nozzle by mass method. Authors are of the opinion that installation with column and manometer could be successfully applied to determine filter nozzle performance curve. In comparison with the reservoir, the installation with column and manometer is more compact and comfortable.

KEYWORDS:
Filter nozzle, column, filtration, washing

INTRODUCTION

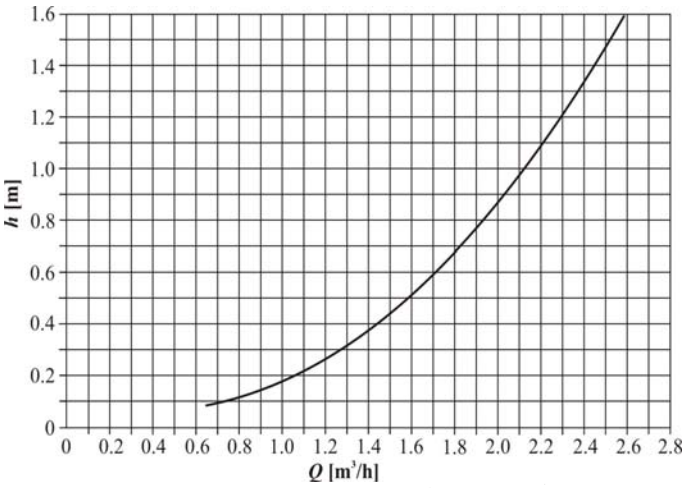
Filter nozzles are placed in:

- *open systems - for preparation of drinking water, industrial waste water treatment, filtration of river or well water for irrigation, water for swimming pools and*
- *closed systems - for preparation of feed, technological and cooling water.*

The filter nozzles are made from the thermoplastic material, with narrow gaps at the head of the nozzles. They enables preparation of water using ion exchangers. The number and width of the filter nozzle gaps vary by model. Thanks to the installed nozzle, this kind of filter has very fast filtration. Filter nozzle enables collection and drainage of filtrate evenly. In the process of washing, nozzles make possible water and air to be evenly distributed. In this way filter nozzles contribute to fast, stabile and economic exploitation of filter stations.

One of the most important characteristic of filter nozzle is to deliver sufficient volume of water in processes filtration and washing. In order to check filter nozzle it is necessary to conduct test before installation. Also is necessary to determine performance curve of filter nozzle before installation. The performance curve actually represents the nozzle water gauge head vs flow rate. This performance curve has been traditionally determined by measuring of hydrostatic pressure above the nozzle with level meters (graduated scale, ultrasound, capacity etc.). In Fig. 1 is shown performance curve of model with 40 narrow gaps, 0.2 mm in width at the head of the nozzles (producer BRAN & LUBBE) [2]. In order to measure a couple of meters water gauge head with this method, a reservoir is necessary.

This research is aimed to examine possibility to apply the installation with column and manometer instead of the installation with reservoir, in order to determine filter nozzle performance curve. The hypothesis of work was that installation with column and manometer could be successfully applied to determine filter nozzle performance curve. The report on filter nozzles testing of models RV001/A, RV001/B and RV001/D (producer RAVEX) provides background for this paper [2]. The RAVEX Company from Vrbas, Serbia, is a leader of filter nozzles production in the Balkan region [3].



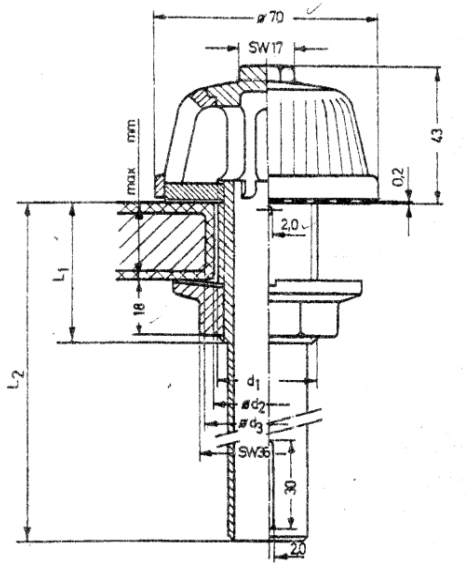


Figure 1. The performance curve of filter nozzle of model with 40 narrow gaps, 0.2 mm in width at the head of the nozzles (producer BRAN & LUBBE) [1]

METHODOLOGY OF INVESTIGATION

An installation with column and manometer for filter nozzles testing has been designed at the Faculty of Technical Sciences, Laboratory for Fluid Mechanics. The filter nozzle model RV001/A was tested to verify method with proposed installation. The model RV001/A corresponds to model in Fig. 1, 40 narrow gaps, 0.2 mm in width at the nozzle head [3]. The tests were carried out for two processes: filtration (Fig. 2) and washing (Fig. 3).

In Fig. 2, Fig. 3 and Fig. 4 are: 1-valve, 2-rubber hose, 3-regulator, 4-housing, 5-manometer, 6-filter nozzle, 7-bottom with threaded connection, 8-built in piece, 9-screw nut, 10-nozzle neck, 11-vessel, 12-precision balance, 13-data acquisition and 14-stopwatch.

The length of the housing is $h_k = 550$ mm*, which is more than the length of the nozzle neck (*$h_d = 400$ mm*). Regulation of water flow rate (*$\dot{m}$*) was carried out by balance valve (3). The pressure at the position 5 was measured by manometer of producer YOKOGAWA, model EJA530A [4].*

The measuring range of manometer is $p = 0 \div 400$ mbar*, with uncertainty of* $\pm 0{,}35\ \%$*. The change of filter nozzle position for two testing processes (filtration in Fig. 2 and washing in Fig. 3) was enabled by bottom with threaded connection 7 and built in piece 8. The mass of water (m) was measured with precision balance (12) with uncertainty of* $\pm 0{,}02\ \%$*, while the time (t) was measured with digital stopwatch (14).*

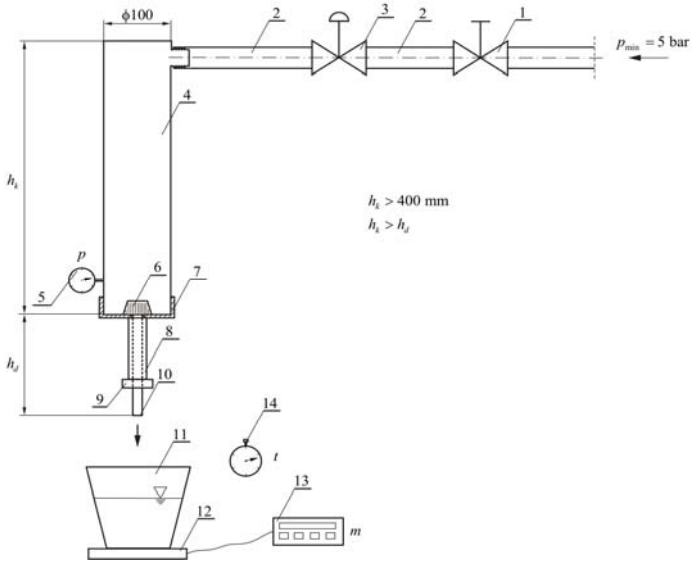


Figure 2. Scheme of installation with column and manometer for filtration process

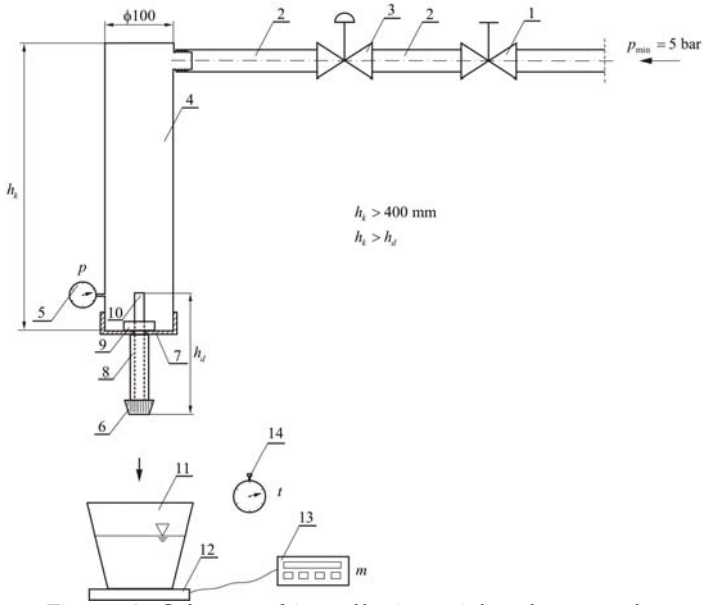


Figure 3. Scheme of installation with column and manometer for washing process

Mass flow rate is as follows: $\dot{m} = \dfrac{m}{t}$.

Volumetric flow rate is: $Q = \dfrac{\dot{m}}{\rho}$.

The water gauge head is: $h = \dfrac{p}{\rho g}$,

where are:
p - preassure [Pa];
ρ - density of water [kg/m^3];
g - earth accelaration [m/s^2].
The water gauge head (h) depends on determined volumetric flow rate (Q). The flow rate was varied by regulator and relation equation $Q = f(h)$ was formed.

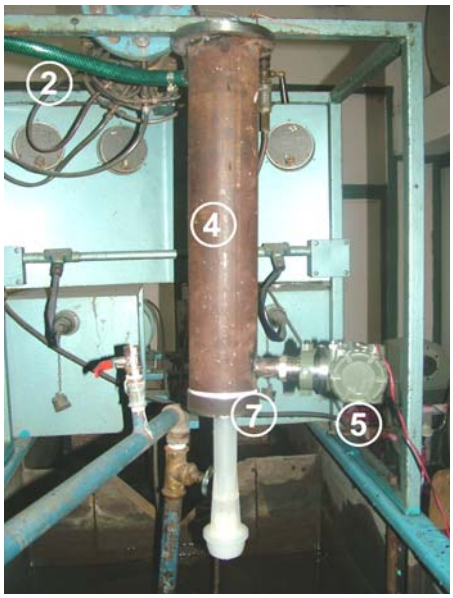


Figure 4. View of installation with column and manometer for washing process

EXPERIMENTAL RESULTS AND ANALYSIS

The results of filter nozzle testing of producer RAVEX, model RV001/A are shown in Fig. 5 and Fig 6. In the Fig. 5 is shown performance curve for the filtration process and in the Fig. 6 performance curve for the washing process.
The gained performance curves for filtration and washing processes in Fig. 5 and Fig. 6 were expected. These curves thoroughly suit curves for filter nozzles with 40 narrow gaps, 0.2 mm in width at the nozzle head.

In this way hypothesis of work was proved and installation with column and manometer could be successfully applied to determine filter nozzle performance curve. In comparison with the reservoir, the installation with column and manometer is more compact and comfortable. The performance curve in filtration process which was determined by installation with the reservoir had up to 1.6 m water head gauge, as shown in Fig.1. It means that maximal level of water in the reservoir is 1.6 m. The performance curve in filtration process which was determined by installation with column and manometer had up to 3 m water head gauge, as shown in Fig. 5. For the same water head gauge, the level of the water in the reservoir should be 3 m. On the other hand the height of column was only 0.5 meter.

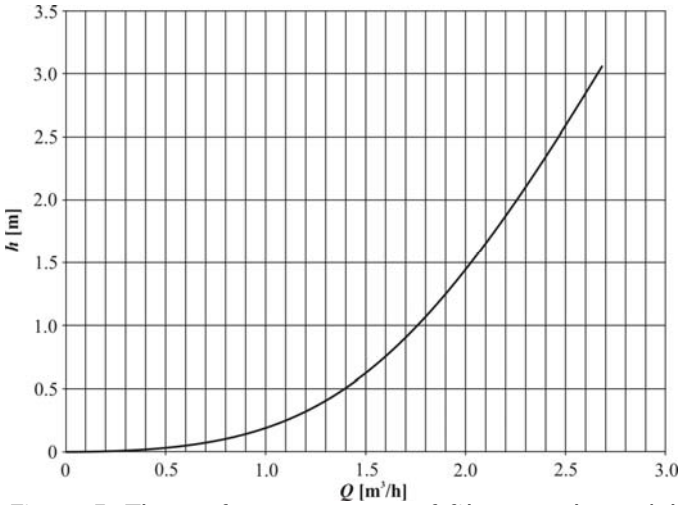


Figure 5. The performance curve of filter nozzle model RV001/A for the filtration process

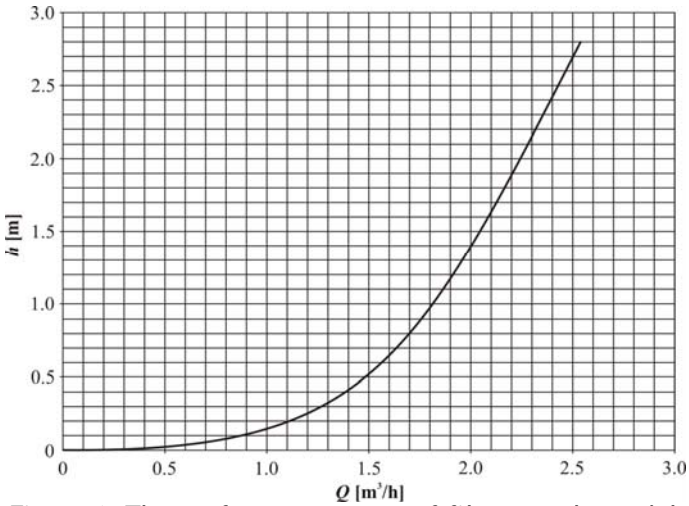


Figure 6. The performance curve of filter nozzle model RV001/A for the washing process

CONCLUSIONS

The same model of filter nozzles was tested with the help of the installation with reservoir and the installation with column and manometer, respectively. Very good agreement between these two performance curves was obtained.

Authors are of the opinion that column could be successfully applied to determine filter nozzle performance curve. In comparison with the reservoir, the installation with column and manometer is more compact and comfortable.

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REFERENCES

[1.] *http://www.branluebbe.com/*
[2.] *Bikić, S. (2009) Izveštaj ispitivanja filter dizni proizvođača Ravex d.o.o Vrbas, modeli RV001/A, RV001/B i RV001/D, Fakultet tehničkih nauka u Novom Sadu, februar 2009, broj izveštaja 01-192/55.*
[3.] *RV Program filterskih dizni, http://ravex-vrbas.net/*
[4.] *Model EJA510A and EJA530A Absolute Pressure and Gauge Pressure Transmitters, User's Manual, Yokogawa, http://www.yokogawa.com/*

AUTHORS & AFFILIATION

[1.] *Siniša BIKIĆ,*
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GROWING GREENHOUSE CUT FLOWER IN HYDRO-CULTURE

ABSTRACT:
The importance of hydro-cultural growing is significantly increasing. We have been dealing with the hydro-cultural growing of cut flowers at the Department of Ornamental Plant Growing and Maintenance of Gardens at the College Faculty of Horticulture at Kecskemét College since 1988. We started our experiments by growing carnation in growing establishment without soil then we introduced other species of cut flowers and potted ornamental plants into our research work (Lévai et al., 2010/b). Our aim was to examine the effect of Grodan and PU-sponge media on the growth, the yield of flowers, the diameter of the flowers and the length of the stem concerning the species of carnation 'Pink Castellaro'. In case of comparing the species our aim was to examine the effect on the development of the plants, the yield and the characteristics of the flowers: the diameter of the flower and the length of the stem.
The Phytomonitor instrument is placed in the French Filclaire greenhouse and we at the Floriculture and Park Maintaining Department measure rose culture parameters in hydroponics. We measure the following factors: air temperature, leaf temperature, radiation, relative humidity of air, stem diameter and soil moisture (Lévai- Turiné, 2009.) Using Phytomonitor data processing make it possible to use nutriments in an optimal level thus apply a low-cost environmentally friendly technology.

KEYWORDS:
hydroculture, carnation, Rose, PU sponge, Grodan, Phytomonitor

INTRODUCTION

The effect of the species on the flower diameter of carnation: Most of the species in the experiment reached or exceeded the parameters of 1st class products determined by the standards, minimum was 7.0 except for the values of 6,91 and 6,96 of 'Candy' and 6,87 and 6,89 of 'Ondina' average yearly flower diameter (Lévai et al, 2010).
The largest flower diameters of the red species were experienced in the case of 'Iury' and 'Rodolfo', from the point of flower diameter these species are worth being involved in hydro-cultural growing. In case of the 'Castellaro' species 'Pink Castellaro' produced significantly larger flowers (Lévai – Turiné, 2005).
Experiments with the species:

- *'Danton' is of high growth, of good yield, with large flowers and long stem*
- *'Gigi' is of high growth, of good yield, with large flowers and long stem*
- *'Iury' is of high growth, of average yield, with large diameter of flower and long stem*
- *'White Castellaro' is of high growth, of good yield, with large diameter of flower and long stem*
- *'Pink Castellaro' is of high growth, of excellent yield, with large flower and long stem*
- *'Candy' is of average growth, of excellent yield, with average size of flowers, with average long stem*
- *'Rimini' is of high growth, of good yield, with large flowers, really long stem*
- *'Rodolfo' is of high growth, of excellent yield, really large flowers, really long stem*
- *'Ondina' is of average growth, of good yield, with average size of flowers, long stem*
- *'Olivia' is of high growth, of excellent yield, with large flowers and long stem*

Each of the species in the survey is adequate for hydro-cultural growing (Lévai – Turiné, 2005a, b; Lévai – Turiné, 2007).

MATERIAL AND METHODS

We made experiments of hydro-cultural growing of carnation with the following species: 'Danton', 'Gigi', 'Iury', 'White Castellaro', 'Pink Castellaro' and 'Candy', 'Rimini', 'Rodolfo', 'Ondina', 'Olivia'.
The experiments of carnation were carried out by the French Filclair growing establishment, growing was arranged in a closed, circular system. The planting of shoots with roots was arranged by 40 pieces/m^2 at the end of May. We applied PU-sponge as the medium of plantation for the comparative experiments, the length of the growing season was one year. The experiment was carried out by repeating the procedure four times. The supply of nutritional material was made by using complex chemical fertilizer, the pH of the nourishing solution was 5,0-6,5, the conductivity was 2,5-3,5 mS and these

parameters were continuously controlled. We measured the quantity of the picked flowers from the beginning of blooming each time. We chose 10-10 of the picked flowers by random choice and measured the characteristics of flower quality: the diameter of the flower and the length of the stem.

A PhyTech company plays a pioneer role in the Phytomonitoring ™ system, it detects the plants remotely. It uses advanced methods, collects and analyses the data derived from wireless communication sensors and innovative softwares. The main purpose is the detection of early plant stress, optimal growth and quality of product to increase income.

Results

The effect of the media on the height of the carnation

In case of the hydro-cultural growing of carnation both the polyurethane-ether sponge and Grodan had a good effect on the growth of the plant, both are adequate as a plantation media but the stock grown in the sponge was higher.

The effect of the media on the yield of the carnation

We managed to reach the average flower yield of 7-9 flowers per stem (Figure 1.) characteristic of the traditional chemo-cultural growing in case of hydro-cultural growing in polyurethane-ether sponge and in Grodan that is both are adequate plantation media for hydro-cultural growing.

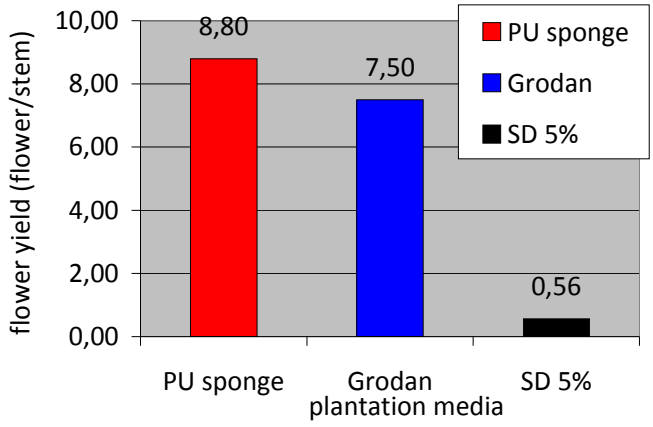

Figure 1. The effect of plantation media on the yearly yield of carnation 'Pink Castellaro' (Kecskemét, 1999-2000.)

The effect of the media on the flower diameter of the carnation

During the two growing seasons of the experiments the average diameter of the flowers planted in polyurethane-ether sponge and in Grodan reached the parameters of 1st class flowers that is 7-cm flower diameter. We did not experience significantly better results in case of the two media so both are adequate for the hydro-cultural growing of carnation.

The effect of the media on the length of the flower stem of carnation

The plantation media influenced neither the yearly nor the monthly length of the stem significantly in the years of research.

Taking the yearly average into consideration we reached the requirement of 1st class quality that is 55-60-cm stem length in case of both media.

Considering all the above both polyurethane-ether sponge and Grodan are adequate media for hydro-cultural growing.

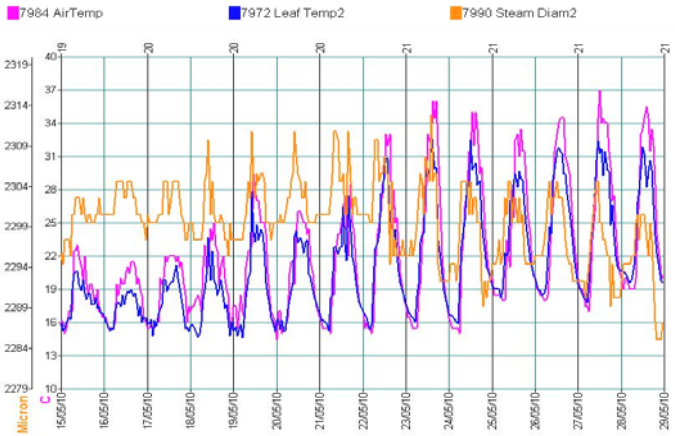

Figure 2: The effect of air temperature on rose leaf temperature and expansion of stem (2010.Kecskemét)

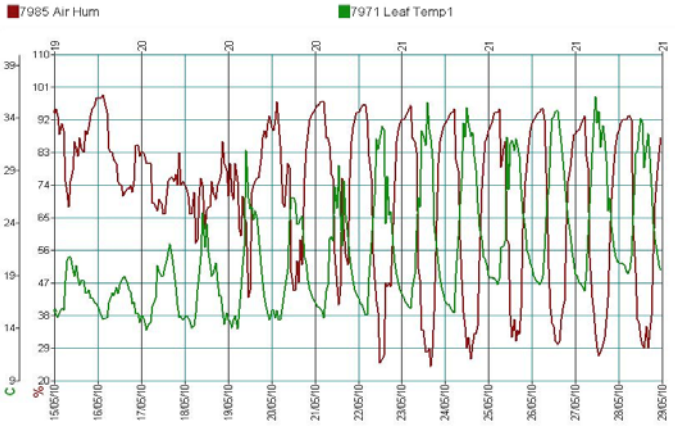

Figure 3.: Rose leaf temperature in relation with the air humidity (2010.Kecskemét)

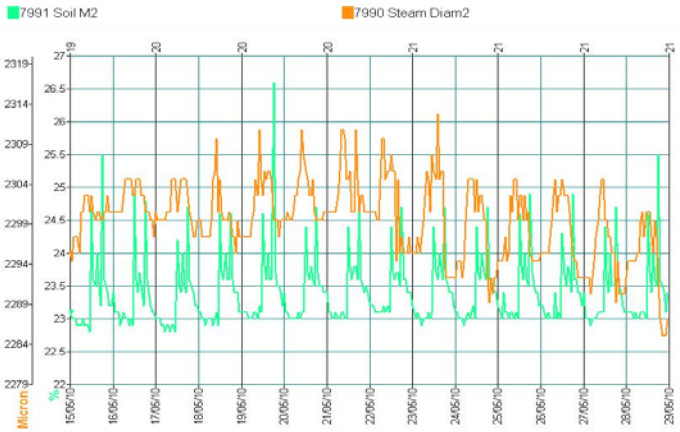

Figure 4: The expansion of rose stem in accordance with soil wetness (2010. Kecskemét)

The fluctuation of air temperature well indicates the change of the phases of the day (Figure 2). The expansion of stem follows this cycle. It was pointed out that the higher was the daily maximum temperature the expansion of stems was more intensive. Respectively the fewer daily fluctuation

made the stem expansion more stable. By the increase of daily temperature the expansion of stems are significant. The temperature of leaves increases paralell with the air temperature.
By the increase of temperature the relative humidity decreases. The temperature change of leaves follows the change of air temperature (Figure 3). According to it the relative humidity is higher in the night and lower in the day.
The wetness of soil indicates the time of irrigation (Figure 4). The expansion of stems well follows the wetness of the soil.

DISCUSSIONS & RESULTS

Concerning environmental protection PU sponge is more and more adequate media for growing carnation since it can be used until complete decomposition. Both PU sponge and Grodan have got a favourable effect on the growth of the plant, the yield of the flowers and the flower quality characteristics that is why Grodan is also an adequate media for the hydro-cultural growing of carnation. Phytomonitoring is one of the growing decision support devices which gives fast information about the tendency of plant development. It is an information technology which provides the grower with incredibly valuable information about the plant physiologic stage.

REFERENCES

[1.] Lévai P. – Turiné Farkas Zs. (2005a).: Development of Hydro-Cultural Carnation Growing. Lippay János – Ormos Imre - Vass Károly Tudományos Ülésszak Budapest, 2005. otóber 19-21. 75 p.
[2.] Lévai P. – Turiné Farkas Zs. (2005b).: The hydroculture of carnation. 10th International Scientific Conference. 20th April 2005, Nitra 51p.
[3.] P. Lévai –Zs. Turiné Farkas (2007): The development of hidroponic way of growing in floriculture. "Lippay János – Ormos Imre – Vas Károly" Tudományos Ülésszak 2007. november 7–8. Összefoglalók, Kertészettudomány. Budapesti Corvinus Egyetem, Kertészettudományi Kar, Budapest 63. p.
[4.] Lévai P. – Turiné Farkas Zs. (2009): Legújabb eredmények a Phytomonitor használatának következtében Erdei Ferenc V. Tudományos Konferencia Kecskemét, 2009. szeptember 3–4.
[5.] Lévai P. – Ferencz Á. – Nótári M. (2010): The Marketing Analysis of some ornamental Plants in Hungary International Society for Horticultural Science 28th International Horticultural Congress Portugal, Lisboa 220.p.
[6.] Lévai P. – Ferencz Á. – Nótári M. (2010): Image Profile Analysis of Cut Flowers in Hungary International Society for Horticultural Science 28th International Horticultural Congress Portugal, Lisboa 221.p.

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ACADEMIC CONFERENCES WORLDWIDE IN 2011 – UPCOMING EVENTS IN ENGINEERING, MANAGEMENT AND RELATED FIELDS

- THE 8th INTERNATIONAL CONGRESS "MACHINES, TECHNOLOGIES, MATERIALS". TOPIC: „INNOVATIVE SOLUTIONS FOR PRODUCT AND PROCESS DEVELOPMENT", 18 - 21 September, Varna, BULGARIA
- THE 8th INTERNATIONAL SCIENTIFIC CONFERENCE ON PRODUCTION ENGINEERING, DEVELOPMENT AND MODERNIZATION OF PRODUCTION, 26 - 30 September, Praha, CZECH REPUBLIC
- INTERNATIONAL CONFERENCE ON INNOVATIVE TECHNOLOGIES - IN-TECH 2011, 1 - 3 September 2011, Bratislava, SLOVAKIA
- THE 9th IEEE INTERNATIONAL SYMPOSIUM ON INTELLIGENT SYSTEMS AND INFORMATICS - SISY 2011, 8 - 10 September, 2011, Subotica, SERBIA
- THE 3rd IEEE INTERNATIONAL SYMPOSIUM ON LOGISTICS AND INDUSTRIAL INFORMATICS - LINDI 2011, 25 - 27 August, 2011, Budapest, HUNGARY
- THE 12th IEEE INTERNATIONAL SYMPOSIUM ON COMPUTATIONAL INTELLIGENCE AND INFORMATICS - CINTI 2011, 21 - 22 November, 2011, Budapest, HUNGARY
- THE 4th INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND STRUCTURES - AMS '11, 27 - 28 October 2011, Timişoara, ROMANIA
- FEDERATED CONFERENCE ON COMPUTER SCIENCE AND INFORMATION SYSTEMS - FedCSIS 2011, 19 - 21 September, 2011, Szczecin, POLAND
- THE 3rd INTERNATIONAL SCIENTIFIC AND EXPERT CONFERENCE - TEAM 2011 (TECHNICS, EDUCATION, AGRICULTURE & MANAGEMENT) & 17th INTERNATIONAL SCIENTIFIC CONFERENCE - CO-MAT-TECH 2011, 19 - 21 October, 2011, Trnava, SLOVAKIA
- THE 1st CENTRAL AND EASTERN EUROPEAN CONFERENCE ON THERMAL ANALYSIS AND CALORIMETRY - CEEC-TAC, 7 - 10 September, 2011, Craiova, ROMANIA
- INTERNATIONAL CENTRE OF ENVIRONMENTAL PROTECTION AND FOOD QUALITY CONTROL - B.EN.A. CONFERENCE - ENVIRONMENTAL ENGINEERING AND SUSTAINABLE DEVELOPMENT, 26 - 27th May, 2011, Alba Iulia, ROMANIA
- INTERNATIONAL CONFERENCE ON ADVANCES IN MATERIALS AND PROCESSING TECHNOLOGIES - AMPT 2011, 13 - 16 July, 2011, Istanbul, TURKEY
- THE VIIth INTERNATIONAL CONFERENCE ON MECHANOCHEMISTRY AND MECHANICAL ALLOYING - INCOME 2011, August 31 - September 3, 2011, Herceg Novi, MONTENEGRO
- THE 11th INTERNATIONAL CONFERENCE "RESEARCH AND DEVELOPMENT IN MECHANICAL INDUSTRY" - RaDMI 2011, 15 - 18 September, 2011, Soko Banja, SERBIA
- INTERNATIONAL SYMPOSIUM ON LIQUID METAL PROCESSING AND CASTING - LMPC 2011 25 - 28 September, 2011, Nancy, FRANCE
- THE 2nd INTERNATIONAL CONFERENCE AND EXHIBITION ON CLEAN TECHNOLOGIES IN THE STEEL INDUSTRY, 26 - 28 September, 2011, Budapest, HUNGARY
- INTERNATIONAL EXHIBITION OF MACHINERY AND SUPPLIES FOR CASTING, FORGING, ROLLING AND SURFACE TREATMENT - TRASMET 2011, 27 - 30 September, 2011, Bilbao, SPAIN
- THE 34th INTERNATIONAL CONFERENCE ON PRODUCTION ENGINEERING - ICPE 2011, 28 - 30 September, 2011, University of Nis, Nis, SERBIA
- THE 48th FOUNDRY DAYS 2011, WITH ACCOMPANYING EXHIBITION, 11 - 12 October, 2011, Brno, CZECH REPUBLIC
- THE 14th INTERNATIONALE TRADE FAIR FOR MATERIALS APPLICATIONS, SURFACE TECHNOLOGY AND PRODUCT ENGINEERING - MATERIALICA 2011, 18 - 20 October, 2011, Munich, GERMANY
- INTERNATIONAL FAIR FOR STEEL, NON-FERROUS METALS, TECHNOLOGIES AND PRODUCTS - SteelMET 2011, 18 - 20 October, 2011, Sosnowiec, POLAND
- THE 9th INTERNATIONAL TRADE FAIR FOR INDUSTRIAL PARTS AND SURFACE CLEANING, 25 - 27 October, 2011, Stuttgart, GERMANY
- INTERNATIONAL CONFERENCE ON DEFORMATION AND FRACTURE IN PM MATERIALS - DFPM 2011, 6 - 9 November, 2011, Stará Lesná, High Tatras, SLOVAKIA
- THE 6th EUROPEAN OXYGEN STEELMAKING CONFERENCE - EOSC 2011, 7 - 9 September, 2011, Stockholm, SWEDEN
- THE 2nd INTERNATIONAL CONFERENCE ON MATERIAL AND MANUFACTURING TECHNOLOGY - ICMMT 2011, 8 July 2011, Xiamen, CHINA
- THE 7th INTERNATIONAL CONFERENCE ON ADVANCES AND TRENDS IN ENGINEERING MATERIALS AND THEIR APPLICATIONS - AES-ATEMA'2011, 4 - 8 July 2011, Milan, ITALY

- *THE 8th INTERNATIONAL CONFERENCE ON ADVANCES AND TRENDS IN ENGINEERING MATERIALS AND THEIR APPLICATIONS - AES-ATEMA'2011 - RIGA'2011, 11 - 15 July 2011, Riga, LATVIA*
- *THE 9th INTERNATIONAL CONFERENCE ON ADVANCES AND TRENDS IN ENGINEERING MATERIALS AND THEIR APPLICATIONS, AES-ATEMA'2011, 1 - 5 August 2011, Montreal, Quebec, CANADA*
- *INTERNATIONAL SYMPOSIUM ON ADVANCED COMPLEX INORGANIC NANOMATERIALS, 11 - 14 September 2011, Namur, BELGIUM*
- *NANOMECHANICAL TESTING IN MATERIALS RESEARCH AND DEVELOPMENT, 9 - 14 October 2011, Lanzarote, Canary Islands, SPAIN*
- *INTERNATIONAL CONFERENCE ON MECHATRONICS AND MATERIALS PROCESSING - ICMMP2011, 18 - 20 November, 2011, Guangzhou, CHINA*
- *THE 3rd INTERNATIONAL CONFERENCE ON MECHANICAL AND ELECTRICAL TECHNOLOGY - ICMET 2011, 26 - 27 August 2011, Dalian, CHINA*
- *THE 10th INTERNATIONAL CONGRESS ON AUTOMOTIVE "AUTOMOTIVE AND ENVIRONMENT" - CAR 2011, 2 - 4 November 2011, Pitesti, ROMANIA*
- *THE 8th INTERNATIONAL CONFERENCE ON ELECTROMECHANICAL AND POWER SYSTEMS - SIELMEN 2011, 11 - 15 October, 2011 (Craiova, Iasi, 11 - 13 October 2011 and Chisinau, 13 - 15 October), ROMANIA*
- *INTERNATIONAL SYMPOSIUM ON THE ENVIRONMENTAL DAMAGE IN STRUCTURAL MATERIALS UNDER STATIC/CYCLIC LOADS AT AMBIENT TEMPERATURES, 14 - 19 August 2011, Krakow, POLAND*
- *INTERNATIONAL CONFERENCE ON ENGINEERING TRIBOLOGY AND ADVANCED MATERIALS - ICETAM 2011, 25 - 27 October, 2011, Cairo, EGYPT*
- *COMPUTATIONAL MECHANICS AND VIRTUAL, 20 - 22 October, 2011, Brasov, ROMANIA*
- *THE 8th JOINT MEETING - THE EUROPEAN SOFTWARE ENGINEERING CONFERENCE & THE ACM SIGSOFT SYMPOSIUM ON THE FOUNDATIONS OF SOFTWARE ENGINEERING - ESEC/FSE 2011, 5 - 9 September, Szeged, HUNGARY*
- *THE 7th CENTRAL AND EASTERN EUROPEAN SOFTWARE ENGINEERING CONFERENCE - CEE-SECR 2011, 1 - 3 November, 2011, Moscow, RUSSIA*
- *THE 2nd EASTERN EUROPEAN REGIONAL CONFERENCE ON THE ENGINEERING OF COMPUTER BASED SYSTEMS - ECBS-EERC 2011, 05 - 06 September 2011, Bratislava, SLOVAKIA*
- *THE 5th INTERNATIONAL CONFERENCE SMALL AND MEDIUM SIZED ENTERPRISES IN A GLOBALIZED WORLD, 22 - 24 September 2011, Cluj-Napoca, ROMANIA*
- *INTERNATIONAL CONFERENCE ON MANUFACTURING SYSTEMS, 20 - 21 October 2011, Iasi, ROMANIA*
- *THE 5th INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING* - INGEO 2011, *22 - 24 September, 2011, Brijuni, CROATIA*

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

ACTA TECHNICA CORVINIENSIS
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THE 19th ANNUAL INTERNATIONAL CONFERENCE ON COMPOSITES/NANO ENGINEERING – ICCE-19

July 24 - 30, 2011
Shanghai, CHINA

MESSAGE FROM ICCE CHAIRMAN

The ICCE conference is unique in that while it is an engineering conference, it has attracted numerous chemists, physicists and scientists from diverse fields in our efforts to promote interdisciplinary research on composites. Of particular concern is the challenge for materials engineers to understand the wide diversity of length scales ranging from nano to micro to macro and full scale and to question the validity of the theories or models which are known to be valid only in certain length scales. The ICCE is among the first composite materials conferences which take a leading vital role to bridge the gap between nano-chemistry and nano-engineering, and attracted hundreds of papers in this existing relatively new field of nano-composites engineering.

The ICCE conference will provide a forum for the exchange of information and ideas in virtually all areas composite materials research. The goals of the ICCE conference are:

1. *To BRIDGE THE GAP between Materials Science, Mechanics and manufacturing of Composite Materials;*
2. *To ENCOURAGE INTERDISCIPLINARY research bridging the gap between aerospace technology, bio-materials, chemistry, electronics, fluid mechanics, infrastructures, magnetic materials, nanotechnology, physics, powder metallurgy, sensors/actuators, among others and*
3. *To ENCOURAGE LEVERAGING of composite materials research resources through joint research between participants and writing joint research proposals.*

ICCE-19 SCIENTIFIC COMMITTEE AND REVIEW BOARD

B.I. Yakobson	*Kazuhiro Endo*	*Nora F. Savage*	*Tai-Yan Kam*
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Huishen Peng	*Zhenguo Yang*	*Shaofan Li*	

ICCE-19 Advisory Board

Major Topics of ICCE-19

- Aging, Flammability
- Bio-Composites
- Mathematical Modeling
- Chemistry of Materials
- Coatings and Wear
- Metal Matrix Composites
- Ceramics Composites
- Micromechanics
- Packaging Barrier
- Electronic/Magnetic Materials
- Particulate Composites
- Engineering Science and Structures
- Metals Research
- Powder Metallurgy
- Textile Composites
- Functionally Graded Materials
- Impact Engineering
- Vibration
- Infrastructures Composites
- Computational Materials
- Durability
- Natural Fibers
- Processing
- Biology
- Physics of Materials

Major Symposium of ICCE-19

- Nano Bio Materials
- Nano Devices and Actuators
- Inorganic Nanowires
- Nano-Fabrication,
- NanoLithography
- Nanosensors
- Magnetic Materials
- Thin Films
- Surface-Coating
- Processing/Characterization
- Durabilty of Composites

Detailed Two Pages Short Paper Preparation Guidelines

Detailed two pages short papers that contains enough results to clearly convey the approach of your research is required.
Presentation Type – Preference for ORAL or POSTER presentation should be indicated in your submission.
Language: All detailed short papers are to be written in English.
Format: Please refer to the ICCE-19 Short Paper Sample to prepare your detailed short paper.

1. *Authors' names, affiliations, corresponding author's mailing address and e-mail address should be included.*
2. *The manuscript must be in two-column and saved in PDF or MS-Word format.*
3. *2 pages will be allotted to each short paper and last page should be filled up. Page numbering should NOT be set in the electronic file.*
4. *The electronic file of each manuscript should not exceed 1 MB in file size.*

Detailed Two Pages Short Paper Submission Guidelines

1. *The ICCE-19 conference proceedings will consist of detailed short papers.*
2. *Short papers must be submitted by email (please do not submit short papers by postal mail.*
3. *Please underline the name of the presenter. Whenever possible, please put presenter as first author and corresponding person, since we file all short papers by first author.*
4. *Short papers will be reviewed and published in World Journal of Engineering. Short papers must be full of details and results, thus, please include as many figures as possible.*
5. *Short papers should be emailed immediately, or as soon as possible, but before June 1, 2011. After this date we will gladly continue to receive short papers if there are vacancies.*
6. *Interested authors should email IMMEDIATELY (do not assume email comes through until you receive the acknowledgement) the tentative PAPER TITLES and a suggested subject category*

Full Length Paper Preparation Guidelines

Language: All full length papers are to be written in English.
Format: Please refer to the ICCE-19 Full Length Paper Sample to prepare your full length paper. Authors' names, affiliations, corresponding author's mailing address and e-mail address should be included.

1. *The manuscript must be in two-column and saved in PDF or MS-Word format*
2. *The minimum length for manuscript is 4 pages. There is no maximum page limit for full length paper. Page numbering should NOT be set in the electronic file.*
3. *The electronic file of each manuscript should not exceed 3 MB in file size.*

Full Length Paper Submission Guidelines

1. *The full length papers originating from ICCE-19 Shanghai, should be much more than four pages (two columns per page). They will be quickly reviewed and published in World Journal of Engineering. Quickly review means that the response reactions of the audience, during your oral presentations is counted as one review, and the recommendation of the session chair is another review, along with at least one other reviewer (two or three reviews).*
2. *The submission of full-length paper should best be done by changing the paper title of the short paper (different paper title and thus, count as different paper in your vita), add more figures, and more in depth analysis, more focus on specific usefulness or applications, and pave the way for future exciting research on nano or composites materials.*
3. *If the author prefers to submit to other journals, they can do this on their own. We, as conference organizer will not interfere with the editorial decisions of these journals, except mention that it was presented at ICCE.*
4. *Full-length papers should be emailed as soon as possible or before July 17, 2011*

Important Dates

Submission	
Deadline for Submission of Short Paper	*June 1, 2011*
Deadline for Full Length Paper	*July 17, 2011*
Registration Fee Payment	
Deadline for Early Bird Registration 1	*Received Before May 24, 2011*
Deadline for Early Bird Registration 2	*Received Before June 24, 2011*
Deadline for Early Bird Registration 3	*Received Before July 17, 2011*
On-site Registration	*Received On-sit*
Reduced Registration Fee	
Deadline for Early Bird Registration 1	*Received Before May 24, 2011*
Deadline for Early Bird Registration 2	*Received Before July 17, 2011*
On-site Registration	*Received On-site*

Special Timely Symposiums

Solar Cells and Optoelectronic Materials
Professor Huisheng Peng (Chair)
Associate Professor Jinhu Yang (Co-chair)
Nano Biomedicine
Associate Professor Chao Lin (Chair)
Assistant Professor Yongyong Li (Co-chair)
Biomaterials and Neural Engineering
Dr Jiayi Zhang (Chair)
Dr Lei Yang (Co-chair)
Multi-Scale and Multi-Phase Modelling in Composite Materials
Dr Longyuan Li (Chair)
Oxide Nanocomposites and Heterostructures
Professor Tamio Endo (Chair)
Professor Kazuhiro Endo (Co-chair)
Natural Fibre Composites
Dr Karen Cheung (Chair)
Professor Alan K. T. Lau (Co-chair)
Novel Catalysts and Support Materials For Fuel Cells
Dr Petra Bele (Chair)
Assembly of Composites Components
Dr Chensong Dong (Chair)
Professor David Hui (Co-chair)
Virtual Research Infrastructures Supporting Translational Research in Nanotechnology
Dr Simon Grange (Chair)
Materials For Nuclear Application
Dr Celine Hin (Chair)
Dr Liuming Yan (Co-chair)

Small-Scale Solid Mechanics and Its Application
Professor C.Q. Ru (Chair)
Professor W.Q. Chen (Co-chair)
Materials Chemistry
Associate Professor Atsushi Mori (Chair)
Dr Masanori Kikuchi (Co-chair)
Nanomaterials for Energy Applications
Professor Zhiyong Fan (Chair)
Professor Johnny C. Ho (Co-chair)

ORGANIZER

Professor David Hui
Department of Mechanical Engineering
University of New Orleans, New Orleans, LA 70148
Tel: (504) 280 6652; Fax: (504) 280 6192
E-mail: dhui@uno.edu
Welcome to Shanghai and to ICCE-19 July 24-30, 2011!

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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THE 3rd IEEE INTERNATIONAL SYMPOSIUM ON LOGISTICS AND INDUSTRIAL INFORMATICS
LINDI 2011
25 – 27 August, 2011
Budapest, HUNGARY

ORGANIZED BY:

Óbuda University, Budapest, Hungary

INVITATION

Authors are welcome to submit original and unpublished papers and attend the 3rd IEEE International Symposium on Logistics and Industrial Informatics (LINDI 2011) to be held on August 25-27, 2011 in Budapest, Hungary.

TOPICS

TOPICS include but not limited to:

- INDUSTRIAL CONTROL AND MANAGEMENT SYSTEMS
- INTELLIGENT MANUFACTURING SYSTEMS
- CAD/CAM/CAE SYSTEMS
- DISTRIBUTED AND NETWORK-BASED CONTROL
- EMBEDDED SYSTEMS
- FAULT-TOLERANT SYSTEMS
- NETWORK MANAGEMENT AND DIAGNOSTICS
- TRANSPORT AND LOGISTICS SYSTEMS
- COMMUNICATION PLATFORMS AND APPLICATIONS
- ENTERPRISE MANAGEMENT SYSTEMS
- INTELLIGENT INFORMATION SYSTEMS
- PROCESS AND WORKFLOW MANAGEMENT SYSTEMS

GENERAL INFORMATION

Date and Place

The symposium will take place on August 25-27, 2011, in Budapest, Hungary.

Official Language

The official language of the Symposium is English. All the camera-ready manuscripts should be submitted in English, and presentations should be made in English. No translation is provided.

Presentation

All paper must be presented either in oral session or in poster session. If a paper, included into the proceedings, fails to be presented any way at the conference, all authors of the paper will be bar out from paper submission to conferences of the organizers in the future.

Oral Presentation

Presentations can be made by using OHP or data projector. All authors are kindly asked to take their presentation on CD or USB drive. To present the paper it is not allowed to use own computer. Conference room is supplied with OHP and data projector with PC.

Poster Presentation

If you choose to present your paper in a poster session, not in an oral session, please prepare the presentation into 9 A4 sheets or 1 large (70x100 cm) sheet, bring it with you to the conference and post it to the chart. Poster presentation does not mean just to print out your final paper, but it should be edited to make it scenic.

Paper Submission

The official language of the symposium is English. Authors should submit IEEE standard double-column paper with the maximum pages of 6. Authors are kindly asked to submit their paper through electronic paper submission system. Papers sent by email are not acceptable.

ORGANIZING COMMITTEE

AUTHORS' SCHEDULE

Full paper submission: May 27, 2011
Notification: July 1, 2011
Final paper submission: July 29, 2011

CORRESPONDENCE

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RIM 2011

THE 8th INTERNATIONAL SCIENTIFIC CONFERENCE ON PRODUCTION ENGINEERING "DEVELOPMENT AND MODERNIZATION OF PRODUCTION"

26 – 30 September
Praha, CZECH REPUBLIC

ORGANIZERS

FACULTY OF TECHNICAL ENGINEERING FROM BIHAC, and
SOCIETY FOR ROBOTIC OF BOSNIA AND HERZEGOVINA

ORGANIZING BOARD

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D.Sc. DARKO UJEVIĆ

THEMATICALLY AREAS

A. RESEARCH AND DEVELOPMENT OF MECHANICAL ENGINEERING PRODUCTION SYSTEMS AND TECHNOLOGIES
MACHINING, NONCONVENTIONAL MACHINING, TOOLS, RAPID PROTOTYPING, MANUFACTURING PROCESSES, WELDING PROCESSES, PLASTIC FORMING PROCESSES, MATERIALS, CAP TECHNOLOGIES, CIM, ENGINEERING OF POLYMERS, POWDER METALLURGY, MEASURING, THIN & THICK COATINGS, SURFACE ENGINEERING, MOLDING PROCESSES, CAM TECHNOLOGIES
B. RESEARCH AND DEVELOPMENT OF WOOD - INDUSTRY PROCESSING
WOOD PRODUCTS, WOODWORKING, WOOD INDUSTRY, PROCESSES, FURNITURE AND FURNITURE COMPONENTS, MANUFACTURING, WOOD MATERIALS, ENGINEERED WOOD, VENEERS, LUMBER
C. TECHNOLOGIES AND TECHNIQUES IN ELECTRICAL ENGINEERING AND ELECTRONICS
MODERN DEVELOPMENTS, TOOLS, POWER, CONTROL, MICROELECTRONICS, TELECOMUNICATIONS, COMPUTERS, ELECTRICAL ENGINEERING, POWER SYSTEMS, ENERGETICS, HARDWARE AND SOFTWARE, SIGNAL PROCESSING, NETWORKING, NEURAL NETWORK, ARTIFICIAL INTELLIGENCE
D. ENGINEERING IN CONSTRUCTION INDUSTRY AND INDUSTRY OF CONSTRUCTION MATERIALS
BUILDING CONSTRUCTION, MATERIALS, MACHINES, INDUSTRIAL CONSTRUCTION, HEAVY AND CIVIL CONSTRUCTION, CONSTRUCTION PROCESSES, EXPERTISES, PROCUREMENTS, DESIGN AND BUILD, ENVIRONMENTAL ENGINEERING, MUNICIPAL ENGINEERING
E. MODERN TECHNIQUES AND TECHNOLOGIES IN TEXTILE AND GARMENT INDUSTRY
ADVANCEMENT IN GARMENT MANUFACTURING, DEVELOPMENT IN TEXTILE MACHINERY, FIBRE PHYSICS AND TEXTILE MECHANICS, NANOTEXTILES, TEXTILE DESIGN AND FASHION, MODELLING AND SIMULATION, MANUFACTURING, MATERIALS
F. HIGH TECHNOLOGIES OF WIDE APPLICABILITY
INDUSTRIAL ROBOTS, MICROROBOTICS, PROGRAMMING, SIMULATION, VIRTUAL MANUFACTURING, AUTOMATION, AEROSPACE TECHNOLOGIES, NANOTECHNOLOGY, NUCLEAR PHYSICS
G. MANAGEMENT, ENTREPRENEURSHIP, ECONOMIC DEVELOPMENT.
KNOWLEDGE MANAGEMENT, PROJECT MANAGEMENT, PRODUCTION MANAGEMENT SYSTEMS
H. QUALITY MANAGEMENT, MANAGEMENT OF HUMAN AND NATURE RESOURCES, VIABLE DEVELOPMENT
QUALITY MANAGEMENT, TQM, MAINTENANCE, QUALITY IMPROVEMENT, QUALITY STANDARDS, QUALITY TERMS

IMPORTANT TERMS

- *Registration fee payment.....June 1th 2011.*
- *Final Programme .....September 1th 2011.*
- *RIM 2011 .....September 26th - 30th 2011.*

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THE 8th INTERNATIONAL CONGRESS "MACHINES, TECHNOLOGIES, MATERIALS"

Topic: „INNOVATIVE SOLUTIONS FOR PRODUCT AND PROCESS DEVELOPMENT"

18 – 21 September 2011
Varna, BULGARIA

ORGANIZERS & CO-ORGANIZERS

- *SCIENTIFIC-TECHNICAL UNION OF MECHANICAL ENGINEERING BULGARIA*
- *FEDERATION OF THE SCIENTIFIC-TECHNICAL UNIONS IN BULGARIA*
- *TECHNICAL UNIVERSITY – SOFIA*
- *TECHNICAL UNIVERSITY - VARNA*
- *RUSE UNIVERSITY „ANGEL KANCHEV"*
- *TECHNICAL UNIVERSITY - GABROVO*
- *TODOR KABLESHKOV UNIVERSITY OF TRANSPORT, BULGARIA*
- *ASSOCIATION OF POLISH MECHANICAL ENGINEERS AND TECHNICIANS – POLAND*

with the support of:

1. *NATIONAL SCIENTIFIC -TECHNICAL SOCIETIES:*

- *SOCIETY OF FOUNDRY*
- *METAL SCIENCE AND HEAT TREATMENT SOCIETY*
- *AUTOMATION OF DISCRETE PRODUCTION SOCIETY*
- *BULGARIAN SOCIETY OF NON-DESTRUCTIVE TESTING*
- *GEAR TRANSMISSIONS AND DRIVING SOCIETY*
- *PLASTIC DEFORMATION SOCIETY*
- *PLASTICS IN MECHANICAL ENGINEERING SOCIETY*
- *SOCIETY OF POWDER METALLURGY AND COMPOSITE MATERIALS*
- *MANAGEMENT AND ENGINEERING SOCIETY*
- *ERGONOMICS AND INDUSTRIAL DESIGN*

2. BULGARIAN WELDING SOCIETY
3. BULGARIAN SOCIETY OF ROBOTICS AND MECHATRONICS
4. BULGARIAN SOCIETY OF TRIBOLOGY

INVITATION

The Eight International Congress "MACHINES, TECHNOLOGIES, MATERIALS '11 - INNOVATIONS FOR THE INDUSTRY" will be carried out on 18th – 21st September, 2011 in the resort "St. St. Konstantin and Elena", region Varna, as a comprehensive scientific-technical manifestation, which includes three main topics and five special congress sub-sections: GEAR TRANSMISSIONS, ERGONOMIC AND ENGINEERING DESIGN, BULTRIB, INDUSTRIAL INFORMATIC, NANOMATERIALS

We invite scientists and researchers to present to their colleagues and to the industry representatives the results of their researches and to publish them in the web-based International scientific-technical journal "MACHINES, TECHNOLOGIES, MATERIALS", which is issued in print and on CD.

We invite the companies to take part with their presentations in the congress meetings and with advertisement in the congress materials to present their machines, equipment, technologies, materials and services, which are currently on the market.

We hope that in this way the Congress will become a bigger innovation mediator between scientific research and industry and we offer you to take advantage of this opportunity.
*The pre-congress program for the weekend before the opening of **MTM'11** will give you the possibility to rest, to have fun and to learn about landmarks, cultural and historical sightseeing on the north coast of the Black Sea.*

MAIN TOPICS

***MACHINES**:*
***KINDS**: Treatment Machines; Machining Machines, Processing Machines, Connecting Machines, Casting Machines, Packaging Machines, Driving Machines, Transporting Machines, Manipulation Machines, Automation Machines,Measurement and Testing Machines.*
TOOLS AND MEASUREMENT DEVICES STORAGE. TRAINING.
***ACTIVITIES**: Designing and Construction. Rapid Prototyping. Manufacturing. Research and Testing. Repair, Operation and Maintenance. Recycling and Utilization. Life Cycle Engineering. Re-Engineering. Training.*
Special Sub-Congress Sections:
1. GEAR TRANSMISSIONS 2011
2. ERGONOMIC AND ENGINEERING DESIGN 2011
TECHNOLOGIES:
COLD AND HOT SHAPEFORMING: Metal Casting, Plastic Deformation, Welding, Soldering and Adhesive Bonding, Machining. SURFACE TECHNOLOGIES. SURFACE TREATMENT. SURFACE MACHINING. CHANGING OF PROPERTIES. TESTING, MEASUREMENT AND CONTROL. AUTOMATION. INFORMATION TECHNOLOGIES. LOGISTIC. LOAD TRATEMENT. MANAGEMENT ENGINEERING. INDUSTRIAL DESIGN. ENERGY SAVING AND ENVIRONMENT FRIENDLY TECHNOLOGIES. TRAINING
Special Sub-Congress Sections:
1. BULTRIB 2011
2. INDUSTRIAL INFORMATIC 2011
MATERIALS:
KINDS: Metal Materials, Non-Metal Materials, Tool Materials, Structural Materials, Accessory Material.
MATERIALS SCIENCE. TRAINING
Special Sub-Congress Section: NANOMATERIALS 2011

IMPORTANT TERMS

*Announcement of the plenary and sectional session's program on our web page: www.mech-ing.com/mtm: **31.07.2011***
*The Organizing Committee will receive posters up to: **01.09.2011***
*Receiving of the application for transfer and Pre Congress Program: **01.09.2011***
*Registration of the participants: **19.09.2011***
*Opening of the congress: **20.09.2011***

REGISTRATION

Online registration** and the whole information about Honorary Committee, International Program Committee, National Organizing Committee, instructions for making papers and posters, fees, payments, visas and transfers on: **http://www.mech-ing.com/mtm/index.html
*For participants in the Congress and accompanying persons for the weekend before the opening of **MTM'11** will give you the possibility to rest, to have fun and to learn about landmarks, cultural and historical sightseeing on the north coast of the Black Sea. You can find more information about the Pre-Congress Program here: **Pre-CP1**, **Pre-CP2**, **Pre-CP3***

PUBLICATION

- *Detached issue of the web based International Scientific-Technical Journal **"MACHINES, TECHNOLOGIES, MATERIALS"** (ISSN 1313-0226).*
- *In **CD**, containing all papers.*

CORRESPONDENCE ADDRESS

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INTERNATIONAL CONFERENCE ON INNOVATIVE TECHNOLOGIES IN-TECH 2011

01- 03 September 2011
Bratislava, SLOVAKIA

WELCOME TO WEBSITE OF IN-TECH 2011

Conference runs from 01.09.2011 to 03.09.2011 in BRATISLAVA, the capital of SLOVAKIA. As the capital of Austria, Vienna is only 80 km from Bratislava, the special trip on 04.09.2011 to Vienna, Austria will be organized.

Authors are invited to submit their abstracts (half page in A4 format) in Microsoft Word or Adobe PDF format via e-mail: info@in-tech.info.

Last International Conference on Innovative Technologies IN-TECH 2010 was organized In Prague (Czech Republic) by the World Association for Innovative Technologies - WAIT and the Center for Surface Treatment Prague. The conference was held in the famous Prague Hotel Pyramid, which is located near the Prague Technical University. IN-TECH 2010 conference was attended about 300 participants from 40 countries.

SPECIAL EXCURSION

The special excursion 04.09.2011 to Vienna, Austria will be organized.

SCOPES OF THE CONFERENCE

- MECHANICAL ENGINEERING
- ELECTRONICS ENGINEERING
- MEDICAL INNOVATIVE TECHNOLOGIES
- BIOTECHNOLOGY AND BIOENGINEERING
- AGRICULTURE INNOVATIVE TECHNOLOGIES
- AEROSPACE AND AERONAUTICAL ENGINEERING
- MATERIAL SCIENCES
- COMPUTER SCIENCE
- INDUSTRIAL ENGINEERING
- MANUFACTURING ENGINEERING
- PRODUCTION ENGINEERING
- ENGINEERING DESIGN
- OPTIMAL SHAPE DESIGN
- NANO SCIENCE
- INTELLIGENT MANUFACTURING SYSTEMS
- MECHATRONICS/ROBOTICS
- MODELING AND SIMULATION
- AI, GENETIC ALGORITHM, NEURAL NETWORKS
- MEASUREMENT AND INSPECTION
- METALLURGY
- AUTOMOTIVE INDUSTRY
- VIRTUAL ENGINEERING
- SIGNAL, IMAGE, AND INFORMATION PROCESSING
- MODELING & OPTIMIZATION OF SYSTEMS AND PROCESSES
- AUTOMATION AND ROBOTICS
- CAD/CAM/FMS/CIMS
- INTERNET LAB SHARING AND NETWORKING
- BIOLOGICAL MANUFACTURING SYSTEMS
- TRIBOLOGY
- ENVIRONMENTALISTICS
- ENERGY, ENERGY PLANTS, THERMAL ENGINEERING
- RENEWABLE AND NON CONVENTIONAL ENERGY SOURCES, ENERGY SYSTEMS
- PRODUCTION MANAGEMENT
- QUALITY MANAGEMENT
- MAINTENANCE, LOGISTICS

IMPORTANT DATE

Registration fee:
before July 10. 2011

SCIENTIFIC COMMITTEE

CORRESPONDENCE

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering
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THE 9th IEEE INTERNATIONAL SYMPOSIUM ON INTELLIGENT SYSTEMS AND INFORMATICS SISY 2011

8 – 10 September, 2011
Subotica, SERBIA

ORGANIZED BY:

ÓBUDA UNIVERSITY, BUDAPEST, HUNGARY
SUBOTICA TECH, SERBIA
UNIVERSITY OF NOVI SAD, SERBIA

INVITATION

Authors are welcome to submit original and unpublished paper and attend the 9th IEEE International Symposium on Intelligent Systems and Informatics (SISY 2011) to be held on September 8-10, 2011 in Subotica, Serbia.
SISY 2011 Call for Papers can be downloaded as a pdf file.
Papers are going to be included into IEEE Xplore database after the symposium.
IEEE reserves the right to exclude a paper from distribution after the conference (e.g., removal from IEEE Xplore), if the paper is not presented at the conference.

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Anikó Szakál, Óbuda University, Budapest, Hungary

AUTHORS' SCHEDULE

Full paper submission: July 1, 2011
Notification: August 1, 2011
Final paper submission: August 15, 2011

OFFICIAL LANGUAGE

The official language of the Symposium is English. All the camera-ready manuscripts should be submitted in English, and presentations should be made in English.

PAPER PRESENTATION

All paper must be presented either in oral session or in poster session. If a paper, included into the proceedings, fails to be presented any way at the conference, all authors of the paper will be bar out from paper submission to conferences of the organizers in the future.

Oral Presentation

Presentations can be made by using OHP or data projector. All authors are kindly asked to take their presentation on CD or USB drive. To present the paper it is not allowed to use own computer. Conference room is supplied with OHP and data projector with PC.

Poster Presentation

If you choose to present your paper in a poster session, not in an oral session, please prepare the presentation into 9 A4 sheets or 1 large (70x100 cm) sheet, bring it with you to the conference and post it to the chart. Poster presentation does not mean just to print out your final paper, but it should be edited to make it scenic.

SECRETARY GENERAL

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FEDERATED CONFERENCE ON COMPUTER SCIENCE AND INFORMATION SYSTEMS – FedCSIS 2011

19 – 21 September, 2011
Szczecin, POLAND

INVITATION

This multi-conference is still very much in the making, but it is already shaping up as the largest (and hopefully the best) computing and information systems conference staged in Poland.
The FedCSIS multi-conference consists of a significant number of Events, but the Call for Events is open in all areas of computer science and information systems and new proposals for associated Events (conferences, symposia, workshops, special sessions, etc.) are cordially invited until 1-May-2011.

EVENT PROPOSALS

The organizers of FedCSIS 2011 invite proposals for associated Events (conferences, symposia, workshops, special sessions). The Events can run over any span of time within the conference dates, i.e. from half-day to three days.
Event proposals should include the following information (within a maximum length of 2 pages):

1. *The nature of the Event.*
2. *The title the Event and a clear description of the topic including a brief justification.*
3. *The complete contact information of the Event organizers, including a link to their personal websites, and an overview of previous experiences with organization of scientific events.*
4. *Indication of the expected number of papers/attendees to attend the Event.*
5. *Information of expected post-event publications, of extended and revised papers in high-quality journals, edited volumes, etc.*

EVENTS OF FedCSIS 2011

- ***AAIA 2011*** *– 6th International Symposium Advances in Artificial Intelligence and Applications - http://aaia.fedcsis.org*
  - ***AIMA 2011*** *- International Workshop on Artificial Intelligence in Medical Applications - http://aima.fedcsis.org*
  - ***ASIR 2011*** *- 1st International Workshop on Advances in Semantic Information Retrieval - http://asir.fedcsis.org*
  - ***WCO 2011*** *- Workshop on Computational Optimization - http://wco.fedcsis.org*
- ***ABICT 2011*** *- International Workshop on Advances in Business ICT - http://abict.fedcsis.org*
- ***CANA 2011*** *- Computer Aspects of Numerical Algorithms - http://cana.fedcsis.org*
- ***IHS 2011*** *- The 1st International Workshop on Interoperable Healthcare Systems - Challenges, Technologies, and Trends - http://ihs.fedcsis.org*
- ***ISSS 2011*** *- International Symposium on Services Science - http://isss.fedcsis.org*
- ***JAWS 2011*** *- Joint Agent-oriented Workshops in Synergy - http://jaws.fedcsis.org*
  - ***ABC:Mi 2011*** *- Workshop on Agent Based Computing: from Model to Implementation VIII - http://abcmi.fedcsis.org*
  - ***MAS&S 2011*** *- 5th International Workshop on Multi-Agent Systems and Simulation - http://mass.fedcsis.org*
  - ***SOCASE 2011*** *- Service-Oriented Computing: Agents, Semantics, and Engineering - http://socase.fedcsis.org*
- ***MMAP 2011*** *- International Symposium on Multimedia Applications and Processing - http://mmap.fedcsis.org*
  - ***MHCI 2011*** *- Special track dedicated to Multimedia Human-Computer Interaction - http://mhci.fedcsis.org*
- ***SSSS 2011*** *- Summer School Service Science and Research Methods 2011 - http://ssss.fedcsis.org*
- ***TAMoCo 2011*** *- Techniques and Applications for Mobile Commerce - http://tamoco.fedcsis.org*

- ***WAPL 2011*** *- 3rd Workshop on Advances in Programming Languages - http://wapl.fedcsis.org*
- ***WoSS 2011*** *- 3rd Workshop on Software Services: Semantic-based Software Services - http://woss.fedcsis.org*

FEDCSIS GENERAL CHAIRS

Ganzha, Maria
Systems Research Institute, Polish Academy of Sciences, Warsaw and University of Gdansk, Poland
Maciaszek, Leszek A.
Wroclaw University of Economics, Poland and Macquarie University ~ Sydney, Australia
Paprzycki, Marcin
Systems Research Institute, Polish Academy of Sciences, Warsaw and Management Academy, Warsaw, Poland

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Rodan Systems S.A., Warsaw, Poland
Szyjewski, Zdzislaw *Local Arrangements Co-Chair*
University of Szczecin, Poland

IMPORTANT DATES

- *Final Submissions and Registrations:* ***July 31, 2011***
- *The Conference Dates:* ***September 19 - 21, 2011***

PUBLICATIONS

Papers accepted and presented at any Event will be published digitally in the IEEE Xplore Digital Library proceedings and on USB memory stick given to FedCSIS participants. The IEEE proceedings will be entitled "2011 Federated Conference on Computer Science and Information Systems (FedCSIS)" and will be published under an ISBN number and under nonexclusive copyright. The nonexclusive copyright implies that Events' organizers can and, indeed, are strongly encouraged to invite extended and revised papers for post-conference publications in high-quality journals, edited volumes, etc.

GOALS

The organizers of FedCSIS 2011 invite proposals for associated Events (conferences, symposia, workshops, special sessions). The Events can run over any span of time within the conference dates, i.e. from half-day to three days.
The FedCSIS Events are expected to provide a platform for bringing together researchers, practitioners, and academia to present and discuss ideas, challenges, and potential solutions on established or emerging topics related to research and practice in computer science and information systems.
The Events will be selected based on the scientific/technical interest and/or their relevance to practitioners in their topics, the clarity of the proposal in addressing the requested information, the innovativeness of the Event topics, and the capacity in the FedCSIS conference program.

CORRESPONDENCE

Faculty of Economics and Management, University of Szczecin
ul. Mickiewicza 64
71-101 Szczecin, POLAND

- *Email: secretariat@fedcsis.org*
- *Web: http://www.fedcsis.org*

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THE 3rd INTERNATIONAL SCIENTIFIC AND EXPERT CONFERENCE (TECHNICS, EDUCATION, AGRICULTURE & MANAGEMENT) – TEAM 2011 & 17th INTERNATIONAL SCIENTIFIC CONFERENCE – CO-MAT-TECH 2011

19 – 21 October, 2011
Trnava, SLOVAKIA

INVITATION

The International TEAM Society in cooperation with Slovak University of Technology, Faculty of Materials Science and Technology in Trnava is honored to invite you to the 3rd International Scientific and Expert Conference TEAM 2011 in the city of Trnava.
We hope that you will participate and benefit from this event. We also wish all authors a lot of success in finding new contacts and partnerships in order to transfer knowledge and best practices to your countries as well as to find new scientific discoveries. Feel free to join us and find new possibilities and trends in modern age.
Beside the conference and technical background, Trnava offers a lot of cultural and historical monuments that could make your stay more pleasant. We are looking forward to meet you in Trnava.

AIM AND SCOPE

- *Transfer of Knowledge and Dissemination of Achievements*
- *Mobility of Teachers and International Cooperation*
- *Interdisciplinary Approach on Development*

ORGANIZED BY:

The Conference is organized under the auspices of the International TEAM Society and

- *University of Applied Sciences of Slavonski Brod, Slavonski Brod, Croatia*
- *Mechanical Engineering Faculty in Slavonski Brod, University Josip Juraj Strossmayer in Osijek, Slavonski Brod, Croatia*
- *Kecskemét College, Faculty of Mechanical Engineering and Automation (GAMF), Kecskemét, Hungary*
- *Slovak University of Technology, Faculty of Materials Science and Technology, Trnava, Slovakia*

TOPICS

Section 1: PRODUCTION ENGINEERING
- *ADVANCED MANUFACTURING TECHNOLOGIES*
- *INDUSTRIAL LOGISTICS*
- *MATERIAL SCIENCE*
- *PRODUCT DESIGN AND PRODUCT DEVELOPMENT*

Section 2: KNOWLEDGE TRANSFER
- *COMPUTER TECHNOLOGIES AND APPLICATIONS*
- *EDUCATION, ENGINEERING, PEDAGOGY AND DIDACTICS*
- *KINESIOLOGIC EDUCATION IN THE FUNCTION OF HEALTH PREVENTION*
- *MOBILITY IN EDUCATION*

Section 3: BIOTECHNOLOGY IN AGRICULTURAL ENVIRONMENT
- *ADVANCED TECHNOLOGY AND TECHNICS IN AGRICULTURE*
- *AGROECOLOGY AND ORGANIC FARMING*
- *LANDSCAPE ARCHITECTURE AND DECORATION*
- *PLANT PROTECTION*
- *WINE AND FRUIT PRODUCTION*

Section 4: MARKET-ORIENTED MANAGEMENT
- *COST MANAGEMENT*
- *KNOWLEDGE MANAGEMENT*
- *INNOVATION MANAGEMENT*
- *EU FUNDING*
- *NEW OPPORTUNITIES IN FINANCIAL ENTREPRENEURSHIP*

DEADLINES:

31.07.2011 - Deadline for sending of full papers

SCIENTIFIC COMMITTEE CHAIRMAN

Prof. Dr. Jozef Peterka
Slovak University of Technology, Faculty of Materials Science and Technology in Trnava

SCIENTIFIC COMMITTEE

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CALL FOR PAPERS

All authors are invited to apply for papers relevant to specified fields that can be found under "Sections" menu button. Paper acceptance procedure is divided in following three steps:

1. Step: Participants Registration

Registration for the conference will be performed by sending the e-mail with registration form to martin.bajcicak@stuba.sk together with abstract. Registration forms can be downloaded from the "Registration" section of official page.

2. Step: Abstract Submission

Papers should be up to date and based on original work of the authors. Abstracts will be submitted via conference system which will forward the abstract to responsible reviewer who will consider the suitability of the paper. Please make a registration in this system so we can identify your abstract and paper (co-authors are registered by the author and they do not need to register by themselfs). Abstract of 200 to 300 words should provide clear information on paper content.

Poster Section

In order to ensure the fluency of the conference, organising committee can propose some articles for poster section in case of having too many papers in particular sections. In case that author would like to apply for publishing the poster, they should clearly provide this information in abstract submission phase.

3. Step: Paper Acceptance

After positive reply from section chair, authors will be asked to send complete paper in given deadline and paper will be registered for the conference. All papers should be written according to the Manuscript template. Paper should contain information on current state of the paper subject, experimental, main results, outcome of the study and references.

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INTERNATIONAL CONFERENCE DEFORMATION AND FRACTURE IN PM MATERIALS – DFPM 2011

6 – 9 November, 2011
Stará Lesná, High Tatras, SLOVAKIA

ORGANIZED BY:

INSTITUTE OF MATERIALS RESEARCH, SLOVAK ACADEMY OF SCIENCES IN KOŠICE, SLOVACIA, and
VIENNA UNIVERSITY OF TECHNOLOGY, AUSTRIA

AIM AND SCOPE

The established orientation of DFPM international conferences is on fundamentals of material properties. The aim of the Conference is to promote information exchange between scientists, researchers and industrial engineers with the aim of improving the properties, lifetime and reliability of PM materials. Furthermore, a closer international cooperation in the field of deformation and fracture behaviour of these materials will be promoted.

GENERAL INFORMATION

The Conference represents a continuation of the International Conferences on Powder Metallurgy organized in the former Czecho-Slovakia at regular intervals since 1962. It directly follows the International PM Conferences, held in Stará Lesná in 1996, 2002, 2005, 2008 and in Piešťany in 1999.

MAIN TOPICS

- MICROSTRUCTURE, PHYSICAL PROPERTIES, FAILURE, FRACTURE MICROMECHANISM
- APPLICATION OF PM MATERIALS UNDER COMPLEX STRESS AND EXPLOITATION CONDITIONS
- MODELLING
- ADVANCED PM TECHNOLOGIES AND MATERIALS

DEADLINES:

- *Submitting Draft of Manuscript: July 15, 2011*
- *Final Manuscript and Payment: August 31, 2011*

MATERIALS OF INTEREST:

All types of powder metallurgy materials, such as ferrous and non-ferrous metals, ceramics and composites, low and high porosity materials, nanomaterials, intermetallics, superalloys, metal foams and gradient materials.

CALL FOR PAPERS:

The conference includes oral and poster presentations. Presented contributions, after the peer review, will be published in journal Powder Metallurgy Progress. For publishing the contribution, sending the final manuscript to the conference organizer's address and payment of the conference fee will be required.

CORRESPONDENCE

DFPM 2011
IMR SAS
Watsonova 47
040 01 Košice, Slovak Republic
Email: dfpm2011@imr.saske.sk

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering
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THE 12th IEEE INTERNATIONAL SYMPOSIUM ON COMPUTATIONAL INTELLIGENCE AND INFORMATICS CINTI 2011

21 – 22 November, 2011 Budapest, HUNGARY

ORGANIZED BY:

Óbuda University, Budapest, Hungary
Hungarian Fuzzy Association
IEEE Hungary Chapter of Computational Intelligence Society
IEEE Hungary Chapter of SMC Society
IEEE Hungary Joint Chapter of Industrial Electronics and Robotics and Automation Societies
John von Neumann Computer Society, Hungary

INVITATION

Authors are welcome to submit original and unpublished papers and attend the 12th IEEE International Symposium on Computational Intelligence and Informatics to be held on November 21-22, 2011 in Budapest, Hungary.

OBJECTIVES

The Symposium is organized with the focus of bringing together scientists from any country working on computational intelligence and its applications with the aims at providing an opportunity for sharing and discussing the recent research developments in this field. The idea is to have a small number of lecturers and participants in a relaxed and informal atmosphere.

GENERAL INFORMATION

Official Language

The official language of the Symposium is English. All the camera-ready manuscripts should be submitted in English.

Registration

Only one paper can be included into the proceedings by paying one registration fee. For including any paper into the proceedings, it is necessary for at least one co-author to be registered and the registration fee has to be paid in advance until October 28.

All paper must be presented either in oral session or in poster session. If a paper, included into the proceedings, fails to be presented any way at the conference, all authors of the paper will be bar out from paper submission to conferences of the organizers in the future.

Paper Submission

Authors are asked to submit electronically a full paper until September 30, 2011 through electronic paper submission system.

The official language of the symposium is English.

Authors should submit IEEE standard double-column paper with the maximum pages of 6.

Authors are kindly asked to submit their paper through electronic paper submission system. Papers sent by email are not acceptable.

COMMITTEES

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Ladislav Madarász, Technical University of Košice

AUTHORS' SCHEDULE

Full paper submission: September 30, 2011
Notification: October 10, 2011
Final manuscript submission: October 28, 2011
All accepted papers which meet IEEE requirements are going to be included into IEEE Xplore database after the symposium. IEEE reserved the right to exclude a paper from distribution after the conference (e.g., removal from IEEE Xplore), if the paper is not presented at the conference.

CORRESPONDENCE

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering
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4th INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND STRUCTURES – AMS '11

27 – 28 October 2011
Timişoara, ROMANIA

ORGANIZED BY:

POLITEHNICA University of Timisoara
with the support of
POLITEHNICA Foundation
and ROMANIAN SOCIETY for BIOMATERIALS

IMPORTANT INFORMATION ABOUT THE CONFERENCE

Proceedings of AMS'11 will be published as separate edition in "Solid State Phenomena"
Volume containing the peer-reviewed papers will be available in full text through www.scientific.net platform, which is one of the leading site and largest online databases in Materials Science.
"Solid State Phenomena" is indexed by Elsevier SCOPUS, ISI (ISTP, CPCI, Web of Science), Ei Compendex (CPX), Cambridge Scientific Abstracts (CSA), Chemical Abstracts (CA), Institution of Electrical Engineers (IEE), Google Scholar, etc.

COMMITTEE

Chairman of the AMS'11 Conference:
Prof. Viorel Aurel Serban, Vice-rector
Secretary of AMS'11:
Assoc. Prof. Mircea Nicoară, Head of Dept. for Materials and Manufacturing Engineering
Members:
Prof. Horia Iovu, Dean of Industrial Chemistry and Materials Science Faculty, University Politehnica of Bucharest, Vice-president of RSB
Assoc. Prof. Aurel Răduţă, Scientific Secretary of Mechanical Engineering Faculty
Prof. Teodor Heput, Dean of Engineering Faculty of Hunedoara
Prof. Liviu Marşavina, Head of Chair for Materials Strenght
Lecturer Cosmin Codrean, Chair of Materials Science and Welding
Lecturer Iulian Antoniac, University Politehnica of Bucharest, President of Romanian Society for Biomaterials
Assist. Prof. Cosmin Lovovei, Chair of Materials Science and Welding
Lecturer Cosmin Sinescu, University of Medicine and Pharmacy „V.Babes" Timisoara

IMPORTANT DEADLINES OF THE AMS'11 INTERNATIONAL CONFERENCE

- *Deadline for paper submission: July 1st, 2011*
- *Conference dates: 27-28 October, 2011*

TOPICS

Topics of the 4th International Conference on ADVANCED MATERIALS AND STRUCTURES (AMS'11):

- ADVANCED MATERIALS: BIOMATERIALS, COMPOSITES, CELLULAR MATERIALS, SUPPER-ALLOYS, AMORPHOUS, NANO-STRUCTURED MATERIALS, ETC.
- BIOMATERIALS
- MODERN FABRICATION AND RECYCLING TECHNOLOGIES
- COMPUTATIONAL TECHNIQUES FOR ADVANCED AND ENGINEERING MATERIALS

CORRESPONDENCE

Advanced Materials and Structures - AMS'11
Mircea Nicoară - secretary of AMS'11
Universitatea POLITEHNICA din Timişoara
Departamentul Ingineria Materialelor si Fabricatiei - IMF
Bd. M. Viteazul 1, 300222 Timişoara, Romania
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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

ACTA TECHNICA CORVINIENSIS
– BULLETIN of ENGINEERING
ISSN: 2067-3809 [CD-Rom, online]

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CAR 2011 – INTERNATIONAL CONGRESS AUTOMOTIVE AND ENVIRONMENT

2 – 4 November 2011
Pitesti, ROMANIA

ORGANISATORS:

The congress is organized under the FISITA patronage by the University of Pitesti and is part of the congresses cycle organized annually by the Society of Automotive Engineers of Romania (SIAR).
Association of Automotives Manufacturers of Romania (ACAROM), Renault Technologie Roumanie and Dacia are co-organizers.
The 10th International Congress on Automotive will be held in Pitesti, Romania, betwen 2-4 November 2011.
The CAR International Congress is a traditional scientific event initiated by University of Pitesti in 1978.

INVITATION

The Congress will be an opportunity for delegates to:

- *update skills and knowledge by attending focused technical sessions*
- *gain insights into the automotive industry*
- *network with potential new partners, clients and suppliers*
- *view the latest technology products and services in the commercial exhibition*

CAR 2011 offers an opportunity to present your latest technical developments, so papers are invited on (but not limited to) any of the congress themes. Any other paper presented on a topic not quoted above but having scientific or technical interest will be taken into consideration.

CONGRESS THEMES

Future Automotive Technology, including: Vehicle Dynamics, Chassis Systems, Advanced Powertrain, Transmission Systems, Advanced Electronics, Mechatronics, e-Engineering (CAD/CAM/CAE)
Vehicles & The Environment, including: Emissions Control and Air Quality, Fuel economy. CO_2 Reduction, Alternative Fuels, Transportation & Road Traffic, Recycling, Life-Cycle Analysis
User Friendly Automobiles, including: Concept Cars & Design Development, Comfort & Ergonomics & Interiors, Vehicle Thermal Management, Interior and Exterior Noise, Vehicle Crashworthiness, Occupant & Pedestrian Protection, Integrated Safety (e-safety)
Advanced Production & Logistics, including: Global design and development, Global manufacturing and economics, Logistics: vehicles and parts supply, Supply chain, Industrial Management, New Technologies & Materials

IMPORTANT DEADLINES

18.04.2011: Submission of abstract
21.05.2011: Notification of acceptance
22.07.2011: Final paper
15.09.2011: Preliminary programme

EXECUTIVE ORGANIZING BOARD

President of the Scientific and Technical Committee
Professor Nicolae PANDREA,
University of Pitesti, member of the Romanian Technical Sciences Academy
Congress Chairman
Prof. Dr. Eng. Ion TABACU
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Congress Vice-Chairman
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Head of Automotive Department
University of Pitesti
Logistics & Organisation
President
Prof. Dr. Eng. Florian IVAN
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STUDENT CONGRESS

The CAR Students Congress, which runs parallel to the main Congress from 2nd to 4th of November 2011, allows students from all over the world a unique opportunity to participate in an international meeting and present a paper related to automotive transportation and technology.
Students will have their own Technical Sessions and will also be given the opportunity to discuss and elaborate on a case study of a chosen automotive company in a working-session. The themes for the Student Congress are the same as those for the main congress.
To join the Students Congress, applicants must contact their university or their national FISITA member society. Students wishing to present a paper at the congress must send an abstract at car 2011@upit.ro. The organisers will select a limited number of students from each country and will give priority to candidates who have submitted an abstract. The best three papers will receive an award. Participation of students is free of charge.

CORRESPONDENCE

University of Pitesti
Automotive Department
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Fax: (00)40248217736
E-mail: car2011@upit.ro

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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THE 12th INTERNATIONAL CONFERENCE - TECHNOLOGY 2011

13 September 2011
Bratislava, SLOVAKIA

ORGANIZED BY:

- SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA, FACULTY OF MECHANICAL ENGINEERING
- INSTITUTE OF TECHNOLOGIES AND MATERIALS
- SOCIETY FOR NEW MATERIALS AND TECHNOLOGIES OF SLOVAKIA
- SAS METAL SCIENCES SOCIETY
- SLOVAK WELDING SOCIETY – REGIONAL GROUP BRATISLAVA
- COMMITTEE FOR NONIRON METALS - SLOVAK FOUNDRYMEN SOCIETY
- SLOVAK ASSOCIATION OF MECHANICAL ENGINEERS
- ASSOCIATION OF SLOVAKSCIENTIFIC AND TECHNOLOGICAL SOCIETIES

CONFERENCE SCOPE:

- Metallic and Non-metallic Materials. New Research, Development and Applications
- Advanced Casting and Solidification Technologies. Control of Crystallisation Processes
- Progress in Theory and Technology of Machining, Forming and Welding. Computer simulation, Monitoring and Optimising of the Processes
- Progressive Machines and Devices for Shaping Processes. CAD/CAM/CIM Technologies
- Cutting Tools and Dies for Forming, Casting and Combined Processes
- Transfer of New Manufacturing Technologies into Industries

PROGRAM COMMITTEE

prof. Ing. A.I. Batyšev, DrSc., MSOU, Moskva, RF
prof. Ing. V.D. Belov, DrSc., MISA, Moskva, RF
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prof. Dr hab. inž. Feliks Stachowicz , Rzeszów, PL
prof. Ing. Ľubomír Šooš, PhD., SjF STU v Bratislave , SK
prof. Ing. Koloman Ulrich, PhD. , MTF STU Trnava , SK

ORGANISING COMMITTEE

Ing. Alena Brusilová, PhD
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doc. Ing. Vojtech Geleta, PhD.
doc. Ing. Pavol Sejč, PhD.
doc. Ing. Ladislav Stanček, PhD.
Ing. Albín Štofila, PhD.

THE SCHEDULE FOR TECHNOLOGY 2011

Deadline for the submission of full papers *10. 6. 2011*
Publication of the Final Program *20. 6. 2011*

CONFERENCE SESSIONS

Session 1
Metallic and Nonmetallic Materials
Chairpersons *doc. Ing. Štefan Emmer, PhD.*
Dr. Pavol Šebo, DrSc.

Session 2
Solidification Processes
Chairpersons *doc. Ing. Ladislav Stanček, PhD*
prof. Ing. Jaroslav Čech, PhD
prof. Ing. Alexander Chaus, DrSc.

Session 3
Technology and Devices for Machining
Chairpersons *doc. Ing. Vojtech Geleta, PhD.*
prof. Ing. Zdenko Lipa , PhD.

Session 4
Technology and Devices for Welding
Chairpersons *doc. Ing. Pavol Sejč, PhD.*
doc. Ing. Milan Marônek, PhD.

Session 5
Technology and Devices for Forming
Chairpersons *doc. Ing. Peter Kostka, PhD.*
prof. Ing. Emil Spišák , PhD.

Poster Session
Industrial Presentations

CONTACT ADDRESS - SECRETARIAL OFFICE OF TECHNOLOGY 2011

Institute of Technologies and Materials *tel. +421 2 4445 5086*
Pionierska 15 *fax +421 2 4445 5086*
831 02 BRATISLAVA 3 *e-mail: technologia@sjf.stuba.sk*
http://technologia.sjf.stuba.sk

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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CEEC-TAC
Central and Eastern European Committee for Thermal Analysis and Calorimetry

1st CENTRAL AND EASTERN EUROPEAN CONFERENCE ON THERMAL ANALYSIS AND CALORIMETRY – CEEC-TAC1

7 – 10 September 2011
Craiova, ROMANIA

OFFICIAL INFORMATION

The ever growing community of Thermal Analysis and Calorimetry scientists working in the Central and Eastern European countries makes the organization of a conference and gathering all those interested in the development of the field a desirable event.

Central and Eastern European Conference on Thermal Analysis and Calorimetry (CEEC-TAC) is wished to become a forum where researchers can meet, present their work, explain their results and discuss the encountered scientific and technical problems of thermal analysis and calorimetry.

Every two years, CEEC-TAC aims to gather scientists from Central and Eastern Europe, from Germany and Switzerland to Russia and Kazakhstan, and from the Baltic countries to the Balkans, Turkey and the Caucasians.

1st CEEC-TAC invites researchers in the field of Thermal Analysis and Calorimetry from all over the world, to share experience and knowledge with those working in complementary fields or just using thermo-analytical techniques.

Besides the regular conference, we wish organizing a working session where in a relaxed and informal environment the participants can talk of their plans and their needs, thus fostering new contacts and further collaborations.

For the 1st CEEC-TAC conference we have chosen the city of Craiova, one of the main cities of Romania and the capital of Oltenia region. Here is the place where Carpathians meet the Danube, just above the Balkans, where Central, Eastern and Southern Europe blend together.

SCOPE OF THE CONFERENCE

The ever growing community of Thermal Analysis and Calorimetry scientists working in the Central and Eastern European countries makes the organization of a conference and gathering all those interested in the development of the field a desirable event.

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TOPICS

1. KINETICS AND CATALYSIS.
2. THERMOPHYSICAL PROPERTIES AND THERMAL REACTIVITY OF SOLIDS. NANOMATERIALS.
3. METALS, ALLOYS, INTERMETALLICS & HIGH TEMPERATURE MATERIALS.
4. THERMALLY STIMULATED PROCESSES IN CERAMICS; FROM ELECTROCERAMICS & MAGNETIC MATERIALS TO THERMOELECTRICS.
5. FUNCTIONAL SOFT INORGANIC, ORGANIC AND MACROMOLECULAR MATERIALS (POLYMERS, COMPLEX PRECURSORS, DYES, TEXTILES, ETC.).
6. THERMAL INVESTIGATION OF THIN FILMS AND OTHER MINUTE MATERIALS.
7. THERMOCHEMISTRY AND CALORIMETRY.
8. THERMODYNAMICS OF BIOMOLECULES; FROM STABILITY TO INTERACTIONS.
9. METASTABILITY IN POLYMERS.
10. COMBUSTION, FUELS & BIOFUELS. ALTERNATIVE SOURCES FOR ENERGY.
11. MATERIALS FOR ENERGY CONVERSION AND STORAGE.
12. ENERGETIC MATERIALS, THERMAL HAZARDS & FIRE SAFETY.
13. ADVANCED MATERIALS PROCESSING AND APPLIED THERMAL ENGINEERING. COMPOSITES IN EXTREME CONDITIONS AND ENVIRONMENTS.
14. INSTRUMENTATION AND THEORY; COUPLED, COMPLEMENTARY AND ALTERNATIVE TECHNIQUES (SAMPLE CONTROLLED THERMAL ANALYSIS, EMANATION THERMAL ANALYSIS, LASER PYROLYSIS, THERMOCHROMATOGRAPHY, ETC.).
15. THERMAL ANALYSIS AND CALORIMETRY IN LIFE SCIENCES, NATURAL PRODUCTS, FERTILIZERS, SOIL SCIENCE, GEOSCIENCES, PHARMACEUTICS, FORENSICS AND ARTS

ORGANISING COMMITTEE

Co-Chairmen:
Andrei ROTARU & Crisan POPESCU
University of Craiova
Vicechairman:
Mihail MANGRA
Vicerector of the University of Craiova

International Committee:
Petru BUDRUGEAC
Commission for Thermal Analysis and Calorimetry of the Romanian Academy
Michael FEIST
Gesellschaft fur Thermische Analyse e.V
Konstantin S. GAVRICHEV
Scientific Council of the Russian Academy of Sciences on Chemical Thermodynamics and Thermochemistry
Csaba NOVAK
Hungarian Thermoanalytical Group
Barbara PACEWSKA
Polish Society of Calorimetry and Thermal Analysis
Vilma PETKOVA
Bulgarian Society of Thermal Analysis and Calorimetry
Peter SIMON
Slovak Group for Thermal Analysis and Calorimetry
Zivan ZIVKOVIC
Serbian Thermal Analysis and Calorimetry Committee

Jerzy BLAZEJOWSKI (Poland)
Manfred BOHN (Germany)
Ionel CHICINAS (Romania)
Valery A. DREBUSHCHAK (Russia)
Ion DRANCA (Moldova)
Svetlana GENIEVA (Bulgaria)
Karlis GROSS (Latvia)
Katarina GYORYOVA (Slovakia)
Herbert IPSER (Austria)
Tiit KALJUVEE (Estonia)
Alfred KALLAY-MENYHARD (Hungary)
Romana CERC KOROSEC (Slovenia)
Mustafa VERSAN KOK (Turkey)
Jiri KUCERIK (Czech Republic)
Jiri MALEK (Czech Republic)
Shiraz A. MARKARIAN (Armenia)
Daumantas MATULIS (Lithuania)
Eric MITTEMEIJER (Germany)
Ion MORJAN (Romania)
Krzysztof PIELICHOWSKI (Poland)
Vlad T. POPA (Romania)
Petre ROTARU (Romania)
Cezar SPÎNU (Romania)
Muhamed SUCESKA (Croatia)
Sergey VYAZOVKIN (USA)
Anke WEIDENKAFF (Switzerland)

THE SCHEDULE

Payment of the late registration fee or of the onsite registration fee: after 15th of July 2011
Short course on Thermal analysis and calorimetry: 7th of September 2011 (8:30 am)
Opening ceremony of CEEC-TAC1 – "Oltenia" Philharmonics: 7th of September 2011 (7:00-7:30 pm)
Plenary lecture: Petru Budrugeac (Bucharest, Romania): 7th of September 2011 (7:30-8:30 pm)
Welcome/Cocktail: 7th of September 2011 (8:30 - 10:30 pm)
Conference sessions: 8th, 9th and 10th of September 2011 (9:00 am)

CONTACT ADDRESS

For general inquires, by e-mail at: office@ceec-tac.org
For personal inquires, by e-mail at: andrei.rotaru@inflpr.ro

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THE 2nd INTERNATIONAL CONFERENCE AND EXHIBITION ON CLEAN TECHNOLOGIES IN THE STEEL INDUSTRY – Cleantech 2011

26 – 28 September 2011
Budapest, HUNGARY

ORGANIZED BY:

HUNGARIAN MINING AND METALLURGICAL SOCIETY (OMBKE),
in co-operation with the following international organizations:
EUROPEAN COMMISSION,
DG ENTERPRISE EUROPEAN CONFEDERATION OF IRON AND STEEL INDUSTRIES (EUROFER)
EUROPEAN STEEL INSTITUTES CONFEDERATION (ESIC)
EUROPEAN STEEL TECHNOLOGY PLATFORM (ESTEP)
INTERNATIONAL SOCIETY OF THE STEEL INSTITUTES (ISSI)
WORLD STEEL ASSOCIATION (WSA)

CO-SUPPORTED BY THE FOLLOWING NATIONAL STEEL ORGANIZATIONS:

AUSTRIAN SOCIETY FOR METALLURGY
MATERIALS CENTRE DE RECHERCHES METALLURGIQUES (BELGIUM)
BRAZILIAN METALLURGICAL SOCIETY ABM
CZECH METALLURGICAL SOCIETY
THE CHINESE SOCIETY FOR METALS ASSOCIATION TECHNIQUE DE LA SIDÉRURGIE FRANCAISE
STEEL INSTITUTE VDEH (GERMANY)
ASSOCIATION OF THE HUNGARIAN STEEL INDUSTRY
ASSOCIAZIONE ITALIANA DI METALLURGIA
THE IRON AND STEEL INSTITUTE OF JAPAN
THE KOREAN INSTITUTE OF METALS AND MATERIALS
POLISH ASSOCIATION OF METALLURGICAL ENGINEERS
TEHNICIANS CENTRO NACIONALE DE INVESTIGATIONES METALLURGICAS (SPAIN)
JERNKONTORET (SWEDEN) IOM_3
THE INSTITUTE OF MATERIALS, MINERALS AND MINING (UK)
AMERICAN IRON AND STEEL INSTITUTE (USA)

INTERNATIONAL COMMITTEE

TARDY, P.	OMBKE Hungarian Mining and Metallurgical Society (Chairman)
ANDERSSON, G.	Jernkontoret, Sweden
KAVANAGH, L.	AISI, USA
DE LAMBERTERIE, B.	EUROFER, ESTEP, Brussels
LÜNGEN, H.B.	VDEh, ESIC, ISSI, Germany
PROKES, P.	European Commission, Brussels
REIMINK, H.	World Steel Association, Brussels
SCHOFIELD, N.	Tata Steel Research, UK
SZÉPVÖLGYI, J.	HAS Institute of Materials and Environment,Hungary
ZHANG, CH.	Chinese Society for Metals, China

OBJECTIVES AND SCOPE OF THE CONFERENCE

Protection of environment is one of the top priorities of sustainable development. International and national organizations are continuously making efforts to improve environmental standards and regulations. Huge spendings on environmental protection, the introduction of environment-friendly technologies to reduce polluting emissions are among others positive proofs of the distinct commitment of the steel industry to the principles of sustainable development.

The conference provides a forum to review recent environmental measures of steel companies, to demonstrate the latest technical achievements in all production phases, to evaluate development in the field of environmental management, to discuss the environmental benefits of using steel and to bring experts together, who work in different countries in the above areas to exchange their experiences and views.

A truly international set of authoritative papers from the industry, from international and national organizations, academic and research institutions will be presented on:

- *INTERNATIONAL AND NATIONAL ACTIONS*
- *FACTORY-WIDE MEASURES TO IMPROVE ENVIRONMENTAL PERFORMANCE*
- *REDUCTION AND UTILIZATION OF WASTES*
- *REDUCING AIR AND WATER POLLUTION IN DIFFERENT PRODUCTION PHASES*
- *IMPROVING ENERGY EFFICIENCY*
- *LIFE CYCLE ASSESSMENT*
- *THE GREENHOUSE GAS CHALLENGE*
- *SPECIAL, NEW SOLUTIONS TO REDUCE POLLUTION IN THE STEEL INDUSTRY*

An exhibition related to the topics listed above will provide the participants further useful information.

Experts of steel companies and their suppliers, universities, research institutions, consulting companies, national and international environment-related organizations are invited to exploit this unique possibility to collect the latest information and meet with colleagues coming from all over the world.

EXHIBITION

Cleantech 2011 will provide companies a unique possibility to advertise their latest achievements to experts from all over the world.

CONFERENCE LANGUAGE

The official language of the Conference is English

PUBLICATIONS

The conference package received by all participants at registration will contain the Conference Proceedings on CD and a handy Conference Booklet containing the abstract of all presentations with space for notices and remarks after each abstract.

CONTACT ADDRESS

Completed Registration Forms, manuscripts of the papers, copy of the bank drafts should be sent to and further information can be obtained on the following address:

MVAE CONFERENCE OFFICE
H-1373 Budapest, 5 POB 548, Hungary
Phone: +361 3275 780, +361 3275 777
Fax: +361 3172 743
e-mail: info@cleantech11.com

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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INTERNATIONAL CONFERENCE ON ENGINEERING TRIBOLOGY, ADVANCED MATERIALS AND METROLOGY FOR TRIBOLOGICAL APPLICATIONS – ICETAM'2011

25 – 27 October 2011
Cairo, EGYPT

JOINTLY ORGANISED BY:

EGYPTIAN SOCIETY OF TRIBOLOGY
CAIRO UNIVERSITY [EGTRIP]
CENTER OF ADVANCED MATERIALS
BRITISH UNIVERSITY IN EGYPT [CAM] &
ARAB FEDERATION FOR METROLOGY [AFM]

ABOUT THE CONFERENCE

The ICETAM'2011, is the 8th international conference on Engineering Tribology, 2nd on Advanced Materials, and 5th on Metrology for Tribological Applications. The conference is jointly organized by the Egyptian Society of Tribology (EGTRIB), Cairo University (CU) and center of Advanced Materials (CAM), British University in Egypt (BUE), and Arab Federation for Metrology (AFM). The ICETAM'2011 will feature technical sessions, short courses/forums, and exhibitions activities. It focuses on the recent and futuristic development in Tribology, cutting edge of Advanced Materials, and related areas. It is a major forum for the exchange of knowledge and provides excellent opportunities to network and meet leading experts and researchers from different countries in the fields of Tribology and Materials. With this conference, the organizing committee optimistically whishes to establish a strong linkage and concrete collaborations among scientists and researchers from Western and Eastern countries.

CONFERENCE THEMES

Tribology nowadays recognized strongly in Agriculture, Architecture, Astronomy, Marine & Transportation, dentistry, Engineering, and all related sciences. Authors are invited to submit an extended abstract not less than 300 words, presenting new recent and futuristic developments in the following categories:

1. *Friction and Wear Processes (FWP)*
2. *Surface Engineering & Coatings (SEC)*
3. *Lubrication & Lubricants (LL)*
4. *Industrial Tribology & Manufacturing Processes (ITMP)*
5. *Bio Tribology and Relevant Issues (BTRI)*
6. *Tribological Assessments & Condition Monitoring (TACM)*
7. *Computational Techniques and Soft Ware Applications (CTSWA)*
8. *Tribology & Environmental Related Topics (CTRT)*
9. *Functional & Multifunctional Material Processing (FMMP)*
10. *Novel Materials (NM)*
11. *Natural & Synthetic Fibres Polymeric Composite Materials (NSFCM)*
12. *Other Related Topics of Tribology and Materials (ORTTM)*

13. Metrology of Engineering Surfaces for Tribological Applications (MESTA)
14. Metrology of Reference Material for Lubricants(MRML)
15. Metrology and Material Testing for TribologicalApplications (MMTTA)

Friction and Wear Processes (FWP) :(1). Wear and friction processes of metals, (2).Ceramic, (3).Polymeric, and Hybrid composite materials, (4).Transfer and back transfer film, Applications and study cases in (5).Sliding and rolling interfaces, (6).Erosion and Corrosion, (7).automotive, (8).agriculture
Surface Engineering & Coatings (SEC): (1).Wear and surface deterioration of Tribosystems, hard metals, polymers and coatings; (2).Surface Coatings for better performance, (3).Treatment of conventional and nonconventional surfaces
Lubricants & Lubrication (LL): (1).Fluid film lubrication, (2).Boundary Lubrication, (2).Hydrostatic Lubrication, (3).Bearings and Gears, (4).Properties of Natural, Mineral, and Synthetic Oil and Grease, (5).Solid lubricant
Industrial Tribology & Manufacturing Processes (ITMP) : (1). Cutting tool wear process, (2).Cryogenic-Tribology, (3).Macro, Micro, and Nano Tribology-Applications and case studies in: (4).agricultural, (5).Automotive, (6).Textiles, (7).Architecture, (8).Mining and desert equipments
Bio Tribology and Relevant Issues (BTRI) : (2).Artificial Prostheses, (3).Human Joints, (4). Friction and wear in Synthetic joints, (5).Modeling, (6).Biotech and Medical Applications
Tribological Assessments & Condition Monitoring (TACM):(1).Novel Techniques and Instrumentations, (2).Preventative maintenance, (3).Early detection of surface damage, (4).Analysis and mitigation of surface damage, (5).Wear control, Surface deterioration of Tribo-system, (6).Modeling and simulation of Tribo systems, (7).Maintenance of Tribo systems, (8).oil analysis, (9).fluid cleanliness and filtration technology, (10).Applications and case studies
Computational Techniques and Soft Ware Applications (CTSWA) : (1). Modeling, Simulation and Software Applications in Tribology, (2).Statistic approaches, (3).Artificial Intelligent Neural Network, (4).computer aided design of Tribo elements, (5).Applications and case studies
Tribology & Environmental Related Topics (CTRT): (1).Tribological waste materials, (2).Recycling, (3).Disposal, (4).Health, (5).Safety and environment issues, (6).Applications and case studies
Functional & Multifunctional Material Processing (FMMP): (1).
Natural & Synthetic Fibres Polymeric Composite Materials (NSFCM): (1).Fibre Polymeric Composite Materials
Novel Materials (NM): (1). Ceramic & (2).Composite Materials, (3).Bio-Nano Materials, (4).Carbon Nanotube materials, (1).Nano Composite Materials, (5).Polymer nanotech
Other Related Topics of Tribology and Materials (ORTTM) -
Metrology of Engineering Surfaces for Tribological Applications (MESTA)
Metrology of Reference Material for Lubricants(MRML)
Metrology and Material Testing for TribologicalApplications (MMTTA)

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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THE 9th INTERNATIONAL CONFERENCE OF NUMERICAL ANALYSIS AND APPLIED MATHEMATICS – ICNAAM 2011

19 – 25 September 2011, Halkidiki, GREECE

AIM & SCOPE:

The aim of ICNAAM 2011 is to bring together leading scientists of the international Numerical and Applied Mathematics community and to attract original research papers of very high quality.

TOPICS TO BE COVERED INCLUDE (BUT ARE NOT LIMITED TO):

All the research areas of Numerical Analysis and Computational Mathematics
(Numerical ODEs, Numerical PDEs (inc. BVPs), Scientific Computing and Algorithms, Stochastic Differential Equations, Approximation, Numerical Linear Algebra, Numerical Integral Equations, Error Analysis and Interval Analysis, Difference Equations and Recurrence Relations, Numerical problems in Dynamical Systems, Applications to the Sciences (Computational Physics, Computational Statistics, Computational Chemistry, Computational Engineering etc.), Differential Algebraic Equations, Numerical methods in Fourier analysis etc)
All the research areas of Applied and Industrial Mathematics
(Mathematical Physics, Mathematical Chemistry, Mathematical Biology and Mathematical Medicine, Optimization and Operational Research, Theoretical Mechanics, Discrete Applied Mathematics, Statistics, Probability, Dynamical Systems, Algorithms, Experimental Mathematics, Theoretical Computer Science, Applied Analysis, Mathematical Modelling (including but not limited to mathematical modelling of engineering and environmental processes, manufacturing, and industrial systems, heat transfer, fluid mechanics, CFD, and transport phenomena; solid mechanics and mechanics of metals; electromagnets and MHD; reliability modelling and system optimization; decision sciences in an industrial and manufacturing context; civil engineering systems and structures; mineral and energy resources; relevant software engineering issues associated with CAD and CAE; and materials and metallurgical engineering, mathematical modelling of social, behavioral and other sciences), Decomposition and Reconstruction Algorithms, Subdivision Algorithms, Continuous and Discrete Wavelet Transform, Time-frequency Localization, Phase-Space Analysis, Subband Coding, Image Compression, Real-Time Filtering, Radar and Sonar Applications, Transient Analysis, Medical Imaging, Multigrid Methods, Frames, Bifurcation and Singularity Theory, Deterministic Chaos and Fractals, Soliton and Coherent Phenomena, Formation of Pattern, Evolution, Complexity Theory and Neural Networks, Analytical Approaches and Simulations for more Accurate Descriptions, Predictions, Experimental Observations and Applications of Nonlinear Phenomena in Science and Engineering, Theoretical and Applied aspects of Computational Geometry, Control Theory and Automation, Fuzzy Sets and Systems and Fuzzy Logic, Applied Algebra, Quality Theory of Differential Equations, Neural Networks , etc.)

IMPORTANT DATES

Late Registration ends (i.e. fees paid and a Bank Slip is arrived in the fax (++ 30210 94 20 091) of Secretary of ICNAAM or a Visa-Master-American Express Card has been charged): July 29, 2011
Submission of Extended Abstract: July 22, 2011 - Final Date
Notification of acceptance: July 29, 2011

Submission of the source files of the camera ready extended abstracts to American Institute of Physics (AIP Conference Proceedings): August 1, 2011 - Final Date
Submission of the full paper for consideration for publication in the journals: September 30, 2011 - January 31, 2012

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ASPAITE, Greece

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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THE 9th INTERNATIONAL CONFERENCE OF COMPUTATIONAL METHODS IN SCIENCES AND ENGINEERING – ICCMSE 2011

02 – 07 October 2011, Halkidiki, GREECE

AIM & SCOPE:

The aim of ICCMSE 2011 is to bring together computational scientists and engineers from several disciplines in order to share methods, methodologies and ideas.

TOPICS TO BE COVERED INCLUDE (BUT ARE NOT LIMITED TO):

- *Computational Mathematics, Theoretical Physics, Computational Physics,*
- *Theoretical Chemistry, Computational Chemistry, Mathematical Chemistry,*
- *Computational Engineering, Computational Mechanics,*
- *Computational Biology and Medicine,*
- *Computational Geosciences and Meteorology,*
- *Computational Economics and Finance,*
- *Financial Forecasting,*
- *Scientific Computation,*
- *High Performance Computing,*
- *Parallel and Distributed Computing,*
- *Visualization,*
- *Problem Solving Environments,*
- *Software Tools,*
- *Advanced Numerical Algorithms,*
- *Modelling and Simulation of Complex Systems,*
- *Web-based Simulation and Computing,*
- *Grid-based Simulation and Computing,*
- *Computational Grids,*
- *Fuzzy Logic,*
- *Hybrid Computational Methods,*
- *Data Mining and Information Retrieval,*
- *Virtual Reality,*
- *Reliable Computing,*
- *Image Processing,*
- *Computational Science and Education.*

IMPORTANT DATES:

Submission of Short Abstract (1/3 A4 page): September 5, 2011 - Final Date
Submission of Short Paper (3-4 A4 pages): September 25, 2011 - Final Date
Notification of acceptance: September 10, 2011

Camera Ready Form of the Accepted Papers and AIP Copyright Transfrer Agreement: 25 September 2011 - 15 October 2011.
Submission of the source files of the camera ready extended abstracts to AIP: 31 October 2011 - Final Date
Submission of the full paper for consideration for publication in the journals: October 31, 2011 - February 28, 2012

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Prof. C. Pouchan, Université de Pau, France.
Dr. G. Psihoyios, Vice-President ESCMSE
Prof. A. J. Thakkar, University of New Brunswick, Canada

PRESENTATIONS:

The conference will have the following format
1. Plenary lectures (only after invitation)
2. Original papers (selection based on short papers of 3-4 A4 pages)
3. Posters (selection similar to original papers)
Plenary lectures
Will cover major accomplishments, trends, and technical challenges in computational methods in sciences and engineering.
Duration: 1 hour.
Presentation of papers
Accepted papers will be divided into several sessions. The full program will be announced later.
Duration: 20 minutes, followed by 10 minutes discussion
Papers in the form of short abstract (1/3 a4 pages) should be send to the secretary not later than 20th September 2011. Papers in the form of short papers (3-4 A4 pages) should be sending to the secretary not later than 03 October 2011.

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THE 10th INTERNATIONAL CONFERENCE ON FRACTURE AND DAMAGE MECHANICS – FDM 2011

19 – 21 September, 2011
Dubrovnik, CROATIA

INVITATION:

The 10th INTERNATIONAL CONFERENCE ON FRACTURE AND DAMAGE MECHANICS (FDM2011) will take place in Dubrovnik, Croatia. The conference follows the success of previous meetings held in London, UK (1999), Milan, Italy (2001), Paderborn, Germany (2003), Mallroca, Spain (2005), Harbin, China (2006), Madeira, Portugal (2007), Seoul, Korea (2008), St. George, Malta (2009) and Nagasaki, Japan (2010).

The conference series has the support of the experts in the field of fracture and damage mechanics and has become established as a leading international forum for presentation latest research. The high quality researches presented at the previous meetings are archived in conference proceedings published in book form. In addition special issues in leading journals such as International Journal of Fracture, Engineering Fracture Mechanics and Key Engineering Materials have been devoted to the work presented at the meeting.

The proceedings one the 10th international conference will be published in the Journal of Key Engineering Materials and distributed to the delegates at the conference.

CONFERENCE CHAIRMEN:

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S-I.Nishida Saga University, Japan
S.W.Shin Hanyang University, Korea
Qingfen Li Harbin Engineering University, China

CONFERENCE TOPICS:

Fracture Mechanics
Fatigue
Failure Analysis
Corrosion
Creep
Non-linear Problems
Dynamic Fracture
Residual Stress
Environmental Effects
Crack Propagation
Repair Technique
Composite Materials
Ceramics & Polymers
Metallic Materials
Concrete
Probabilistic Apects
Risk Analysis
Damage Tolerance
Fracture Control
Computational Methods
Microstructural & Micromechanical Modelling
Special sessions on:
(1) Sustainable technology of structures including architecture and civil engineering field.
(2) Diagnosis, Damage Evaluation, Rehabilitation, Repair, Strengthening, Durability Design technology of Structures.

AIMS:

The aim of the conference is to promote further international co-operation among Scientists and Engineers from different disciplines involved in the study of Fracture and Damage Mechanics.
The overall objective is to produce an integrated approach to problems of Fracture Failure, Fatigue and Safe Design.
The conference will discuss papers on any topics listed below and others related to the objectives of the meeting. The participants are encouraged to review critically existing ideas and to explore new research ideas.

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THE 5th INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING – INGEO 2011

22 – 24 September, 2011
Brijuni, CROATIA

INVITATION:

The 5th International Conference on Engineering Surveying INGEO 2011 held in September 22 - 24, 2011 in Island Brijuni in Croatia. The Event is organized in co-operation of FIG Commission 6, Faculty of Civil Engineering, Slovak University of Technology and the Faculty of Geodesy, University of Zagreb.

ORGANIZED BY:

Slovak University of Technology in Bratislava
Faculty of Civil Engineering, Department of Surveying
and
University of Zagreb
Faculty of Geodesy, Institute of Applied Geodesy

HISTORY:

INGEO2011 is the 5th event in the series of engineering surveying conferences organized by the Department of Surveying at the Slovak University of Technology in Bratislava. This conference is for the fifth time organized as the FIG Regional Event with really close cooperation and supporting of FIG Commissions 6 and 5. INGEO 2011 covers the main topics of these commissions and there WG's. Resulting the outcomes of the last conference in Bratislava, was decided to organize the next conference in another country to underline the cooperation inside the Central and Eastern Europe Region. The organizers have the island Brijuni in Croatia as the new place for the future event chosen, with support of the Faculty of Geodesy the University of Zagreb.

- *1st INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING - INGEO 1998*
  Bratislava, Slovakia, October, 21-23, 1998
- *2nd INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING - INGEO 2002*
  Bratislava, Slovakia, November, 11-13, 2002
- *3rd INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING - INGEO 2004*
  Bratislava, Slovakia, November, 11-13, 2004
- *4th INTERNATIONAL CONFERENCE ON ENGINEERING SURVEYING - INGEO 2008*
  Bratislava, Slovakia, October, 23-24, 2008

CONFERENCE TOPICS:

New methods and tools to support the effective data collection were developed in the last ten years worldwide. Many of producers are coming with new technology at market, which determined the revolutionary evolution of methodology. The questions of effective application and usage of new technology, their reliability and operability must be discussed actually. The quality of these instruments and data processing software is the second but very important question too. The aim of the conference is to bring together professionals in the field of engineering surveying and facility management, to discuss the new technologies, their applicability and operability. The conference discussion will be focused on present-day questions of laser scanning, usage of laser scanners in industry surrounding, for measurement of dynamic deformations, data acquisition and processing.

The topics of the conference are the following:

- *actual tasks of engineering surveying,*
- *trends in methodology and technology development,*
- *engineering surveying procedures for industry (power plants, nuclear facilities, etc.),*
- *industrial metrology in production, assembling and finishing processes in-situ calibration of used technology,*
- *lasers and laser measurement systems, with special emphasis on terrestrial laser scanning,*
- *new technology for deformation measurement,*
- *data integration in facility management,*
- *local information systems for cities and industrial applications,*
- *permanent GNSS networks, application in industry projects,*
- *GNSS usage in cadastre.*

The conference programme is consisting of the plenary session and of discussions in special sections. Discussions in each section will be organized such as to avoid time overlaps in their programme

OTHER ACTIVITIES OF THE CONFERENCE

Parallel with the conference programme INGEO 2011 will be organized the sessions of the FIG Commission 6 WG's for Engineering Surveying.
The social and cultural programme of the conference will include the icebreaker party and sightseeing of the historical part of the island Brijuni.

EXHIBITION

The programme of the conference will be completed by an exhibition of measuring and computer techniques and software products developed for engineering-surveying activities, monitoring of building constructions and automated measuring systems. The organizing committee expects the participation of enterprises that are active in the hardware and software market as well as in the area of design and realization of measuring systems. For exhibitors booths of standard size will be available.

CONFERENCE SECRETARY

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INTERNATIONAL SYMPOSIUM ON THE ENVIRONMENTAL DAMAGE IN STRUCTURAL MATERIALS UNDER STATIC/CYCLIC LOADS AT AMBIENT TEMPERATURES

14 – 19 August, 2011
Krakow, POLAND

INVITATION:

Engineering Conferences International (ECI) is a global engineering conferences program, originally established in 1962, that provides opportunities for the exploration of problems and issues of concern to engineers and scientists from many disciplines.
The format of the conference provides morning and late afternoon or evening sessions in which major presentations are made. Poster sessions will be scheduled for discussion as well. Available time is included during the afternoons for ad hoc meetings, informal discussions, and/or recreation. This format is designed to enhance rapport among participants and promote dialogue on the development of the meeting. We believe the conferences have been instrumental in generating ideas and disseminating information to a greater extent than is possible through more conventional forums.
All participants are expected both to attend the entire conference and to contribute actively to the discussions. The recording/photographing of lectures and presentations is forbidden. As ECI conferences take place in an informal atmosphere, casual clothing is the usual attire.

OBJECTIVES:

The objectives of the Engineering Conferences International are to advance engineering science and practice by identifying and developing international interdisciplinary conferences. The specific objectives and purposes of this program shall be to:

a. *Identify and sponsor professional international engineering conferences in specialty or multidisciplinary technology areas that will benefit from a level of discourse not possible in larger forums.*
b. *Organize conferences that provide an opportunity for engineering professionals and related physical, biological, and social scientists from academic, industrial, and governmental sectors to gather and discuss areas of technological importance.*
c. *Cooperate with professional engineering, scientific, and social science societies to jointly sponsor conferences and to take other joint actions that will foster complementary programming.*
d. *Initiate conferences that will have a significant impact on engineering education, research, practice, and/or development, and that will influence national and international technology policy.*

ABOUT THIS CONFERENCE:

While significant progress in our understanding of environment-assisted cracking (EAC) has been achieved in recent years, important fundamental questions like "how environment affects the crack driving force" remain unanswered.
Our objective is to congregate a group of "skilled in the art" researchers in metallic materials for a workshop that will endeavor to clarify our current understanding of EAC and identify approaches that improve the current semi-quantitative understanding of the mechanisms.

AIMS OF THIS CONFERENCE:

The emphasis of the papers will be on:

- *systematic evaluation of the governing parameters such as thresholds stress intensity factors, crack growth rates, steady state behavior, effects of yield stress, microstructure, and concentration of the aggressive environment (aqueous, gaseous, LME), and load-history on static/cyclic corrosion crack growth;*
- *experimental data on crack initiation and/or growth and unifying principles governing static and cyclic crack growth phenomena;*
- *analysis of crack tip chemistry, morphlogy, stress and strain;*
- *new techniques for measuring crack initiation in aqueous environments;*
- *understanding and quantifying behavior rather than reporting measurements;*
- *ambient temperatures and common service environments.*

ADDITIONAL INFORMATIONS:

The meeting will be held in Krakow, Poland. There will be a series of contributions by the participants during which participation from the audience will be encouraged.
4 days are allocated for Stress Corrosion and 1 day for fatigue.
This conference is designed as a single session (i.e., no parallel sessions), allowing for talks of 20 minutes with 10 minutes for questions/answers.
Suitable papers will be published in Metallurgical Transactions.

CONFERENCE SECRETARY

Conference Organizers

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Henry Holroyd (Luxfer, Inc.) (henry.holroyd@luxfer.net)
Richard Ricker (NIST) (rricker@nist.gov)
Neville Moody (Sandia National Laboratories) (nrmoody@sandia.gov)

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 3 [July-September]

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MANUSCRIPT PREPARATION - GENERAL GUIDELINES

ABSTRACT:
A nonmathematical abstract, not exceeding 200 words, is required for all papers. It should be an abbreviated, accurate presentation of the contents of the paper. It should contain sufficient information to enable readers to decide whether they should obtain and read the entire paper. Do not cite references in the abstract.

KEYWORDS:
The author should provide a list of three to five key words that clearly describe the subject matter of the paper.

GENERAL ASPECTS REGARDING THE MANUSCRIPTS

These instructions are written in a form that satisfies all of the formatting requirements for the author manuscript. Please use them as a template in preparing your manuscript. Authors must take special care to follow these instructions concerning margins. The basic instructions are simple:

- *Manuscript shall be formatted for an A4 size page.*
- *The top and left margins shall be 30 mm.*
- *The bottom and right margins shall be 25 mm.*

The text shall have both the left and right margins justified.

STRUCTURE

The manuscript should be organized in the following order: Title of the paper, Authors' names and affiliation, Abstract, Key Words, Introduction, Body of the paper (in sequential headings), Conclusion, Acknowledgements (where applicable), References, and Appendices (where applicable).

THE TITLE

The title is centered on the page and is CAPITALIZED AND SET IN BOLDFACE (font size 14 pt). It should adequately describe the content of the paper. An abbreviated title of less than 60 characters (including spaces) should also be suggested.

AUTHOR'S NAME AND AFFILIATION

The author's name(s) follows the title and is also centered on the page (font size 11 pt). A blank line is required between the title and the author's name(s). Last names should be spelled out in full and succeeded by author's initials. The author's affiliation (in font size 11 pt) is provided below. Phone and fax numbers do not appear.

TEXT LAYOUT

The manuscript must be typed single spacing. Use extra line spacing between equations, illustrations, figures and tables. The body of the text should be prepared using Times New Roman. The font size used for preparation of the manuscript must be 11 points. The first paragraph following a heading should not be indented. The following paragraphs must be indented 10 mm. Note that there is no line spacing between paragraphs unless a subheading is used. Symbols for physical quantities in the text should be written in italics.

FIGURES AND TABLES

Figures (diagrams and photographs) should be numbered consecutively using Arabic numbers. They should be placed in the text soon after the point where they are referenced.

Figures should be centered in a column and should have a figure caption placed underneath. Captions should be centered in the column, in the format "Figure 1" and are in upper and lower case letters. When referring to a figure in the body of the text, the abbreviation "Figure" is used Illustrations must be submitted in digital format, with a good resolution.

Table captions appear centered above the table in upper and lower case letters. When referring to a table in the text, "Table" with the proper number is used. Captions should be centered in the column, in the format "Table 1" and are in upper and lower case letters. Tables are numbered consecutively and independently of any figures. All figures and tables must be incorporated into the text.

EQUATIONS AND MATHEMATICAL EXPRESSIONS

Equation numbers should appear in parentheses and be numbered consecutively. All equation numbers must appear on the right-hand side of the equation and should be referred to within the text.

CONCLUSION

A conclusion section must be included and should indicate clearly the advantages, limitations and possible applications of the paper. Discuss about future work.

ACKNOWLEDGMENT

An acknowledgement section may be presented after the conclusion, if desired. Individuals or units other than authors who were of direct help in the work could be acknowledged by a brief statement following the text.

REFERENCES

References should be listed together at the end of the paper in alphabetical order by author's surname. List of references indent 10 mm from the second line of each references. Personal communications and unpublished data are not acceptable references.

- *Journal Papers: Surname1, Initials; Surname2, Initials and Surname3, Initials: Title, Journal Name, volume (number), pages, year.*
- *Books: Surname1, Initials and Surname2, Initials: Title, Edition (if existent), Place of publication, Publisher, year.*
- *Proceedings Papers: Surname1, Initials; Surname2, Initials and Surname3, Initials: Paper title, Proceedings title, pages, year.*

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2. NAME SURMANE 2ND AUTHOR

1. 2. COMPLETE AFFILIATIONS OF THE AUTHOR(S)

SUBMISSION

Manuscripts should be submitted to e-mail: redactie@fih.upt.ro, with mention "for ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering".

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