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– BULLETIN of ENGINEERING

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ACTA TECHNICA CORVINIENSIS
– BULLETIN of ENGINEERING
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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 4 [October-December]

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Topical reviews in materials science and engineering, each including:

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CONTENT

Abstract:
Acoustical parameters of porous materials give the necessary and important information for noise control engineers. Profound knowledge their physical characteristics enable an effective sound absorber material design. The theory of sound-absorbing materials has progressed considerably during the last decade. A noise control engineer with serious interest in sound absorbing technology is advised to study all this parameters.
Noise control engineers frequently face problems of design sound absorbing materials that provide the desirable sound absorption coefficient that minimizes the size and cost, does not introduce any environmental hazards, and stands up to hostile environments. The designers of those absorbers must know how to choose the proper material, its geometry and the protective facing. Porous sound-absorbing materials are utilized in almost every areas of noise control engineering. This paper deals with the acoustical parameters of porous materials and their measurement.

Abstract:
Total Quality Management is an organizational strategy founded on the idea that performance in achieving a quality education is achieved only through involvement with the perseverance of the entire organization in improving processes permanently. The objective is to increase the efficiency and effectiveness in satisfying the customers.
The concept of quality has undergone several stages, adapting to every level of technology and market requirements. Thus, gradually, the selection of finished class performance has been replaced by statistical control of quality parts on-stream, then to extend the process, becoming, through the concept of quality an important factor in delivering products and services.
The paper presents some fundamentals aspects about the Total Quality Management (TQM) concept. In is pointed out the representative models: Oakland, SOHAL, three dimensional and also some representative areas of TQM interest.

Abstract:
In the current environment, contractors are had pressed to find ways to gain a competitive advantage and improve slim profit margins. In any given geographical area, construction labor, material and equipment costs are essentially the same. One of the few opportunities to improve the bottom line is to increase productivity. This paper is attempted to identify some ways to improve productivity at the construction site in Libya. Interviews were carried with contractors, owners and consultants. The paper has concluded that the consultants understand both best industry practice and the current construction technologies that can improve productivity. Perhaps most important, the consultants can provide the supervisor and crew with the training that will yield the greatest productivity improvements.

Abstract:
Energetic economy measure has high influence on decreasing pollutive emission of materials as well as green house gasses which are conducive to fulfill state's strategies in environment area and climate changes. Wind is a clean energy; wind power plants do not produce any emissions. They do not pollute surrounding air, water nether the soil, because there is no fuel burning to produce energy. This article highlights the positive effect of a nonstandard source of wind energy used by the M.A.R.S. turbine.
Offshore Wind Energy (OWT) stations produce clean energy without any emissions, which neither cases any climatic changes nor pollute the air. This kind of electric energy production represents the home source of energy production, that we have not have to pay for it to the foreign companies and we become more self-sustaining and energy independent.

Abstract:
Electrochemical investigation methods are widely used for characterization of different kinds of materials and live tissue, as well as of the processes in systems where the electrochemical reactions take part. One such system for electrochemical researches based on PC and LabVIEW software package was developed and described in the paper. An overview of standard electrochemical methods, such as potential measurements, chronopotentiometry, chronoamperometry, cyclic voltammetry and EIS, but also of new methods, is given. For signal generation and recording of the response of investigated electrochemical cell, a measurement and control system was developed, based on a PC. The rest of the hardware consists of a commercially available AD-DA converter and an external interface for analog signal processing. The software platform for desired measurement methods is LabVIEW package. The developed system was adjusted, tested and compared with other commercially available systems.

Abstract:
From the moment when Romania adhered to the European Union, the free circulation of goods is performed based on the EU regulations, chemical fertilizers included. Several accidents have occurred in the chemical industry during the processing of ammonium nitrate. Subsequently, it has been concluded that ammonium nitrate (as fertilizer) can be initiated by an external impulse that can lead to detonation, reaching even to mass explosions. As a result of this series of accidents, it was necessary to restrict the marketing of this product before evaluating its sensitivity to detonation.
A series of laboratory analyses, measurements and tests stipulated by the Regulation (CE) 2003/2003 issued under the auspices of the European Council are made on chemical fertilizers with a high amount of grain ammonium nitrate intended for agricultural purposes. Among these tests and laboratory analyses, there is the detonability test of ammonium nitrate, with high nitrogen content chemical fertilizers.

Abstract:
The research objective in this study is to find solutions for immobilization of Zn(II) ions from spent printing developer in the printing industry by adsorption on natural, low-cost adsorbents: activated carbon (AC, Norit Row 0.8 Supra), natural zeolite (NZ, clinoptilolite) and their mixtures (AC+NZ); by doing this, environmentally-harmful metal Zn(II) would be eliminated. Because of the complexity of printing wastewater we studied the adsorption onto various adsorbents, to gain an insight into the influence of heavy metal Zn(II) on the sorption behavior of these adsorbents, the effect of their nature and optimal concentration, and determine the adsorption capacity and the appropriate contact time. Therefore, these adsorbents of the defined pore size and structure were applied to examine their adsorption efficiency in the removal of Zn (II) ions from the spent printing developer sample. Concentrations of Zn(II) ions in fresh and spent printing developers before and after the adsorption were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), using a PerkinElmer Elan 5000 mass spectrometer. The adsorption of Zn(II) ions onto activated carbon, clinoptilolite and there mixture was studied in laboratory batch mode. The adsorption equilibrium data for Zn(II) ions on AC, NZ and (AC+NZ) were analyzed in terms of the Freundlich isotherm model. The results provided strong support for the Zn(II) ions adsorption onto these adsorbents, and all the data fitted well to the Freundlich isotherm ($R^2 \geq 0.988$). The lowest correlation coefficient for Zn(II) ions was obtained using the mixtures of activated carbon and clinoptilolite. The adsorption capacities of Zn(II) ions decreased in the order: AC>NZ>AC+NZ.

Abstract:
Biosensors are analytical devices which tightly combine biorecognition elements and physical transducer for detection of the target compounds. Biosensors useful serve ecological purposes by enabling precision pollutant control. In practice the most important are biosensors that identify water conditions and to a lesser extent air and soil condition. Two main water pollutant are phosphates and fluorides. For determination of phosphate and fluoride ions enzyme, microbial and multienzyme biosensors can be used. Multienzyme biosensors however are very complex devices.
In this paper a multienzyme inhibitor system is investigated. A hybrid inhibitor biosensor for measuring concentration of phosphate is used. Enzyme kinetic of Michaelis-Menten and ping-pong kinetics is accepted. Partial differential equations of that complex system are solved numerically and are received concentration profiles of five reagents. The influence of starting concentration of inhibitor is investigated and influence of reaction rate constant of inhibitor.

Abstract:
Current trends in the development of robotic equipment links is to the autonomy of these systems. Such a system must have the characteristics of artificial intelligence. Basic concepts of industrial robots, manufactured in the world, reached a high technical level and reliability and are able to cooperate with other production and auxiliary systems in the fields of engineering and non-engineering applications. Variety of service activities in service robotics need to use different principles for solving various tasks, mainly handling.
The paper deals approaches to design service robot body for handling. The advantage of using robots handling tooling service is the integration of service activities and manipulation activities, which can perform such a conception. Part of the article is also a procedure for the preliminary draft skeletal units. A prerequisite for building such systems is a deeper revision of existing design methodologies and their closer links with systematized accumulated knowledge base in the discipline.

Abstract:
Finite element method, as a method of simulation of the cutting phenomenon during machining process allows obtaining information relevant for further computational analysis of tool wear, cutting temperature and cutting forces. These are the most important factors that influence the accuracy of processing and combined with other factors they affect deformation of cutting tools. The paper presents computer modelling of tool deformation and thermal load during turning using finite element method. The modelling was conducted during cutting time from 20 to 180 seconds.

Abstract:
The key problem in Cellular Manufacturing System (CMS) is to identify the machine cells and corresponding part families with an aim to curtail the intercell and intracell movement cost of the items. This paper demonstrates a state-of-the-art Soft-Computing based Simulated Annealing heuristic to cell formation problems in CMS. Thereafter Taguchi's orthogonal design is utilized to solve the critical issues on the subject of parameters selection for the proposed heuristic which is further investigated on 20 widely practiced datasets obtained from related literature. It is shown to outperform the published methodologies such as ZODIAC, GRAFICS, MST, TSP-GA, GA and GP, producing 60% improved solutions.

Abstract:
Constant advances in computer technology widen the field for computer application in engineering, and, therefore, process planning. Basic goal is to create conditions for application of manufacturing technologies capable of rapid adjustment to new production programs, while maintaining high quality, increased productivity, and reduced costs of manufacture.
The importance of cutting tools in production systems requires modern approach to their selection. Automation of tool selection can significantly enhance efficiency of processes planning. Presented in this paper is development of a system for automated selection of cutting tools. Global concepts as well as the concepts of the system's constituent modules are reviewed. Basic modules of the system are knowledge base, and cutting tools database. A case study is also presented. Finally, concluding remarks are given with suggested directions for future investigation.

Abstract:
The information system is a coherently structured assembly, made of electronic computing and communication equipments, software, processes, automated and manual procedures, used as automatic data processing tool within a field of activity.
In the process of welding in shielding gas environment with fusible electrode, there are used either inert or active gases. Therefore, we make the distinction between welding in an inert gas environment with fusible electrode (MIG) and welding in an active gas environment with fusible electrode (MAG).This paper presents the technology development for welding in MIG-MAG shielding gas environment and a new calculation methodology for major welding parameters using an informatics application.
This publication aims to expose the collaborative work and the experiences of our project team in order to design and implement a training tool in the welding domain, which includes interactive educational resources organized into a database. The goal of the project is to design a more attractive multimedia training content, with multimodal character.

Abstract:
Thermal radiation and first order chemical reaction effects on unsteady free convective flow of a viscous incompressible flow past an infinite isothermal vertical oscillating plate with mass transfer in the presence magnetic field is considered. The fluid considered here is a gray, absorbing-emitting radiation but a non-scattering medium. The plate temperature is raised to T_w and the concentration level near the plate is also raised to C'_w . An exact solution to the dimensionless governing equations has been obtained by the Laplace transform method, when the plate is oscillating harmonically in its own plane. The effects of velocity, temperature and concentration are studied for different parameters like magnetic field parameter, phase angle, Schmidt number, chemical reaction parameter, thermal Grashof number, mass Grashof number and time. It is observed that the velocity increases with decreasing magnetic field parameter or radiation parameter. It is also observed that the velocity increases with decreasing phase angle ωt .

Abstract:
The concept of the Six Sigma is a concept of quality company management. At the same time it is a clever way of managing a company or organizational parts of the company. It was created by General Electric, in aim to satisfy the needs of the client more successfully. Companies implementing the Six Sigma concept in the first place put improving the client – customer satisfaction, resulting in reduced cycle time necessary for an almost perfect product / service to be produced and delivered to client. The success of the concept of the Six Sigma implementation depends on the willingness of employees to participate in the same.
Applying the concept of Six Sigma results in permanent improvements in operations, results in excellent financial and non-financial results, and improved performance of the organization. Also, the company provides uplift above average and provide the best possible solution for all stakeholders: customers, employees, owners, society, etc.

Abstract:
The development of continuous casting to produce semi-finished products is now so far advanced that almost any grade of steel can be continuously cast, and in the most appropriate cross section for further shaping. High quality finished products can only be produced by using defect free slabs, blooms or billet. The removal of defects is either performed selectively by removing the specific defect. This paper, based on industrial research, refers to the possibility of defining and cataloguing the surface defects specific to the semi-finished products continuously cast, in order to discover the generating source and to take the proper measures to prevent and remedy them where appropriate. The industrial experiments were carried out over several months in a steel company, period when we searched the number and type of defects detected at the reception of the studied metallic material.

Abstract:
Modification of solid surfaces is a very active field of research. By changing the surface composition we obtain a material with new surface properties. One of the basic experiments for gathering information about surface properties of PET is the measurement of contact angles of water drops on it.
This contribution presents results from measuring contact angles on moderately hydrolyzed PET foils immersed in sodium hydroxide solutions of concentration 0% (distilled water), 2%, 4% and 6% at temperatures 20°C and 40°C. Contact angles and geometric parameters on these substrates were monitored as a function of evaporation time. After the evaporation course, four elementary stages have been evaluated, that allow determining advancing and receding contact angles and wetting behavior of these substrates.

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ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING – FASCICULE 4 [OCTOBER – DECEMBER]. TOME IV / 2011 *includes original papers submitted to the Editorial Board, directly by authors or by the regional collaborators of the Journal* ***[papers #11-12 and #14-20]***.
Also, ***ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING – FASCICULE 4 [OCTOBER – DECEMBER]. TOME IV / 2011*** *include original papers presented in the following conferences, in which the Journal was announced communication and logistical support:*

- ***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 #1-7]***.
- ***THE 11TH INTERNATIONAL SYMPOSIUM ON INTERDISCIPLINARY REGIONAL RESEARCH [SERBIA – ROMANIA – HUNGARY] – ISIRR 2010,*** *organized in* ***SZEGED, HUNGARY, 13 – 15 OCTOBER , 2010 [papers #8-10 and #13]***.

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[1.] Martin VYSOCKÝ, [2.] Pavol LIPTAI, [3.] Zuzana FARKAŠOVSKÁ

ANALYSIS AND IDENTIFICATION OF NOISE SOURCES AND ACOUSTIC PARAMETERS OF ELECTROMOTOR

ABSTRACT:
The electric motor is present in life very often used device, which is needed to study its terms of noise. In this article we analyze the reasons of electromotor vibration and species of electromotor noises. The electromotor noise is a admixture of different frequency and different intensity of noise. Control and detecting of main noise sources is important in term of product quality, safety and impact on human health.
Designers make choices regarding structure, materials and components in a product. The tools they use should allow them to anticipate the effect of these choices on sound quality. This discussion recounts the role of psychoacoustics in product design and product acceptability and notes the results of that work in metrics for sound quality and consumer/ user perceptions about the product.

KEYWORDS:
electromotor, acoustic quality, noise sources

INTRODUCTION

On introduction this contributions is needed to say, what this is in fact acoustic quality of products and why it is important for presentation. Noise us round everywhere about, at home, in the streets, in work, in industries, transport etc. But a noise we can to find on appliance too, whether already is going about fridge, washing machine or mixer and when is more friendly for man, thereby we can to talk about higher acoustic quality of products. It doesn't need to be quite eliminated, even though is this most ideal solution, but be enough, as far as is possible identify and partly lower.

ACOUSTIC QUALITY OF PRODUCTS

Designers make choices regarding structure, materials and components in a product. The tools they use should allow them to anticipate the effect of these choices on sound quality. This discussion recounts the role of psychoacoustics in product design and product acceptability and notes the results of that work in metrics for sound quality and consumer/ user perceptions about the product.[1]
Sounds of assistance can be displeased, but also can be luck to. Every engineer should be take note of product by managerial views, because analysis of acoustic signal, humane perception, design and coast-benefit analysis to general profit too are criterion for quality assurance of products. Responsibilities designer, whether manager is propose and try quality of products, remove limitations still during testing products and take to high-class product on market. All these products are before application on market testing and feigned. Important factor for arbitration qualities of products is department psychoacoustics.
Psychoacoustics is science or study that is dealt thereby, how given product perceive single man, and then centre his acoustic receptors on surroundings extraditing sound whether noise. Main aid of psychoacoustics is alternate testing, where people are asked to reception various sound, then is testing and there are additionally producing specific performance chart about sound. Industries use near for training experts a panel or "sensory profiles" (Figure 1.).[2]

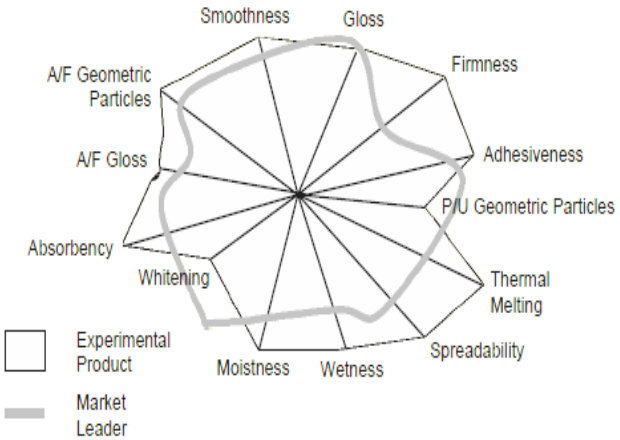

Figure 1. Sensory profiles of two skin care products [2]

SOURCES OF NOISE ELECTROMOTOR

Electromotor we can classify as one of major source of transmission sound from appliance and it is needed more closely present of this problem. Electromotor is machine, wherein is electric energy turn on kinetic energy revolving sections of electromotor, rotor. Electromotores utilize physical phenomenon electromagnetics, but there have been motores bottom on by other electromechanical phenomenon e.g. electrostatics, piezoelectric phenomenon and below. Every electromotor is unloaded from duo basic sections - statically boot immobile sections - stator, and mobile sections (usually spinning) rotor. (Figure 2).

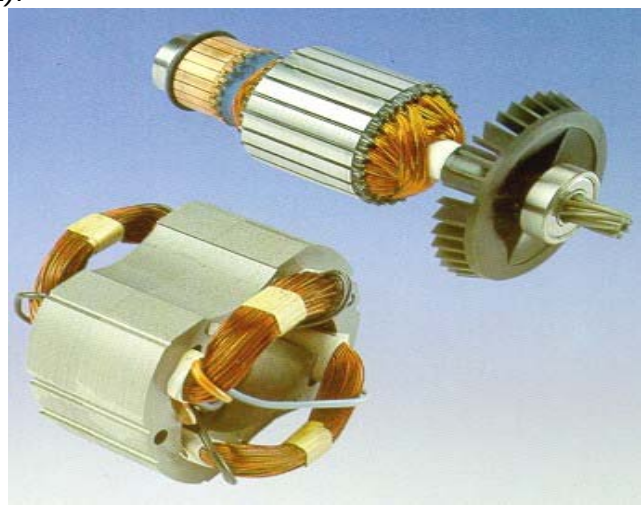

Figure 2. Electromotor of appliance

Between general sources of noise in electromotor belong:

- *Unbalance of electromotor,*
- *Bearing of electromotor,*
- *Commutators,*
- *Aerosound (scoring on rotor).*

a) Unbalance of electromotor

Concerning noise electromotor by his unbalance, is this narrowly linear just with vibration of rotor in electromotor, then given noise is doing single vibrations, it is unbalance rotor. We can to say, that unbalance is one from source judder.

Judder are considered as very suitable operating parameter, by that is possible assess AF - audio frequency dynamic construction sequence cases. On creation of vibration in construction sections of electromotor is sharing different sorts of source vibration, mainly recollection unbalance and further mechanical clearance of mounting, resonance of construction, abnormal wear bearing or snap small shovel rotor.

Suitable cap for creation exciting vibration in the working condition machinery is half-round placing rotor and stator of electromotor (Figure 3.). Inaccuracy production rigger ganglion (rotor - bearing - stator) and his consistent working resort influence mutual dynamic eccentricity to excitement vibration. [6].

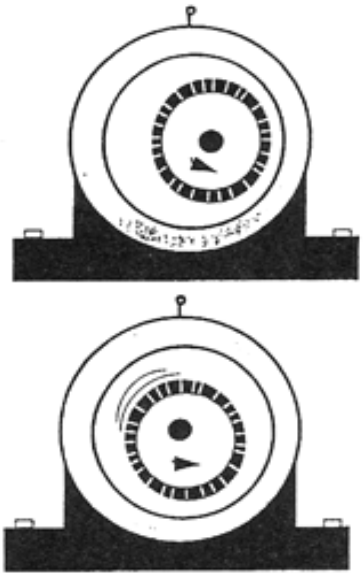

Figure 3. Drive vibrations in electromotor [6]

b) Bearing of electromotor

On part of electromotor in appliance are bearing, that are be instrumental to placing rotor in electromotor (Figure 4). They are next possible of cause noise of electromotor and thanks for bearing is raising life of electromotor and products or appliance too.

Figure 4.Bearing of electromotor for appliance Source: http://www.okokchina.com

Good and effective diagnostics is able to prevent crash and meaningly to lower repair for costs. Providing electromotor allows timely revelation "inadmissible" technical conditions bearing with exchange bearing in optimally time in several tenth euros without serious after-effects or damage prominent sections of electromotor. If electromotor isn't monitoring, is able to come about disintegration of bearing, in pursuance of st. (under working arrangements) is rotary part aggrieving stator and resort to destruction winding or to deformation mechanical sections and in extremeness case to complete destruction of electromotor. [4]

c) Commutators

Commutators (Figure 5.) create conductive half-ring uncross isolating layer. Every commutator is connected with one end of reel and act motion of rotation included with cateterisation.

Brushes invariable one's position, and are conductivity connection with district and source. Commutator and brushes still baffle whereupon is reel turn on drowe energy. This machinery we are talking about electromotor.[5]

Good commutantion lead the way assumption of correct functions commutator to dress. Below concept commutantion is understand complex march in reel winding rotor, that are near turning curl grind from influence one's pole below another pole. Near this change is through the medium commutator changing direction flow in reel. Volts every commutating reel, in who is turn direction flow, arrive together toward connecting briefly over brushes and lamella of commutator. [5]

Figure 5. Commutator

d) Aerodynamic noise of electromotor

Tone noise is editing providing, when flow over blown space too. Its infliction shift of backward whirls, which are stroke on border wall and further are throwing back about additional walls. Flow further and form new maelstroms (Figure 6).

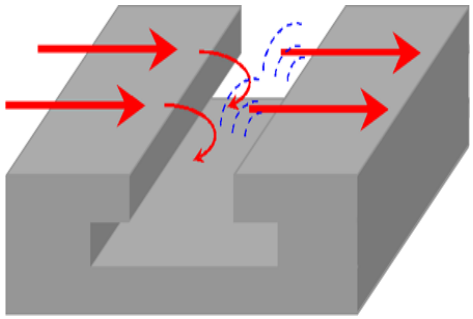

Figure 6. Flowinf of sound in hollow spaces [3]

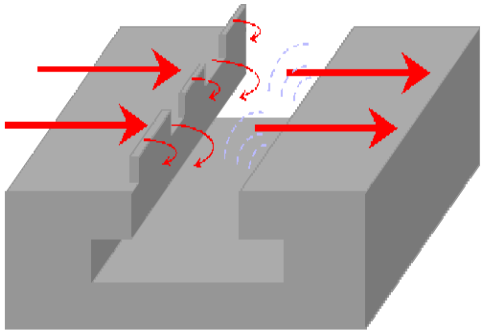

Figure 7. Measure for cut-down aerodynamic noise in hollow spaces [3]

Flowing acoustic coupling can be cut-down additional groove on front edge of sections walls (Figure 7).

As a result is turbulence with different length weight and thereby creation small constructive sound of windy. In the last analysis is concerned the same thought, in to have be near falling noise around cylindral surface sections electromotor.[3]

CONCLUSION

This article apprised reader not only with acoustic quality of products and main sources of noise in electromotor for appliances too, but also abets possibilities of improvements acoustic qualities of products, then possibility noise reduction on electromotor.

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STUDIES OF CARBON STEEL CORROSION IN ATMOSPHERIC CONDITIONS

ABSTRACT:
One of the most frequently corrosion type is the atmospheric corrosion. Carbon steel behavior at atmospheric corrosion is presented on base of the literature data study. This has been reported to account for more failures in terms of cost and tonnage than any other type. About 80% from all degradations produced by corrosion in the metallic constructions are due to the atmospheric corrosion. The atmospheric conditions for corrosion are very complex and the corrosion rates vary in function of geographic zone, of season and daily time. The complexity of the atmosphere, as corrosion environment, results from atmosphere composition and from presence of some factors as pollutants, temperature, humidity, wind speed and direction, etc. These variables make meaningful results from laboratory experiments very difficult to obtain. The object of this work is to outline the principles that govern atmospheric corrosion of the carbon steel – the construction material with the largest application – how is influenced his corrosion rate by the atmospheric variables and that are the corresponding corrosion products.

KEYWORDS:
carbon steel, atmospheric corrosion

INTRODUCTION

One of the most frequently corrosion type is the atmospheric corrosion. This has been reported to account for more failures in terms of cost and tonnage than any other type. About 80% from all degradations produced by corrosion in the metallic constructions are due to the atmospheric corrosion. The atmospheric conditions for corrosion are very complex and the corrosion rates vary in function of geographic zone, of season and daily time. The complexity of the atmosphere, as corrosion environment, results from atmosphere composition and from presence of some factors as pollutants, temperature, humidity, wind speed and direction, etc. [1]. These variables make meaningful results from laboratory experiments very difficult to obtain.

The atmospheric corrosion is conveniently classified in three [2, 3] types: (1) dry oxidation, (2) damp corrosion and (3) wet corrosion. Dry oxidation takes place in the atmosphere with all metals that have a negative free energy of oxide formation. For metals forming non-porous oxides, the films rapidly reach a limiting thickness since ion diffusion through the oxide lattice is extremely slow at ambient temperatures, and at the limiting thickness, the oxide films on metals are invisible. For certain metals and alloys, these films confer remarkable protection on the substrate, e.g. stainless steel, titanium and chromium. The damp and wet atmospheric corrosion are characterized by the presence of a thin, invisible film of electrolyte solution on the metal surface (damp type) or by visible deposits of dew, rain, sea-spray etc. (wet type). In these categories may be placed the rusting of iron and steel, 'white rusting' of zinc (wet type) and the formation of patina on copper and its alloys (both types).

The corrosion products may be soluble or insoluble. Usually, those insoluble reduce the corrosion rate by isolating the substrate from the corrosive environment. Less commonly, they may stimulate corrosion by offering little physical protection while retaining moisture in contact with the metal surface for long periods. The soluble products may increase corrosion rates.

The severity of atmospheric corrosion depends on the environment type [4, 5]: rural, urban, industrial, marine and combined.

The rural atmosphere generally the least corrosive and normally does not contains chemical pollutants. The principal corrosive agents are moisture, oxygen and carbon dioxide.

The urban atmosphere is similar to the rural type in that there is little industrial activity. Additional contaminants are of the SO_x and NO_x variety, from motor vehicle and domestic fuel emissions.

The industrial atmospheres are associated with heavy industrial processing facilities and can contain sulphur dioxide, chlorides, phosphates and nitrate.

The marine atmospheres are usually highly corrosive, due to the presence of chlorides, and corrosivity tends to be significantly dependent on wind direction, wind speed and distance from the coast.

The object of this work is to outline the principles that govern atmospheric corrosion of the carbon steel – the construction material with the largest application – how is influenced his corrosion rate by the atmospheric variables and that are the corresponding corrosion products.

CORROSION PRINCIPLES OF CARBON STEEL IN ATMOSPHERE

A fundamental requirement for electrochemical corrosion process is the presence of an electrolyte. This film 'invisible' electrolyte tends to form on metallic surfaces under atmospheric exposure conditions after certain critical humidity level is reached. The critical humidity level is not constant and depends on the corroding material, the tendency of corrosion products and surface deposits to adsorb moisture, and the presence of atmospheric pollutants. For iron, the relative critical humidity is 60% in atmosphere free of sulphur dioxide.

In absence of the pollutants, in an atmosphere with relative humidity of least 70%, the carbon steel corrodes with formatting in time of $Fe(OH)_2$, after the electrochemical mechanism [6], conform to the reactions:

Anodic reaction:

$$2Fe \rightarrow 2Fe^{2+} + 4e \qquad (1)$$

Cathodic reaction:

$$O_2 + 2H_2O + 4e \rightarrow 4OH^- \qquad (2)$$

The products of these reactions combine forming ferrous hydroxide – a compound insoluble at neutral pH – that deposits on the metal surface:

$$2Fe^{2+} + 4OH^- \rightarrow 2Fe(OH)_2 \qquad (3)$$

In presence of the oxygen, the ferrous hydroxide oxidizes and forms the rust.

If oxygen from the atmosphere diffuses through the electrolyte film to the metal surface, a diffusion-limiting current density should apply. It has been shown that a diffusion transport mechanism for oxygen is applicable only to an electrolyte-layer of approximately of 30 μm and under strictly isothermal conditions [3]. The predicted theoretical limiting current density of oxygen reduction in an electrolyte-layer of 30 μm significantly exceeds the practical observations on atmospheric corrosion rates. Therefore, the overall rates of the atmospheric corrosion are likely to be controlled not by the cathodic oxygen reduction process, but rather by the anodic reaction(s).

In the presence of gaseous air pollutants, other reduction reactions, involving ozone, sulphur dioxide and nitrogen species have to be considered [7]. It be noted that corrosive contaminant concentrations can reach relatively high values in the thin electrolyte films, especially under conditions of alternate wetting and drying.

THE ROLE OF THE IMPORTANT VARIABLES IN ATMOSPHERIC CORROSION OF CRBON STEEL

Humidity. From the above theory, it should be apparent that presence of electrolyte on the corroding surface (time of wetness) is a key parameter, directly determining the duration of the electrochemical corrosion process. This variable is a complex one, since all the means of formation and evaporation of an electrolyte solution on a metal surface must be considered.

The time of wetness is strongly dependent on the critical relative humidity. The relative humidity of the air varies in large limits, in function of geographic zone, of season and daily time.

Apart from the primary humidity, associated with clean surfaces, secondary and tertiary critical humidity levels may be created by hygroscopic corrosion products and capillary condensation of moisture in corrosion products, respectively. A capillary condensation mechanism may also account for electrolyte formation in microscopic surface cracks and the metal surface-dust particle interface. Other sources of surface electrolyte include chemical condensation (by chloride, sulphates and carbonates), adsorbed molecular water layers, and direct moisture precipitation (ocean spray, dew, rain).

Temperature. The effect of temperature on the atmospheric corrosion rates is quite complex. An increase in temperature will tend to stimulate corrosive attack by increasing the rate of electrochemical reactions and diffusion processes. For a constant humidity level, the increase in temperature would lead to a higher corrosion rate. However, raising the temperature will, generally, lead to a decrease in relative humidity and more rapid evaporation of the surface electrolyte. When the time of wetness is reduced in this manner, the overall corrosion rate tends to diminish.

For closed air spaces, it has been pointed out that the increase in relative humidity associated with a drop in temperature has an overriding effect on corrosion rate [8]. This implies that simple air conditioning that decreases the temperature without additional dehumidification will accelerate atmospheric corrosion damage. An important factor in corrosion favoring is the continue oscillations of temperature.

For atmospheric corrosion of metals, the extreme temperatures do not an important role.

Atmospheric contaminants. The electrolyte film that forms on metallic surface contains various compounds resulted from the atmospheric pollutants. Karlson et al [9] observed a severe corrosion of steel if in atmosphere there is sulphur dioxide (SO_2) or alkaline chlorides (in principal NaCl).

Sulphur dioxide. SO_2, a product of combustion of fossil fuels containing sulphur, play an important role in atmospheric corrosion in urban and industrial atmospheres. For all metals, SO_2 appears to be selectively adsorbed from the atmosphere, less so for aluminum than for other metals, and for rusty steel it is almost quantitatively adsorbed even from dry air at

0^oC [2]. Under humid conditions sulphuric acid is formed, the oxidation of SO_2 to SO_3 being catalysed by metals and by metallic oxides.

For non-ferrous metals, SO_2 is consumed in the corrosion reaction whereas in the rusting of iron and steel it is considered [2] that ferrous sulphate is hydrolysed to form oxides and thus the sulphuric acid is regenerated. Sulphur dioxide thus acts as catalyst such that one SO_4^{2-} ion can catalyse the dissolution of more 100 atoms of iron [2]. The reactions can be summarized as follows:

$$Fe + SO_2 + O_2 \rightarrow FeSO_4 \quad (4)$$

$$4FeSO_4 + O_2 + 6H_2O \rightarrow 4FeOOH + 4H_2SO_4 \quad (5)$$

$$4H_2SO_4 + 4Fe + 2O_2 \rightarrow 4FeSO_4 + 4H_2O, at\ seq. \quad (6)$$

The high solubility of SO_2 (of 1300 times more soluble than O_2 in water) [2] would make it a more effective cathodic reactant than dissolved oxygen even though its concentration in the atmosphere is comparatively small.

Chlorides. The corrosion rates of the carbon steel increase in marine atmosphere due to its salinity [3]. Apart from enhanced surface electrolyte formation by hygroscopic salts such as NaCl and $MgCl_2$, direct participation of chloride ions in the electrochemical corrosion reactions is also likely. In case of the ferrous metals, chloride anions are known to compete with hydroxyl ions, to combine with ferrous cations produced in the anodic reaction. In the case of hydroxyl ions, stable passivating species tend to be produced. In contrast, iron chloride complexes are soluble, resulting in further stimulation of corrosive attack, according to reactions [10]:

$$Fe + H_2O \Leftrightarrow FeOH_{ads} + H^+ + e \quad (7)$$

$$(FeOH)_{ads} + Cl^- \rightarrow (FeCl)_{ads} + OH^- \quad (8)$$

$$(FeCl)_{ads} \Leftrightarrow Fe^{2+} + Cl^- + e \quad (9)$$

Other atmospheric contaminants, related to industrial emissions in specific microclimates are: hydrogen sulphide, hydrogen chloride, and chlorine that can intensify atmospheric corrosion damage. Hydrogen sulphide is known to be extremely corrosive producing Hydrogen Embrittlement Corrosion of alloys [11]. The corrosive effects of gaseous chlorine and hydrogen chloride in presence of moisture tend to be stronger than those of chloride salts anions because of the acidic character of the former species.

The deposition of solid matter from atmosphere can have a significant effect on atmospheric corrosion rates, particularly in the initial stages. Such deposits can stimulate the atmospheric attack by three mechanisms:

(1) reduction in the critical humidity levels by hygroscopic action;

(2) the provision of anions, stimulating metal dissolution, and

(3) microgalvanic effects by deposits more noble than the corroding metal (carbonaceous deposits deserve special mention in this context) and by different aeration, so it shows in Fig. 1.

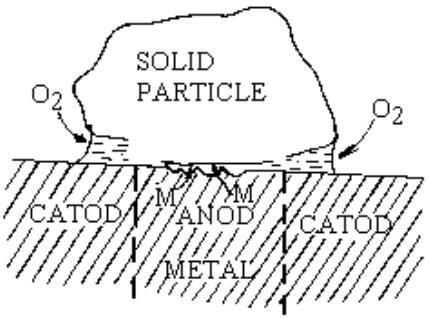

Figure 1 – Corrosion in centre of a surface covered by a solid particle

THE CORROSION PRODUCTS FORMATTED ON CARBON STEEL IN ATMOSPHERIC CORROSION

In presence of oxygen the ferrous hydroxide (reaction 3) oxidizes forming the rust. The iron corrosion products, the rust, have complex composition.

Hiller [12] given a scheme (figure 2) that shows the principal crystalline components of the rust and possible way of their formatting.

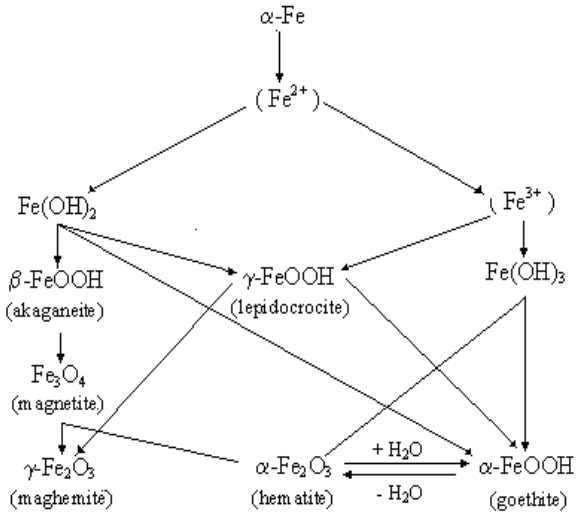

Figure 2 – Hiller scheme for the iron rust compounds [12]

In the first phase of the steel rusting forms $Fe(OH)_2$, which it oxidizes suddenly forming lepidocrocite (γ-FeOOH), a crystalline phase with rhombic structure. In function of water presence or absence, this isomerises in goethite (α-FeOOH), with rhombic structure also. If the corrosion rate is low, a part of lepidocrocite it transforms in maghemite (γ-Fe_2O_3), having a cubic structure.

Akaganeite(β-FeOOH), with tetragonal structure, it forms in the environments with high chlorides content. After Keller [13] akaganeite is the most unstable oxihydrate formed at corrosion steel. In humidity conditions this it transforms in magnetite (Fe_3O_4), having cubic structure. After Hiller [12] magnetite it forms only in direct contact with metal surface and in presence of a high humidity. This compound does not appear in the incipient phases of rusting; it is a product that forms in time from akaganeite, conform to the reaction:

$$2FeOOH + Fe(OH)_2 \rightarrow Fe_3O_4 + 3/2H_2 \quad (10)$$

Another oxihydroxide of iron, crystallite (δ-FeOOH), having a hexagonal structure, it forms especially in the

atmosphere with low humidity [14]. This can find and in the amorphous state– feroxite.

After K.A. van Oecteron [15] the most important compounds of the rust are oxihydroxides of iron and magnetite.

In presence of the pollutants and in the incipient stages of the carbon steel corrosion, sometimes, forms on metal surface the, so called 'green rust' [16-20].

Green rust is a mixture of hydroxide-salts of Fe(II, III) with formulae:

$$\left[Fe^{II}_{(1-x)}Fe^{III}_{x}(OH)_2\right]^{x+}\cdot\left[\frac{x}{n}A^{n-}\cdot\frac{m}{n}H_2O\right]^{x-} \qquad (11)$$

This has a structure in which the iron hydroxide layers with positive charge alternate with negative charged anion layers and with water molecules, leading to a hexagonal symmetry. The green rust is classified [21] in two types:

- green rust I, in which A^{n-} are anions with planar structure, as Cl^-;
- green rust II, in which A^{n-} are anions with three-dimensional structure, as, sulphate, carbonate, etc.

The change in corrosion rate with time varies markedly for different metals due to the differing degrees of protection conferred by the corrosion products. The behavior of steel is conditioned by the alloying elements present for any given environment. Thus the decrease in corrosion rate with time for carbon steel is very much slower than for low-alloy steel. This can attributed to the much more compact nature of the rust formed on the latter type.

CONCLUSION

The atmospheric corrosion, the most frequently corrosion type of the carbon steel takes place in presence of the humidity surface layer after the electrochemical corrosion mechanism. The principal parameters that determine the corrosion rate are: humidity temperature and presence of pollutants as sulphur dioxide and chloride ions. The carbon steel corrosion products – the rust – have a complex composition, being formatted of various iron oxides and oxihydroxides types.

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IMPLICATION OF NON-COMPLETION PROJECTS IN MALAYSIA

ABSTRACT:
The construction industry continues to occupy an important position in the nation's economy even though it contributes less than the manufacturing or other service industries. The contribution of the construction industry to national economic growth necessitates improved efficiency in the industry by means of cost-effectiveness and timelines and would certainly contribute to cost savings for the country as a whole. A major criticism facing the construction industry is the growing rate of delays in project delivery. Delay is a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. Thus, this paper is investigated the implication of non-completion in construction projects in Malaysia.

KEYWORDS:
Projects, Implications, Non-completion, Delay, Malaysia

INTRODUCTION

The construction industry continues to occupy an important position in the nation's economy even though it contributes less than the manufacturing or other service industries. The contribution of the construction industry to national economic growth necessitates improved efficiency in the industry by means of cost-effectiveness and timelines and would certainly contribute to cost savings for the country as a whole. A major criticism facing the construction industry is the growing rate of delays in project delivery. Delay is a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. In countries such as United State of America (USA), United Kingdom (UK) and Western Germany, Mobbs (1982) found that 'construction time' is better. The Construction Sector is one of the important sectors that contribute to Malaysia's economic growth. The sector accounted for nearly 3.3% of GDP in the year 2005 and employed about 600,000 workers including 109,000 foreign workers (MALBEX, 2005). The huge volume and complexity of projects in Malaysia's construction sector pose a great challenge and provide a wealth of opportunities to various companies in the construction industry. In Nigeria, Ajanlekoko (1987) observed that the performance of the construction industry time wise is poor. An investigation by Odeyinka and Yusif (1997) shows that seven out of ten projects surveyed suffered delays in their execution. According to Chan and Kumaraswamy (1993) timely delivery of projects within budget and to the level of quality standard specified by the client is an index of successful project delivery. When projects are delayed, they are either accelerated or have their duration extended beyond the scheduled completion date. These are not without some cost consequences. The conventional approach to managing the extra cost is to include a percentage of the project cost as contingency in the pre-contract budget. According to Akinsola (1996) conventional allocation of contingency is based on judgment. However construction projects are unique; as they may have a distinctive set of objectives, require the application of new technology or technical approaches to achieve the required result. This uniqueness makes the contingency allowance allocation based on assumption and intuition inadequate and unrealistic. An investigation by the authors revealed that in Nigeria 5–10% of pre-contract estimate is in most cases allowed as contingency. This allowance was found to be inadequate. Inadequate contingency implies extra financial commitments, which in some cases are beyond the capacity of the owner. Clients are in some cases not prepared for such extra cost and so fund inform of loan are sought to offset the unexpected costs.

PROJECT NON-COMPLETION/ABANDONMENT AND DELAY

Construction projects have been managed since time immemorial. Traditionally this was the responsibility of the "master of the works" – a concept retained in the modern French. It emerged as industrial societies started to build complex systems such as rail and power networks. Projects are classically defined by the need to complete a task on time, to budget, and with appropriate technical performance/quality. In recent decades, projects have tended to become more time-constrained, and the ability to deliver a project quickly is becoming an increasingly important element in winning a bid. There is an increasing emphasis on tight contracts, using prime contractor ship to pass time-risk onto the contractor.

i. Project Delay

Failure to complete a complete a project either by the original planned time or budget, or both, ultimately results in project delay. The social and economic costs of delay can be staggeringly high and to a certain extent cannot be absorbed by the industry. When a delay can no longer be absorbed by the client, it will result in the project being abandoned. Thus, it is important to predict and identify problems in the early stages of construction and diagnose the main causes and implement the most appropriate and economical solutions to prevent further negative impacts of delay. In construction, delay could be defined as the time over run either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time. Stumpf (2000) defined delay as an act or event that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity. He showed, in his article, that delay does matter, and that different methods for analyzing schedule delay lead to different results for the owner and contractor. Construction delays became an integral part of the project's construction life. Even with today's advanced technology, and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back (Stumpf, 2000).

ii. Project non-completion/Abandonment

There are several stages, as defined by the ministry, before a project is declared abandoned. If it has passed its promised delivery date by 10%, it is considered late; if the delay stretches beyond 10%-30%, then it is considered 'sick'; and finally, if no work has been carried out or no workers are on the project site for up to six months, then it is deemed abandoned (The star, 2009). Abandoned housing development means where a licensed housing developer had refused to carry-out or delayed or suspended or stopped or ceased works continuously for a period of six months or more or beyond the stipulated period of completion as agreed under a sales and purchase agreement (Sabah, 2005). A housing project is classified as "abandoned" by the Ministry of Housing and Local Government (MHLG) when there is no activity at the project site, continuously, for more than six months after the expected date of delivery of vacant possession. This is based on the date of the first Sale and Purchase Agreement (SPA) signed between the developer and a purchaser. A project is also classified as abandoned if, within this six month period, the developer has been wound-up and the company taken over by an official receiver or private liquidator recognised or affirmed by the Housing Controller, who is the Secretary-General of MHLG.

MALAYSIAN ABANDONED PROJECT

Project delays are known to affect project cost, workers morale, quality of completed works and the industry's reputation. Modern construction techniques and the use of sophisticated ICT tools on their own do no ensure that a project can be delivered on time. The right level of knowledge, experience, methods and management skills are needed to ensure a greater chance for projects to be completed on or before the deadlines. Delay is a serious problem in the construction industry. It is costly for both owner and contractor. The owner loses by missing out on the potential revenues from the use of the project and by increased overhead cost for contract administration and supervision. The contractor also loses due to increased costs in over-head and tied-up capital. His losses may include lost opportunities for new projects because of diminished financial capabilities. In public projects, the public may also be affected by the delay in the utilization of the facilities and by the extended inconveniences such as traffic disturbances. Delay, therefore, is an important issue to the construction industry. Investigation into this problem area is needed in order to better manage delay situations and to mitigate their consequences. Assessing the frequency of delay, the extent to which delay may occur, and the responsibility for delay can provide insights for early planning to control these factors and improve project performance. Every step prescribed under the Housing Development (Control and Licensing) Act (the Act) is being taken by the Ministry of Housing and Local Government (MHLG) to minimise the number of abandoned housing projects in the country. However, there are unforeseen circumstances

beyond the control of the ministry, such as the Asian financial crisis of 1997-98 and increases in the cost of building materials that have hurt many small housing developers and caused project abandonment. The public relies on this legislation and the enforcers to protect them in their quest for homeownership and many are fed-up with the lack or lax enforcement when problems surfaced. In the past, weak enforcement and monitoring had allowed errant developers to flourish. The previous Prime Minister, Abdullah Badawi was on 22.11.2005 quoted as saying: "If the projects have been monitored on a regular basis from the start, any sign of them being abandoned could have been detected and the projects salvaged" (Please see Table 1).

Table 1. Statistic of Abandoned Housing Project

STATISTIK PROJEK-PROJEK PERUMAHAN BERMASALAH (LEWAT, SAKIT & TERBENGKALAI)
SEHINGGA FEBRUARI 2009

BIL.	NEGERI	PROJEK LEWAT			PROJEK SAKIT			PROJEK TERBENGKALAI			JUMLAH		
		BIL. PROJEK	BIL. UNIT RUMAH	BIL. PEMBELI	BIL. PROJEK	BIL. UNIT RUMAH	BIL. PEMBELI	BIL. PROJEK	BIL. UNIT RUMAH	BIL. PEMBELI	BIL. PROJEK	BIL. UNIT RUMAH	BIL. PEMBELI
1	PERLIS	3	67	52	2	30	27	0	0	0	5	97	79
2	KEDAH	14	1,301	847	14	2,473	1,502	9	1,445	709	37	5,219	3,058
3	PULAU PINANG	32	4,162	2,415	18	4,123	3,607	10	6,517	4,784	60	14,802	10,806
4	PERAK	52	3,182	1,713	43	3,622	1,925	6	822	597	101	7,626	4,235
5	SELANGOR	39	6,130	3,221	68	21,972	17,998	39	21,733	14,642	146	49,835	35,861
6	WP KUALA LUMPUR	10	2,471	896	9	895	564	6	2,408	1,365	25	5,774	2,825
7	NEGERI SEMBILAN	17	2,276	936	10	1,135	948	20	4,743	2,383	47	8,154	4,267
8	MELAKA	9	510	350	6	1,448	1,033	7	1,109	570	22	3,067	1,953
9	JOHOR	15	1,142	508	30	6,958	5,053	32	9,280	5,419	77	17,380	10,980
10	PAHANG	9	779	181	7	1,000	750	11	3,866	1,972	27	5,645	2,903
11	TERENGGANU	3	261	213	3	52	48	1	21	20	7	334	281
12	KELANTAN	5	193	109	6	286	228	3	519	367	14	998	704
13	SABAH	0	0	0	1	455	45	4	326	260	5	781	305
14	SARAWAK	0	0	0	0	0	0	8	406	288	8	406	288
JUMLAH KESELURUHAN		208	22,474	11,441	217	44,449	33,728	156	53,195	33,376	581	120,118	78,545
PERATUS		36	19	15	37	37	43	27	44	42	100	100	100

Source: Ministry of Housing & Local Government
NOTE: These figures do not include unlicensed and 'commercial' project developers.

Between 1990 and December 2005, a total of 261 housing projects were identified as abandoned by MHLG. These projects totaled 88,410 units, involving 58,685 house buyers for properties valued at a total of RM8.04 billion. Of these, 87 projects were revived and completed by white knights and another six by Syarikat Perumahan Negara Bhd (SPNB). Of the 168 remaining, 149 projects were classified as having the potential to be revived. These contained 63,894 units involving 42,706 buyers and a total sales value of RM5.4 billion. Another 10 projects housing 4,191 units, 2,074 buyers and RM426.2 million in sales value have been taken over by new developers, while nine others involving 2,866 units, 1,364 buyers and RM 335.29 million in sales value were classified as "not viable for revival". Of the total 70,960 units abandoned in the 168 projects, 31,276 are high-cost houses, 18,731 medium-cost and 20,953 low-cost units. The total number of abandoned projects makes up only 1.3 per cent of the 13,286 projects implemented between 1990 and December last year. It must be noted that the developers that abandoned the 261 projects between 1990 and December 2005 had their licenses issued before the housing law was amended on Dec 1, 2002.

CAUSES OF NON-COMPLETION PROJECT

There are a number of factors behind the abandonment of a housing project:

i. Finance
ii. Poor marketing and sales strategies
iii. Technical problems faced during construction
iv. Problems caused by compensation demanded by squatters for resettlement.

The MHLG's findings have shown that 118 or 70 per cent of the 168 projects abandoned were due to the financial problems of developers. Another 23 (14 per cent) arose from poor marketing and sales strategies while 27 (16 per cent) failed over problems arising from squatter resettlement, poor company management and disputes between developers and contractors or with landowners (News Tarikh, 2006). There are financial problems of a developer caused by incidences such as the 1997-98 economic crisis. Crisis within the development company, including disputes between shareholders or embezzlement of progress payment collections, problems involving contractors and even disagreements with landowners are more reasons for abandoned housing projects. There are many reasons why delays occur. They may be due to:

i. strikes,
ii. rework,
iii. poor organization,
iv. material shortage,
v. equipment failure,
vi. change orders,
vii. Act of God and so on.

In addition, delays are often interconnected, making the situation even more complex (Alkass, 1996). The factors which may give rise to non completion or late completion of projects cannot be exhaustively discussed due to space constraints, so only some are dealt with below. It is the responsibility of the parties to take account of any risk which might distort the completion of the plant, its operation and revenue stream (Dow and Andrews-Speed, 1998). Lenders as well as sponsors need be aware of the events which may endanger the completion of the project and the implication of leaving such factors unabated.

i. Insolvency Of Contractor

The insolvency of a contractor engaged in the construction of housing might mean distortion for the completion schedule. This is particularly an instance where a turn-key contract proves inadequate to mitigate completion risk, unless the contractor's obligation had been guaranteed under a bond by a credit-worthy third party. Although it might not be possible to predict the contractor's state of affairs such as to determine impending insolvency, engaging an experienced, financially responsible and strongly capitalized contractor is a way to mitigate this risk.

ii. Cost Overrun

Cost overrun can arise from so many events which include: an increase in the cost of energy supply for

the construction, transportation cost, labour cost and material cost. Cost overrun may also arise from delay which can give room for inflation. Sometimes, design changes initiated by the owners or the government after the commencement of construction could so gravely invite cost overrun. Recently for instance, Multiplex Construction, the contractor in charge of the Wembley National Stadium in the UK has threatened to sue the clients for £150 Million allegedly being overrun cost it has suffered for the over 560 design changes made by the clients (Rogers, 2006). A power project experiencing cost overrun faces the risk of delay in completion pending the determination of the party committed or obliged to make provision for the overrun cost, unless adequate provisions had been made to salvage such eventuality. Sometimes, this determination emerges after a long and heated litigation process. Also, it could lead to outright non completion by frustrating the furtherance of construction work on the project where the party under obligation for the overrun cost is incapable of providing for it. This is especially so because power project sponsors, are often not as hugely capitalized as their oil counterparts, and in oil there is often resort to a great deal of joint ventures which helps to easily absorb such overrun risk.

iii. Currency Fluctuation

Whenever there is mismatch between one currency against another in a single project for loan disbursement and construction cost, there could arise the issue of currency fluctuation. The construction phase for a conventional plant has an average lead time of at least three years (Beck, 1994); thus within this time; cost overrun could set in arising from an unfavourable fluctuation of exchange rate. An example could be a loan denominated in British Pounds Sterling for which construction contract and machinery accessories are in American Dollars. A devaluation of the Pounds Sterling against the Dollar would mean that more Pounds would be needed to fulfill the completion of the original plan. This was the case in Indelpro polypropylene plant in Mexico, where cost overrun was experienced partly as a result of fluctuation of the Mexican Pesos rate against the American Dollars (IFC, 1999). Thus currency fluctuation is an issue for consideration in mitigating completion risk. Lenders can explore a host of methods, including but not limited to denominating the loan currency in the currency of the technology to be adopted, however where this is not practicable.

iv. Regulatory Changes

There could be delays due to changes in policies, standards and regulations; these could also result in extreme cases of non-completion/cancellation. In the United States (US), majority of the unjustifiable cancellations of nuclear plants were blamed on constraints set in by ever evolving regulatory requirements (Joskow and Schmalensee, 1983). Often, some conditions like requirements to use modern and costly technology, are subsequently imposed which have the effect of eroding the bankability of the project, and for which the lenders would never have advanced capital had they been put in place from the very beginning. The difficulty has always been borne by parties who had no fault, drawn from the change in government regulation of the enterprise. With ever increasing environmental standards, it becomes even worse to predict what environmental compliance would be required of a power plant by the government. This is a potent risk in view of the long lead times of a conventional power plant. Environmental regulation contributed to the California electricity debacle - it was more cumbersome to get sitting and permitting approvals for new plants than in other US states and also the legal system gave the inhabitants and environmental groups the right to substantially delay the construction of new plants leading to inability to complete plants as scheduled.

v. Contractual Disputes

Disputes may be inevitable whenever parties to a contract have duties and obligations. With the several contracts needed to put a housing project into operation (concession, construction, loan, shareholders, interlenders, power purchase agreement and so on), the non existence of well established institutions and processes for dispute resolution, could lead to delay in completion of a housing project. Court proceedings are often presided over by judges who have no special training in the kind of contracts involved; and could also evidence very extensive delays. This is an area that a lender should not ignore in its objective to see the project completed according to schedule. Arbitration is the easy alternative since it gives the parties the flexibility to frame the process to suit their own peculiar circumstance, but even that is not a final solution in itself since arbitration awards will have to be enforced by a regular court. In India for example, a dispute concerning transfer of technology cannot be a subject of arbitration and the courts will not enforce any such award.

IMPLICATION OF NON-COMPLETION PROJECT

Abandoned housing projects have certain implications on the affected parties. Losses and difficulties faced by house buyers in servicing the interest on housing loans they have taken while paying house rental as well is one. The revival of an abandoned project involves:

- *High capital injection, either by the developer or by other parties interested in reviving the project. This is due to vandalism at the project site, price increases of raw materials and changes in building requirements.*
- *Developers also face non- performing loans and land-owners risk their land being foreclosed.*
- *There is also, the possibility that a project may no longer be viable for revival or that no company is interested in reviving it. All these mean a loss to the economy.*

Non-completion projects have certain implication on the affected parties. Managing and reviving a non-completion project is a complicated affair involving the developer, purchaser, financer, landowner and

other parties. It will take time for all parties to reach a consensus since each parties want to protect their interest. When a single building is faced case of non completion, there is usually a confrontation between these parties. What to do with the project and who has to pay are usually sensitive issues that end up in costly and slow lawsuits. Abandoned buildings also have a significant impact towards socio economics nature and environment. Some closed ended implications are as follows:

i. End user/ house buyers

The consequences of abandoned housing projects are many. Some of them are, first, on part of the purchasers, they surely are unable to occupy the houses on time as promised by the developers in the Sale and Purchase agreement. The construction of the houses are terminated and partly completed which results to the fact that they are useless for occupation for a long duration of time (mostly), unless they could, expeditiously be revived. Apart from the inability to occupy the houses, the purchasers too have to pay monthly installments to their banks. This is pathetic as the purchasers have to part with their monies but they could not get the houses. There are many side effects to home buyers especially those who still do not have their own homes and are forced to rent a house while waiting for the house is completed. They had to bear interest bank loans in addition pay the cost of rental houses while. This is their burden of middle income and low cost of living due to the increasing. There are not uncommon cases, where banks had made the purchasers bankrupt on the ground that they failed to pay monthly installments.

ii. Developers/ clients

Developer or client who is interested in reviving the project was burdened by the high capital injection. This is due to vandalism at the project site, price increases of raw materials and changes in building requirements. They also face non-performing loans and yet the land being foreclosed. Consequently, there is the possibility that the project may no longer viable for revival or there is no company interested to invest in the project. All these mean a loss to the economy. Private sector failures are sometimes solved by the public administration so the transfer of cost happened between private and public sector.

iii. Illegal activities are conducted

Studies showed that abandoned buildings are magnets for crime. First, they provide centres for the pursuit of a range of criminal activities, including prostitution, the consumption and trafficking of drugs, and crimes against property. Evidence of this is found in Spelman's (1993) study of 59 abandoned residential buildings in a low-income Austin, Texas neighborhood. Of these buildings, 34% were being used for illegal activities. Of the 41% of buildings that were unsecured, some 83% were being used for illegal activities (Spelman, 1993). Greenberg and other's (1990) study of TOADS in the 15 largest American cities finds that vacant buildings are frequently used as crack houses, and cites the use of TOADS as locales for drug dealing as one of the most prominent social ills associated with abandonment. According to Spelman (1993), abandoned buildings are ideal places to trade, conceal, and consume drugs. Activity within them is rarely visible from the street, while police officers are reluctant to enter abandoned buildings for legal reasons, because of general uncertainty and the possibility of danger and because of the low probability of a worthwhile payoff (i.e. slight chance of making an arrest). Evidence of drug use was found in 19% of the abandoned buildings in Spelman's study. Spelman (1993) also finds evidence of sexual activity and prostitution in 20% of the buildings in his study, and evidence of two different types of crimes against property. First, almost all of the unsecured buildings in Spelman's study are found to have been plundered by trespassers. Copper piping and wire, appliances, carpets and furniture are favorite targets. Second, 8% of the buildings in the study are found to be housing goods ranging from wallets to lawn furniture to bicycles stolen elsewhere. Abandoned buildings are not just centres where illegal activities are conducted. They also provide meeting places where offenders who perpetrate crimes elsewhere can gather, meet and plan their activities. Spelman (1993) suggested that abandoned buildings are well suited for this purpose because they physically shield criminals from the attention of outsiders. He even argues that, used as meeting places, abandoned buildings might actually foster and exacerbate criminal tendencies. This occurs as the lack of the usual social surveillance mechanisms erodes the self -control of those who meet there, while promoting group cohesion and the illusion of invulnerability. A clear association between abandoned buildings and neighborhood crime rates emerges from Spelman's (1993) study. City blocks blighted by unsecured abandoned buildings were found to suffer crime rates (including cases of drug, theft, and violent crimes) that were twice as high as those found in "control blocks" characterized by the absence of abandoned residences. Of course, this is not definitive proof that abandonment fosters criminal activity — perhaps the crime pre-dated and actually caused the abandonment, rather than the other way around. This possibility must be taken seriously because of the evidence that crime causes abandonment in Newman (1980). Spelman (1993) argues, however, that the "crime causes abandonment" thesis is not consistent with the qualitative features of the pattern of abandonment observed in Austin, Texas during the later 1980s. For example, abandoning owners were largely absentee landlords not local residents, who were responding to plummeting real estate prices throughout the region, not block specific characteristics such as crime rates. This provides some indication that the association between abandonment and neighborhood crime rates in Spelman's study is, indeed, explained by the notion that abandonment causes crime.

i. Cost overrun and time overrun

Cost overrun and time overrun (elongation of project duration) were the two most frequent effects of delay in the construction industry. Delay had significant effects on actual project duration. The model relating delay and actual project duration provide a benchmark for future research work in the study of project management in Nigeria and also facilitate comparison with other countries. Loss and expense claims arising from delay and fluctuation claims during the delay period had significant effect on cost overrun. The models provide a benchmark for future research work in the study of project management in Nigeria and also facilitate comparison with other countries. Loss and expense claims arise from ascertained and approved delay caused by the client or his agent. The significant effect of loss and expenses claims on project cost overrun suggests that clients are a significant cause of delay in Nigerian building projects. This corroborates the result of a previous study where client-related delay was found to be significant. Delays in project completion seem to be a perennial problem and the lack of oversight by various ministries and departments in the procurement of goods and services continue to cost the Government hundreds of millions of ringgit. Delays in project completion, work not done in accordance with the original scope of works will increased project costs due to the inclusion of procurement of equipment and assets in the scope of works, unutilised facilities upon completion, improper payments made for works not done and shortage of officers in project supervision. These range from multi-billion ringgit infrastructure projects to the procurement of laptops and maintenance of government assets. For example, Kolej Kemahiran Tinggi Mara Balik Pulau in Penang paid RM 84, 640 for two laptops or RM 42, 320 per laptop and spent RM2.08mil on computer software that was not used, among other things. Then, there is the over RM15mil the Perak government spent on new purchases of cars and maintenance over the past four years and still not being able to manage its vehicles properly.

ii. Dispute and Arbitration

Furthermore, associated delay problems can also result in dispute, arbitration, total abandonment and protracted litigation by the parties. To some extent the contract parties through claims usually agree upon the extra cost and time elongation associated with delay. Nevertheless, this has in many cases given rise to heated arguments between the owner and contractor. The question of whether a particular delay to progress of work warrants an extra cost and or extension of project duration is usually the cause of disagreement. Such situations, usually involve questioning the facts, causal factors and contract interpretation, which have been addressed by (Alkass et al., 1995). In specific terms, Odeyinka and Yusuf (1997) have addressed the causes of delays in Nigeria building projects. Another problem that has been identified is the disagreement prevailing among the purchasers, bankers, local authorities and the contractors concerned when it comes to revive the abandoned housing projects. This problem is complex as is evident in many cases. Consequently, the projects could or may not be rehabilitated as there is no common consensus among them.

iii. Rehabilitation Problem

Further to aggravate and worsen the situation, in the event there are plans for rehabilitation, the plans and attempts to rehabilitate are not easy. Many impending problems and difficulties, neither subtle nor obvious, would be awaiting the purchasers and the developers. Among the traumatic problems are the impossibility to revive the projects as the projects have been too long overdue without any prospect of reviving and to rehabilitate them, needing additional and substantial costs and expenditure. Cases show that most of the purchasers are reluctant to take additional money out from their own pockets on the ground, 'that it was not their fault', as the 'fault was squarely due to the developers'. 'Thus, the developers concerned should advance their own money to revive the projects'. Matters would not be settled that easy since most of the developers involved do not have enough money, which may be due to poor management or they had calculatedly siphoning off the company's assets and monies through unreasonable directors' allowances and high overhead operating costs. Worst still and of all, most of them have been wound up and the directors have absconded, unable to be traced and contacted.

iv. Delay on completion Time and Delay on Payment

Delays defer income, while interest keeps accumulating. Long delays may result in projects ending up in the so-called 'interest trap' (Flyberg et al., 2004), where a combination of escalating construction costs, delays and increasing interest payments result in cost overrun. According to Arditti et al., (1985), lengthy delays in inflationary environments increase cost overruns tremendously. The overall lack of finance to complete a project, or delays in the payments for services by the project owners or clients can lead to significant problems. If the costs of a project have increased significantly beyond the original estimate, then work on the project may have to be stopped or be delayed until additional funds can be found. Delays on payment may some times provoke the contractor to claim for interest rates. If the payment by a project owner is slow, the contractor may begin to commit fewer resources to a project, and may even cease work if cash flow becomes a problem.

v. Late Site Hand Over or Change of Location of Construction site

Late hand over of construction sites, some times may happen and substantially increase the cost of construction projects. In most international projects in Ethiopia late site hand over is a common form of claim source for compensation for contractors (Girmay, 2003). For example, the Addis Ababa Bolle International Airport Project has suffered an

additional cost of about $1,000,000.00 USD due to late site hand over (Girmay, 2003). Fortunately, domestic contractors do not ask for compensation due to late site hand over. Sometimes the owner may decide to change the location of the project after the award to the winning contractor. This is a rare phenomenon butt it does happen due to sudden and unavoidable circumstances. The change of location of a project might extensively change the entire character of the work that was initially required under the (awarded) contract or the new location of the construction site may have different sub surface condition that may necessitate the structure to be redesigned. In such cases it is rightly alleged that the changes do alter the "general scope of work" and therefore, the final cost of the project might exceed the original contract amount.

vi. Acceleration Costs

Acceleration occurs when a project has been delayed, yet the owner demands that the contractor completes the contracted work before the contract completion date, or agreed upon changed completion date, or when the contractor wants to complete early. When acceleration occur the contractor typically will incur additional direct and indirect costs. While direct costs are relatively easy to quantify, indirect costs are difficult to identify and quantify (William, 2002). If the contractor establishes a valid acceleration claim, it is entitled to recover the costs incurred. These costs may include increased mobilization and demobilization costs due to the need to commit additional resources in terms of labor, equipment and supervision at the project than originally contemplated by the original schedule; specifically, direct labor costs include such items as increased wage costs for additional workers, overtime pay and rental costs for additional equipment. Further, the contractor may incur additional costs for inefficiencies in labor. These inefficiencies may include congestion or fatigue from extensive overtime work. Labor inefficiencies are a hidden butt very expensive cost of acceleration. Nevertheless, while labor inefficiencies are a very real part of an acceleration cost, they are extremely difficult to quantify.

vii. Environmental impacts:

Visual impact: View quality is partially dependent on relatively unchanging landscape elements like mountains or valleys; views are also affected by more readily altered landscape features, particularly built structures such as buildings (Miller, 2001). In case of abandoned buildings view quality can be seriously deteriorated, especially if towering over flat coastal areas where the visual field is wide and open. Puntillo Del Sol building (Tenerife) is composed of two enormous unfinished and badly preserved fifteen-storey buildings. Its dilapidated appearance and its location at the top of a cliff generate a huge negative visual impact (CIEM, 2003). Similar visual impact has Azaña Hotel, also in Tenerife, a twenty-storey building seriously deteriorated. In these and other cases, and in accordance with Kearny et al., (2008), the existing regulations do not meaningfully reflect general public attitudes regarding visual impacts.

viii. Landscape modification.

The original topography is significantly changed once urbanisation process starts. Waste soils, gravels and residues, temporary soil piles on construction sites, vegetation elimination and asphalt cover are common actions during urbanisation. These processes change progressively the especially sensitive coastal landscapes. Once the coastal stretch has become superficially indistinguishable from the rest of the hinterland's landscape in terms of vegetation and apparent sedimentary inactivity, development pressures and the absence of strict planning controls leads to encroached urbanisation in a number of prime locations. For instance Costa Esury housing development, in Huelva, consists of 2,184 houses (half of them under construction), two shopping malls, hotels and two golf courses. All of the latter elements are also under construction. The current bankrupt situation of the building company has paralysed the works. Up to date the landscape has changed drastically, and what before was riverside land nowadays is half-built housing development.

ix. Erosion

At most locations, the occupation of the back-beach by infrastructural work has affected the littoral dynamics in a predictable way. The back-beach, which had previously been effective as a coastal defense feature through the provision of protection in rare severe wave conditions, became fixed by vegetation during relatively long periods of inactivity. In the most highly urbanised sections of the coastal fringe, the complete elimination of the back-beach as a morphological feature has occurred. Also digging and moving of soil and rocks leave abandoned loose earth and residues. Experimental studies and field investigations show that loose silt and earth piles formed by urban construction can be eroded seriously (Hu et al., 2001). In Lanzarote, the tracks generated thirty years ago during the construction phase of Atlante Del Sol site still remain. These tracks cause severe erosion problems in the area. The vegetation is unable to remain in these conditions as the little forest cover of the soil disappears and the area become more vulnerable to erosion. The deterioration of Puntillo Del Sol Building in Tenerife and its possible collapse are considered serious environmental hazards. It can produce erosive phenomena and affect to the Cabrera precipice and to the inter-tidal space located down the precipice (CIEM, 2003).

x. Biodiversity decrease

As coastal habitat conservation is directly related to species conservation, degradation of coastal areas would end in a decrease of biodiversity. Club Mediterranee de Cadaqués, in Catalonia, is located in the high ecological value area of Cap the Creus, part of the Natura 2000 network and Especial Protected Area. It is the damage to biodiversity and ecological values resulting from the abandoned of the resort what has driven Public Administration to order its

demolition (BOE, 2008). Atlante Del Sol is located in an arid area of Lanzarote Island, but despite extreme conditions this area is rich in species of plants (CIEM, 2008). However, due to the fragility of this ecosystem, plants population has decreased in the surroundings areas of the abandoned building due to the erosion process described above.

xi. Pollution

Abandoned buildings usually trigger the creation of uncontrolled and unsupervised garbage disposal. As the case of Arenales Del Sol Hotel, in Alicante, this is dirty, full of garbage, an attraction to rats and a focus for illnesses. Besides garbage, half-built housing development may bring other kind of pollution. In Costa Esuri, Huelva, some people are currently living without sewage treatment plant. The pollution generated is being noticed downstream the Guadiana´s river, where organic pollution is increasing. Pollution effects can be summarise as a decrease of water quality for aquatic life and recreational activities, eutrophication, alteration of ecological conditions and increase of illnesses related to water (DHG, 2009).

MEASURES TO PREVENT NON-COMPLETION /ABANDONED PROJECT

These are some of the measures MHLG has taken to prevent housing projects from becoming abandoned:

- *Tightening procedures for issuance of housing development licenses and focusing on a developer's financial capacity;*
- *Continuous project monitoring through Form 7f;*
- *Regular visits to the project site and developer's premises to counter-check information provided in Form 7f;*
- *Exercising greater control over the Housing Development Account to ensure compliance with the Housing Development Regulations;*
- *Counter-checking all claims made on the Housing Development Account;*
- *Ensuring developers submit their annual audited financial reports;*
- *Taking legal action against developers for offences; under the Act and its Regulations; and*
- *Allowing licensed developers to apply for the minister's permission to revoke SPAs should they be unable to fulfill their obligations to purchasers.*

EFFORT TO REVIVE ABANDONED PROJECT

Since housing projects are abandoned at various stages of construction for a variety of reasons, MHLG has adopted several approaches in the revival process. However, its main role is to:

- *Act as mediator/facilitator to house buyer committees, financiers and developers to determine the direction of the revival scheme;*
- *Act as adviser to project revivers (white knights) and other affected parties to ensure their full co-operation and commitment to revive the scheme;*
- *Request SPNB to conduct viability studies to revive and complete a project should no other party want to;*
- *Allow for winding up of a developer and placing of a project under an official receiver or applying for a court order to appoint receivers and managers, or a white knight to revive it with the consent of the majority of the buyers;*
- *Allow a project financier, as debenture holder, to use its powers to appoint receivers to take control, revive and complete a project;*
- *Direct a company to assume, control and carry on the business of a developer vide the minister's powers under Section 11 (1) (c) or to use Section 11 (1) (d) to direct a developer to petition the High Court to wind up its business.*

STAGES IN REVIVING AN ABANDONED PROJECT

Basically, all abandoned housing projects are first classified as having the "potential for revival". Subsequently, this classification is further stream-lined into four categories.

The first category is for abandoned projects newly identified in a particular year. At this stage, MHLG will focus on information gathering and allow for the appointment of a receiver or private liquidator for the developer, with the winding-up petition being served. Thereafter a feasibility study will be conducted on the project. This is normally done one year or more after the project is declared abandoned. It is at this stage that white knights may surface with project revival proposals. The MHLG will act as facilitator, giving advice and guidance to all affected parties.

The third stage in project revival is the selection of a white knight and ensuring all affected parties have reached a consensus on the project revival proposals. At this point, MHLG will act as a coordinator between the white knight and other technical agencies in order to speed up the approval of plans for the project to take off.

The fourth stage is when the contractor is appointed and construction is under way.

PROBLEMS REVIVING ABANDONED PROJECTS

Managing and reviving an abandoned project is a complicated affair involving the developer, purchasers, bridging financier, landowner and other parties. It will take time for all parties to reach a consensus, since each wants to protect its interest. Some of the hurdles MHLG faces in reviving abandoned projects include:

- *The involvement of the developer in other business activities or in a company with a diversified business portfolio. Though a Housing Development Account has been opened for the project, the receivers will take stock of all the developer's financial accounts when it goes into receivership. While project revival and debt settlement remain a priority, at times there would be very little left in the account to complete the project and settle liabilities.*
- *When a developer is wound-up, the master charge is to get the first priority for debt repayment - and it usually wants the project foreclosed.*

- Developers also impose conditions in their consent for project revival in order to get returns for the effort they have put in from the parties reviving the projects.
- Some developers don't own the land they are developing, so the rights of the landowners cannot be denied, especially if they have imposed conditions to protect their rights.
- Consultants of developers who are in possession of detailed or amended building plans often refuse to cooperate with receivers or liquidators until their dues are paid.
- Purchasers often insist that the late delivery clause in a SPA be honored, or that no additional payment be imposed on them to revive the scheme.
- Drawn-out court battles against developers by squatters, landowners, bridging financiers or contractors over contractual matters may further delay the revival of a project.

CONCLUSION

The issue of non completion of construction projects is one that has tremendous effects on the industry and economy of the country. From this research, we have identified the implications of non completion of projects from high capital injection, inability to occupy houses on time by the end users, building being subject to crime, cost and time over run, disputes, arbitration and protracted litigation by parties, difficulty in rehabilitation, project delay, increased cost of construction, environmental implications such as altered landscape view, unsightly scenery due to wastes, residues, soils etc, erosion, pollution, biodiversity decrease; socio-economic implications such as unemployment increase, conflicts between the public administration and the private sector, loss of economic value of the project and the area at large, consequential marginalization of the population to unwarranted transfer of cost between private and public sector; and numerous causes of non completion of projects which includes inadequacy of finance, poor marketing and sales strategies, technical problems faced during construction, problems caused by compensations demanded by squatters for resettlement, insolvency of contractor, cost overrun and currency fluctuation amongst others. We have also identified some possible measures towards cropping this problem both from the public and private sector namely: tightening procedures for issuance of housing development licenses and focusing on a developer's financial capacity; continuous project monitoring through Form 7f; regular visits to the project site and developer's premises to counter-check information provided in Form 7f; exercising greater control over the Housing Development Account to ensure compliance with the Housing Development Regulations; counter-checking all claims made on the Housing Development Account; Ensuring developers submit their annual audited financial reports; taking legal action against developers for offences; under the Act and its Regulations; and allowing licensed developers to apply for the minister's permission to revoke SPAs should they be unable to fulfill their obligations to purchasers.

We observed that there have been efforts made by the government towards reviving abandoned and non completed projects and some problems faced in this course. However, it is important to note that abandoned projects do not benefit the construction industry and has negative effects on the economy of the country and most effectual on the end users. It is therefore, expedient that efforts are made jointly by the public and private sector to crop this problem.

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ACOUSTICAL PARAMETERS OF POROUS MATERIALS AND THEIR MEASUREMENT

ABSTRACT:
Acoustical parameters of porous materials give the necessary and important information for noise control engineers. Profound knowledge their physical characteristics enable an effective sound absorber material design. The theory of sound-absorbing materials has progressed considerably during the last decade. A noise control engineer with serious interest in sound absorbing technology is advised to study all this parameters.
Noise control engineers frequently face problems of design sound absorbing materials that provide the desirable sound absorption coefficient that minimizes the size and cost, does not introduce any environmental hazards, and stands up to hostile environments. The designers of those absorbers must know how to choose the proper material, its geometry and the protective facing. Porous sound-absorbing materials are utilized in almost every areas of noise control engineering. This paper deals with the acoustical parameters of porous materials and their measurement.

KEYWORDS:
porosity, flow resistivity, tortuosity, measurement

INTRODUCTION

A small part of the acoustical parameters used to describe the visco-inertial and thermal behavior of acoustical porous materials are directly measurable. This is the case for the open porosity, the static air flow resistivity and the high frequency limit of the dynamic tortuosity.

OPEN POROSITY

The open porosity, term commonly reduced to "porosity", refers to the ratio of the fluid volume occupied by the continuous fluid phase to the total volume of porous material. For acoustical materials, its range of values is approximately [0.70 0.99]. The schematic representation of an acoustical porous medium is shown on figure 1. The fluid phase, in white, is made up of a network of connected pores. The closed pores are considered to be a part of the solid phase, in grey. [9].

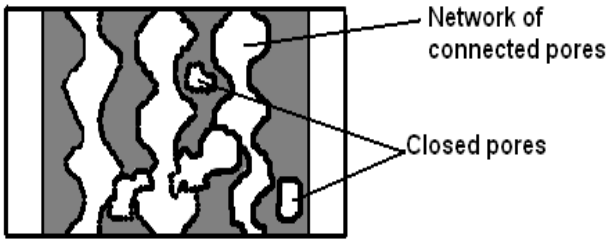

Figure 1. Schematic representation of an acoustical porous medium [9]

Open porosity measurement

The porosity can be directly measured and there are several methods to do so [2].

The gravimetric measurement of porosity requires the weighing of a known volume of dry material. Shot can be separated from fiber by a centrifuge process. The dry weight can be used together with the sample volume to calculate the bulk density ρ_B. Subsequently an assumed solid density is used to calculate the porosity h from [7]:

$$h = 1 - \frac{\rho_A}{\rho_B} \qquad (1)$$

where: h - is the porosity, ρ_A- is the solid density [kg.m^{-3}], ρ_B - is the bulk density [kg.m^{-3}].

A gravimetric method may be used with some consolidate granular materials is to saturate the sample with water and deduce the porosity from the relative weights of the saturated and unsaturated samples. Mercury has been used as the pore-filling fluid in some applications, but for many materials the introduction of liquids affects the pores.

The dry method of porosity determination has been developed by Champoux et al.[3] is based on the measurements of the change in pressure within a sample container subject to a small known change in volume. The lid of the container is a plunger, which is driven by a precise micrometer. The pressure inside the chamber is monitored by a sensitive pressure transducer and an air reservoir connected to the

container through a valve serves to isolate the system from fluctuations in atmospheric pressure. The system has been estimated to deliver values of porosity accurate to within 2%. This method measures the porosity of connected air-filled pores. However the gravimetric methods do not differentiate between sealed pores and connected pores. The open porosity measurement apparatus is shown on figure 2.

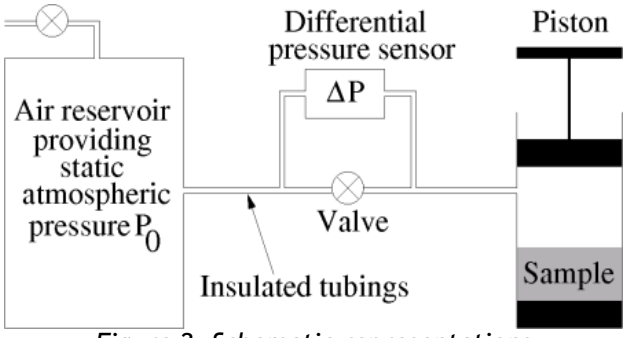

Figure 2. Schematic representations of the open porosity measurement apparatus presented by L. Beranek [9]

An acoustical (ultrasonic) impulse method for measuring porosity using the impulse reflected at the first interface of a slab of air-saturated porous material has been proposed and has been shown to give good results for plastic foams.

STATIC AIR FLOW RESISTIVITY

The static air flow resistivity, term commonly reduced to "resistivity", is one of the two most known parameters, with the open porosity, used to describe the acoustical behavior of porous materials. It characterizes, partly, the visco-inertial effects at low frequencies. Sound is vibrations in the air, so it is easy to imagine that sound cannot easily propagate through materials which air can hardly pass through [10]. In other word, flow resistivity can represent the difficulties of the propagation of sound (air-borne sound) in the gap in porous materials. A material such as iron and rubber etc. which air cannot pass through easily does not propagate the air-borne sound but propagate only the structure-borne sound (vibration). The models by Delany-Bazley [4] and Delany-Bazley-Miki [6] use only this parameter to describe the behavior of fibrous acoustical materials.

For bulk -, blanket -, or board-type porous materials the flow resistivity R_1 is defined as specific flow resistance per unit thickness [7]:

$$R_1 = \frac{R_f}{\Delta x} \quad [N.s.m^{-4}] \text{ or } [Pa.s.m^{-2}] \qquad (2)$$

where:

R_f - is the airflow resistance [N.s.m^{-3}] or [Pa.s.m^{-1}],

Δx- is the thickness of the layer [m].

The flow resistivity is a measure of the resistance per unit thickness inside the material experienced when a steady flow of air moves through the test sample. Flow resistance R_f represents the ratio of the applied pressure gradient to the induced volume flow rate and has unit of pressure divided by velocity. [7]

$$R_f = \frac{\Delta p}{\upsilon} \quad [N.s.m^{-3}] \text{ or } [Pa.s.m^{-1}] \qquad (3)$$

where:

Δp- pressure [N.m^{-2}] or [Pa],

υ - velocity [m.s^{-1}].

If a material has a high flow resistivity it means that it is difficult for air to flow through the surface. For acoustical materials, its range of values is approximately [10^3 10^6]. [9]

STATIC AIR FLOW RESISTIVITY MEASUREMENT

The resistivity can be directly measured [5]. The measurement of the flow resistance and flow resistivity of porous building materials has been standardized on a compressed-air apparatus [1]. In this measurement the pressure gradient across the sample in a fixed sample holder is monitored together with various flow rates. Compressed air is passed through a series of regulating valves and very narrow opening into chamber E. This creates an area of low pressure immediately in front of the three tubes connected to the rest of the system. Air is drawn from the environment through the sample as a result of the pressure differential. The rate of airflow through the system is controlled by three flowmeters, giving a total measurement range between 8.7 and 0.1 L/min. Normally the flow rate must be kept below 3 L/min to avoid structural damage to the sample. The schematic representation of compressed-air apparatus for laboratory measurement of flow resistance is shown on figure 3. [7]

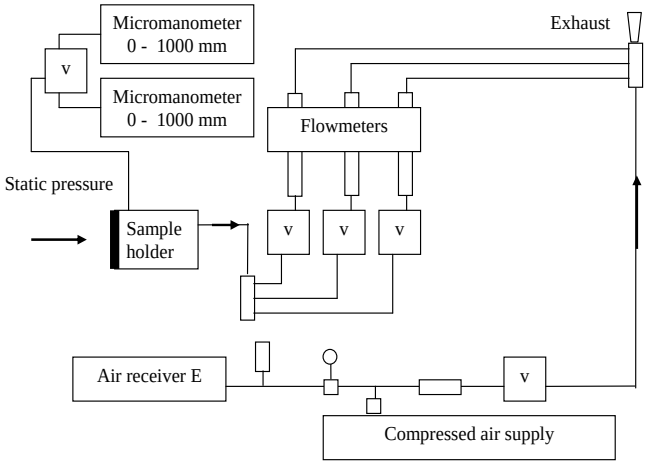

Figure 3 Schematic representation of a compressed-air apparatus for laboratory measurement of flow resistance [7]

A comparative method [8] makes use of a calibrated known resistance placed in series with the test sample. Variable capacitance pressure transducers are used to measure pressure differences across both the test sample and the calibrated resistance. For steady, nonpulsating flow, the ratio of flow resistance equals the ratio of measured pressure differences. The schematic representation of this apparatus is shown on figure 4.

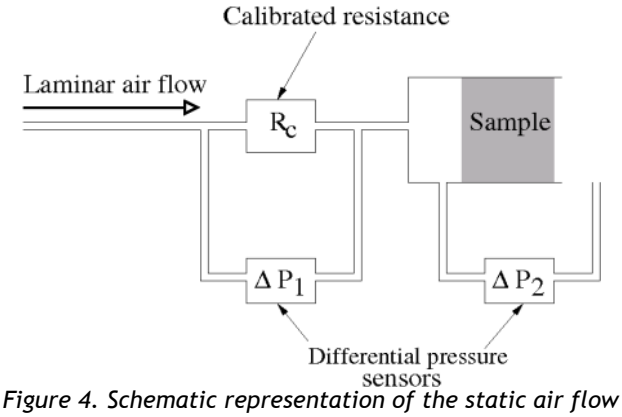

Figure 4. Schematic representation of the static air flow resistivity measurement apparatus presented in [ISO 9053]

TORTUOSITY

The tortuosity or the structural form factor of the material takes into account the curliness of the pores (see figure 5).

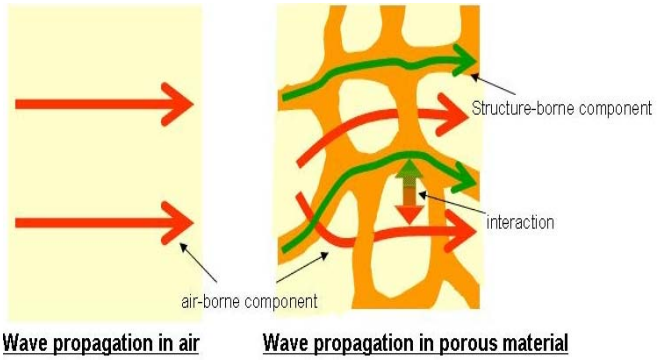

Figure 5. The sound propagation in the air (left) and in a porous material (right)[10]

Tortuosity is responsible for the difference between the speed of sound in air and the speed of sound through a rigid porous material at very high frequencies. Tortuosity is related to the formation factor used to describe the electrical conductivity of a porous solid saturated with conducting fluid. Indeed tortuosity can be measured using an electrical conduction technique in which the electrical resistivity of such a saturated porous sample is compared to the resistivity of the saturating fluid alone. Thus:

$$T = \frac{F}{h} \qquad (4)$$

where:
h - is the porosity of the sample,

F - is the formation factor defined by $F = \frac{\sigma_S}{\sigma_f}$ *where* σ_f *and* σ_S *are the electrical conductivities of the fluid and fluid saturated sample, respectively. These in turn are defined by* $\sigma = \frac{GL}{A}$ *where L is the length of the sample, A is the area of the end of the sample, and G is the ratio of the resulting current to the voltage applied across the sample. [7]*

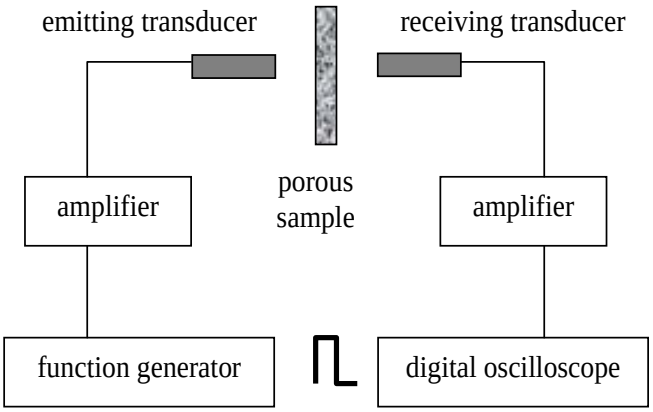

Figure 6. Schematic representation of the tortuosity measurement apparatus [11]

Tortuosity measurement is based on the measurement of formation factor. To measure the formation factor, first a cylindrical sample of the material is saturated with a conducting fluid. Saturation is achieved by draving the fluid through the sample after forming a vacuum above it. Agitation of the sample is also required if the pore sizes are small. A voltage is applied across the saturated sample placed between two similarly shaped electrodes at a known separation. The conductivity of the fluid is measured at similar voltages within a separate fluid-tight unit. The use of separate current and voltage probes assures a good contact between the end of the sample and the electrodes, eliminates problems associated with voltage drop at the current electrodes, and allows the simultaneous measurement of the electrical resistivities of the fluid and the saturated porous material. Tortuosity can be measured by measuring the velocity of sound which is transmitted in the fluid that fills the porous material, in ultrasonic domain. Therefore, the measurement system is composed of sensors for transmitting and receiving ultrasound, power amp and oscilloscope.

CONCLUSION

Acoustical parameters of porous materials give the necessary and important information for noise control engineers. Profound knowledge their physical characteristics enable an effective sound absorber material design. The theory of sound-absorbing materials has progressed considerably during the last decade. A noise control engineer with serious interest in sound absorbing technology is advised to study all this parameters.

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STUDIES ABOUT THE TOTAL QUALITY MANAGEMENT CONCEPT

ABSTRACT:
Total Quality Management is an organizational strategy founded on the idea that performance in achieving a quality education is achieved only through involvement with the perseverance of the entire organization in improving processes permanently. The objective is to increase the efficiency and effectiveness in satisfying the customers.
The concept of quality has undergone several stages, adapting to every level of technology and market requirements. Thus, gradually, the selection of finished class performance has been replaced by statistical control of quality parts on-stream, then to extend the process, becoming, through the concept of quality an important factor in delivering products and services.
The paper presents some fundamentals aspects about the Total Quality Management (TQM) concept. In is pointed out the representative models: Oakland, SOHAL, three dimensional and also some representative areas of TQM interest.

KEYWORDS:
quality, management, TQM, models, areas of interest

INTRODUCTION

Total Quality Management is an organizational strategy founded on the idea that performance in achieving a quality education is achieved only through involvement with the perseverance of the entire organization in improving processes permanently. The objective is to increase the efficiency and effectiveness in satisfying the customers.
The concept of Total Quality Management (Total Quality Management - TQM) has been proposed by Dr. Edwards Deming in 1940 but its use started in 1985 with the takeover by American principles of working in Japanese industry:

- *focus on process improvement permanent, so that processes are visible, repeatable and measurable;*
- *focus on analyzing and eliminating undesirable effects of production processes;*
- *consideration of how the users use products in order to improve product;*
- *expanding beyond concerns of product management.*

TQM is a description of culture, attitude and organization of a company that strives to provide clients with products and services that meet their needs and expectations. This culture involves all the processes as the company did so well in the first, zero defects, zero waste.

The concept of quality has undergone several stages, adapting to every level of technology and market requirements. Thus, gradually, the selection of finished class performance has been replaced by statistical control of quality parts on-stream, then to extend the process, becoming, through the concept of quality an important factor in delivering products and services.
Charge on a gate of which are increasingly a concern for quality led to the appearance TQM as a full definition concept which has a dimension in time correlate thus competing with the concept and simultaneous engineering.

METHODOLOGY

To successfully implemented TQM organization should focus on 6 key elements:

1. *CONFIDENCE;*
2. *TRAINING;*
3. *TEAMWORK;*
4. *LEADERSHIP;*
5. *RECOGNITION;*
6. *COMMUNICATION*

1. CONFIDENCE – It is a result of integrity and ethics of the organization without trust cannot be built within the work of TQM. The trust helps the full participation of all employees.

Allows every employee empowerment which leads to involvement and engagement. Allow decisions to be made at levels closest to the problem, encourages risk taking individual and continuous improvement to help ensure that everyone on measurement indicators is made to accuse employees.
Trust is essential to ensure customer satisfaction and is one that builds a climate of cooperation essential for TQM.
Ethics – It is discipline which transposes each situation in terms of good or bad. Has two components represented the organization's ethics and individual ethics.
Organizational Ethics establishes a code of ethics guidelines emphasize that you should join all the employees when operating. Ethics include the individual opinion of what is right and what is bad.
Integrity - honesty involved, morals, values, honesty, sincerity and support with facts. It is important that expects and deserves to get the client (internal or external). As opposed to the integrity of character have duplicity. In a duplicity atmosphere, TQM cannot work.
2. TRAINING – Training is very important for employees to be very productive. Supervisors are responsible for implementing TQM in their departments and to spread the philosophy of TQM among employees operate.
Training of employees who need to refer to interpersonal skills, the ability to work as a team, techniques for solving, the ability to make decisions, performance analysis in order to improve the work, understanding the business is located. You have to be trained to become more efficient and more effective.
3. TEAMWORK – To be successful in business teamwork is an essential element of TQM, with the team can find solutions faster and better to the problems that occur in the organization. Teams can provide improvement of processes and activities.
The teams people feel more comfortable to highlight problems that may occur and may receive help from colleagues to find and implement solutions. There are mainly three types of teams that TQM organizations have:

a. *Quality improvement teams. Temporary teams created in order to analyze the problems that appear or reappear, often are established for periods of 3-12 months.*
b. *Teams to solve problems. Intended to solve certain problems and to identify the true root causes. Usually they have duration of life between one week and three months.*
c. *Work Teams. These are small working groups comprised of skilled workers who share the same tasks and responsibilities.*

These teams use concepts such as: employee involvement, self leadership, quality circles. These teams meet one or two hours per week.

4. LEADERSHIP – Probably the most important element of TQM. Appears everywhere in organization.
Leadership in TQM means that the manager must have the vision to inspire, to trace the strategic directions that would be understood and implemented by all employees that will lead subordinates. For TQM to be successful in business supervisor must be dedicated leadership subordinates. A leader must understand the TQM, believe in his principles and to demonstrate this fact by faith every day. Supervisor to ensure that strategies, philosophies, values and goals are transmitted down the organization in order to provide focus, clarity and direction.
A key factor is that TQM must be introduced and led by management at the highest level. Personal involvement and commitment is absolutely necessary from the top management in determining values and goals for all levels in line with company objectives and define the systems, methods and measurable indicators to achieve these goals.
5. COMMUNICATION – is one that unites all these concepts. This acts as a vital link between all elements of TQM. Communication is there a common understanding of the ideas so that it emits and the one who receives them.
TQM success is conditioned by the communication between all members of the organization, suppliers and customers. Superiors should create and maintain channels of communication through which to receive and transmit information about TQM processes.
Sharing of accurate information is vital.
For a credible communication is absolutely necessary that the message be clear that the interpretation of receptor to be in the sense in which the broadcaster has intentionally.
6. RECOGNITION – This is the last element of the system, it should be given both for and suggestions for performance, both for teams and individuals.
Employees shall endeavor to obtain recognition for themselves and for their teams. Detection and recognition of individual contribution is the most important duty that each supervisor has.
Then when people recognized the merits of producing major changes in terms of self respect, productivity, quality and quantity of effort for each task.
Recognition is the greatest impact when it is close can be a reward or just a message from top management.

RESULTS

It was proposed several models for the representation of TQM, in accordance with definitions given by different researchers.
Model Oakland (1989) proposes that TQM representation of a pyramid in the supply chain to customer-supplier of quality systems, tools of statistical quality control method of teamwork. These are integrated to support communication by stimulating the cultivation of a new industrial crops and immediate employment of all managerial structures.

The model focuses on meeting customer requirements in the external and the internal (which is translated by satisfying the requirements of any recipient of services or track the flow of production), the firm commitment to quality that has to start from the high level of management and should be reflected until the last level. This commitment is found both in quality investments for the specific field of activity, and by increasing the risk taken in an effort to get success.

A good quality management system covers all major aspects of business such as management, conception, design, materials, manufacturing processes, qualifications, distribution of products and services.

TQM requires a continuing review of compliance with agreed standards of clients and performance tracking tools with statistical control of processes.

The "team work" model involves promoting the idea of continuous and sustained improvement, and implementation in the organization.

Model SOHAL (1989) suggests that quality improvement continues to come from an integrated approach to quality control action plans at various operations during the business cycle.

The principal elements of the model are:

- *focusing the customer: the objective of all of the organization should improve the quality of processes and services delivered.*
- *engage management to build a culture and an environment of quality, expressed by changing attitudes and expectations and supported by the measurement and quality control.*
- *total staff participation from the base to the peak, the problems associated with understanding the processes in the sense of moral responsibility and membership.*
- *use of statistical techniques for analysis of correlated data and to solve various problems.*
- *a systematic process of solving problems using the cycle execution-check-action-and concentration items on clients business process.*

Three dimensional model proposed by Price and Gaskill. This model is to:

- *the size of products and services, and the degree to which a customer is satisfied with our products and services;*
- *personal dimension and the degree to which a customer is satisfied relationship with the organization providing personnel;*
- *size processes and the degree to which the supplier is satisfied with the internal working processes, which are used to develop products and services provided to the client.*

The three dimensions are considered together and reflect the organization and request that it can evaluate, analyze and can only improve business.

In terms of scope of TQM, there are implementations in the different areas are:

- *protection of health education and research;*
- *government agencies;*
- *the environment;*
- *banks;*
- *manufacturing.*

The difficulties encountered in implementing TQM come most often from:

- *lack of sufficient involvement of top management;*
- *resistance to change;*
- *insufficient training and education;*
- *the poor communication;*
- *lack of resources, high costs.*

For the enterprise stimulation and implementation of the TQM, the European Foundation for Quality Management (EFQM) has developed starting with 1991, European Quality Award – EQA.

Developing this reward system, was achieved with the help of European Organization for Quality and European Commission.

The pressure of new conditions in the world economy, globalization of market demand orientation and relaxation dynamics of technology and resources, orientation and expectations of customers, forcing the application of appropriate managerial concepts, this being a condition of competitiveness

By entering the European Quality Award, is meant by the European Foundation for Quality Management (EFQM) the stimulation and implementation of the TQM.

CONCLUSION

TQM refers to an integrated approach by management to focus all functions and levels of an organization on quality and continuous improvement.

Over the years TQM has become very important for improving a firm's process capabilities in order to achieve fit and sustain competitive advantages. TQM focuses on encouraging a continuous flow of incremental improvements from the bottom of the organization's hierarchy.

TQM is not a complete solution formula as viewed by many – formulas cannot solve managerial problems, but a lasting commitment to the process of continuous improvement.

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IDENTIFYING WAYS TO IMPROVE PRODUCTIVITY AT THE CONSTRUCTION INDUSTRY

ABSTRACT:
In the current environment, contractors are had pressed to find ways to gain a competitive advantage and improve slim profit margins. In any given geographical area, construction labor, material and equipment costs are essentially the same. One of the few opportunities to improve the bottom line is to increase productivity. This paper is attempted to identify some ways to improve productivity at the construction site in Libya. Interviews were carried with contractors, owners and consultants. The paper has concluded that the consultants understand both best industry practice and the current construction technologies that can improve productivity. Perhaps most important, the consultants can provide the supervisor and crew with the training that will yield the greatest productivity improvements.

KEYWORDS:
Productivity, Improvement, Construction industry, Interviews, Libya

INTRODUCTION

Productivity is one of the key components of every company's success and competitiveness in the market. Productivity translates directly into cost savings and profitability (Proverbs et al., 1998). A construction contractor stands to gain or lose, depending on how well his company's productivity responds to competition. Construction companies may gain advantage over their competitors by improving upon productivity to build projects at lower costs; yet, most contractors do not systematically and properly address this strategic issue or evaluate its impact on the project's profit. It is no longer sufficient to outbid a singular, neighboring contractor because many companies compete nationally and/or internationally for construction contracts. Contractors must strive to improve productivity continuously or risk losing important contracts. A company has the ability to increase its competitiveness through enhanced productivity by raising the level of value-added content in products and/or services more rapidly than competitors. The concept of productivity is importantly linked to the quality of input, output, and process. Productivity is also a key to long-term growth (Helander, 1981).

A sustainable improvement in productivity, when associated with economic growth and development, is that productivity generates noninflationary increases in wages and salaries (Banik, 1999; Rojas & Aramvareekul, 2003b). A productive industry also may be profitable, allowing for growth and innovation while having a positive effect on society. For example, productivity improvement in the housing construction market may contribute to the supply of more affordable housing (Haas et al., 1999); however, sometimes the very nature of construction industry makes the productivity concept a complex one, due to such variables as small firm sizes, low profit margins, industry fragmentation, environmental issues, limitations on the supply of skilled labor, and other resources (Bernstein, 2003). Despite the importance of the productivity concept, productivity enhancement in construction has been overlooked for decades. While the manufacturing industry drew benefits from proven production management techniques (Neumann et al., 2003), the construction industry lagged due to insufficient research in the area of productivity.

Methods for improving construction productivity to assist managers in identifying productivity barriers and offer solutions were limited. In contrast, there are few studies of enhanced productivity in the construction industry. In reality, increasing productivity benefits the stakeholders' in several ways:

- *Projects are completed more quickly;*
- *Project cost is lowered;*
- *The contractor can submit more competitive bids; and*
- *The project can be more profitable*

Most of the previous studies indicated that workers on a construction project are unproductive for 50 percent of their time on site. Waiting eats up more than half of an employees' unproductive time and about one-third of total project time. It can wreck a schedule and reduce the contractor's profits. Some studies indicated that a third of waiting periods result from factors under managements control. By improving management practices, a construction company can therefore reduce waiting time significantly. Besides long periods of waiting, there are many other drains on productivity at the construction site, including:

- *Poorly planned materials management;*
- *Cleaning up the job site;*
- *Materials waste and theft;*
- *Accidents;*
- *Substance abuse;*
- *Redoing substandard work and completing client punch lists*

Improving site productivity is easy to pose as a strategic objective, but not so easy to achieve given the complexity of the construction process. The study is carried out to identify some effective ways to increase the productivity in a construction company. A quantitative approach has been conducted with 25 project managers, contractors, consultants who are working with in the city of Benghazi in Libya. Based on their opinions and suggestion, the useful effective ways has been discussed briefly in the next section.

RESULT FINDINGS

From the interviews, it can said that these are the most effective ways that recommended by the interviewers who are working the construction filed within the city of Benghazi in Libya. They are as following:

Analyze the entire construction process in detail

A construction company should analyze each phase of its process to determine what the barriers are to improving productivity. It should begin by measuring key factors and setting benchmarks and goals for improvement. For example, the company can carefully observe the percentage of productive and nonproductive time at a site. By comparing project, the company can determine why one project was more productive that the other. For instance, perhaps productivity always slides when a certain piece of equipment is used. The construction company or firm can set a goal for using the equipment more efficiently, and then provide the training the crew needs to reach the goal.

Providing better planning

There will never be a magic solution that eliminates all work changes, but better planning will mitigate the impact of work changes and also eliminate the unnecessary waits that result from imprecise planning. For example, if contractor do not order material to arrive at the date it is needed, the crew will be forced to wait until the material arrives. Therefore, better planning is essential. There is also need to develop a measurement for determining how accurate the current planning process is, plus develop a realistic benchmark for improvement.

Train supervisors and the crew

Interviews confirmed that an important key to improving productivity is to train the crew. This is especially for construction supervisors, whose knowledge and skills can make or break a project in sound management principles and techniques. Construction companies rarely hesitate to train employees in specific skills such as how to operate a new piece of equipment. The benefit of training is measurable almost immediately: the employee is more productive as soon as he or she has mastered the new skill. Supervisor training should be specifically related to how to improve productivity at the job site. Supervisors must be trained to look at the job non on a day-to–day basis, but a work process with many discrete steps that must be completed over an extended, if limited period of time.

Regular meetings

In order to resolve the productivity problems associated with the management, a weekly informational staff meeting is recommended among the project manager, the project superintendent and their assistants. The weekly meeting would benefit productivity and profitability of project through prompt exchange of information. Weekly issues facing the project, information received from the engineer and owner, the project schedule, safety, critical materials and the machinery were among the topics to be discussed in the weekly meetings between the project's key personnel.

Safety planning

From the interviews, it can be indicated that some of the new workers seemed not to have a clear understanding of safety culture on the project. Some of the new workers did not utilize fall protection (despite the availability of this equipment on site), when standing at the edge of an excavation deeper than six feet. There were some workers who wore no hearing protection when working at different areas of the site that had a high level of noise. There was no orientation program for new hires and no training was performed for hazard identification and elimination. There were no safety incentives in place for recognition of goal directed behavior. Therefore, safety planning is an important element for increasing the productivity at construction sites.

INTRODUCTION

Productivity is a serious issue for the construction industry, which because of it large size has a dramatic impact on the economy. This research was carried out in the developing economy of Libya. It may be that the issues of the key factors, the model developed and the alternative solutions here can provide guidance to the other economies in transition. Concepts such as practicing productivity in construction sites are not well understood by construction personnel. They often do not realize that there are many alternative ways that can lead the productivity and improve its achievements and values. The 5 identified ways can

actually contribute to an increase in the value of construction productivity and could increase the performance level as well.

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WIND TURBINE M.A.R.S. AS A NONSTANDARD SOURCES OF WIND ENERGY

ABSTRACT:
Energetic economy measure has high influence on decreasing pollutive emission of materials as well as green house gasses which are conducive to fulfill state's strategies in environment area and climate changes. Wind is a clean energy; wind power plants do not produce any emissions. They do not pollute surrounding air, water nether the soil, because there is no fuel burning to produce energy. This article highlights the positive effect of a nonstandard source of wind energy used by the M.A.R.S. turbine.

KEYWORDS:
Wind energy, offshore wind energy, turbines M.A.R.S.

INTRODUCTION

Offshore Wind Energy (OWT) stations produce clean energy without any emissions, which neither cases any climatic changes nor pollute the air. This kind of electric energy production represents the home source of energy production, that we have not have to pay for it to the foreign companies and we become more self-sustaining and energy independent.

OFFSHORE WIND ENERGY

Currently are mostly construct OWT with watts in the range of 1,5 – 2,5 MW. Modern OWT are less noisy than the old one, that's why they are also accepted by vicinetum. The designed life of those OWT is 20 till 25 years. During the designed life, the OWT should work at least 120 thousands of hours.

Suitable areas for an OWT are areas where the average wind speed is at least 6 m/s in the high of 60m above the terrene. The areas with lower average wind speed are not suitable due to lower power of a wind. The best areas are the mountain areas and the lowlands. The construction of an OWT is forbidden in the national parks which decreases the amount of suitable areas with enough wind power. This kind of restriction eliminates a huge part of suitable areas in Slovakia to construction an OWT, nevertheless there are a lot of areas where they can be built the OWT ranches. It is also important to mention, that the enough wind power is just one part of requirements to build an OWT ranch. The other requirements are: ability to connect to the distribution network, area that does not affect the national parks or the diversity of human population in near by areas. Those factors also eliminate a lot of suitable areas [1].

MAGENN AIR ROTOR SYSTEM (M.A.R.S.)

The system Magenn air rotor system (M.A.R.S.) is one of the types of OWT. This kind of turbine is lighter than the air. It uses the wind power to produce electric energy. The reason why it is possible to stay in higher level of atmosphere is the Helium that is used to fulfill the turbine. This helps the turbine to be in areas where wind has higher speed, than on the lower levels of atmosphere. The M.A.R.S. spins around the horizontal axis following the wind direction. This way is produced more energy from the wind power, which is transferred to the surface transformer station using the cables. It has a lot of advantages comparing to the conventional OWT e.g. low cost of produced electric energy, lower noise, turbine is placed in higher location, lower constrains where it can be placed, high mobility level, it is not required to use a heavy duty machines, lover risk to harm a birds or bats.

The OWT M.A.R.S. can be taken out higher over the surface, than the conventional systems, so it can catch more power full wind. The conventional systems are placed in areas where the wind is higher over the surface e.g. coastlines or mountain terrenes. The most suitable areas are in national parks, areas far away from the consumers of the electric energy, which raise up the energy losses during the long-distance power transmission. This mentioned problems are able to be solved using the M.A.R.S.

Figure 1. Turbine M.A.R.S. [2]

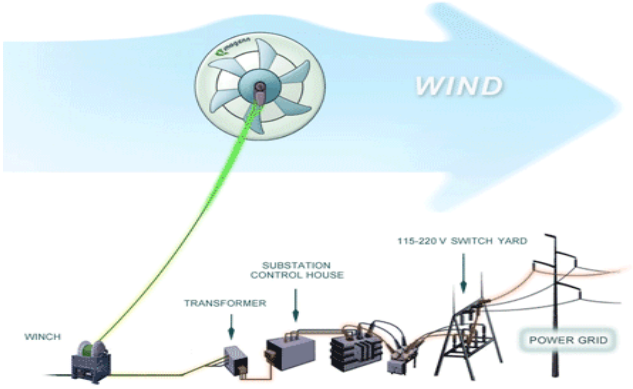

Figure 2. Schema of wiring connection for the M.A.R.S. [2]

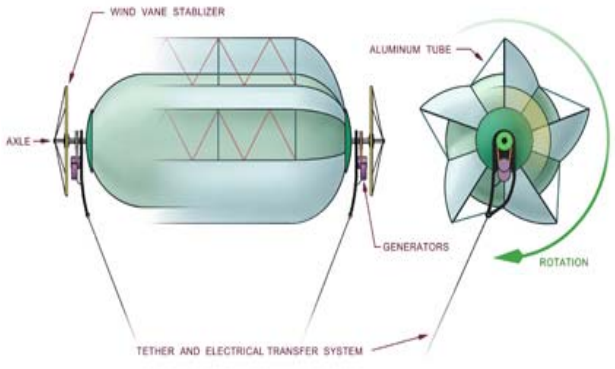

Figure 3. System functioning fundaments of M.A.R.S. [2]

The OWT M.A.R.S. cannot be placed in any air-space nor closer than 8km from the airport. The caring balloon contains the reflex material and also radar using the frequency in the range 200 - 2700 MHz. The cover and backband of the M.A.R.S. system is made of material that are lighter and stronger then the steel, has almost no absorbability, abrasively resistance and UV rays.

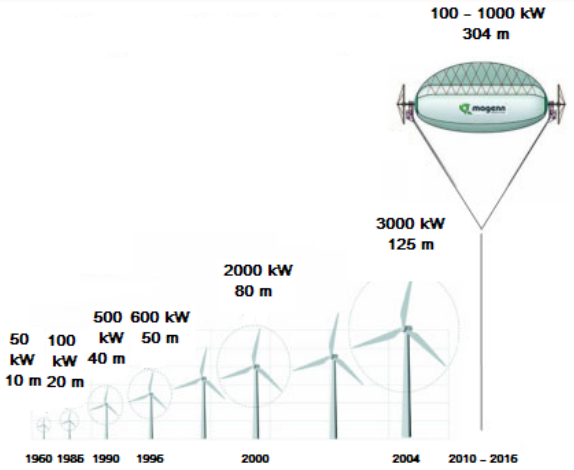

Figure 4. Overview of wind turbines. [2]

IMPACT OF WIND TURBINES ON THE ENVIRONMENT

The biggest problem of the classical OWT is that there is a direct contact with birds and bats that end by death. The rotors of turbines are moving, which case a lot of problems to avoid for them. The advantage of the M.A.R.S. is that it stays on one place without moving, which allows the birds and bats to easily avoid it.

CONCLUSION

The OWT M.A.R.S. is suitable to produce the electric energy due to its ability to use in the developing countries with reduced infrastructure or in the areas of country where is no infrastructure. This approach of energy producing is also able to use on islands, outlying farms, during the nature catastrophes.

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HARDWARE AND SOFTWARE OF A SYSTEM FOR ELECTRO-CHEMICAL AND BIO-ELECTRO-CHEMICAL INVESTIGATIONS

ABSTRACT:
Electrochemical investigation methods are widely used for characterization of different kinds of materials and live tissue, as well as of the processes in systems where the electrochemical reactions take part. One such system for electrochemical researches based on PC and LabVIEW software package was developed and described in the paper. An overview of standard electrochemical methods, such as potential measurements, chronopotentiometry, chronoamperometry, cyclic voltammetry and EIS, but also of new methods, is given. For signal generation and recording of the response of investigated electrochemical cell, a measurement and control system was developed, based on a PC. The rest of the hardware consists of a commercially available AD-DA converter and an external interface for analog signal processing. The software platform for desired measurement methods is LabVIEW package. The developed system was adjusted, tested and compared with other commercially available systems.

KEYWORDS:
Electrochemical Measurements, Bioelectrochemistry, Measurement system, LabVIEW, Hardware, Software

INTRODUCTION

Electrochemical investigation methods are widely used for characterization of different kinds of materials and live tissue, as well as of the processes in systems where the electrochemical reactions take part [1, 2]. There is a series of well known methods, but some new methods from electrotechnic area have been introduced. So, first of all it was given an overview of the standard electrochemical methods and parameters, beginning with potential measurement and simple methods such as chronopotentiometry and chronoampermetry, till electrochemical impendance spectroscopy. The last named method is adapted for systems containing large capacitancies, that became actual with appearance of electrochemical supercapacitors. New methods are Dirack voltage excitation and Dirack current excitation. Measurement system described here is a new, updated version of previously developed one by the same authors at Technical faculty in Bor [3]. The system is assigned for electrochemical laboratories at faculties and institutes where it could replace expensive and/or old measurement equipment, rising work comfort and quality of obtained results at a higher level.

HARDWARE

For signal generation and data acquisition it was developed a measuring and control system based on PC Pentium 4. Beside PC, hardware consists of ADDA converter and external interface for analog signals conditioning [4-6]. ADDA conversion is performed using commercially available converter NI 6251 from National Instruments. National Instruments M series high-speed multifunction data acquisition (DAQ) devices are optimized for superior accuracy at fast sampling rates. They have an onboard NI-PGIA2 amplifier designed for fast settling times and high scanning rates, ensuring 16-bit accuracy even when measuring all channels at maximum speeds. All high speed devices have a minimum of 16 analog inputs, 24 digital I/O lines, seven programmable input ranges, analog and digital triggering, and two counter/timers [7].

Measurement interface designed for the needs of the electrochemical investigations by controlled current or voltage excitation have the next characteristics:

- *two control voltage inputs ±10 V,*
- *one measuring current input ± 100 mA.*
- *one voltage output ±10 V for input current of ± 100 mA,*

- *one voltage input for the reference potential recording,*
- *the reference electrode input resistance higher then 10^{12} Ω,*
- *one the three-electrode output for electrochemical cell with the next possibilities:*
  - *voltage range ± 5 V with the possibility of superimposing the small signal in the range of ±10 mV,*
  - *current range ± 100 mA.*

Figure 1 presents the photograph of the electrochemical measurement system, and figure 2 presents the block diagram of the interface.

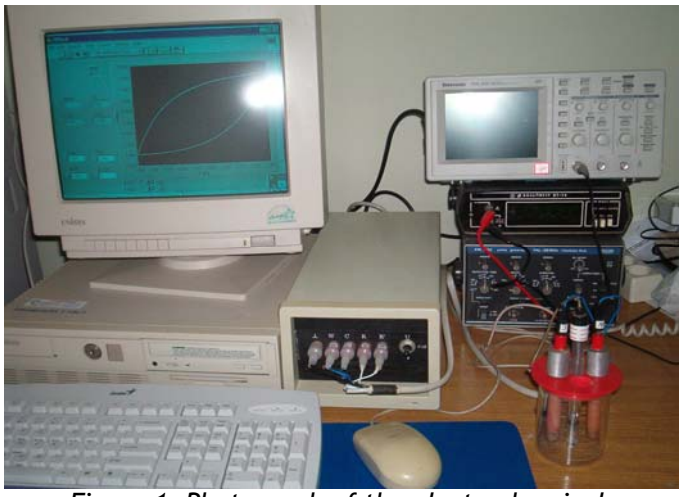

Figure 1. Photograph of the electrochemical measurement system

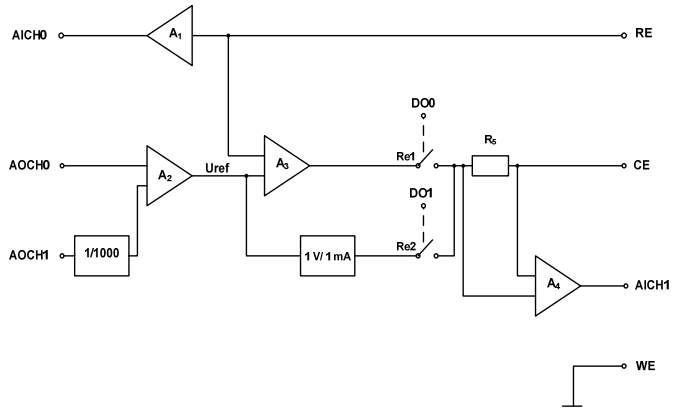

Figure 2. The block diagram of the interface

SOFTWARE

The software platform for predicted measurement methods was National Instruments LabVIEW package, which is regarded as a high standard in the area of modern virtual instruments [8]. LabVIEW is based on the principles of virtual instruments with the graphical user interface. Graphical user interface has two windows:

- *control panel for process control and monitoring,*
- *application diagram which presents used virtual instruments, relations between them, the course of signals and error detection.*

In LabVIEW, one builds a user interface by using a set of tools and objects. The user interface is known as the front panel. One then add code using graphical representations of functions to control the front panel objects. The block diagram contains this code.

Figures 3, 4, 5 and 6 presents control panels for galvanostatic method, potentiostatic method, cyclic voltammetry and electrochemical impedance spectroscopy, respectively.

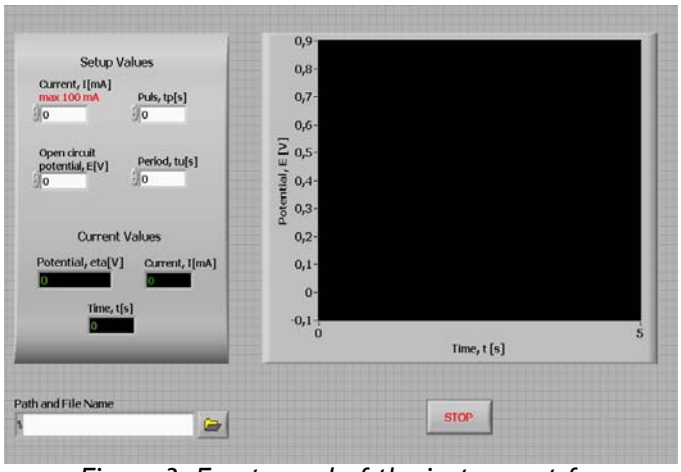

Figure 3. Front panel of the instrument for galvanostatic method

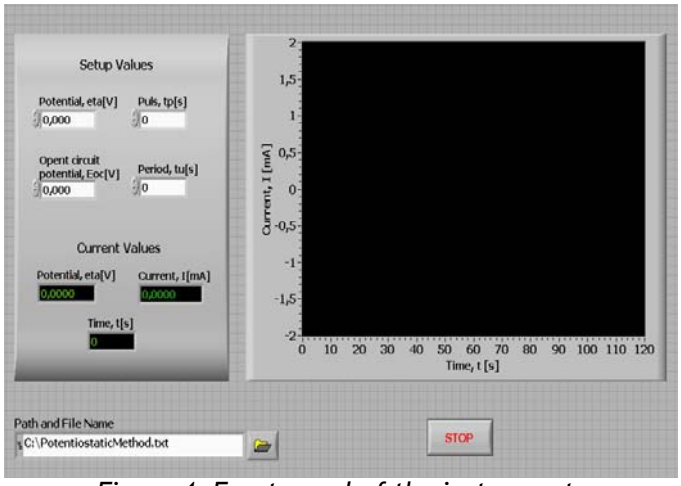

Figure 4. Front panel of the instruments for potentiostatic method

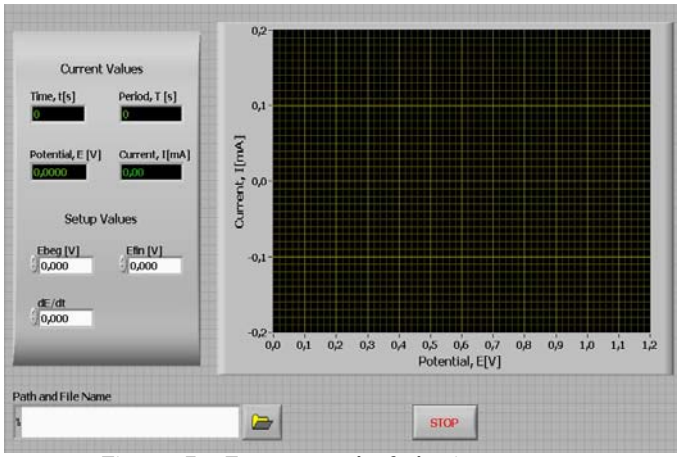

Figure 5. Front panel of the instrument for cyclic voltammetry

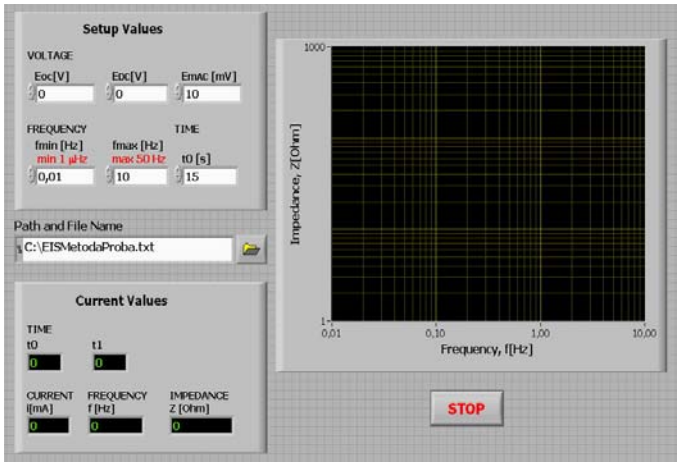

Figure 6. Front panel of the instruments for electrochemical impedance spectroscopy

EVALUATION AND CONLUSION

The system is calibrated using high accurate measurement instruments predicted for laboratory instruments adjusting (PRIMA B7-21A, PRIMA B7-38 and PHILIPS 5712). Measurement error less than 0.5 % in all ranges is achieved. The results obtained using this system are compared with those obtained in the same conditions using commercial galvanostat-potentiostat AMEL 551, and also with the results obtained by simulation in ORCAD software package. Excellent agreement of compared data can be seen.

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TEST RESULTS TO EVALUATE DETONABILITY OF CHEMICAL FERTILIZERS WITH A HIGH NITROGEN CONTENT CARRIED OUT BY INCD – INSEMEX ROMANIA

ABSTRACT:
From the moment when Romania adhered to the European Union, the free circulation of goods is performed based on the EU regulations, chemical fertilizers included.
Several accidents have occurred in the chemical industry during the processing of ammonium nitrate. Subsequently, it has been concluded that ammonium nitrate (as fertilizer) can be initiated by an external impulse that can lead to detonation, reaching even to mass explosions. As a result of this series of accidents, it was necessary to restrict the marketing of this product before evaluating its sensitivity to detonation.
A series of laboratory analyses, measurements and tests stipulated by the Regulation (CE) 2003/2003 issued under the auspices of the European Council are made on chemical fertilizers with a high amount of grain ammonium nitrate intended for agricultural purposes. Among these tests and laboratory analyses, there is the detonability test of ammonium nitrate, with high nitrogen content chemical fertilizers.

KEYWORDS:
EC fertilizer, detonability, thermal cycles, led cylinder

PRESENTATION OF THE METHOD IN ACCORDANCE WITH THE REGULATION (CE) 2003/2003

The harmonization of the requirements used by the Romanian industries with the requirements stipulated by the Directives issued by the European Union requires that all Romanian producers make the fertilizers intended for the European market observe these requirements.
The chemical fertilizer defined as ammonium nitrate with a high content of nitrogen is produced and used at industrial scale for various purposes.
The largest amount of ammonium nitrate is not intended for industrial explosives and military purposes, but as chemical fertilizer in agriculture.
The method consists in the determination of deformation by compression of witness test items – lead cylinders (see fig.1).
The deformation of lead cylinders occurs after the detonation of the ammonium nitrate fertilizer test item confined into a steel tube and initiated by a suitable explosive charge.
The test item for the two tests shall be conditioned in accordance with the chart shown in Annex III, parag. 3 of the EC Directive 2003/2003 and „Thermal cycles" before the detonability test.
Accidents may happen during the testing period (incandescent sharp – edged metallic splinters flying at more than 2000 m/s).

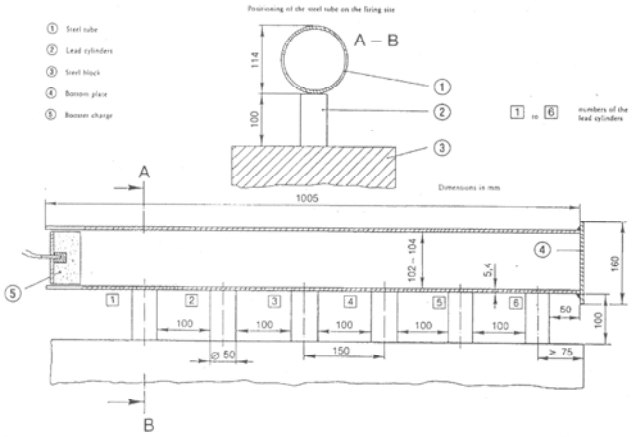

Figure 1 – Positioning of the steel tube on the firing site

Subsequently, testing shall be carried out only in special arranged areas (stand for the detonation of explosive materials), so as to provide protection both for the testing staff and for any other persons or goods nearby, presented Photo no.2.

Figure 2 – The firing place (reinforced steel concrete bunker).

The ammonium nitrate – fertilizer shall be conditioned with several successive thermal cycles before the start of the proper testing.
The test item is put inside a metallic box, the box is closed and sealed. The test item is heated from the ambient temperature up to 50^{0}C and it shall be maintained for one hour at this temperature. Subsequently, the test item is cooled down to 25^{0}C and it shall be maintained at this temperature for one hour. (Figure no.3).

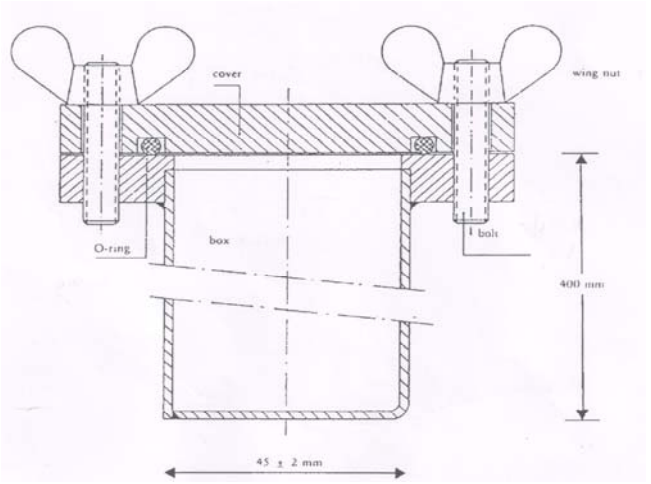

Figure 3 – Metallic box for thermal cycles.

The combination of these two stages (maintaining temperature at 50^{0}C and then at 25^{0}C) is a thermal cycle. The test item shall be subjected to 5 thermal cycles and afterwards, the temperature of the test item shall be maintained at 20±3^{0}C for the carrying out of the detonability test.
An amount, sufficient for one detonation, is introduced into the box and the box is covered with a lid. Put the box into the water vessel and heat up the water up to 51^{0}C (temperature is measured in the center of the test item of ammonium nitrate – fertilizer). An hour after reaching 50^{0}C, the water is cooled down. An hour after reaching 25^{0}C, the water is heated again to start the second thermal cycle.
Whether two water vessels are used, transfer the box from one vessel into another after each heating / cooling cycle.
At the end of thermal cycles, introduce the test item of ammonium nitrate – fertilizer into the rolled tube (seamless steel tube in accordance with ISO 65-1981 – high resistance, nominal size DN/100 (4 inch), external diameter 113.1 – 115.0 mm; wall thickness →5.0-6,5 mm, length 1005±2 mm) and initiate by one of the two methods stipulated by EC Directive 2003/2003, Annex III.
In order to make a clear difference between the ammonium nitrate intended for explosives and the ammonium nitrate intended for agriculture, i.e. product classified as from class 1 „explosives" in accordance with to the UN compared to the ones from class 5.1. – „oxidizing materials substances", the European Union has adopted special regulations to determine the nature of ammonium nitrate introduced on the market and the hazard level of this compound.
Regulation (CE) 2003/2003 stipulates a series of requirements on the ammonium nitrate – fertilizer. Beside the requirements on purity, there are other requirements on environment protection who stipulate the need to test the detonability of nitrogen.
This last requirement includes strict conditions whose targets are both to prevent the occurrence of unwanted events during the storage, transportation or handling of explosive matters that may lead to mass explosions (products from class 1.1.A.-UN) or the use during terrorist attacks (the product can be easily available).
The manufactures of chemical fertilizers shall produce these fertilizers so that they cannot be initiated efficiently during the detonability test stipulated by the Regulation (CE) 2003/2003 of the European Union.
The detonation shall be initiated by boosters and the test item shall be ammonium nitrate. The regulation stipulates the fact boosters should meet certain quality requirements related to the detonation velocity and the amount of explosive material.
The testing and measuring means are stipulated by the Annex III of EC Directive 2003/2003:
Materials:

- *plastic explosive comprising 83…86% pentrite to initiate the detonation of ammonium nitrate – fertilizer, density: 1500÷1600 kg/m^3; explosion velocity: 7300÷7700 m/s, mass: 500±1 g;*
- *seven flexible detonating cords with nonmetallic sleeve / one charge, the weight of the detonating cord charge: 11÷13 g/m, length of each detonating cord: 400÷2 mm;*
- *secondary explosive, compressed tablets with a central hole for the detonator; density: 1500÷1600 kg/m^3, diameter: 19÷21 mm; height: 19÷23 mm; the central hole for the accommodation of the electric detonator shall have a diameter of 7÷7.3 mm and depth of 12 mm;*
- *steel seamless rolled tube, in accordance with ISO 65-1981- high resistance, series with nominal sizes*

DN/100 (4 inch), outside diameter 113.1÷115.0 mm, walls width: 5.0÷6.5 mm, length 1005±2 mm;

- *the base plate shall be made of steel, with suitable qualities to welding, overall size: 160x160 mm, thickness: 5-6 mm;*
- *six lead cylinders / one test, diameter:50±1 mm, height: 100-101 mm; the purity of lead shall be at least 99.5%;*
- *steel block of min. 1000 mm in length, min. 150 mm in width, min. 150 mm in height, and a weight of at least 300 kg;*
- *plastic or cardboard cylinder for the explosive charge used to initiate the ammonium nitrate – fertilizer test item, walls width: 1.5÷2.5 mm, diameter: 92÷96 mm, height: 64÷67 mm;*
- *wooden disc of 91÷96 mm diameter; the diameter shall fit the internal diameter of the steel tube, thickness: 20 mm;*
- *electric or non-electric detonator with the initiation power of 8÷10;*
- *wooden rod of the same size as the detonator;*
- *fastening and clamping devices max. length: 20 mm.*

APPARATUS USED IN THE APPLICATION OF THERMAL CYCLES

One thermostatically controlled water vessel for the temperature range 20^0C÷51^0C, with a minimum heating and cooling rate of 10^0C/min. or two thermostatically controlled water vessels: one at 20^0C and the other one at 51^0C. The water in the vessel is continuously circulated and the volume of the vessel shall be sufficiently large to allow a good circulation of the water.

The sealed stainless steel box shall be provided with a central thermocouple.

External overall size of the box shall be 45±2 mm, with a width of the wall of 1.5 mm. The height and the length of the box shall be in connection with the overall size of the water vessel, for ex: 600 mm in length, 400 mm in width.

PREPARING THE STEEL TUBE FOR TESTING

Two holes shall make on the apposite sides. The diameter of the holes shall be of 4 mm, perpendicular to the surface of the wall, 4 mm away from the edge. There shall be a butt – welding between the base plate and the apposite end of the tube, filling fully the right angle between the base plate and the wall of the tube with metal all through the whole circumference of the tube. The ammonium nitrate – fertilizer test item, the steel tube and the initiation charge shall be conditioned at a temp. of 20^0C (±5^0C). Approx. 16÷18 kg of test item is necessary for the two tests.

Lay the steel tube vertically, with the square-shaped base plate on a flat, steady (concrete preferably) surface. The test item is introduced into the tube until it fills almost one third of its length. Then, the tube is left to fall freely on the ground from a height of 10 cm for 5 times, so that the grains of the fertilizers fill all void spaces. To speed up this process, the side walls of the tube are hit with a 750÷1000 g hammer. Hit the side walls 10 times, add some new test item and repeat the operation. At the end, the extra amount of ammonium nitrate shall allow that the charge fill the tube up to 70 mm of the holes made at the end of the tube (see the part with the preparing the steel tube for testing).

The height of the charge inside the tube shall be so that the initiation charge (introduced afterwards) be in close contact with the test item all through its surface.

The upper part of the wooden disc shall be 6 mm under the end of the tube. It is very important a close contact between the explosive charge and the test item (so there shall be added or removed small amounts of the test item to this end).

There shall be also used safety bolts which are going to be introduced through the holes nearby the free end of the tube (see photo no.4).

Figure 4 – The charge before applying the buster

Figure 5 – The charge before firing

The steel tube and the lead cylinders shall be arranged similarly as in photo no.5.
The lower parts of the lead cylinders shall be numbered. There are marked six positions 150 mm away of the central line of the steel block, on a horizontal plane, the first sign at least 75 mm away from the edge of the block. Lay one lead cylinder vertically on each of these signs, the central lower part of the cylinder being located on the corresponding sign.
Lay the ready steel tube horizontally on the lead cylinders so that the axis of the tube comes parallel to the central line of the steel block and the welded end of the tube overrun the 6th lead cylinder with 50 mm. To prevent the rollover of the tube, small wooden wedges shall be introduced between the upper part of the lead cylinder and the wall of the tube (one each side) or a wooden cross shall be introduced between the tube and the steel block.
A full contact shall be provided between the steel tube and all the six lead cylinders, whether the tube is slightly curved, it shall be rotated around its longitudinal axis. Whether the lead cylinder is, too high, slightly tap it with a hammer.

EVALUATION OF TEST RESULTS

If, in each firing, the crushing of at least one lead cylinder is less than 5%, the test shall be considered conclusive and the sample in conformity with the requirements of Annex III.2 of the Regulation (CE) 2003/2003.

CONCLUSIONS

The requirements of the European Union with respect to the marketing of ammonium nitrate – fertilizer refer to the test of specific features of chemical fertilizers, their sensitivity to detonation so as to be able to be introduced on the EU market as „EC FERTILIZER".

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ADSORPTION EFFICIENCY OF LOW-COST MATERIALS IN THE REMOVAL OF Zn(II) IONS FROM PRINTING DEVELOPER

ABSTRACT:
The research objective in this study is to find solutions for immobilization of Zn(II) ions from spent printing developer in the printing industry by adsorption on natural, low-cost adsorbents: activated carbon (AC, Norit Row 0.8 Supra), natural zeolite (NZ, clinoptilolite) and their mixtures (AC+NZ); by doing this, environmentally-harmful metal Zn(II) would be eliminated. Because of the complexity of printing wastewater we studied the adsorption onto various adsorbents, to gain an insight into the influence of heavy metal Zn(II) on the sorption behavior of these adsorbents, the effect of their nature and optimal concentration, and determine the adsorption capacity and the appropriate contact time. Therefore, these adsorbents of the defined pore size and structure were applied to examine their adsorption efficiency in the removal of Zn (II) ions from the spent printing developer sample. Concentrations of Zn(II) ions in fresh and spent printing developers before and after the adsorption were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), using a PerkinElmer Elan 5000 mass spectrometer. The adsorption of Zn(II) ions onto activated carbon, clinoptilolite and there mixture was studied in laboratory batch mode. The adsorption equilibrium data for Zn(II) ions on AC, NZ and (AC+NZ) were analyzed in terms of the Freundlich isotherm model. The results provided strong support for the Zn(II) ions adsorption onto these adsorbents, and all the data fitted well to the Freundlich isotherm ($R^2 \geq 0.988$). The lowest correlation coefficient for Zn(II) ions was obtained using the mixtures of activated carbon and clinoptilolite. The adsorption capacities of Zn(II) ions decreased in the order: AC>NZ>AC+NZ.

KEYWORDS:
Equilibrium; Adsorption; Adsorption isotherm; Spent printing developer; Clinoptilolite; Activated carbon; Printing industry

INTRODUCTION

Printing industry is at the top of industrial polluters according to the amount of highly emerging pollutants released into the ecosystem. Due to lack of wastewater treatment and recycling, highly polluted wastewater with emerging inorganic and organic pollutants is present in the printing industry. In Serbia, there is a great deficiency in the adequate facilities for treatment of printing plants wastewaters. Hence, the raw wastewaters are directly discharged into the municipal sewerage, threatening to endanger the water quality because of the potential increase in the concentrations of some metals and organic pollutants (Kiurski 2008; Kiurski 2009; Prica 2010).

In the printing industry waste is generated from the three basic phases of the technological process: pre-press, press and post-press. The offset pre-press process is a complex printing operation which involves the use of many toxic and hazardous chemicals, such as printing developer.

The role of printing developer in the plate or film development process is to convert the latent images to visible ones. The most present components of fresh printing developer are potassium silicate, sodium silicate, sodium carbonate, potassium hydroxide, D-sorbitol, sodium sulfite, potassium bromide, metol [4-(methylamino)phenol sulfate] and hydroquinone. After the development process, printing developer (spent developer) is enriched by plate surface compounds: novolac, organic polymeric binders, photosensitive compounds, dyes and some others. Heavy metal ions found in spent printing developer come from the dye residue. Therefore, in order to have a pollution-free environment, the toxic metals should be removed from wastewater before its disposal. The requirements for an adequate treatment of spent printing developer are to be met, to prevent increased the concentrations of heavy metals and organic pollutants (Shuiping 2003a; Shuiping 2003b;Vengris 2004; Llanes Monter 2007; Oliveira 2007;Vengris 2007; Malakootian 2009) from the printing industry.

Among all the approaches proposed, adsorption of heavy metal on low-cost effective adsorbents is one of the most popular methods, and it is currently considered as an effective, efficient and economic method for liquid waste purification. In the past two decades, researches have been carried out focused on using low-cost sorbents for heavy metal adsorption, like natural zeolites and activated carbon (Rao 2006; Kocaoba 2007). Clinoptilolite, as a most common natural zeolite, has a high sorption capacity and selectivity, resulting from its porosity and sieving properties. Activated carbon, due to its versatility and wide range of applications, is also used as a medium for removal of a variety of contaminants (Babel 2003; Genc Fuhrman 2007).

The aims of the study were to examine the efficiency of natural, low-cost adsorbents: activated carbon (AC, Norit Row 0.8 Supra), natural zeolite (NZ, clinoptilolite) and their mixture (AC+NZ) for immobilization of Zn(II) ions from spent printing developer and to investigate the equilibrium parameters involved in the adsorption process.

MATERIAL AND METHODS

The adsorption of Zn(II) ions from spent printing developer was investigated using activated carbon (AC, Norit Row 0.8 Supra), natural zeolite (NZ, clinoptilolite) and the mixture of AC and NZ (AC+NZ) as adsorbents. Samples of fresh and spent printing developer were taken from the pre-press unit of a Novi Sad (Serbia) offset printing plant.

The commercial powdered activated carbon (Row 0.8 Supra, Norit, USA) and clinoptilolite (High Tech zeolite producer, Turkey) were used in this study and their characteristics are presented in Tables 1 and 2.

Table 1. Physicochemical characteristics of activated carbon

Characteristic	Value
Iodine number	1050
Methylene blue adsorption (g/100g)	22
Total surface area (BET) (m^2/g)	1150
Apparent density (kg/m^3)	390
Density backwashed and drained (kg/m^3)	345
Particle size < 0.60 mm (wt %)	0.1
Ash content (wt %)	7
pH value	10.3
Moisture (as packed) (wt %)	2

Table 2. Chemical composition of clinoptilolite

Oxides	%
SiO_2	66.9
Al_2O_3	13.5
Fe_2O_3	0.98
MgO	0.69
CaO	3.85
K_2O	0.54
Na_2O	0.37
SO_3	1.18

All the chemicals used were of analytical reagent grade (Merck, Germany). Deionized water was used throughout the experiments. Working solution was prepared by diluting the stock metal solution (1000 mg/l) with deionized water to obtain 17.302 mg/l Zn(II) ions.

APPARATUS

Concentrations of Zn(II) ions were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), using a PerkinElmer Elan 5000 mass spectrometer. Before introducing the sample into the instrument, nitric acid (ρ =1.4 g/cm^3) was added to obtain pH 2. Every ICP-MS result given in Table 3 represents the average concentration of three measurements with relative deviations less than 5%.

Table 3. Concentrations of Zn(II) ions in the printing developer before and after adsorption

Heavy metal	Concentration (mg/l) ± RD		
	Before adsorption		
	Fresh developer	Spent developer	
Zn(II)	1.278 ± 0.064	17.302 ± 0.865	
Heavy metal	Concentration (mg/l) ± RD		
	After adsorption		
	AC*	NZ*	AC+NZ *
Zn(II)	6.233 ± 0.312	7.624 ± 0.381	9.567 ± 0.478

**Spent printing developer after adsorption on AC, NZ and (AC+NZ)*

The pH and temperature were measured on a Multi pH/Cond/Temp 340i handheld meter. Samples were shaken on a mechanical shaker (26 rpm), and the solid phase was separated by centrifuging at 3000 rpm (Tehtnica Železniki, Slovenia).

EQUILIBRIUM TIME EXPERIMENTS

The starting conditions of experiments were 0.2 g of the adsorbent, 25 ml of metal working solution with the concentration 17.302 mg/l for Zn(II) ions, pH = 5.7, temperature 24.1℃ and shaking speed 26 rpm, while the time varied from 60 to 110 min. As can be seen from Fig. 1, the adsorption of Zn(II) ions increased first and then remained constant when the equilibrium was attained, which occurred after about 90 minutes for all the adsorbents. Based on the trend of the curves in Fig. 1, it can be predicted that the optimal contact time for adsorption on mixture (AC+NZ) would be also 90 minutes.

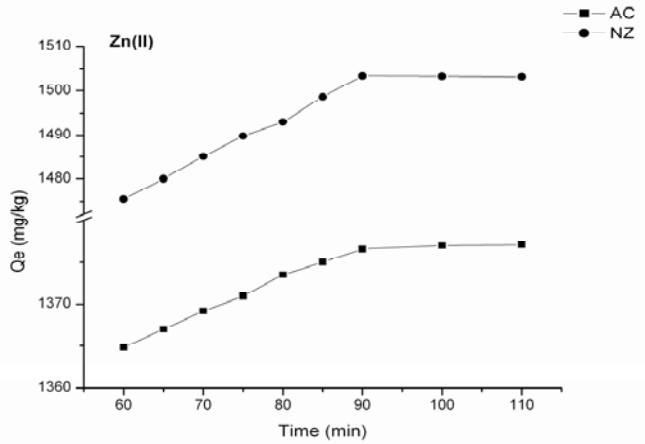

Fig. 1 Adsorption time dependence of Zn(II) ions on AC and NZ

EQUILIBRIUM ADSORPTION EXPERIMENTS

The equilibrium isotherms were obtained using the different amounts (0.04-0.24 g, with an increment of 0.04 g) of AC, NZ and (AC+NZ). The equilibrium amount of metal adsorbed from the aqueous solution was calculated from the equation (1):

$$Qe = \frac{V(C_0 - C_e)}{M} \quad (1)$$

where Q_e is the amount of metal ions adsorbed at equilibrium (mg/kg); C_0 is the initial concentration of metal ions (mg/l); C_e is the equilibrium concentration of metal ions (mg/l); M is the adsorbent mass (kg); and V is the volume of the aqueous solution (l) (Kocaoba 2007).

The distribution ratio was calculated using equation (2):

$$K_d = \frac{C_0 - C_e}{C_0}\frac{V}{M}, \quad (2)$$

where K_d is the distribution ratio (L/kg), C_0 is the initial concentration of metal ions (mg/L); C_e is the equilibrium concentration of metal ions (mg/L); M is the adsorbent mass (kg), and V is the volume of aqueous solution (L) (Erdem, 2004). It is evident that the values of distribution coefficient (K_d) increase with the decrease amount of adsorbent, as shown in Fig. 2. The K_d values depend on the type of the adsorbent, and they decrease for Zn(II) ion in the following order: AC>NZ>(AC+NZ).

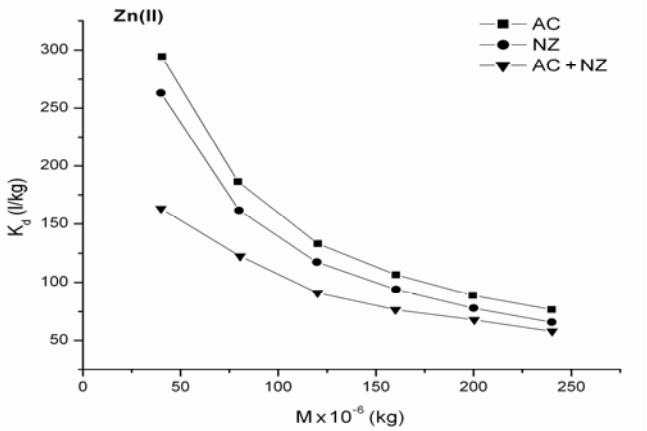

Fig. 2 Dependence of the distribution coefficient on the adsorbent amount for Zn(II) ions

ADSORPTION ISOTHERM MODELS

The adsorption equilibrium data for Zn(II) ions on AC, NZ and (AC+NZ) were analyzed in terms of the Freundlich, Langmuir and Dubinin-Kaganer-Radushkevich (DKR) isotherm models.

Thus the Freundlich isotherm is given by equation (3):

$$\log Q_e = \log K_f + \frac{1}{n}\log C_e, \quad (3)$$

where Q_e is the equilibrium removal, i.e. the amount adsorbed per unit weight of the adsorbent (mg/kg); C_e is the equilibrium metal ion concentration in the solution (mg/l).

The Freundlich isotherm constants, K_f and n, are related to the adsorption capacity and adsorption intensity, respectively.

The conventional Langmuir isotherm written in a linearized form as in equations (4) and (5):

$$\frac{C_e}{Q_e} = \frac{1}{Q_m k_L} + \frac{C_e}{Q_m} \quad (4)$$

or

$$\frac{1}{Q_e} = \frac{1}{Q_m k_L}\frac{1}{C_e} + \frac{1}{Q_m} \quad (5)$$

where the constants Q_m and k_L, are related to the adsorption capacity and the energy of adsorption, respectively (Rao 2006; Kocaoba 2007).

The DKR isotherm for describing the adsorption of metal ions on all adsorbents was used the following equation:

$$\ln Q_e = \ln X_m - \beta\varepsilon^2 \quad (6)$$

where Q_e is the amount of metal ions adsorbed per unit weight of the adsorbent (mg/kg); X_m is the maximum adsorption capacity (mg/kg); β is the coefficient of activity related to the mean sorption energy (mol^2/J^2), and ε is the Polanyi potential equation (7), which is equal to

$$\varepsilon = RT\ln(1 + \frac{1}{C_e}) \quad (7)$$

where R is the gas constant (J/mol K) and T is the temperature (K).

The adsorption energy (E) can be calculated using the following equation (Erdem et al. 2004):

$$E = \frac{1}{\sqrt{-2\beta}}. \quad (8)$$

RESULTS AND DISCUSSION

The adsorption isotherms for Zn(II) ions were obtained for different amounts of three adsorbents, with constant parameters: pH, temperature and shaking speed. Fig. 3 shows that all adsorption isotherms have similar trend, characteristic for the Freundlich isotherm. The corresponding adsorption parameters are summarized in Table 4, and point out that Zn(II) ions were adsorbed effectively on all adsorbents.

Table 4. Freundlich parameters in the equilibrium isotherms for AC, NZ and (AC+NZ)

		Freundlich adsorption isotherm constants		
		K_f (mg/kg)	n	R^2
AC	Zn(II)	60.20	0.50	0.9982
NZ		17.52	0.50	0.9963
(AC+NZ)		5.14	0.34	0.9879

According to the K_f values, the adsorption capacity of Zn(II) ions follows the sequence of adsorption efficiency: AC>NZ>(AC+NZ). It is evident that highest adsorption capacity for Zn(II) ions on AC was 60.20 mg/kg. On the other hand, the least effective was the adsorption of Zn(II) ions on mixture (AC+NZ).

The correlation coefficients (R^2) indicate that the adsorption data for Zn(II) ions on AC, NZ and (AC+NZ) fitted well to the Freundlich isotherm. It can be concluded that AC is most effective for the removal of Zn(II) ions from spent printing developer.

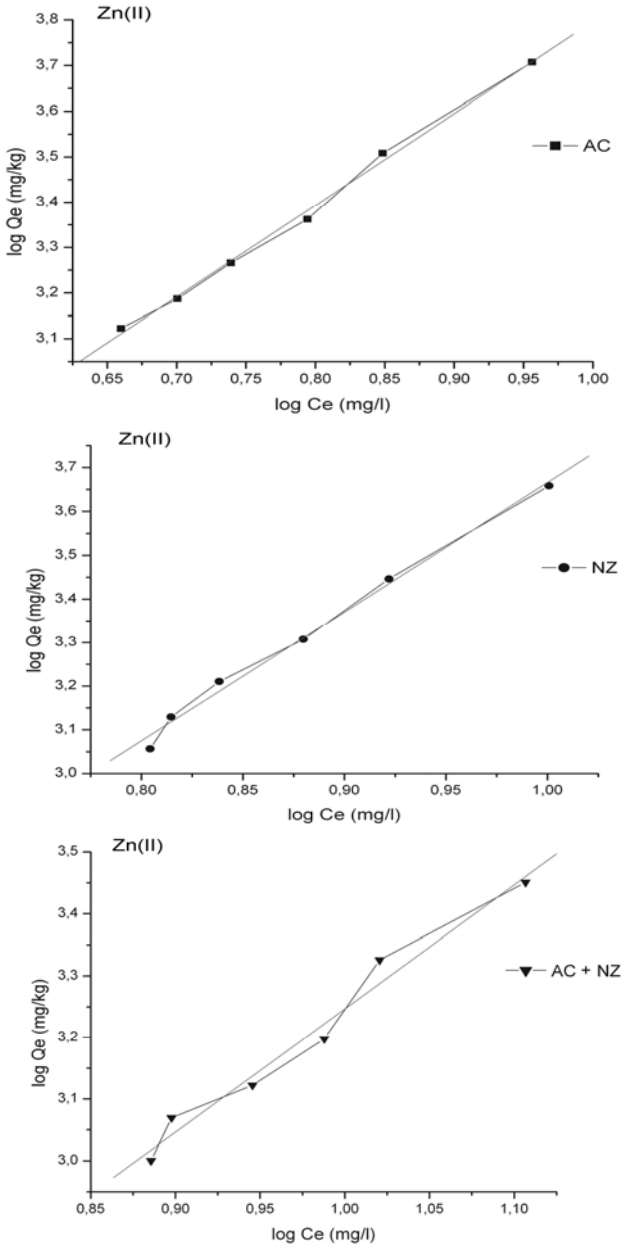

Fig. 3 Freundlich isotherms of Zn(II) ions on AC, NZ and (AC+NZ)

Table 5. Langmuir parameters in the equilibrium isotherms for AC, NZ and (AC+NZ)

		Langmuir adsorption isotherm constants		
		Q_m (mg/kg)	k_L	R^2
AC	Zn(II)	-0.20	-869.56	0.9589
NZ		-0.11	-833.33	0.9332
(AC+NZ)		-0.18	-483.09	0.9572

The experimental data from Table 5 did not fit to the Langmuir isotherm, giving negative slopes and intercepts, leading to the conclusion that the adsorption behavior of the tested systems does not follow the assumption on which the Langmuir approach is based.

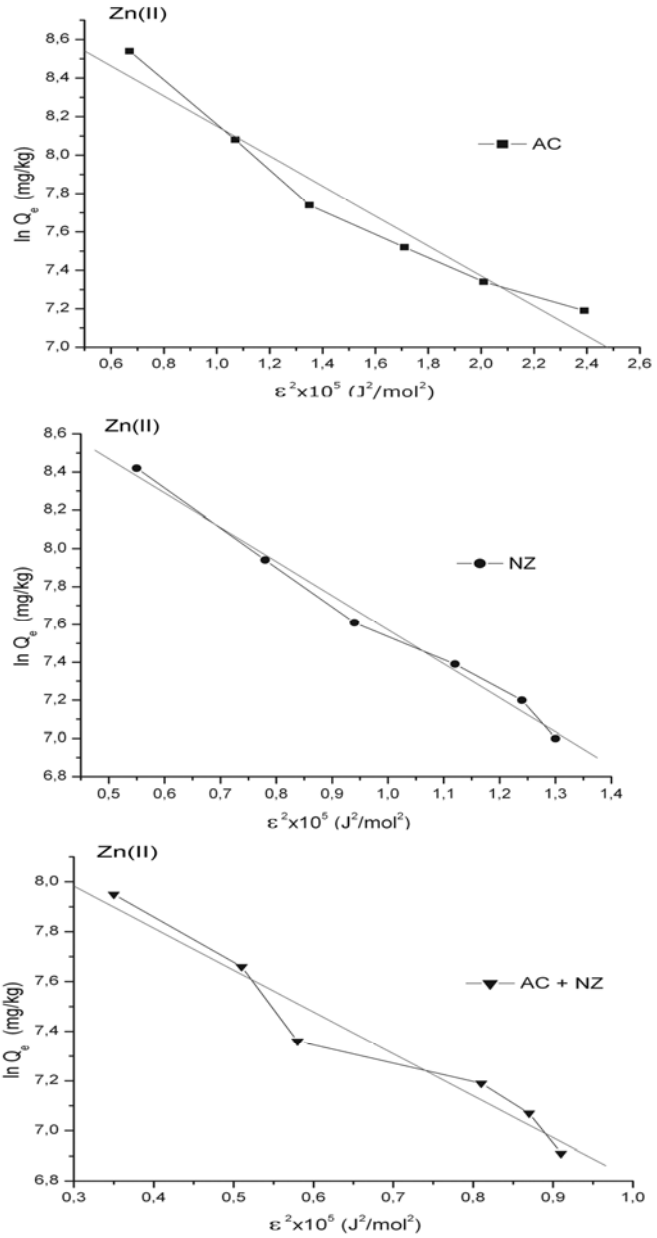

Fig. 4 DKR isotherms for Zn(II) ions on AC, NZ and (AC+NZ)

The DKR plots of ln Q_e against ε^2 for the adsorption of Zn(II) ions on the tested adsorbents are shown in Fig. 4. The DKR parameter (β) gives negative values for all the adsorbents and investigated metal ion, because it was calculated from a negative slope, while the parameter X_m was calculated from the intercept. The values of the DKR parameters and the corresponding correlation coefficients are summarized in Table 6. According to the X_m values, the adsorption capacities of Zn (II) ions show the following decreasing order: NZ>AC>AC+NZ.

Table 6. DKR parameters in the equilibrium isotherms for AC, NZ and (AC+NZ)

		DKR parameters			
		X_m (mg/kg)	β (mol²/J²)	E (J/mol)	R^2
AC	Zn(II)	7562.07	-0.7799	0.80	0.9540
NZ		11698.20	-1.7948	0.53	0.9905
(AC+NZ)		4855.42	-1.6842	0.54	0.9534

The influence of the different amount of the adsorbents (AC, NZ and their mixture) on the adsorption efficiency in the removal of Zn(II) ions is shown in Fig. 5. As can be seen, the adsorption efficiency of Zn(II) ions increases considerably with increasing the adsorbent amount. The maximum adsorption efficiencies were 73.6%, 62.9%, 55.1% for AC, NZ and (AC+NZ), respectively. Besides the amount of adsorbents, the removal efficiency of metal ions depends on adsorbent fraction size and physicochemical characteristics of metal ions.

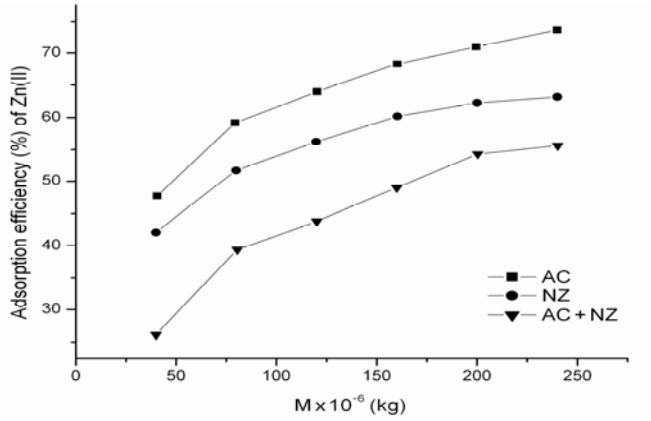

Fig. 5 The influence of the adsorbent amount on the adsorption efficiency of Zn(II) ions

The adsorption efficiency of the adsorbents used in the removal of Zn(II) ions is illustrated in Table 3, showing the corresponding decreases in the concentration in spent printing developer after adsorption. As can be seen, the concentration reduction of Zn(II) ions in the spent printing developer after adsorption is almost 2 to 2.5 times.

According to the Regulation of hazardous matters in water recipients ("Official Gazette of Socialist Republic of Serbia" No. 31/82), the maximum allowed concentration (MAC) for Zn(II) ions is 1.0 mg/l. It is evident that the concentrations of Zn(II) ions in the spent printing developer after adsorption are almost 6-9 times higher than the MAC values. Hence, spent printing developer must not directly discharge into sewerage, but it can be reuse in the development process by application of adequate treatments.

CONCLUSIONS

The study showed that the adsorption of Zn(II) ions from spent printing developer using adsorbents: activated carbon, clinoptilolite and their mixture was most effective within the contact time of 90 minutes. The adsorption process was interpreted in terms of the Freundlich, Langmuir and DKR isotherm models. It was found that the Freundlich isotherm gave the best agreement over the whole adsorption range and the corresponding correlation coefficients (R^2) for Zn(II) ions on activated carbon, clinoptilolite and their mixture being ≥0.988. These investigations showed that the use of low-cost adsorbents may be an effective way for removal Zn(II) ions from spent printing developer.

The adsorption capacity of Zn(II) ions decreased in the following order: AC>NZ>(AC+NZ). The adsorption efficiency achieved was 55 - 74%. Thus, the application of AC was the most effective for the removal of Zn(II) ions, but spent printing developer still not enough to discharge into sewer, although it may be reuse in the development process.

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INHIBITOR MULTIENZYME BIOSENSOR SYSTEM INDYNAMICMODE – PHOSPHATE MEASUREMENT

ABSTRACT:
In this paper a multienzyme inhibitor system is investigated. A hybrid inhibitor biosensor for measuring concentration of phosphate is used. Enzyme kinetic of Michaelis-Menten and ping-pong kinetics is accepted. Partial differential equations of that complex system are solved numerically and are received concentration profiles of five reagents. The influence of starting concentration of inhibitor is investigated and influence of reaction rate constant of inhibitor.

KEYWORDS:
mathematical modeling, inhibitor biosensor, simulations, phosphate

INTRODUCTION

Biosensors are analytical devices which tightly combine biorecognition elements and physical transducer for detection of the target compounds. Biosensors useful serve ecological purposes by enabling precision pollutant control [1, 2, 3]. In practice the most important are biosensors that identify water conditions [4, 5, 6, 7, 8] and to a lesser extent air [9, 10] and soil condition [11]. Two main water pollutant are phosphates and fluorides. For determination of phosphate and fluoride ions enzyme, microbial and multienzyme biosensors can be used. Multienzyme biosensors however are very complex devices.

DESCRIPTION OF THE MATHEMATICAL MODEL

The starting concentrations of substrate, co-substrate and inhibitor in the research medium are denoted with S0,C0, I0. The concentration profiles for substrate S(x), co-substrate C(x) and inhibitor I(x) are formed in the active membrane. In this paper a hybrid biosensor with two enzymes acid phosphatase (AP) and glucoseoxidase (GOD) is used for the investigation.
Operation principle of the hybrid biosensor is based on the given biochemical reaction:

$$\text{glucose}-6-\text{phosphate}+H_2O \xrightarrow{AP} \text{glucose}+HPO_4^{2-} \quad (1)$$

$$\text{glucose}+O_2 \xrightarrow{GOD} \text{gluconolactone}+H_2O_2$$

Under the activity of the enzyme acid phosphatase the glucose-6-phosphate is hydrolyzed to glucose and inorganic phosphate. In the second reaction the oxygen present oxidizes the obtained glucose. The amount of hydrogen peroxide being produced is measured electrochemically. In the presence of phosphate the hydrogen peroxide is produced at a slower rate. This happens because of the inhibitory effect of those element have on the catalytic activity of the acid phosphatase. As a result the glucose production is decreased which leads to more production of H2O2. As the AP is inhibited from the phosphate the substance can be identified with a biosensor according to its ability to support the formation.
The reactions above can be present with following successive enzyme reactions with competitive inhibition:

$$S \xrightarrow{E_1} P_1 + P_2$$
$$I \xrightarrow{E_1} EI \qquad (2)$$
$$P_1 + C \xrightarrow{E_2} P_3+P_4$$

AP is the first enzyme, let denote its reaction velocity with V_1, GOD is the second enzyme let denote its reaction velocity with V_2; P_1 - glucose, first product; P_2 - second product, not informative; S - glucose-6-phosphate, substrate; I -(KH_2PO_4) measured inhibitor, C - oxygen, co-substrate; P_3 - product H_2O_2 and P_4 - galactonic acid.
We admit that indicatory electrode has symmetrical geometry and assume that diffusion is one-dimensional in space and is described with second Fick's law than we can write the system of equations for those bi-substrate sensitive amperometric system.

$$\frac{\partial S}{\partial t} = Ds\frac{\partial^2 S}{\partial x^2} - \frac{V_1 S}{Ks\left[1+\frac{I}{k_I}\right]+S}$$

$$\frac{\partial I}{\partial t} = Ds\frac{\partial^2 S}{\partial x^2} - \frac{V_1 S}{Ks\left[1+\frac{I}{k_I}\right]+S} \qquad (3)$$

$$\frac{\partial C}{\partial t} = Dc\frac{\partial^2 C}{\partial x^2} - \frac{V_2}{1+\frac{Kp_1}{P_1}+\frac{Kc}{C}}$$

$$\frac{\partial P_1}{\partial t} = Dp_1\frac{\partial^2 P_1}{\partial x^2} + \frac{V_1 S}{Ks\left[1+\frac{I}{k_I}\right]+S} - \frac{V_2}{1+\frac{Kp_1}{P_1}+\frac{Kc}{C}}$$

$$\frac{\partial P_3}{\partial t} = Dp_3\frac{\partial^2 P_3}{\partial x^2} + \frac{V_2}{1+\frac{Kp_1}{P_1}+\frac{Kc}{C}}$$

where: Ds, Dc, Dp_1, Dp_2 and Dp_3 are diffusion coefficients for substrate, co-substrate, product 1 and product 3, Ks - reaction constant for substrate, Ki - reaction constant for inhibitor, Kc - reaction constant for co-substrate, Kp_1 - reaction constant for product 1, Kp_3 - reaction constant for product 3. The output current is proportional to gradient of H_2O_2 concentration at the electrode surface

$$I = nFAD_{P_3}\frac{\partial P_3}{\partial x}\Big|_{x=d} \text{ ,[A]} \qquad (4)$$

where: n is the number of electrons taking part in electrochemical reaction, F is the Faraday's number, A is the electrode surface [m^2].

Let we denote x = 0 for the bulk/membrane interface and x = d for the electrode surface. The action in biosensor starts when some quality of substrate is appears into biological recognition element - active membrane. The initial conditions are:

t = 0 S(x,0) = So I(x,0) = Io C(x,0) = Co

P_1(x,0) = 0 P_3(x,0) = 0 (5)

Limiting conditions are:

x = 0 S(0,t) = So I(0,t)= Io

C(0,t) = Co P_1(0,t) = 0 P_3(0,t) = 0 (6)

The substrate, and co-substrate didn't react with the electrode, oxygen and glucose fully exhausted and medium is well stirred and it remain constant at the electrode surface, then the limiting conditions are:

x = d

$$\frac{\partial S}{\partial x}\Big|_{x=d} = 0, \quad C(d,t) = 0 \quad P_1(d,t) = 0$$

$$\frac{\partial P_1}{\partial x}\Big|_{x=d} = 0,$$

P_3(d,t) = 0 (7)

RESULTS AND DISCUSSIONS

For solving system (4) of non-linear partial differential equations (PDE) we use Matlab solver pdepe. It use both finite difference and finite element methods as described in [12]. pdepe solve initial-boundary value problems for system of parabolic-elliptic PDEs in the one space variable x and time t. The ordinary differential equations resulting from discretization in space are integrated to obtain approximate solutions at times specified in a time vector. Time vector specifying the points at which a solution is requested for every value in distance vector. The pdepe function returns values of the solution on a mesh provided in a distance vector. Distance vector specifying the points at which a numerical solution is requested for every value in time vector.

Concentration profiles of substrate, co-substrate, inhibitor, product 1 and product 3

Because oxygen is consumed during enzymatic conversion output current of biosensor is descending function. Parameters used for simulations are

n = 2 , So =100 mM, Co = 0,25 mM, Io = changed, Po1 = 0,0mM , Po3 = 0,0 mM

F = 96,5A.s / mmol - Faraday's number

A = 7,85.10-7 m2 - diameter of cathode is 1mm

K_s = 80 mM - reaction rate constant for substrate

K_c = 0,5 mM - reaction rate constant for oxygen

K_i = 0,1 mM, K_{P_1} = 100 mM - reaction rate constant for inhibitor and products 1

D_S=2,50. 10^{-10} m^2/s, D_C=2,5. 10^{-11} m^2/s, D_I=2,50. 10^{-9} m^2/s, D_{P1}=2,5.10^{-10} m^2/s, D_{P3}=2,5.10^{-10} m^2/s,

d = 60 μm, Vm1 = 1 mM/s , Vm2 = 20 mM/s ,

At fig.1, 2, 3, 4, and 5 in three dimensional size are given concentration profiles of substrate S(x,t), inhibitor I(x,t), co-substrate C(x,t), product 1 P_1(x,t), product 3 P3(x,t) in active membrane with thickness d = 60μm for the time t = 8s, for values of reaction velocities V_1 = 1 mM/s and V_2 = 20 mM/s. The value of inhibitor is Io=0.0 mM and the value of substrate is So=100 mM.

Figure 7 shows the output current I which is proportional to the concentration of the oxygen. It is seen that oxygen is consumed very rapidly for the case starting concentration Io =0, because there is no inhibitor in the research medium. Hydrogen peroxide (product P3) has value about 0.25 because the oxygen is almost exhausted. The velocity of changing of concentration of co - substrate depends of presence of the inhibitor (eq.3), because now there is no inhibitor oxygen is consumed very rapidly- fig.4.

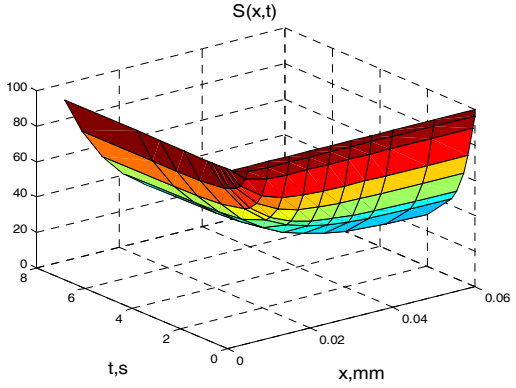

Fig. 2. Concentration profile of substrate. Io = 0 mM

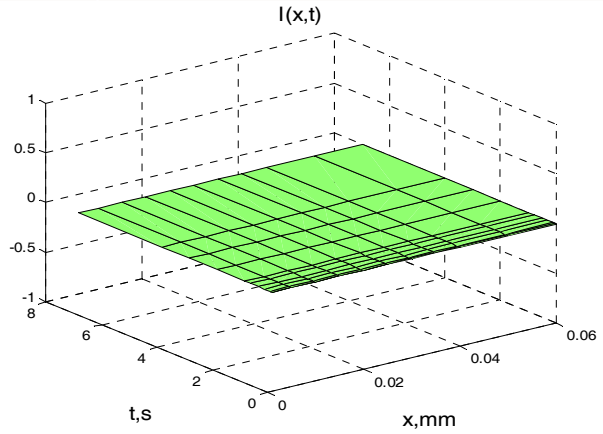

Fig. 3. Concentration profile of inhibitor.Io = 0 mM

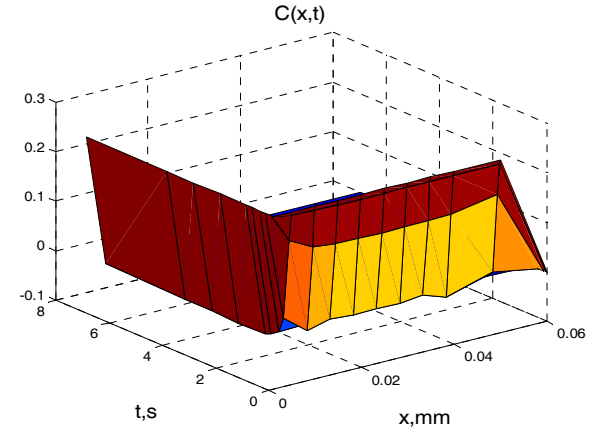

Fig. 4. Concentration profile of co-substrate. Io = 0 mM

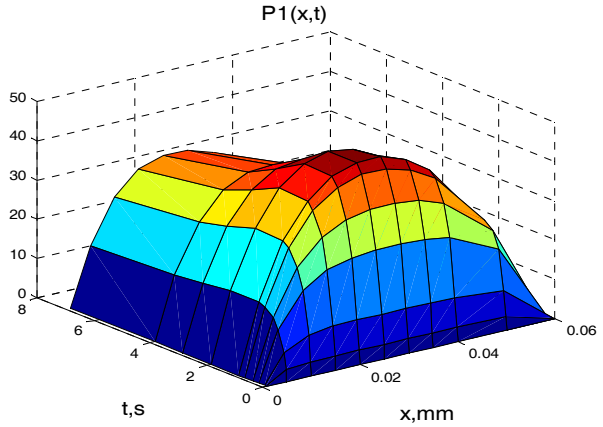

Fig. 5. Concentration profile of Product 1.Io = 0 mM

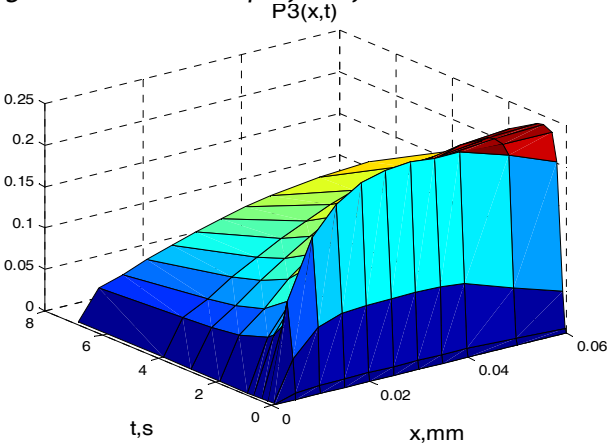

Fig. 6. Concentration profile of Product 3. Io = 0 mM

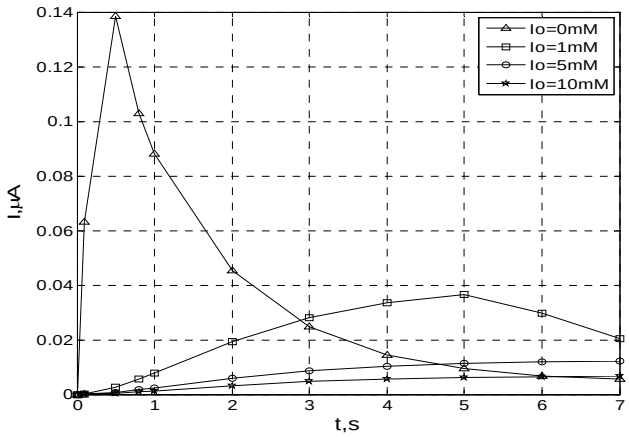

Fig. 7. Output current of the biosensor

The investigated biosensor is co-substrate sensitive and because of that it is important to analyze of changing of c0-substrate C and inhibitor I. At the next pictures are given the dependence of the output current of the biosensor and concentration profiles of substrate, co - substrate, inhibitor and products for the values of I = 1.0 mM.

At fig.8, 9, 10, 11, and 12 are given concentration profiles of substrate S(x,t), inhibitor I(x,t), co-substrate C(x,t), product 1 P_1(x,t), product 3 P3(x,t) for the starting value of inhibitor Io = 5.0 mM.

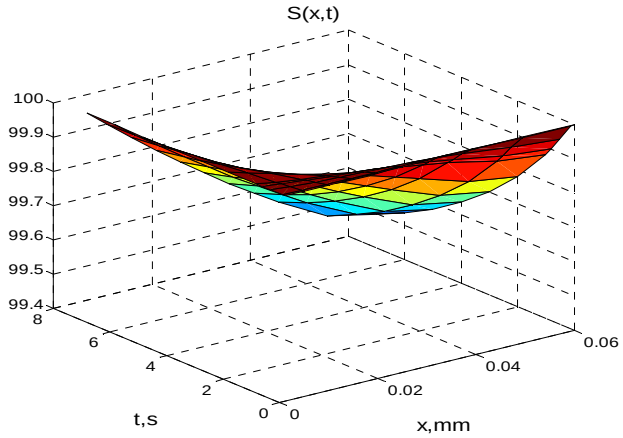

Fig. 8. Concentration profile of substrate. Io = 5 mM

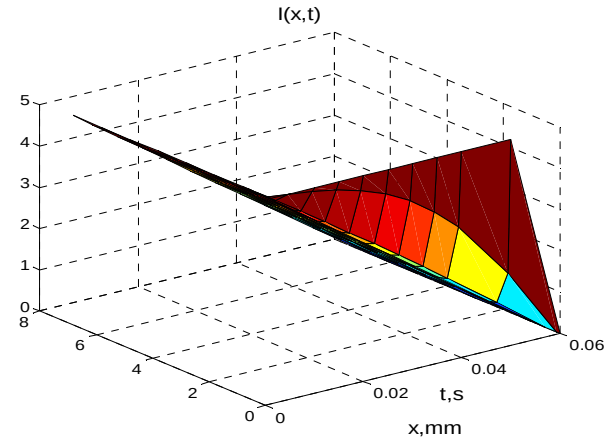

Fig. 9. Concentration profile of inhibitor. Io = 15mM

It is seen clearly how the inhibitor effects over the all reagents. Substrate decreasing very little - from 100mM to 98mM, for the difference at figure 2 where

the decreasing is from 100mM to 20 mM when there is missing inhibitor in the medium. Consuming of the oxygen is less, product 3 formation is increase (fig.12) with the time for the difference at fig.6 where is poorly.

At fig. 7 is given the transient process of the output current for the four values of starting concentration of inhibitor Io = 0, 1, 5 and 10 mM. For the bigger starting concentration of Io the value of steady state of the current is increasing (this is the value fo rthe time biggre thet 7 s), but it is seen that the dependancy is non linear. At fig. 13 it is seen more precise, value of Io are -0, 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 mM.

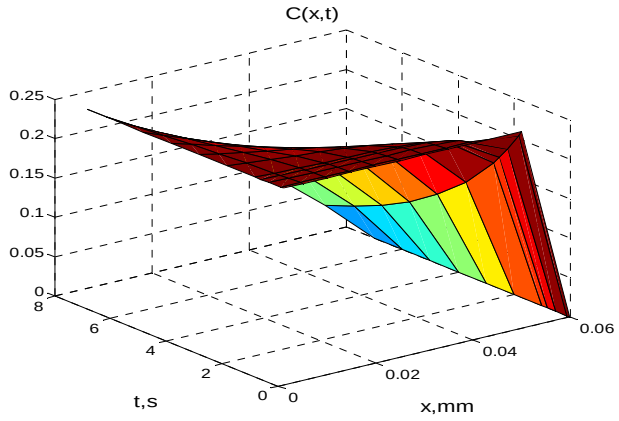

Fig. 10. Concentration profile of co-substrate. Io = 5 mM

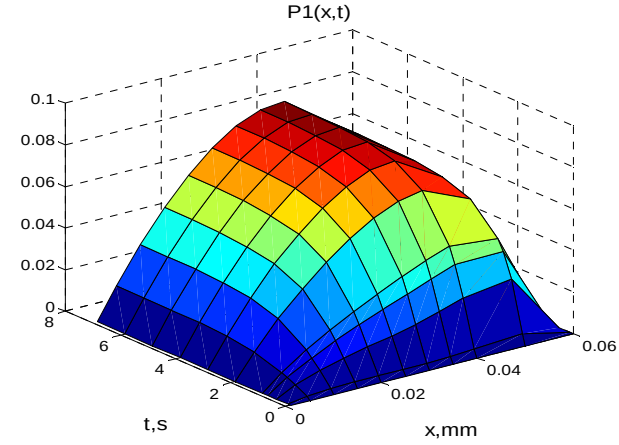

Fig. 11. Concentration profile of Product 1. Io = 5 mM

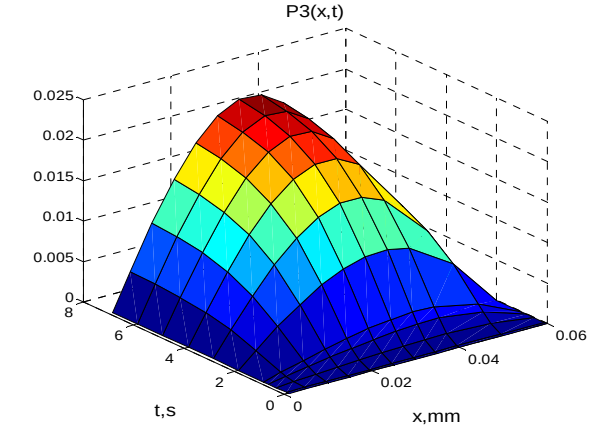

Fig. 12. Concentration profile of Product 3. Io = 5 mM

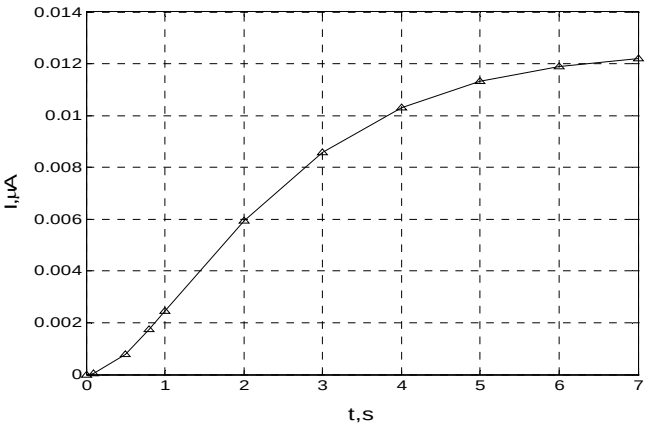

Fig. 13. Output current of the biosensor. Io = 5 mM

At fig. 14 is invstigated the influence of reaction rate constante for inhibitor Ki - 0,05 0,1 0,5 1 2 5 mM at the constante starting concentration of Io = 5mM over substrate concentration profile S (x,t) for x=d. With increasing the Ki substrate consentration in active membrane is decreasing.

At fig. 15 is invstigated the influence of reaction rate constante for inhibitor Ki - 0,05 0,1 0,5 1 2 5 mM for the constante starting concentration of Io = 5mM over the output current. It is seen that transient proceses for the output current strongly depend from Ki. With increasing the reaction rate constante for inhibitor transient process of the current loosing it first order system form.

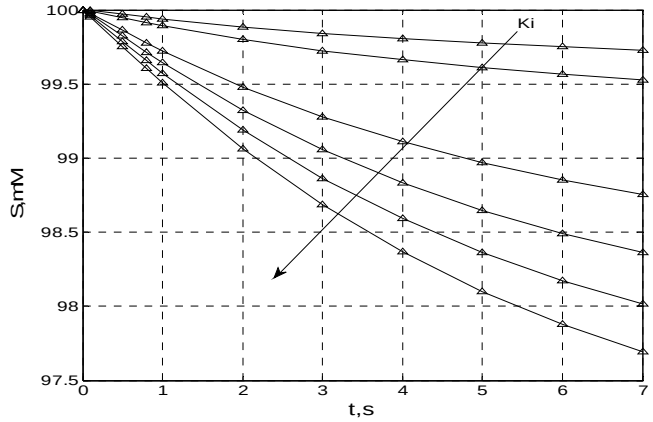

Fig.14.Influence of reaction rate constante over substrate concentration

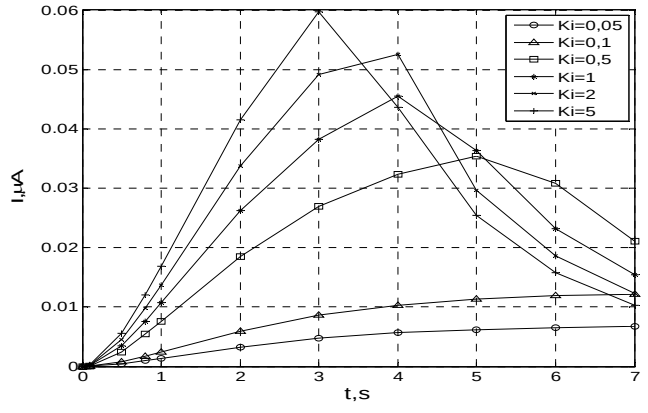

Fig. 15. Influence of reaction rate constante over output current

CONCLUSION

In the paper is investigated the influence of inhibitor starting concentration over biosensor output current for the hybrid biosensor with two enzymes - acid phosphatase and glucoseoxidase in the dynamic mode. Partial differential equations of that complex system are solved numerical and received concentration profiles of five reagents. In the future it will be investigated the influence of enzymes rate over biosensor response and some technical parameters.

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DESIGN SERVICE ROBOT BODY FOR HANDLING

ABSTRACT:
The paper deals approaches to design service robot body for handling. The advantage of using robots handling tooling service is the integration of service activities and manipulation activities, which can perform such a conception. Part of the article is also a procedure for the preliminary draft skeletal units. A prerequisite for building such systems is a deeper revision of existing design methodologies and their closer links with systematized accumulated knowledge base in the discipline.

KEYWORDS:
service robot body, handling, CAD Design

INTRODUCTION

Current trends in the development of robotic equipment links is to the autonomy of these systems. Such a system must have the characteristics of artificial intelligence. Basic concepts of industrial robots, manufactured in the world, reached a high technical level and reliability and are able to cooperate with other production and auxiliary systems in the fields of engineering and non-engineering applications. Variety of service activities in service robotics need to use different principles for solving various tasks, mainly handling [1].

Handling body integrates a buffer and transport handling. Thus integrating the two elements we can achieve high efficiency and flexibility for single and series production.

DESIGN PROCESS OF HANDLING EXTENSIONS

Basic assumptions for the design construction is to determine which kinematical chains such as cut-off parameters perform the handling tasks in terms of geometry - then it is possible to find a clear solution in terms of handling the structural requirements. The next step we determine the kinematical characteristics of at least approximately in the sense that we try to minimize the number of options for minimizing the transfer time, or to minimizing the speed and acceleration. Such an investigation will show trends, but not a clear solution. Based on the range of characteristics is necessary to determine the final concept prototype, taking into account the dynamic characteristics (Figure 1).

After the draft concept of the superstructure of the type series, devise modules according to the concept of solutions. Using system profiles there is a building superstructure to the desired shape. Following this is followed by a preliminary calculation, specifying the dimensional characteristics of the individual and the ballast element. For each element, it is necessary to bring the energy distribution (electric power, power. Signal, ...), which will allow us to interconnect these devices.

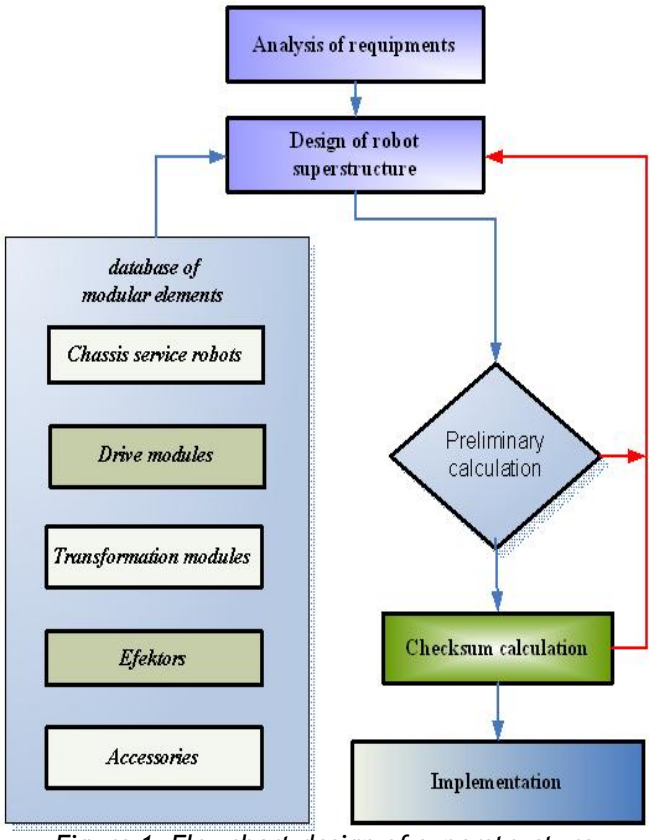

Figure 1. Flowchart design of superstructure

If necessary, use different types of sensors results in their installations. After creating the following proposed superstructure is necessary to transfer control and carry out the conversion of mutual distance, the geometric dimensions given the assignment requirements (internal dimensions, throughput, max landing, ...). When checking (testing) there is a fine-tuning the relative positions of the superstructure and fixed. In case of unsatisfactory results, it is necessary to revise any of the various parts of the superstructure or change the concept of solutions. If the extension meets the required parameters, it is possible to make control design solutions with routes of energy security.

The preliminary draft is to be combined with computer-aided tools [5] preliminary calculations and estimates to refine ideas based on the chosen design parameters (kinematic scheme aa major nodes or sets). These are mainly estimates of kinematic parameters and the required engine power and the choice of the optimum gear ratio. Next, it estimates power ratios, accuracy and stiffness of individual kinetic units. It draws upon earlier experiences and results of verification of their own structures from the analysis of competing products.

CALCULATION OF THE PARAMETERS ROTARY AND TRANSLATION DRIVE UNIT

After estimating the basic dimensions of kinematics scheme and range of motion before the start of cross-sectional design and shape of pieces of physical units is necessary to establish preliminary performance engines and choose a particular manufacturer and dimensional types [2]. Engines, respectively drives constitute a significant burden on the effects of their materials. In doing so, however, their determination takes place at a time when we do not have enough data for their proposal - it is not known and the distribution of body size and other elements of units.

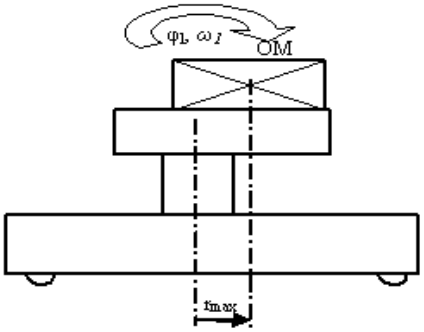

Figure 2. Input values for the design of rotary unit

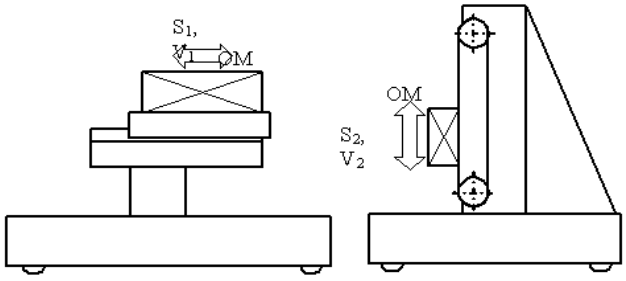

Figure 3. Input values for the design of translation unit

In Figure 2 and Figure 3 are indicated by the input parameters, of them based on estimates of other values of calculation parameters of the drive.

Legend:

m - weight [kg]

r - max. radius [m]

φ_1, s_1, s_2,- max. transfer object manipulation (OM) [rad, m]

ω_1, v_1, v_2 - nominal transfer speed of the OM [s^{-1}, ms^{-1}]

To determine the rotational power unit will be based on the known (1):

$$P_r = \frac{(M_n + M_d)}{\eta} \cdot \omega \qquad (1)$$

η - transfer efficiency between the engine and modulators

M_n - moment of unbalanced masses, including OM relative to the axis of rotation

M_d - dynamic torque at start-up, reflect only the cost of some simplification

Assume a trapezoidal velocity profile, Figure 4.

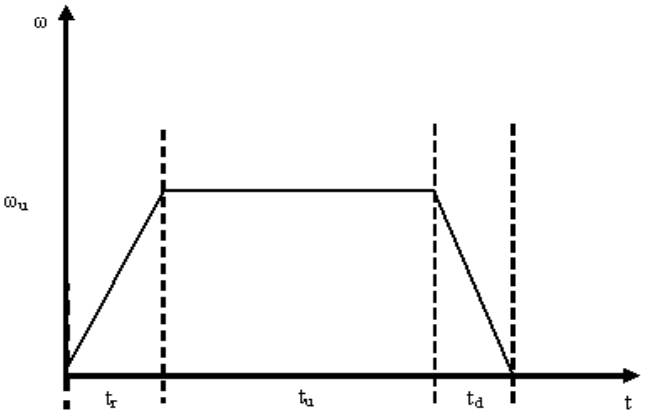

Figure 4. Trapezoidal velocity profile, length start $\varphi_r = k_1 . \varphi$; length end $\varphi_h = k_1 . \varphi$

The value of k_1 can be determined from the consideration that for given ω (or in) as the speed of the transfer facility will be handling the transfer time is shorter (ie higher speed design features), where k_1 is smaller, but the result will be more dynamic loads on mechanical power and lower life structural elements, problems with management (with vibration) and possibly extend the period of relocation (if it is necessary to wait for the vibration). It is optimizing the role.

Consider the normative dynamic loads and accelerations in [ms^{-1}] at similar manipulators and the same class as the calculation of 1.5 a.

For a linear actuator with values normally obtained with stroke = 1m and speed v = 1 ms-1 is then possible to track the acceleration estimate (2).

$$s_r = \frac{1}{2} a t_r^2 , \qquad t_r = \frac{v}{a}$$

$$s_r = \left(\frac{a}{2}\right)\left(\frac{v}{a}\right)^2 = \frac{v^2}{2a} = \frac{1^2}{2.2,5} = 0,2[m] \qquad (2)$$

Taking as an example a = 2.5 [ms-1], then it is possible to estimate:

$$k_1 = \frac{S_r}{S} = \frac{0,2}{1} = 0,2 \qquad (3)$$

Engine power for rotary units we can calculate (4)

$$\varphi_r = \frac{\varepsilon}{2} t_r^2 = \frac{\varepsilon}{2}\left(\frac{\omega}{\varepsilon}\right)^2 ; \quad \varepsilon = \frac{\omega^2}{2\varphi_r} = \frac{\omega^2}{2k_1\varphi} ; \qquad t_r = \frac{\omega}{\varepsilon} \tag{4}$$

To estimate the moment of inertia of masses moving units (5)

$$I = I_r + I_M = k_2 I_r ; \quad I_r = m_{(M)} r^2 \tag{5}$$

I_M - moment of inertia of the rotating parts manipulator at. r_{max},
k_2 - rate design structure, obtained by a similar type of analysis module.
For example k_2 = 1,8 - 2,3 (6)

$$M_d = I.\varepsilon = k_2 I_r \frac{\omega^2}{2k_1\varphi} = k_2 m_{(M)} r^2 \frac{\omega^2}{2k_1\varphi}$$

$$M_n = k_3 m_{(M)} g r \cos\alpha \tag{6}$$

and k_3 we find again transferred from the earlier structures, expresses the dependence of the total unbalanced moment to load manipulator.(7)

$$k_3 = \frac{M_n}{m_{(M)} g r} \tag{7}$$

To estimate power of rotation for moving units around a horizontal axis [4]. (8)

$$P_r = \frac{(M_n + M_d)}{\eta}\cdot\omega =$$

$$= \left(k_3 m_{(M)} g r \cos\alpha + k_2 m_{(M)} r^2 \frac{\omega^2}{2k_1\varphi}\right)\frac{\omega}{\eta} = \tag{8}$$

$$= \frac{\omega r m_{(M)}}{\eta}\left(k_3 g \cos\alpha + \frac{k_2 r \omega^2}{2k_1\varphi}\right)$$

For rotation around the vertical (z axis) does not work to drive them mass (Mn). (9)

$$P_{r(z)} = \frac{m_{(M)} r^2 \omega^3}{\eta\varphi}\left(\frac{k_2}{2k_1}\right) =$$

$$= \frac{m_{(M)} r^2 \omega^3}{\eta\varphi}\left(\frac{2}{2.0.1}\right) = 10\frac{m_{(M)} r^2 \omega^3}{\eta\varphi} \tag{9}$$

CONCLUSION

The importance lies in developing solutions and integrated solutions to improve handling equipment and systems. Prerequisite for building such systems is further reprocessing of the existing design methodologies and their closer links with systematized accumulated knowledge base in the discipline [3].

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MODELING MECHANICAL AND THERMAL LOAD OF GUTTING TOOL

ABSTRACT:
Finite element method, as a method of simulation of the cutting phenomenon during machining process allows obtaining information relevant for further computational analysis of tool wear, cutting temperature and cutting forces. These are the most important factors that influence the accuracy of processing and combined with other factors they affect deformation of cutting tools. The paper presents computer modelling of tool deformation and thermal load during turning using finite element method. The modelling was conducted during cutting time from 20 to 180 seconds.

KEYWORDS:
finite element method, mechanic, thermal load control, turning

INTRODUCTION

Machining is one of the most important and most common manufacturing processes in the metal processing industry. Cost of production in the metal processing industry is primarily achieved by optimal choice of all the factors that influence the cutting process.

The application of digital computers has brought revolutionary changes in the domain of various engineering and scientific disciplines, and one of the first was the area of mechanics of solids.

Increase processor enabled computer can significantly improve the relationship between price systems and their performance, resulting in an increased number of users in industry who Finite Element Method (FEM) systems integrated into the process of construction and development.

In recent years, finite element analysis has become a major method in simulation of metal cutting. Recently developed software systems based on the method of finite elements that are exclusively designed for cutting process simulation.

The process of cutting occurs when edge of cutting tools penetrate with cutting speed v in to processing materials. Entering edge of cutting tools, under the influence of external forces (cutting force F); there is a conversion of surplus material and thickness (depth of cut) in the chip thickness as [1, 2].

The appearance of the heat in the cutting zone is a consequence of converting mechanical energy into heat. Heat affects: the chip forming process, chip plastic deformation, chip compression ratio, cutting forces, the buildup edge, the intensity of the development of tool wear process of the structure and thickness of the machining surface defective layer.

More than 99.5% of energy (mechanical work) consumed in the deformation processing of material, and mastering of friction forces on contact surfaces cutting tools surfaces (rake and flank) is transformed into heat, so that the quantity of generated heat during cutting process [1]:

Generated heat in the cutting zone leads to a warming workpiece chip and cutting tool as well as the appearance of the characteristic temperature field and temperature.

FINITE ELEMENT METHOD

By definition, the finite element method is a method for approximately solving the so-called space problem. Finite element method is a method of computer analysis of problems in mechanics, fluid mechanics, thermodynamics, etc... In manufacturing, mostly in the metal forming process, the finite element method has proved to be an irreplaceable tool in research and development as well as in industrial applications. The basic principle of the finite element method is the division of the continuum (space) on a finite number of parts or elements. Thus the initial, very complex problem, we have a finite number of discrete and independent problems [3].

SOFTWARE PACKAGE

For temperature analysis during turning was used ANSYS software package. ANSYS is a general-purpose software package designed for analysis using finite elements. ANSYS Contains equations that governs the

behavior of finite elements, fixes them and gives a comprehensive explanation of the functioning of the system as a whole. These results can be presented in tabular or graphical form [4].
The steps in solving problems of ANSYS software package:

- Development of geometric models
- Defining the properties of materials
- Generation Network
- Defining loads
- Troubleshooting
- Find results presentation

THE FINITE ELEMENT METHOD ANALYSIS OF FORCE EFFECTS DURING TURNING

Computer analysis of the effects of cutting force in turning was realized using the ANSYS Workbench v11 software system and its module for structural analysis. The computer simulated analysis for the processing time of 1 and 2 seconds.

Building of geometry

In the first phase closed 2D contour is modeled using the Design Modeler and its module Sketcher. Using 3D modeling command Extrude, model tools and workpiece are given a third dimension. 3D model is then introduced into the ANSYS Workbench's module Simulation for further analysis where the meshing of the model is performed (Fig. 1.).

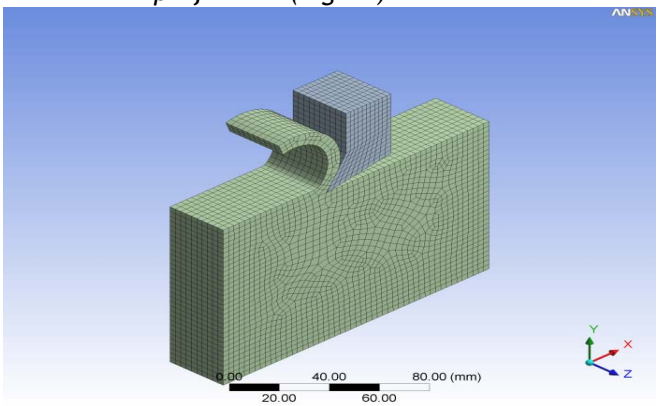


Fig. 1. Mesh of 3D model

Defining material properties

After the phase of generating discrete 3D model, mechanical and thermal properties of tool material [5,6] (Table 1.) are entered in Engineering Data window.

Table 1. Tools and workpiece material properties

	Module of elasticity [N/m^2]	Specific density [kg/m^3]	Poisoned coefficient	Heat conduction [W/m°C]	Specific heat [J/kg°C]
Tool material	$4{,}15 \cdot 10^{11}$	14300	0,2	55	560
Workpiece material	$2{,}17 \cdot 10^{11}$	7850	0,3	41,5	460,5

Defining the type of analysis and boundary conditions

Flexible Dynamic (dynamic load variable over time) analysis is selected. It allows analysis of deformation caused by the action of forces that occur during cutting. It is necessary to constrain the tool, to take away its degrees of movement freedom in the direction of X, Y and Z-axis (Fixed Support).

Defining loads

For defining of boundary conditions and input data of the cutting forces data from the literature is used [4]. The following experimental data for the force (Load) Fr = 2410 N (X = 880N, Y = -2200 N, Z = -440 N) is used. The value of cutting force was obtained on the universal lathe. During machining the following cutting conditions were used feed = 0.426 [mm/rev], cutting speed = 2 [m/s], rpm = 530 [rpm], depth of cut = 2 [mm] machining diameter = 72 [mm] tool material HM P25 and workpiece material steel Č.1730.

Solving the mathematical model

Since all the necessary elements for a specific analysis were defined, next step in solving the problem was using a command SOLVE.
After solving a problem ANSYS Workbench provides a graphical display of the results obtained in the form of images and/or animation.
Chosen output result parameters were:

- Directional Deformation X
- Directional Deformation Y
- Directional Deformation Z
- Total Deformation
- Equivalent Elastic Strain
- Strain Energy
- Total Acceleration
- Total Velocity
- Vector Principal Elastic Strain

ANALYSIS AND OUT-LINE OF RESULTS

The analysis results are shown in Table 2. which contains data about tool deformation in individual axes and the overall deformation.

Table 2. Results of finite element analysis

	Minimum [mm/mm]	Maximum [mm/mm]
Equivalent Elastic Strain	7,4402e-016	8,879e-004
Directional Deformation X	-3,4122e-003	2,4002e-003
Directional Deformation Y	-8,3198e-003	8,8709e-005
Directional Deformation Z	-2,682e-003	5,9462e-005
Total Deformation	0	9,2854e-003

Figures 2 to 4 shows Deformation of cutting tool in 3 orthogonal direction and Figure 5 shows total deformation of cutting tool.
Analysis of the occurrence of tools deformation in cutting metal, simulating the effects of cutting forces in three-dimensional model of the tool by use of the finite element method, gave satisfactory results. The result of the total deformation, due to the effects of force, after one second is 0.0054 mm, and after two seconds 0.0092 millimeters.

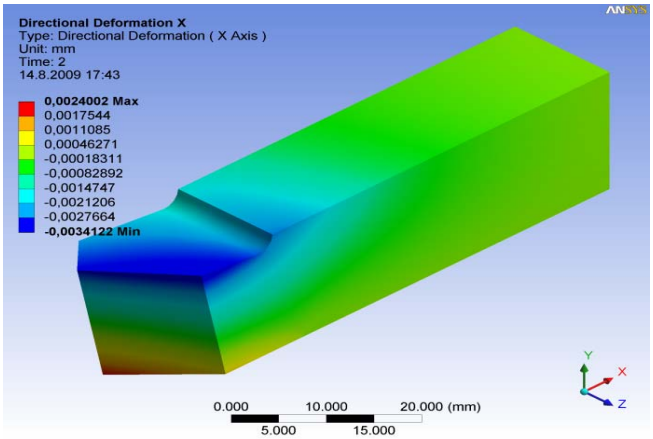


Fig. 2. Directional deformation X-axis

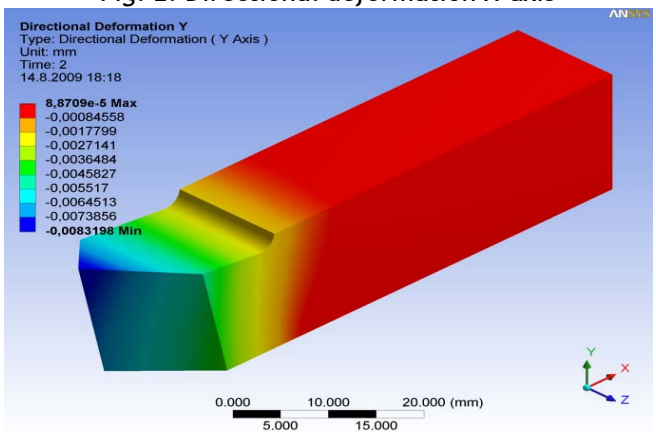


Fig. 3. Directional deformation Y-axis

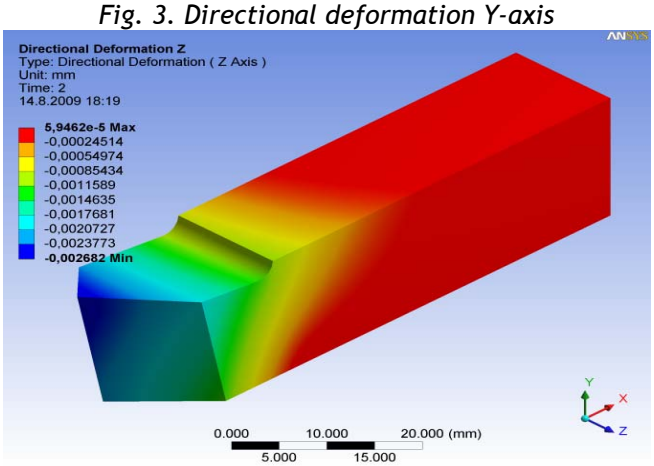


Fig. 4. Directional deformation Z-axis

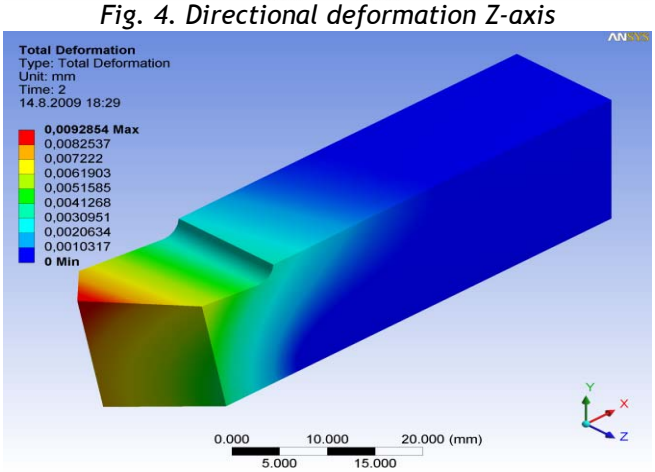
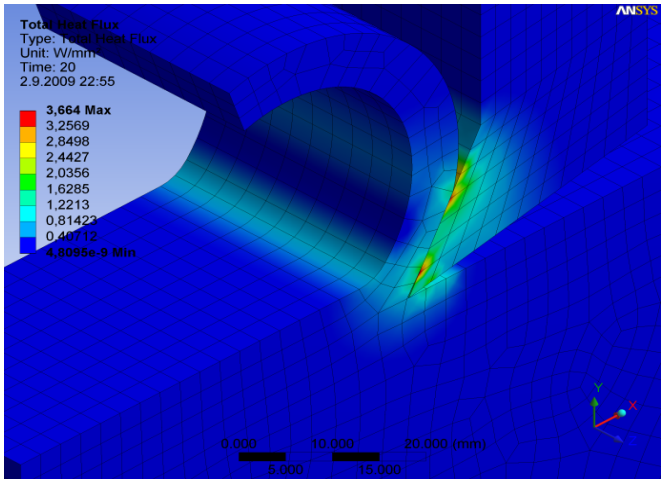


Fig. 5. Total Deformation

Analysis Of Temperature In Turning Heat By Finite Element Method

The amount of heat flux is approximated by a computer model. Heat source of variable intensity simulation in four phases was generated by tool movement. In the first phase of setting of heat load modeled was tool in the admission procedure, and cutting process is modeled after 20 [s] of machining. Based on the given feed movement, which was 0.428 [mm / rev] and speed v = 112 [m / min], after 20 [s] machined was 72 [mm] of workpiece length. At this phase the heat flux taken from the literature [5] and [6] based on the maximum temperature of operation, was about 0.0018 x 106 [J/m^{2}s] because relations for the determination of heat flux that goes into the chips were not available in the literature. At the end of the first phase, after 20 [s] calculate heat flux was 0.0029 x10^6 [J/m^{2}s].



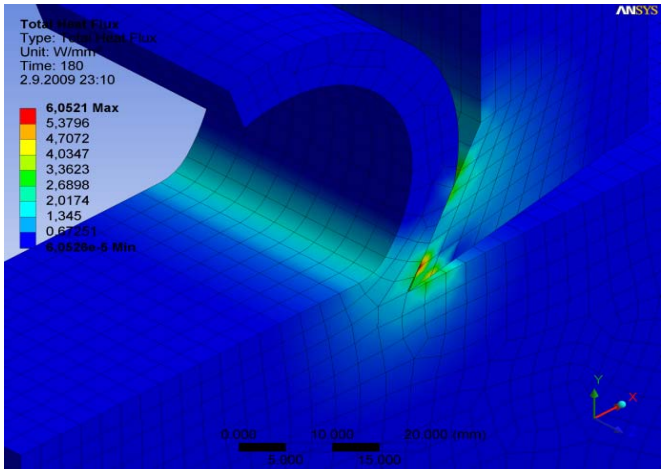


Fig.6. Schedule of heat flux after 20 and 180 seconds

The second stage continued a definition of loading on the first phase. After 80 [s] at the same speed and feed were processed the next 290.4 [mm] of workpiece.

In the third and fourth phase of processing is modeled after 140 [s] or 180 [s], provided that the always contain the next phase as input outputs from previous phases.

Heat flux (Fig. 6.) in the cutting zone gradually changes until equilibrium is established between the created and taken the heat.
From the point of increase in temperature, a computer model has given satisfactory results in some points almost coincide with the experimental (minimum deviation 0.61%) [7, 8]. Primary opportunity for improving the thermal model used is a modification of the heat flux process; its calculation is based on finite difference or finite volume. According to available information from the literature to analyze the process of turning (determining the cutting heat flux) is the most suitable method of finite differences.
Parameterization of the characteristic geometric size, such as dimensions of workpiece, contact length of chip and so on considerably would simplified the iterative modeling of process variation of some characteristic like size, thereby enabling the optimization of machining processes on the basis of selected parameters. In this way the computer model could be used not only to predict the maximum temperature and temperature field distribution, but could find application in one comprehensive system for planning and managing the process of cutting.

CONCLUSIONS

Finite element method as a method for modelling of the cutting phenomena allows obtaining of information relevant for further computational analysis, tool life assessment as one of the most important factors for testing the accuracy of processing in which, among other factors certainly affect deformation cutting tools and heat load.
In the paper shedule in time of heat flux was determined.
Defermation of tool under the load of experimentalz determined cutting forces was determined.

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TAGUCHI'S ORTHOGONAL DESIGN BASED SOFT COMPUTING METHODOLOGY TO SOLVE CELL FORMATION PROBLEM ON PRODUCTION SHOP FLOOR

ABSTRACT:
The key problem in Cellular Manufacturing System (CMS) is to identify the machine cells and corresponding part families with an aim to curtail the intercell and intracell movement cost of the items. This paper demonstrates a state-of-the-art Soft-Computing based Simulated Annealing heuristic to cell formation problems in CMS. Thereafter Taguchi's orthogonal design is utilized to solve the critical issues on the subject of parameters selection for the proposed heuristic which is further investigated on 20 widely practiced datasets obtained from related literature. It is shown to outperform the published methodologies such as ZODIAC, GRAFICS, MST, TSP-GA, GA and GP, producing 60% improved solutions.

KEYWORDS:
Group Technology, Cell Formation, Cellular Manufacturing, Clustering Approach, Simulated Annealing, Heuristic, Soft Computing

INTRODUCTION

Cellular manufacturing systems (CMS) exploit group technology (GT) as a manufacturing metaphysics which groups similar parts into part families depending on its manufacturing designs, features and geometric shapes and constructing machine cells to produce the part families [1]. Designing manufacturing cells has been named cell formation problem (CF/CFP), consists of the following procedures: usually similar parts are grouped into part families following their processing needs, and heterogeneous machines are grouped into machine cells and subsequently part families are designated to cells. The problem confronted in CMS is formation of such cells regardless of its category [2]. Not fundamentally the aforementioned steps are accomplished in precise sequences. Depending upon the requirements three solution methodologies are adopted: (i) part family identification and subsequent machine cell formation subject to the processing necessities of the part families, (ii) manufacturing cell formation by assembling heterogeneous machines and thereby the part families are assigned to cells, (iii) part families and machine cells are formed alongside. Numerous intelligent algorithms are widely practised in solving the CF problems owing to its NP-Complete nature [3].

Two diverse methodologies are realized in past literature in order to form machine-part cells, first is production flow analysis (PFA) which deals with processing necessities, operational sequences and operational time of the parts on the machines [4]. Another approach is the Part Coding Analysis (PCA) which utilizes predefined coding schemes to facilitate the process using several attributes of parts such as geometrical shapes, materials, design features and functional requirements etc. [5].

Various techniques are developed to solve manufacturing cell formation problems over the past four decades, these include similarity coefficient methods, clustering analysis, array based techniques, graph partitioning methods etc. The similarity coefficient approach was first suggested by McAuley [6]. The basis of similarity coefficient methods is to compute the similarity between each pair of machines and then to group the machines into cells based on their similarity measures. Few studies proposed to measure dissimilarity coefficients instead of similarity coefficient for machine-part grouping problems [7]. Clustering methods are categorized as hierarchical and non-hierarchical methods. Standard or typically designed clustering techniques could be utilized to build clusters of either components or machines. Most clustering based CF solution methodologies utilize machine-part incidence matrix, such as Single linkage clustering [6], Average linkage clustering algorithm [8]. Machine-part grouping problem is based on production flow analysis, in which the machine-part production cells are formed by permuting rows and

columns of the machine-part incidence matrix. Some of the methods are Rank Order Clustering (ROC) [9], Bond energy algorithm [10] etc. Dimopoulos and Mort [11] has proposed a hierarchical algorithm combined with genetic programming for efficient cell formation in CMS.

Array based methods consider the rows and columns of the machine-part incidence matrix as binary patterns and reconfigure them to obtain a block diagonal cluster formation. The ROC algorithm is the most familiar array-based technique for cell formation [9]. Substantial alterations and enhancements over ROC algorithm have been described by King and Nakornchai [12] and Chandrasekharan and Rajagopalan [13]. The direct clustering analysis has been stated by Chan and Milner [14], and bond energy analysis is performed by McCornick et al.[10].

Graph Theoretic Approach depicts the machines as vertices and the similarity between machines as the weights on the arcs. An ideal seed non-hierarchical clustering algorithm for cellular manufacturing is proposed Chandrasekharan and Rajagopalan [15]. Srinivasan [16] implemented a method using minimum spanning tree (MST) for the machine-part cell formation problem. A polynomial-time algorithm based on a graph theoretic approach was developed by Veeramani and Mani [17].

In present article a novel approach has been developed using Median Linkage Clustering (MLC) algorithm to produce an initial feasible solution to CFP. Thereafter a Soft Computing based Simulated Annealing (SA) heuristic is adopted to enhance the quality of the initial solutions obtained. During past few decades Soft Computing techniques are exhaustively practiced by researchers in the vicinity of CMS. Tavakkoli-Moghaddam et al. [18] explained that dynamic condition of CFP becomes more complex and proposed Tabu Search (TS), Simulated Annealing (SA) and GA methods to solve this type of problems. Their study indicated that SA is better in terms of solution and complexity than TS, GA. Other authors [19] introduced an integer programming model for dynamic CFP and implemented SA algorithm to obtain the optimal solutions. Das et al.[20] proposed the multi-objective mixed integer-programming model for CMS design by minimizing machine operating and utilization cost and total material handling cost and maximizing system reliability. Lei and Wu [21] worked with multi-objective cell formation (CF) problem and proposed a Pareto-optimality based on multi-objective tabu search (MOTS) with different objectives: minimization of the weighted sum of inter cell and intra cell moves and minimization of the total cell load variation. A hybrid methodology based on Boltzmann function from simulated annealing and mutation operator from GA was proposed by Wu et al.[22] to optimize the initial cluster obtained from similarity coefficient method (SCM) and rank order clustering (ROC). Arkat et al.[23] developed a sequential model based on SA for large-scale problems and compared their method with GA. Ateme-Nguema and Dao [24] investigated an Ant Algorithm based TS heuristic for cellular system design problem (CSDP) and the methodology proved to be much quicker than traditional methods when considering operational sequence, time and cost. Authors further proposed quantized Hopfield network for CFP to find optimal or near-optimal solution and TS was employed to improve the performance and the quality of solution of the network [25]. Durán et al.[26] reported a modified Particle Swarm algorithm with proportional likelihood instead of using velocity vector on CF problems where the objectives are the minimization of cell load variation and inter cellular parts movement and reported the stability of the method with low variability. A similar study was also performed by Anvari et al.[27] where a hybrid particle swarm optimization technique for CFP was reported. The initial solutions generated either randomly or using a diversification generation method and the technique also utilized mutation operator embedded in velocity update equation to avoid reaching local optimal solutions. Thereafter with due consideration, a wide variety of machine/part matrices were effectively solved by this approach. Interested readers could obtain an elaborated survey on Soft Computing based approaches in CMS proposed by Ghosh et al. [28].

PROBLEM FORMULATION

The cell formation problem in group technology begins with two fundamental tasks, namely, machine cell formation and part family identification. Similar machines are grouped to form machine cells and dedicated for the manufacture of one or more part families. In part family formation, parts with similar design features, attributes, shapes are grouped, so that the group of parts can be manufactured within a cell. Generally the cell formation problems are presented using a matrix namly machine-part incident matrix in which all the elements are either 0 or 1. Parts are arranged in cloumns and machines are in rows of the incidence matrix. An example matrix is presented in Figure 1.

In this matrix a 0 indicates no mapping or no processing and an 1 indicates mapping or processing. Therefore it depicts that machine 1 processes parts 2, 3, 5, machine 2 processes parts 1, 4, 5 and machine 3 processes parts 3, 5.

	p1	p2	p3	p4	p5	p6	p7
m1	1				1	1	1
m2		1	1	1	1		
m3			1	1	1	1	
m4	1	1	1	1			
m5		1		1	1	1	

Figure 1. Machine-part incidence matrix of example dataset (5×7)

From this problem matrix a solution matrix could be obtained which presents the formation of cells as diagonal square boxes (Figure 2). Once some appropriate technique is employed to CFP this solution matrix is believed to be obtained. It can be interpreted that cell 1 contains {machines 1, 3 || parts

2, 3, 5} and cell 2 contains {machine 2 || parts 1, 4}. An 1 outside the block means a part is processed through some machine which does not belong to any machine cell, therefore the intercellular move cost will be added. This element is known as an 'exceptional element' (EE) and a 0 inside a cell mean lesser utilization of space and increased intracell move cost. It is known as a 'void'. The objective of cell formation is to minimize the EEs and voids.

	p1	p7	p6	p4	p3	p5	p2
m1	1	1	1			1	
m2				1	1	1	1
m3			1	1	1	1	
m5			1	1		1	1
m4	1			1	1		1

Figure 2. Final block diagonal cell formation of example dataset (5×7)

To formulate the cell formation problem the following are considered,
i=1,…,M, denotes machine index
j=1,…,P, denotes part index
k=1,…,K, denotes cell index
The incidence matrix is A=[a_{ij}] demonstrates the mapping between machines and parts,

$$a_{ik} = \begin{cases} 1 & \text{if part } j \text{ processed by machine } i \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

To measure the goodness of solutions, different performance measures have been proposed by researchers since past few decades. Various measures can be obtained from the critical survey of performance measures [29]. In this study grouping efficacy has been considered which is heavily utilized by other authors to measure the efficiency of their solutions [30] and it is given as:

$$\tau = \frac{E - E_e}{E + E_v} \quad (2)$$

Where: E = Total number of 1s;
E_e = Total number of EEs; E_v = Total number of voids
The objective function which maximizes the efficiency is as follows:

$$\text{Maximize } F = \frac{E_v \mid E_e}{E + E_v} \quad (3)$$

subject to

$$\sum_{k=1}^{K} x_{ik} = 1 \qquad i = 1,\dots,M \quad (4)$$

$$\sum_{k=1}^{K} y_{jk} = 1 \qquad j = 1,\dots,P \quad (5)$$

$$\sum_{k=1}^{K} x_{ik} \geq 1 \qquad k = 1,\dots,K \quad (6)$$

$$\sum_{k=1}^{K} y_{jk} \geq 1 \qquad k = 1,\dots,K \quad (7)$$

$$x_{ik} = 0 \text{ or } 1 \qquad i = 1,\dots,M;\ k = 1,\dots,K \quad (8)$$

$$y_{jk} = 0 \text{ or } 1 \qquad j = 1,\dots,M;\ k = 1,\dots,K \quad (9)$$

where,

$$x_{ik} = \begin{cases} 1 & \text{if machine } i \text{ is in cell } k \\ 0 & \text{otherwise} \end{cases} \quad (10)$$

and

$$y_{ik} = \begin{cases} 1 & \text{if part } j \text{ is in cell } k \\ 0 & \text{otherwise} \end{cases} \quad (11)$$

To evaluate the objective function F, it can be demonstrated:

$$E_e = E - \sum_{k=1}^{K}\sum_{i=1}^{M}\sum_{j=1}^{P} a_{ij}\, x_{ik}\, y_{jk} \quad (12)$$

$$E_v = \sum_{k=1}^{K}\sum_{i=1}^{M}\sum_{j=1}^{P} (1 - a_{ij})\, x_{ik}\, y_{jk} \quad (13)$$

The function F is a fractional function in x and y. The constraints (4) and (5) depict that each machine and each part is assigned to exactly one cell, respectively. Further constraints (6) and (7) demonstrate each cell contains at least one machine and one part respectively. Binary variables are expressed in (8) and (9). Constraints (6) and (7) ensure the elimination of empty cells, if any.
The objective of the proposed methodology is to maximize the value of function F (equation (3)). Therefore in order to achieve this objective, the number of Ees and voids are believed to be minimized. Thus equation (12) and (13) are utilized as the objective function of the proposed Soft Computing technique.

SOLUTION METHODOLOGY

The proposed methodology is developed using Soft Computing based SA algorithm to achieve optimal solutions. The SA algorithm simulates the physical annealing process, where particles of a solid arrange themselves into a thermal equilibrium. An introduction to SA can be found in the book by Aarts and Korst [31]. The general applications concerns combinatorial optimization problems of the following form where S is a finite set of feasible solutions.

$$\min_{x \in S} g(x) \quad (14)$$

The algorithm uses a pre-defined neighborhoods structure on 'S'. A control parameter called temperature in analogy to the physical annealing process governs the search behavior. In each iteration, a neighbor solution y to the current solution x is computed. If y has a better objective function value than x, the solution y is accepted, that is, the current solution x is replaced by y. If, on the other hand, y does not have a better objective function value than x, the solution y is only accepted with a certain probability depending on (i) the difference of the objective function values in x and y, and (ii) the temperature parameter. The pseudocode below demonstrates SA procedure.

Pseudocode (SA)
initialize;
repeat
generate a candidate solution;
evaluate the candidate;
determine the current solution;
reduce the temperature;
until termination condition is met;

Initial Solution Generation

In this article Sorenson's similarity coefficient method[32]is exploited which is further combined with median linkage clustering technique to form the

machine cell.Median Linkage Clustering Algorithm is theoretically and mathematically simple algorithm practiced in hierarchical clustering analysis of data [33]. It delivers informative descriptions and visualization of possible data clustering structures. When there exists hierarchical relationship in data this approach can be more competent.

Similarity Coefficient Method

The Sorenson's similarity coefficient metricis demonstrated as,

$$S_{ij} = \frac{2a_{ij}}{(a_{ij} + b_{ij}) + (a_{ij} + c_{ij})} \quad (15)$$

S_{ij} = Similarity between machine i and machine j,
a_{ij} = the number of parts processed by both machines i and j,
b_{ij} = the number of parts processed by machine i but not by machine j,
c_{ij} = the number of parts processed by machine j but not by machine i.

In order to facilitate the computation in Matlab the similarity matrix obtained using equation (15) further transformed into distance matrix using,

$$d_{ij} = 1 - S_{ij} \quad (16)$$

Utilizing (16)dissimilarity relationship can be obtained between machines and an m×m dissimilarity matrix can be obtained as depicted in Figure 3.

	m1	m2	m3	m4	m5
m1	0	0.75	0.5	0.75	0.5
m2		0	0.25	0.25	0.25
m3			0	0.5	0.25
m4				0	0.5
m5					0

Figure3. Similarity matrix obtained of the example dataset (5×7)

Machine Group Formation

The proposed hybrid technique takes the input of the similarity matrix obtained from the previous stage and produces dendrogram structure that links individual machines or subgroup of machines according to their values of similarity coefficients. Median linkage function is implemented on the basis of hierarchical cluster information. If machine cell r is formed combining cell p and q, and n_r is the number of machines in cell r, x_{ri} is the i^{th} machine of cell r, then median linkage is computed using the formula,

$$d(r,s) = \|\bar{x}_r - \bar{x}_s\|_2 \quad (17)$$

which is the Euclidean distance between the weighted centroids of two cells where,

$$\bar{x}_r = \frac{1}{2}(\bar{x}_p + \bar{x}_q) \quad (18)$$

The matrix Z is generated from this function is a (m-1)×3 matrix, where m is the number of machines in the original dataset. Columns of the matrix contain cluster indices linked in pairs to form a binary tree. The leaf nodes are numbered from 1 to m. Leaf nodes are the singleton clusters from which all higher clusters are built. Further the dendrogram can be obtained from the matrix which indicates a tree of potential solutions. The dendrogram is presented in Figure 4 which visualize the hierarchical cluster formation.

$$z = \begin{matrix} 3.0000 & 5.0000 & 0.2500 \\ 2.0000 & 6.0000 & 0.2165 \\ 4.0000 & 7.0000 & 0.3698 \\ 1.0000 & 8.0000 & 0.6636 \end{matrix}$$

A threshold value is used for cutting the linkage matrix Z obtained from previous step into clusters. Clusters are formed when a node and all of its subnodes have inconsistent value less than the threshold value. All leaves at or below the node are grouped into a cluster. Output is a vector of size m containing the cluster assignments of each machine row.

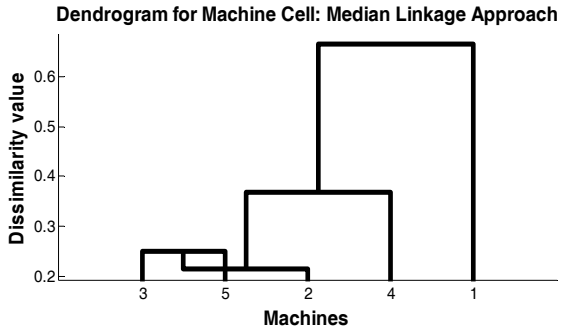

Figure 4. Dendrogram construction for the machine groups of example dataset (5×7)

Therefore the vector obtained could be presented as,
S_1 = [1, 2, 2, 1, 2]

Part Group Formation

In order to obtain the part family, similar steps are repeated on part-machine incidence matrix which is a transpose matrix of machine-part incidence matrix. The dendrogram could also be obtained for part cluster on the similar manner of achieving the machine dendrogram. Thereafter the vector containing the cluster assignments for parts is presented as,

S_2 = [1, 2, 2, 2, 1, 1, 1]

Therefore the initial solution generation algorithm is explained as,

Input: machine-part incidence matrix
Step 1. Procedure Similarity()
Step 1.1. Compute similarity values between pair of machines using equation (15)
Step 1.2. Compute the similarity matrix of the parts
Step 1.3. transform the similarity matrix into a distance matrix using equation (16)
Step 1.4. End
Step 2. Procedure MedianCluster()
Step 2.1. loop
Step 2.2. Compute the distance between two clusters using equation (17)
Step 2.3. Construct matrix Z of size (m-1)×3 to from the hierarchical tree structure
Step 2.4. Construct the dendrogram from Z
Step 2.5. loop
Step 2.6. create machine cells for the minimum level of dissimilarity coefficient and obtain S_1
Step 2.7. A=Transpose(A) and Go to step 1
Step 2.8. create part families for the minimum level of dissimilarity coefficient and obtain S_2
Step 2.9. stop
Output: S_1 and S_2

The Proposed Soft Computing Technique

This subsection describes the proposed SA algorithm in depth. In this algorithm, the number of cells resulting in the best solution is fixed initially. The initial input is a solution string to the problem in hand which is generated from Median Linkage technique. Therefore

the initial input string is S_0 which is obtained combiningS_1 and S_2,

S_0= [1, 2, 2, 1, 2, 1, 2, 2, 2, 1, 1, 1]

The size of the solution string is m+p. where m is the number of machines and p is the number of parts. Each bit of the string represents cell number of the corresponding machine or part (string indices). Therefore T2 states machine 1 is placed in cell 1, and machine 2, 3, 4, 5 are placed in cell 2, and part 1 and 7 are placed in cell 1, and part 2 to 6 are placed in cell 2.

To understand the goodness of the solution a performance evaluation criterion is assumed to be explained which is presented by equation (3). Thereafter the objective is set to minimize the count of EEs and voids to improve the fitness of obtained solutions. Some symbolization used in the algorithm are introduced as,

S_{cur} → current solution
S_i → neighbourhood solution
S_{best} → best solution found so far
T_{init} → initial temperature
T_{final} → freezing temperature
T → current temperature
a → temperature reducing factor
M → Markov chain length
iter → iteration number
f_i → current fitness value
f_{best} → best fitness value

The steps of the proposed algorithm can be summarized as follows.

Step 1. Obtain an initial solution S_0 by using similarity coefficient and Median Linkage procedures
Step 2. Evaluate S_0 and Calculate corresponding fitness value f_0;
$f_0 = f(S_0)$
Step 3. Set $f_{best}= f_0$,
Set $S_{best} = S_0= S_{cur}$.
Step 4. Initialize SA Heuristic and its parameters: T_{init}, T_{final}, a, M, iter = 0, count=0, count1=0.
Step 5. If count < M, then repeat Steps 5.1 to 5.9.
Step 5.1. Generate a new machine cell formation configuration neighbourhood searching by performing single-move (randomly selecting a part or machine and moving it to another cell).
Step 5.2. Read cell formation configuration from above steps and generate corresponding neighbourhood solution S_i.
Step 5.3. If $f(S_i) > f_{best}$, then $S_{best} = S_i$, $S_{cur} = S_i$, count = count + 1,
go to Step 5.
Step 5.4. If $f(S_i) = f_{best}$, then $S = S_i$, count1= count1 + 1, count = count + 1,
go to Step 5.
Step 5.5. Compute $\delta = f(S_i)- f(S_{cur})$. Obtain a random variable r in the range of U(0,1).
Step 5.6. If $e^{\delta/T} > r$,
Step 5.7. set $S_{cur} = S_i$,
Step 5.8. count1= 0;
Step 5.9. else count1 = count1 + 1.
Step 5.10. iter = iter + 1.
Step 5.11. until freezing temperature (T_{final}) is reached;
Step 5.12. reduce the temperature using $T_i=a\times T_{i-1}$ function;

The SA procedure is repetitively employed until a solution is achieved which attains the highest fitness score. All the parameters and counters are initialized in step 4. A special move, namely single-move, is utilized in the proposed algorithm to guide the solution searching procedure. From the understanding of exhaustive testing, it is spotted that single move ordinarily leads to improved solutions effortlessly and competently. Thus single-move is practiced as a principle component for finding better neighborhood solution in step 5.1. The algorithm also verifies the number of instances when neighborhood solutions become static. If this number attains a pre-fixed constant value, the fitness value of current configuration is compared to the optimal solution obtained thus far to conclude whether to prolong the iterations or stop with the best solution achieved.

EXPERIMENTAL VERIFICATIONS

In order to apply the proposed Soft Computing technique as a solution methodology to solve the CF problem, the effects of changing the values of the various parameters are studied. Determining the optimal set of parameters is crucial in this regards. Therefore in this article the Taguchi's orthogonal design method is employed to determine the optimal values of the parameters.

Taguchi Method for Parameters Selection

The parameters are Initial temperature (T_{init}), temperature reducing factor (a) and Markov chain length (M) (Other parameter such as final temperature (T_{final}) is taken as constant value = 0.00000001 initially). The parameters are termed as factors, and each factor has three discrete levels (Table 1). Hence an L9 orthogonal array is used, and this recommends that 9 sets of Taguchi experiments are prerequisite and the results are evaluated by using an analysis of variance (ANOVA) technique. The parameter settings for each experiment are shown in Table 2.

Table 1. Levels of parameters tested

levels	Parameters		
	M	a	T_{init}
1	20	0.75	10
2	30	0.85	20
3	40	0.95	30

Table 2. The Experimental Settings of the Taguchi Experiments

Experiments	T_{init}	a	M	responses
1	10	0.75	20	0.636364
2	10	0.85	30	0.680000
3	10	0.95	40	0.695652
4	20	0.75	30	0.625000
5	20	0.85	40	0.695652
6	20	0.95	20	0.695652
7	30	0.75	40	0.680000
8	30	0.85	20	0.695652
9	30	0.95	30	0.695652

Table 3 presents the results of the corresponding ANOVA analysis with S/N ratio (Larger-the-better). In Table 3, the variance ratios (F ratios) of the factors are determined. A test of significance at 95% confidence level is employed to spot the significance of these factors. The P values of the factors T_{init} , a, M are investigated and value of a is seen to be less than the critical level with degrees of freedom at (2, 8). This suggests that ais the most significant factor in the proposed approach. The response table (Table 4) depicts the average of each response characteristic for each level of each of the factors. The table includes ranks based on Delta (δ) statistics, which compare the relative magnitude of effects. The Delta statistic states the difference between the largest and the smallest average for each factor. Ranks are assigned

based on Delta values. Using the level averages in the response table optimal set of levels of the factors could be determined which yields the best result.

Table 3. ANOVA table

Factors	Degrees of Freedom	Factor Sum of squares	Mean Square (Variance)	F Ratio (Variance)	P Value
T_{init}	2	0.000729	0.000364	2.67	0.273
a	2	0.004258	0.002129	15.58	0.060
M	2	0.000847	0.000424	3.10	0.244
Error	2	0.000273	0.000137		
Total	8	0.006108			

In present study, the ranks indicate that temperature reducing factor (a) has the greatest influence. Markov chain length (M) has the next greatest influence, followed by Initial temperature (T_{init}). The objective of the simulated annealing is to maximize the value of fitness function of equation (3), therefore factor levels should be fixed in such a way that the highest objective value could be achieved. The level averages in the response table and the main effects plot of Figure 5 show that the optimal solution is obtained when T_{init}, a and M are set to 30, 0.95, 40 respectively.

Table 4. Response table

Levels	T_{init}	a	M
1	0.6707	0.6471	0.6759
2	0.6721	0.6904	0.6669
3	0.6904	0.6957	0.6904
δ	0.0198	0.0485	0.0236
Rank	3	1	2

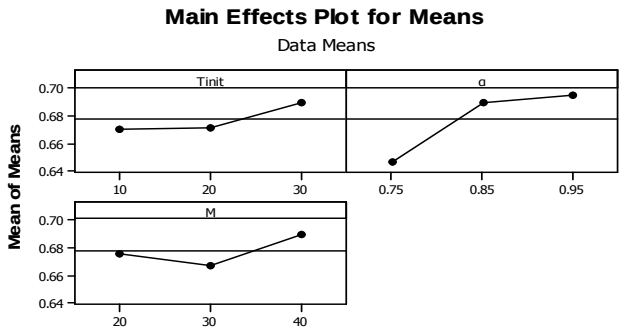

Figure 5. Main effects plot

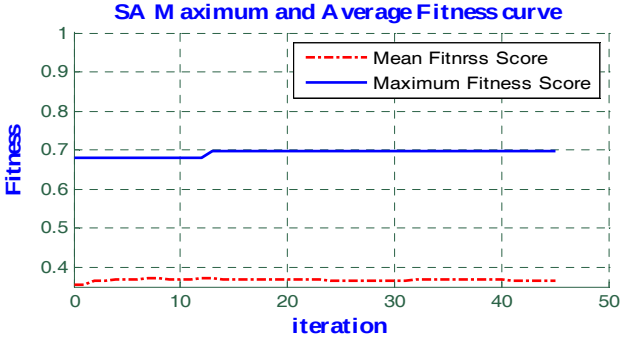

Figure 6. Convergence curve obtained from the heuristic approach for problem #1

Convergence Analysis

Convergence analysis is almost equivalent for all the problem datasets. Problem #1 of size 5×7 is selected as an example to demonstrate the convergence curve during iterations of the proposed metaheuristic technique as presented in Figure6. For the first iteration the fitness score attained a value of 68. Since the computer program is designed to maximize the fitness function with the iteration counts therefore at 13^{th} iteration it attained the value of 69.56, an increase of 2.3%. The final optimal solution is obtained with the fitness score of 69.56.Based on the experimentation for all the datasets reported in this article, it is observed that the fitness score is increased with the iteration counts till it reaches the best fitness score at some iteration and thereafter the fitness score continues to remain constant even if the number of iterations is increased. Since the proposed metaheuristic algorithm gives the same pattern of convergence for all the tested problems therefore the convergence property is established. For the 5×7 problem the proposed approach is executed for 45 iterations and took 1.7797 CPU seconds to attain the best solution which proves its computational efficiency.

Computational Results

The proposed method is tested with a set of 20 problems that have been published in the past literature and have been widely used in many comparative studies. All the data sets were transcribed from the original articles to avoid the inconsistencies in data. The sources of the datasets are shown in Table 5. The proposed method is simulated with Multivariate Statistical Analysis Toolbox and Matlab 7.1 and tested on a laptop with a 2.1 GHz processor and 2GB of RAM. Comparisons of the proposed SA method against other algorithms from the literature are given in Table 6. These algorithms include ZODIAC [34], GRAFICS [35], TSP based Genetic Algorithm [36], Genetic Algorithm [37], MST [16], GP [11]. For the problems solved with the proposed method to obtain optimal solution, the grouping efficacy value is improved or identical in all instances. This observation indicates that this technique is efficient and less complex because of its minimalism in simulation. All the solutions are obtained with negligible computational time (< 15 sec. for the largest datasets tested) Therefore this technique is highly comparable with complex soft computing techniques such as genetic algorithms (GA), evolutionary techniques, GA-TSP, Genetic Programming (GP) etc.

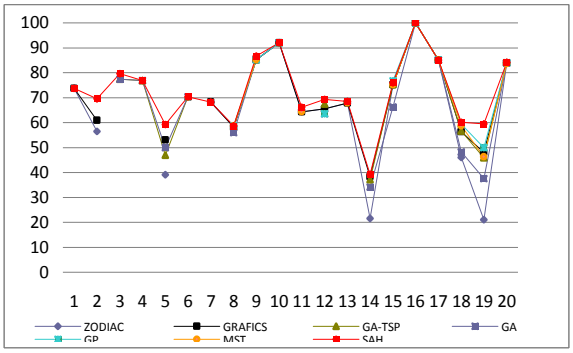

Figure 7. Improvement curve of the proposed hybrid technique with respect to the published result

Figure 7 portrays the substantial improvement achieved by the proposed SA heuristic while comparing with the other techniques. The above SA heuristic is shown to outperform the standard techniques in 12 instances, and equal in 8 instances, which further illustrates 60% improved result which is significant in terms of solution quality, time and space complexities.

Table 5. Source of Datasets

#	Dataset References	size
1	[12]	5×7
2	[38]	5×7
3	[39]	5×18
4	[40]	6×8
5	[41]	7×11
6	[42]	7×11
7	[8]	8×12
8	[13]	8×20
9	[13]	8×20
10	[14]	10×15
11	[43]	14×24
12	[44]	14×24
13	[45]	16×30
14	[46]	20×20
15	[47]	20×35
16	[48]	24×40
17	[48]	24×40
18	[44]	30×50
19	[44]	30×50
20	[48]	40×100

Table 6. Computational Result

#	ZODIAC	GRAFICS	GA-TSP	GA	GP	MST	SAH*
1	73.68	73.68					73.68
2	56.52	60.87					69.56
3			77.36	77.36			79.59
4			76.92	76.92			76.92
5	39.13	53.12	46.88	50			59.26
6			70.37	70.37			70.37
7	68.3	68.3					68.3
8	58.33	58.13	58.33	55.91	58.7	58.72	58.72
9	85.24	85.24	85.24	85.24	85.2	85.24	86.67
10	92	92	92	92	92		92
11	64.36	64.36				64.36	66.2
12	65.55	65.55	67.44	63.48	63.5		69.33
13	67.83	67.83				67.83	68.5
14	21.63	38.26	37.12	34.16			39.23
15	75.14	75.14	75.28	66.3	76.7	75.14	75.9
16	100	100	100	100	100	100	100
17	85.1	85.1	85.11	85.11	85.1	85.11	85.11
18	46.06	56.32	56.61	48.28	59.4	58.7	60.12
19	21.11	47.96	45.93	37.55	50	46.3	59.53
20	83.92	83.92	84.03	83.9	84	83.66	84.15

**SAH: SA heuristic*

CONCLUSION

This study portrays a Soft Computing based Simulated Annealing heuristic to construct manufacturing cells on production shop floor. The initial feasible solution to the proposed technique is obtained using Sorenson's similarity coefficient method and median linkage clustering technique. This article also exploits Taguchi's orthogonal design approach to select optimal set of parameters to the SA heuristic which is a crucial factor influencing the performance of the proposed technique. Computational results presented in previous section demonstrate that the proposed technique not only outperforms the standard techniques, but also several other well-known soft computing based cell formation solution methodologies such as genetic algorithms, GA-TSP, GP etc. from the literature. The proposed method attains 60% improved solutions by consuming lesser computational time and resources than that of the traditional complex soft computing based methodologies.

It is also shown that the proposed hybrid technique performs at least as well as, and often better than, some of the best algorithms for the cell formation on all problems tested.

Further work can be done by utilizing this technique in more complex cell formation problem which deals with ratio data for production volume, lot sizes, operational time, worker assignment and other multi-objective factors, often known as generalized cell formation problems.

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A SYSTEM FOR COMPUTER-AIDED SELECTION OF CUTTING TOOLS

ABSTRACT:
The importance of cutting tools in production systems requires modern approach to their selection. Automation of tool selection can significantly enhance efficiency of processes planning. Presented in this paper is development of a system for automated selection of cutting tools. Global concept as well as the concepts of the system's constituent modules are reviewed. Basic modules of the system are knowledge base, and cutting tools database. A case study is also presented. Finally, concluding remarks are given with suggested directions for future investigation.

KEYWORDS:
cutting tool, data base, knowledge base

INTRODUCTION

Constant advances in computer technology widen the field for computer application in engineering, and, therefore, process planning. Basic goal is to create conditions for application of manufacturing technologies capable of rapid adjustment to new production programs, while maintaining high quality, increased productivity, and reduced costs of manufacture.

These technologies feature high level of automation and flexibility, which is the strategy of development of flexible manufacturing systems. This can be illustrated by numerous examples of developed CAx systems and software applications of various purpose, which are used to automate tasks in product design, process planning, product management etc [1, 4].

Within a manufacturing system, the factors which most influence the quality of process planning are: type of blank, cutting technology, sequence of machining processes, machine tools, structure of machining processes, concentration of processes and operations, cutting tools, fixtures, measuring devices, and other. In order to improve process planning, all of these parameters must be optimized [8]. In the chain of factors influencing the output effects of manufacturing process, cutting tools are of great significance. Inadequate management of cutting tools reduces efficiency and economic effects of manufacturing system as a whole.

Development of a proper system for cutting tools selection allows improvement and rationalization of process planning. Computer-based system for cutting tools selection is one of the segments of computer integrated system (CIM), and as such is integrated into the sub-system for production planning and management [6].

There are several general characteristics of the so far developed systems for automated cutting tools selection [2, 3, 5, 6, 7]:

- *these systems were developed for parts of pre-defined geometry,*
- *they allow interactive selection of cutting tools for specific set of machining processes,*
- *they are based on a rigid, algorithmic structure,*
- *they do not take into account all parameters that influence optimum selection of cutting tools.*

The goal of this paper is to solve the above listed problems, through a development of an integrated and intelligent system for automated cutting tools selection. The system should allow selection of cutting tools for as large number of cutting processes, and typical operations as possible, regardless of complexity of part geometry.

SYSTEM STRUCTURE

The structure of the system for automated cutting tools selection is shown in Fig. 1.

The system input consists of necessary input information. These information are crucial for system functioning. According to entity characteristics which they describe, input data can be classified into:

- *geometry data – comprise all data which are directly related to workpiece design, including the data related to geometric specification of product (dimensions, tolerances, surface quality, etc.).*

- *manufacturing data – which completely define manufacturing process, and are listed within process charts of the pocess plan. One part of manufacturing data is entered by the user, while the rest of the data are generated during system operation which relies on the knowledge base.*

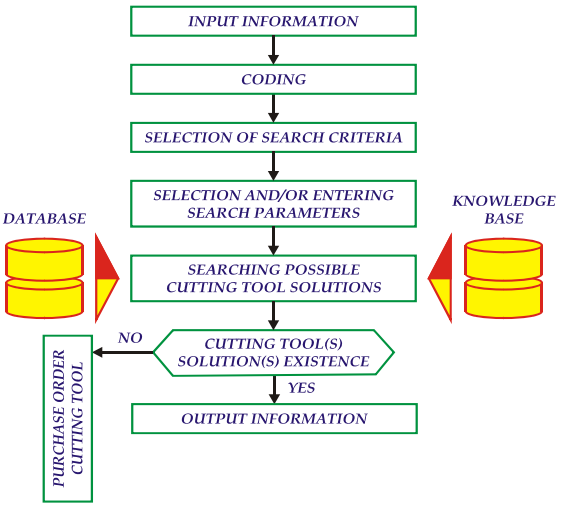

Fig. 1 System structure

Input information pertain to:

- *characteristics of workpiece material (type, sort, strength, hardness, tensile strength, etc.),*
- *type of machining,*
- *machine tool group,*
- *machine tool used for machining,*
- *number of machined surfaces,*
- *quality of machined surfaces*
- *type of machining process,*
- *typical operation,*
- *batch size,*
- *cutting regimes (speed, feed, etc.),*
- *surface quality,*
- *characteristic dimensions of machined surfaces,*
- *used coolant, etc.*

In order to select cutting tools which are required for particular cutting operations within a cutting process, it is necessary to perform coding. The coding must be suitable for software implementation. Based on the coded input information and the developed production rules, stored in the knowledge base, the database is searched for solutions which satisfy the set criteria. In this phase, cutting tools are selected. If there are several solutions that satisfy the criteria, which is often that case, the user selects a final solution which is derived based on built-in production rules.

Output information (cutting tool data) do not have unique format for all cutting tools, but are custom formatted for each tool. In no solutions have been found, an order for acquisition of the required cutting tool is issued.

Successful application of the system is possible only if prerequisites for its development have been provided. The basic prerequisites for the development of this system are knowledge base and cutting tools database.

SYSTEM DATABASE

Database design was based on the analysis of the three required groups of elements:

- *entities (objects or events) - represent an element for which the data should be stored. This element can be identified at any moment, i.e., it is possible to establish whether it exists or not. Entity can be an object (e.g., a cutting tool), or an event (e.g., a cutting process). There can be any number of instances of a particular type in the database (for example, a cutting process is the type which has following instances: face turning, hole drilling, slot milling, etc.),*
- *relationships (relationships between entities) - are established between two or more types of entities (e.g., relationship between machining process and a matching cutting tool for that process),*
- *attributes (features of entities and their relationships) - An entity is described by its attributes, i.e. its features. Thus, for instance, a product is described by its classification code, designation, material, dimensions, etc. If an attribute has some particular features, then it can also become an entity (e.g., exchangeable insert tip in a cutting tool). The same rule holds if an attribute can have several different values simultaneously.*

The development of the database was realized through three distinctive phases:

- *conceptual database design,*
- *logical database design, and*
- *physical database design.*

Conceptual database design comprises: semantic description of the problem, definition of all entities and relationships between them, creation of entity relationship (ER) diagram of the database data model.

The result of conceptual design phase is materialized in the conceptual scheme, i.e., the ER model of the system database. The ER model is defined by entity diagram, which shows all the database entities with their relationships, and types of relationships.

Logical database design contains: a detailed description of data and creation of entity relationship model. The detailed data description means listing of attributes of all entities in the database, with their primary keys.

Physical database design encompasses following: physical description of structures which contain data, definition of tables, data types, lengths, indices, entering of data into database. Physcial database design is essentially the process which extends into the system exploitation phase. Beside the data entered by users, there is also a large quantity of data generated during the decision-making process which is based on the knowledge base. After that, the data are incorporated into the physical databse structure.

The database stores all the data required for successful functioning of the system. It contains data on each stored cutting tool. These data contain: identification number of cutting tool, cutting tool

designation, cutting tool manufacturer, geometric features of cutting tool (dimensions, characteristic angles, etc.), and other.

The database can be constantly updated with new data, while the existing data can also be edited. The database user interface is adjusted to various database entities. This is logical, having in mind that, for example, attributes of the cutting tools which are entered in the database are different, even if they belong to the same group. The input of such data is controlled by input masks (which check on the data syntax, data ranges, and data types) which are implemented within the user interface to prevent user errors which could ultimately compromise the data consistency.

SYSTEM KNOWLEDGE BASE

System knowledge base must comprise a large volume of various knowledge in order to allow efficient integration of all elements of system architecture. There are several types of knowledge which the knowledge base must incorporate: procedural knowledge (rules, strategies procedures), declarative knowledge (concepts, objects, facts), meta-knowledge (knowledge on other kinds of knowledge and ways of their implementation), heuristic knowledge (unwritten, empirical knowledge), and structural knowledge (sets of rules, relationships between constructs, relationships between constructs and objects). One of the key components is heuristic knowledge which is based on assessment, and engineering intuition.

The knowledge base was developed by combining the data structures stored in the database, and the developed procedures. In this way, a system based on IF/THEN production rules was created.

IF represents a condition, while THEN represents a consequence of rule. If a condition is fulfilled, then the consequence is true, while the successive activation of several rules constitutes an inference chain. In this particular case, forward chaining was used, which is also known as the strategy driven data, since the user starts with the known conditions and searches for the consequences.

Shown in Fig. 2 is an example of using production rules for the selection of cutting tools for a hole drilling cutting process.

A condition can contain one or more conditional clauses which are interconnected by logical operators: AND, OR, NOT, ... If a condition is true, that is, if it satisfies all logical operators, the rule is activated, which means that the corresponding consequence is executed. In the opposite case, the rule is rejected.

The architecture of the knowledge base for cutting tools selection comprises parameter-based decision levels. The basic level of decision-making is based on typical operations, and it is further differentiated into decision-making sub-levels, which, depending on a particular case, are based on following parameters: machine tool, cutting process, and dimensions. By applying the knowledge base, one generates all required cutting tools for the cutting process in hand.

If
Workpiece material = Cast iron, and
Workpiece hardness = 220 HB, and
Typical operation = Drilling, and
Feature type = Inner hole, and
Batch size = 100, and
Nominal diametar = 8 mm, and
Upper tolerance = 0.012 mm, and
Lower tolerance = 0, and
Cuttnig lenght = 10 mm, and
Surface quality = N7

Then
Cutting tool = Twist drill
Cutting tool code = 338 - 7.8
Cutting tool = Reamer
Cutting tool code = 212 - 8

Fig. 2. An example of production rules

CASE STUDY

In order to verify the proposed system model, software solutions of some system modules were developed. To check their functionality, some tests were performed on real industrial examples.

The workpiece (cylinder liner) shown in Fig. 3, undergoes a process of internal honing of Ø125$^{+0.025}$ hole on a conventional vertical honing machine. Machining speed is 120 m/min, feed 22 m/min. Production is serial, with a 1000 pcs. batch size. Workpiece material is cast iron (SSL-3) with 250 HB hardness.

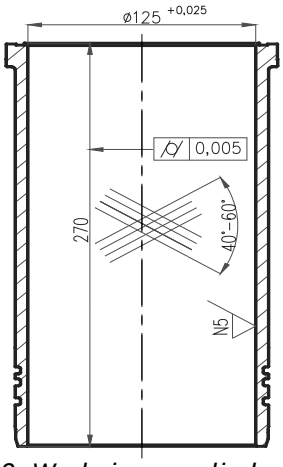

Fig. 3. Workpiece – cylinder liner

Upon starting the software application, the user begins an interactive work using interface forms. During work, the user answers the read questions by entering data and/or by selecting pre-defined data in particular fields. The user defines his/her own search criteria, depending on the problem in hand, by checking appropriate boxes (Fig. 4). It is possible to set one or more serach criteria for the selection of cutting tools. Depending on the set criteria, various forms are open (Fig. 5) and are used to select and/or directly enter appropriate geometric and manufacturing parameters.

Fig. 4. Selection of search criteria

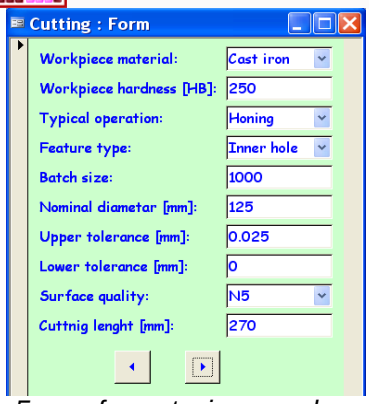

Figure 5. Forms for entering search parameters

In this way, by making queries based on input information, and the developed production rules, reports containing search results are generated. Shown in Fig. 6 is an example of output information for the selection of cutting tool (honing head) for the machining process of cylinder liner honing.

Fig. 6. Form showing a selected cutting tool

CONCLUSION

The system for cutting tools selection presented in this paper is based on modular principle, and relies on a database, a set of production rules, and an integrated software solution. The structure of this system required thorough systematization of prerequisite information for the selection of cutting tools. The basic pre-requisites are selection criteria and adequate decision-making logic. Under the given conditions, the developed system produces adequate solutions in real industrial applications, which results in the selection of the cutting tool which is most appropriate for the required cutting process.

Bearing in mind that computers by far surpass human abilities regarding processing capacity, memory, speed, and quality of work, automation of cutting tool selection results not only in higher quality solutions, but also significantly speeds up the process, thus reducing total costs. Furthermore, the level of designer's satisfaction is higher, while his/her work effort is reduced in almost all design phases.

Wider application of the proposed system which would result in practical manufacturing and economic effects, requires further comprehensive activities on database development, accompanied with adequate number of reliable manufacturing data. In addition, the modules within the already developed system structure require further improvement. Their introduction into practical industrial application should be alleviated by adjustments to the needs of particular production programs. System efficiency rate could be increased through integration with a system for computer-aided design (CAD), and computer-aided process planning (CAPP). These systems are capable of generating most of the input information required by the proposed system.

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[1] Vasile ALEXA

DEVELOPMENT TECHNOLOGY FOR WELDING IN MIG-MAG SHIELDING GAS ENVIRONMENT

ABSTRACT:
The information system is a coherently structured assembly, made of electronic computing and communication equipments, software, processes, automated and manual procedures, used as automatic data processing tool within a field of activity.
In the process of welding in shielding gas environment with fusible electrode, there are used either inert or active gases. Therefore, we make the distinction between welding in an inert gas environment with fusible electrode (MIG) and welding in an active gas environment with fusible electrode (MAG). This paper presents the technology development for welding in MIG-MAG shielding gas environment and a new calculation methodology for major welding parameters using an informatics application.
This publication aims to expose the collaborative work and the experiences of our project team in order to design and implement a training tool in the welding domain, which includes interactive educational resources organized into a database. The goal of the project is to design a more attractive multimedia training content, with multimodal character.

KEYWORDS:
welding, Mig-Mag, informatics, software

INTRODUCTION

The information system is a coherently structured assembly, made of electronic computing and communication equipments, software, processes, automated and manual procedures, used as automatic data processing tool within a field of activity.
The designing and developing of computer systems is appropriate in new IT systems, or for developing, upgrading or maintaining the existing ones.
In case of designing, the information system development team must carry out the following successive modelling processes [5], [6]:

- *information modelling that provides the critical description of the existing system and defines the functional requirements measured by the objectives to be met by the new information system;*
- *conceptual modelling that describes the structure and functional solution of the new system to meet in the best possible conditions the required objectives, independent of computer, operating system or data management system;*
- *technical or detailed modelling that implies the transformation of the functional solution into an operational solution on a particular type of computer and data management system.*

In database applications, the tables are updated by means of specialized models, called forms, which provide:

- *end-user friendly interface, achieved through various controls (buttons, text boxes, etc.) or other embedded graphics;*
- *simultaneous updating of multiple tables through subforms;*
- *validation rules in addition to those defined in the tables.*

THE MIG-MAG WELDING PROCEDURE

Today, the shielded metal arc welding procedure - sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding - is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. Unlike welding processes that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. The shielded metal arc welding procedure is currently one of the most popular welding methods, especially in industrial environments. It is used extensively by the sheet metal industry and, by extension, the automobile industry, which uses this procedure welding almost exclusively. Another advantage is the

extremely high productivity that MIG-MAG welding makes possible. It is a versatile method which offers a lot of advantages.

Welding in protective environment is the generic term for all the welding processes in which the weld pool and the metal transferred into it are protected, by a shielding gas, against the action of the atmosphere. The arc between the electrode and work piece burns visible.

The processes of welding in shielding gas environment can be classified according to the type of electrode, shielding gas and the electric arc protection used.

A first classification can be done by electrode type [1], [2]. Thus, the processes can be divided into non-fusible electrode processes and fusible electrode processes.

The non-fusible electrode - or "permanent" - is made of tungsten, and that's why this procedure is called gas-shielded arc welding with a non-fusible electrode.

In case of fuse welding electrode, this is simultaneously one of the electric arc poles, and filler. It has the same chemical composition or very close to that of base material. This procedure is called gas-shielded arc welding with a fusible electrode.

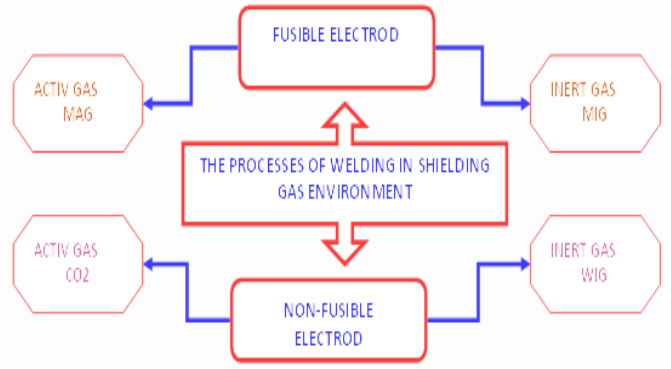

Fig. 1. The processes of welding in shielding gas environment

These two categories can be differentiated by the shielding gas they use [1].

In the process of welding in shielding gas environment with non-fusible electrode, there are used inert or noble gases. The term "inert" comes from Greek and means "indifferent'' or „slow in reaction". Among the noble gases available, for welding in inert gas environment with fusible electrode (WIG) there are mainly used argon or helium, or mixtures thereof.

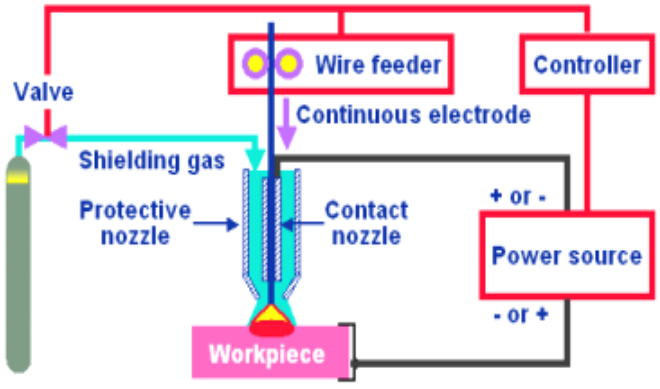

Fig. 2. MIG / MAG welding process

In the process of welding in shielding gas environment with fusible electrode, there are used either inert or active gases. Therefore, we make the distinction between welding in an inert gas environment with fusible electrode (MIG) and welding in an active gas environment with fusible electrode (MAG).

Another distinction is made depending on the type of shielding gas used, i.e. between the MAGM welding, where there are used mixtures of argon-based gasses with addition of active components, as CO_2 and O_2 (also known as GMMA = "gas-mixture metal arc" welding), and the MAGC welding, where it is used technical carbon dioxide, CO_2 (also known as GMA-CO_2).

TECHNOLOGY DEVELOPMENT FOR WELDING IN MIG/MAG SHIELDING GAS ENVIRONMENT

Classically, this technology involves the following stages [4], figure 3:

- *presentation of backlash shape and establishing the actual sizes;*
- *choice of welding materials;*
- *calculation of parameters and welding technology;*
- *tabulation.*

The first stage, presentation of backlash shape and establishing the actual sizes, figure 4, will be based on the following features [3]:

- *reduced diameter of the electrode wire;*
- *lack of coating material;*
- *high current densities.*

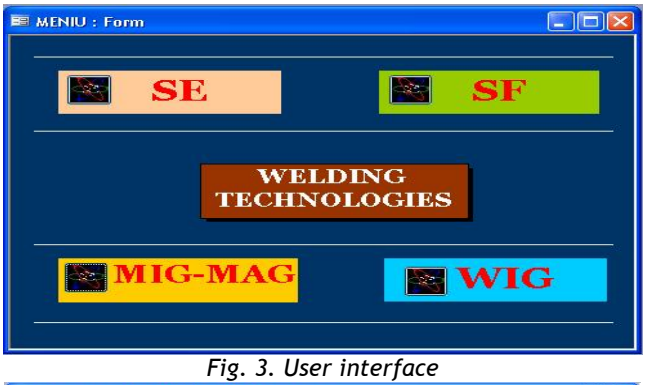

Fig. 3. User interface

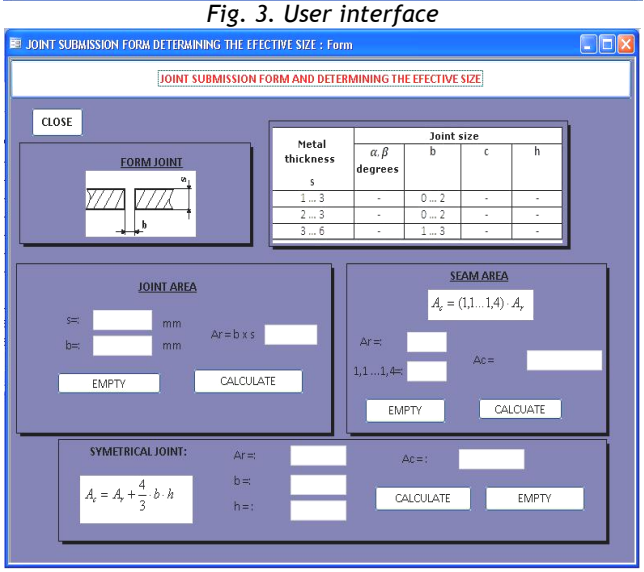

Fig. 4. Joint submission form and determining the effective size

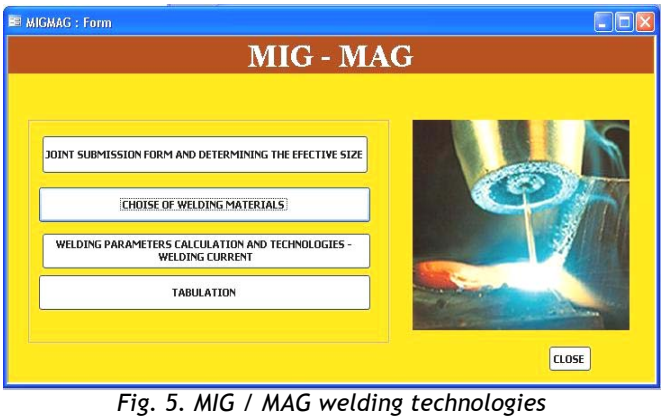

Fig. 5. MIG / MAG welding technologies

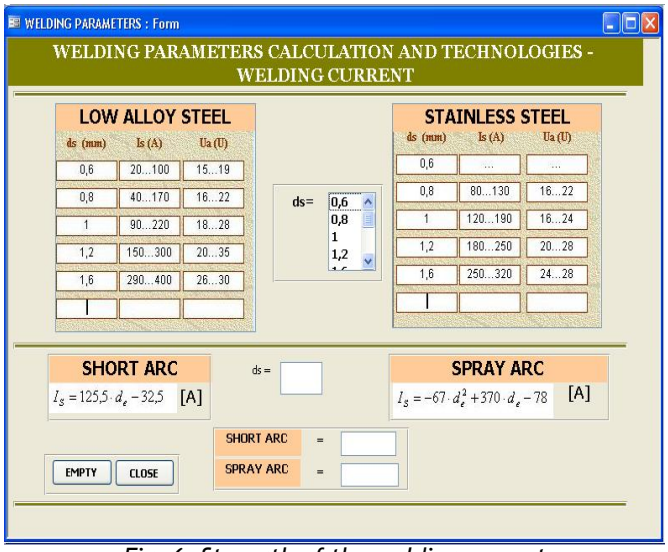

Fig. 6. Strength of the welding current

The inadequately chosen of backlash sizes and the mismatch of technological welding parameters can lead to malfunctions, as follows:

- *puncture and drainage of molten metal material at the root;*
- *electrode wire passing among components without arc ignition, or its discontinuation;*
- *lack of penetration at the root;*
- *root unmelting.*

The second stage, choice of welding materials, includes:

- *choosing the wire brand and shielding gas;*
- *establishing the electrode wire diameter;*
- *determining the number of passes;*
- *arrangement of passes.*

The third stage, calculation of parameters and welding technology, aims to establish, figure 6:

- *the welding variance;*
- *free length of electrode wire;*
- *current amperage;*
- *spring tension*

The first form of application is called Interface and allows the launching of the other options of the application, figure 3.

The program requires data entry in the afferent fields. Then, by pressing the button „CALCULATE", the requested result is automatically displayed.

CONCLUSIONS

This type of information system enables the development of welding technology automatically, saving time, because the engineer disposes of a comprehensive database, from where he extracts the values of the imposed welding parameters.

So, the values of the other parameters are going to be calculated based on the extracted values, through an intuitive and friendly interface, create of interactive learning resources structured in database, for the acquisition of knowledge and skills in the welding field.

This publication aims to expose the collaborative work and the experiences of our project team in order to design and implement a training tool in the welding domain, which includes interactive educational resources organized into a database.

The goal of the project is to design a more attractive multimedia training content, with multimodal character (accessible on keywords-based consultation, or in training route mode), which will contribute to the development of personal and professional autonomy of the employees, students and European people in training and further training activities in welding domain, since the practitioner level until the welding engineer.

This publication was developed to promote the visibility of the project and its progress, and is dedicated, also, to the intent of dissemination and exploitation of the project results.

ACKNOWLEDGMENTS

The training tool is currently in developing progress under a two years European project, funded by the LLP/Lifelong Learning Program / Sectorial Program Leonardo da Vinci/Partnerships.

The transnational project team consists of four partner organizations, of which AFPA from Lyon, France, ensures the coordination of the project, and University „Politehnica" Timisoara – Faculty of Engineering from Hunedoara, Romania, the Institut de Soudure from Paris, France, and Le FOREM from Bruxelles / Charleroi, Belgium, are the partners.

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THERMAL RADIATION AND MHD EFFECTS ON FLOW PAST AN VERTICAL OSCILLATING PLATE WITH CHEMICAL REACTION OF FIRST ORDER

ABSTRACT:
Thermal radiation and first order chemical reaction effects on unsteady free convective flow of a viscous incompressible flow past an infinite isothermal vertical oscillating plate with mass transfer in the presence magnetic field is considered. The fluid considered here is a gray, absorbing-emitting radiation but a non-scattering medium. The plate temperature is raised to T_w and the concentration level near the plate is also raised to C'_w . An exact solution to the dimensionless governing equations has been obtained by the Laplace transform method, when the plate is oscillating harmonically in its own plane. The effects of velocity, temperature and concentration are studied for different parameters like magnetic field parameter, phase angle, Schmidt number, chemical reaction parameter, thermal Grashof number, mass Grashof number and time. It is observed that the velocity increases with decreasing magnetic field parameter or radiation parameter. It is also observed that the velocity increases with decreasing phase angle ωt .

KEYWORDS:
chemical reaction, radiation, oscillating, vertical plate, magnetic field

INTRODUCTION

Magnetoconvection plays an important role in agriculture,petroleum industries, geophysics and in astrophysics. Important applications in the study of geological formations, in exploration and thermal recovery of oil,and in the assessment of aquifers,geothermal reservoirs and underground nuclear waste storage sites. MHD flow has application in metrology, solar physics and in motion of earths core. Also it has applications in the field of stellar and planetary magnetospheres, aeronautics, chemical engineering and electronics. The effects of transversely applied magnetic field, on the flow of an electrically conducting fluid past an impulsively started infinite isothermal vertical plate was studied by Soundalgekar et al (1979). MHD effects on impulsively started vertical infinite plate with variable temperature in the presence of transverse magnetic field were studied by Soundalgekar et al (1979a). The dimensionless governing equations were solved using Laplace transform technique.

The Effect of a chemical reaction depend whether the reaction is homogeneous or heterogeneous. This depends on whether they occur at an interface or as a single phase volume reaction. In well-mixed systems, the reaction is heterogeneous, if it takes place at an interface and homogeneous, if it takes place in solution. Chambre and Young (1958) have analyzed a first order chemical reaction in the neighbourhood of a horizontal plate. Das et al (1994) have studied the effect of homogeneous first order chemical reaction on the flow past an impulsively started infinite vertical plate with uniform heat flux and mass transfer. Again, mass transfer effects on moving isothermal vertical plate in the presence of chemical reaction studied by Das et al (1996). The dimensionless governing equations were solved by the usual Laplace-transform technique and the solutions are valid only at lower time level.

Radiative heat and mass transfer play an important role in manufacturing industries for the design of fins, steel rolling, nuclear power plants, gas turbines and various propulsion device for aircraft, missiles, satellites and space vehicles are examples of such engineering applications. England and Emery (1969) have studied the thermal radiation effects of a optically thin gray gas bounded by a stationary vertical plate. Radiation effect on mixed convection along a isothermal vertical plate were studied by Hossain and Takhar(1996). The governing equations were solved analytically. Das et al(1999) have analyzed radiation effects on flow past an impulsively started infinite isothermal vertical plate.

The flow of a viscous, incompressible fluid past an infinite isothermal vertical plate, oscillating in its own plane, was solved by Soundalgekar (1979). The effect on the flow past a vertical oscillating plate due to a combination of concentration and temperature differences was studied extensively by Soundalgekar and Akolkar (1983). The effect of mass transfer on the flow past an infinite vertical oscillating plate in the presence of constant heat flux has been studied by Soundalgekar et al. (1994).

However the combined study of MHD and thermal radiation effects on infinite oscillating isothermal vertical plate in the presence of chemical reaction of first order is not studied in the literature. It is proposed to study the chemical reaction effects on unsteady flow past infinite isothermal vertical oscillating plate, in the presence of magnetic field and thermal radiation. The dimensionless governing equations are tackled using the Laplace transform technique. The solutions are in terms of exponential and complementary error function.

BASIC EQUATIONS AND ANALYSIS

Here the unsteady flow of a viscous incompressible fluid which is initially at rest and surrounds an infinite vertical plate with temperature T_∞ and concentration C'_∞ . Here, the x-axis is taken along the plate in the vertically upward direction and the y-axis is taken normal to the plate. Initially, it is assumed that the plate and the fluid are of the same temperature and concentration. At time $t'>0$, the plate starts oscillating in its own plane with frequency ω' and the temperature of the plate is raised to T_w and the concentration level near the plate are also raised to C'_w. The plate is also subjected to a uniform magnetic field of strength B_0. The fluid considered here is a gray, absorbing-emitting radiation but a non-scattering medium. It is assumed that the effect of viscous dissipation is negligible in the energy equation and there is a first order chemical reaction between the diffusing species and the fluid. Then by usual Boussinesq's approximation, the unsteady flow is governed by the following

$$\frac{\partial u}{\partial t'} = g\beta(T-T_\infty)+g\beta^*(C'-C'_\infty)+\nu\frac{\partial^2 u}{\partial y^2}-\frac{\sigma B_0^2}{\rho}u \qquad (1)$$

$$\rho C_p\frac{\partial T}{\partial t'} = k\frac{\partial^2 T}{\partial y^2}-\frac{\partial q_r}{\partial y} \qquad (2)$$

$$\frac{\partial C'}{\partial t'} = D\frac{\partial^2 C'}{\partial y^2}-K_l C' \qquad (3)$$

In most cases of chemical reactions, the rate of reaction depends on the concentration of the species itself. A reaction is said to be of the order n, if the reaction rate if proportional to the n^{th} power of the concentration. In particular, a reaction is said to be first order, if the rate of reaction is directly proportional to concentration itself.

With the following initial and boundary conditions:

$$\begin{aligned} t'\le 0:&\quad u=0, && T=T_\infty, && C'=C'_\infty && \text{for all } y\\ t'>0:&\quad u=u_0\cos\omega' t', && T=T_w, && C'=C'_w && \text{at } y=0\\ &\quad u=0, && T\to T_\infty, && C'\to C'_\infty && \text{as } y\to\infty \end{aligned} \qquad (4)$$

The local radiant for the case of an optically thin gray gas is expressed by

$$\frac{\partial q_r}{\partial y} = -4a^*\sigma\left(T_\infty^4-T^4\right) \qquad (5)$$

It is assume that the temperature differences within the flow are sufficiently small such that T^4 may be expressed as a linear function of the temperature. This is accomplished by expanding T^4 in a Taylor series about T_∞ and neglecting higher-order terms, thus

$$T^4 \cong 4T_\infty^3\,T-3T_\infty^4 \qquad (6)$$

By using equations (5) and (6), equation (2) reduces to

$$\rho C_p\frac{\partial T}{\partial t'} = k\frac{\partial^2 T}{\partial y^2}+16a^*\sigma T_\infty^3(T_\infty-T) \qquad (7)$$

On introducing the following non-dimensional quantities:

$$\begin{aligned} U&=\frac{u}{u_0}, t=\frac{t'u_0^2}{\nu}, Y=\frac{yu_0}{\nu}, \theta=\frac{T-T_\infty}{T_w-T_\infty},\\ Gr&=\frac{g\beta\nu(T_w-T_\infty)}{u_0^3}, C=\frac{C'-C'_\infty}{C'_w-C'_\infty},\\ Gc&=\frac{\nu g\beta^*(C'_w-C'_\infty)}{u_0^3}, \omega=\frac{\omega'\nu}{u_0^2},\\ R&=\frac{16\,a^*\nu^2\sigma T_\infty^3}{ku_0^2}, Pr=\frac{\mu C_p}{k},\\ Sc&=\frac{\nu}{D}, M=\frac{\sigma B_0^2\nu}{\rho u_0^2}, K=\frac{\nu K_l}{u_0^2} \end{aligned} \qquad (8)$$

in equations (1) to (4), leads to

$$\frac{\partial U}{\partial t} = Gr\,\theta+Gc\,C+\frac{\partial^2 U}{\partial Y^2}-M\,U \qquad (9)$$

$$\frac{\partial\theta}{\partial t} = \frac{1}{Pr}\frac{\partial^2\theta}{\partial Y^2}-\frac{R}{Pr}\theta \qquad (10)$$

$$\frac{\partial C}{\partial t} = \frac{1}{Sc}\frac{\partial^2 C}{\partial Y^2}-K\,C \qquad (11)$$

The initial and boundary conditions in non-dimensional form are

$$\begin{aligned} &U=0, && \theta=0, && C=0, && \text{for all} && Y, t\le 0\\ t>0:\ &U=\cos\omega t, && \theta=1, && C=1, && \text{at} && Y=0\\ &U=0, && \theta\to 0, && C\to 0, && \text{as} && Y\to\infty \end{aligned} \qquad (12)$$

SOLUTION PROCEDURE

All the physical variables are defined in the nomenclature. The solutions are obtained for hydrodynamic flow field in the presence of first order chemical reaction. The equations (9) to (11), subject to the boundary conditions (12), are solved by the usual Laplace-transform technique and the solutions are derived as follows:

$$\theta = \frac{1}{2}\left[\begin{aligned}&\exp(2\eta\sqrt{Rt})\,erfc(\eta\sqrt{Pr}+\sqrt{at})\\&+\exp(-2\eta\sqrt{Rt})\,erfc(\eta\sqrt{Pr}-\sqrt{at})\end{aligned}\right] \qquad (13)$$

$$C = \frac{1}{2}\left[\begin{aligned}&\exp(2\eta\sqrt{KtSc})\,erfc(\eta\sqrt{Sc}+\sqrt{Kt})\\&+\exp(-2\eta\sqrt{KtSc})\,erfc(\eta\sqrt{Sc}-\sqrt{Kt})\end{aligned}\right] \qquad (14)$$

$$\begin{aligned} U=&\frac{\exp(i\omega t)}{4}\left[\begin{aligned}&\exp(2\eta\sqrt{(M+i\omega)t})erfc(\eta+\sqrt{(M+i\omega)t})\\&+\exp(-2\eta\sqrt{(M+i\omega)t})erfc(\eta-\sqrt{(M+i\omega)t})\end{aligned}\right]\\ &+\frac{\exp(-i\omega t)}{4}\left[\begin{aligned}&\exp(2\eta\sqrt{(M-i\omega)t})\,erfc(\eta+\sqrt{(M-i\omega)t})\\&+\exp(-2\eta\sqrt{(M-i\omega)t})erfc(\eta-\sqrt{(M-i\omega)t})\end{aligned}\right]\\ &+(d+e)\left[\begin{aligned}&\exp\left(2\eta\sqrt{Mt}\right).erfc\left(\eta+\sqrt{Mt}\right)\\&+\exp\left(-2\eta\sqrt{Mt}\right).erfc\left(\eta-\sqrt{Mt}\right)\end{aligned}\right]\\ &-d\exp(at)\left[\begin{aligned}&\exp\left(-2\eta\sqrt{(M+b)t}\right).erfc\left(\eta-\sqrt{(M+b)t}\right)\\&+\exp\left(2\eta\sqrt{(M+b)t}\right).erfc\left(\eta+\sqrt{(M+b)t}\right)\end{aligned}\right] \end{aligned}$$

$$- e\exp(bt)\left[\exp\left(-2\eta\sqrt{(M+c)t}\right).erfc\left(\eta-\sqrt{(M+c)t}\right)\right.$$
$$\left.+\exp\left(2\eta\sqrt{(M+c)t}\right).erfc\left(\eta+\sqrt{(M+c)t}\right)\right]$$
$$- d\left[\begin{array}{l}\exp\left(2\eta\sqrt{Rt}\right).erfc\left(\eta\sqrt{\Pr}+\sqrt{at}\right)\\+\exp\left(-2\eta\sqrt{Rt}\right).erfc\left(\eta\sqrt{\Pr}-\sqrt{at}\right)\end{array}\right]$$
$$-d\exp(at)\left[\exp\left(-2\eta\sqrt{\Pr(a+b)t}\right).erfc\left(\eta\sqrt{\Pr}-\sqrt{(a+b)t}\right)\right.$$
$$\left.+\exp\left(2\eta\sqrt{\Pr(a+b)t}\right).erfc\left(\eta\sqrt{\Pr}+\sqrt{(a+b)t}\right)\right]$$
$$-\frac{d}{2}\left[\begin{array}{l}\exp\left(2\eta\sqrt{KtSc}\right).erfc\left(\eta\sqrt{Sc}+\sqrt{Kt}\right)\\+\exp\left(-2\eta\sqrt{KtSc}\right).erfc\left(\eta\sqrt{Sc}-\sqrt{Kt}\right)\end{array}\right]$$
$$+e\exp(bt)\left[\exp\left(-2\eta\sqrt{Sc(K+c)t}\right).erfc\left(\eta\sqrt{Sc}-\sqrt{(K+c)t}\right)\right.$$
$$\left.+\exp\left(2\eta\sqrt{Sc(K+c)t}\right).erfc\left(\eta\sqrt{Sc}+\sqrt{(K+c)t}\right)\right] \quad (15)$$

where, $a=\frac{R}{Pr}, b=\frac{M-R}{Pr-1}, c=\frac{M-KSc}{Sc-1}, d=\frac{Gr}{2b(1-Pr)}$

and $e=\frac{Gc}{2c(1-Sc)}$, *where* $\eta=Y/2\sqrt{t}$ *and erfc is called complementary error function.*

RESULTS AND DISCUSSION

The numerical values of the velocity, temperature and concentration fields are computed for different parameters like Magnetic field parameter, chemical reaction parameter, Schmidt number, thermal Grashof number and mass Grashof number. The purpose of the calculations given here is to assess the effects of the parameters M, K, R, Gr, Gc *and* Sc *upon the nature of the flow and transport. The solutions are in terms of exponential and complementary error function.*

Figure 1 illustrates the effect of the concentration profiles for different values of the chemical reaction parameter ($K = 0.2,2,5,10$ *) at* $t = 0.4$. *The effect of chemical reaction parameter is important in concentration field. The profiles have the common feature that the concentration decreases in a monotone fashion from the surface to a zero value far away in the free stream. It is observed that the velocity increases with decreasing chemical reaction parameter.*

The temperature profiles are calculated for different values of thermal radiation parameter($R = 0.2,2,5,10$ *) at time* $t = 0.4$ *and these are shown in figure 2. The effect of thermal radiation parameter is important in temperature profiles. It is observed that the temperature increases with decreasing radiation parameter.*

The velocity profiles for different phase angles ($\omega t = 0, \pi/6, \pi/3, \pi/2$ *),* $R=10, M=0.2, K=2, Gr=Gc=2$ *and* $t = 0.2$ *are shown in figure 3. It is observed that the velocity increases with decreasing phase angle* ωt. *Figure 4. demonstrates the effects of the magnetic field parameter on the velocity when (* $M = 0.2,2,5$ *),* $\omega t=\pi/6, Gr=Gc=5, R=10, K=5, Pr=0.71$ *and* $t = 0.6$. *It is observed that the velocity increases with decreasing magnetic field parameter.*

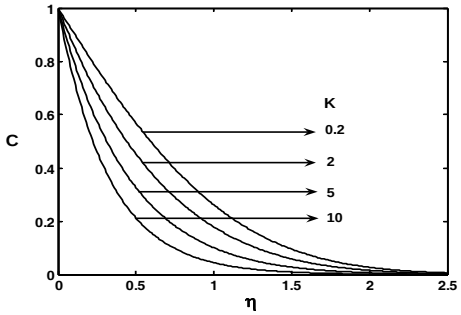

Fig. 1: Concentration profiles for different values of K

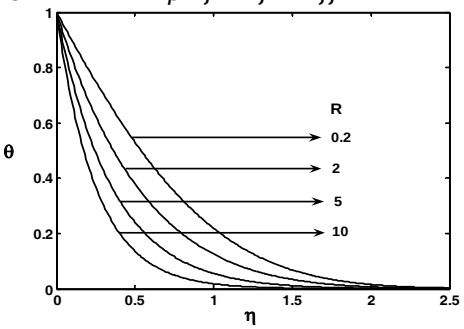

Fig. 2: Temperature profiles for different values of R

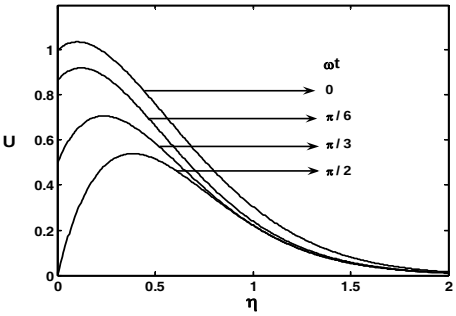

Fig. 3: Velocity profiles for different values of ωt

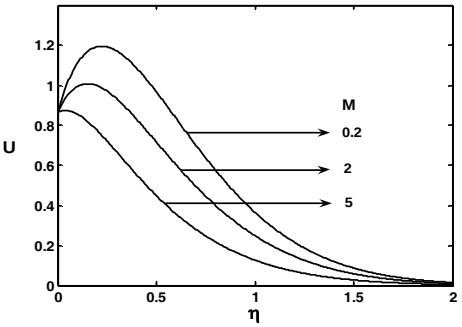

Fig. 4: Velocity profiles for different values of M

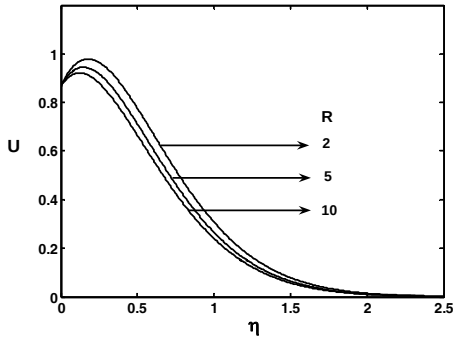

Fig. 5: Velocity profiles for different values of R

The effect of velocity for different values of the radiation parameter ($R = 2,5,10$*),* $\omega t = \pi/6$*,* $K = 2$*,* $M = 0.2$*,* $Gr = Gc = 2$ *and* $t = 0.6$ *are shown in figure 5. The trend shows that the velocity increases*

with decreasing radiation parameter. It is observed that the velocity decreases in the presence of high thermal radiation. Figure 6 illustrates the effect of the velocity for different values of the reaction parameter ($K = 0.5,5,15$), $\omega t = \pi/4$, $R = 10$, $M = 0.2$, $Gr = Gc = 2$ and $t = 0.6$. The trend shows that the velocity increases with decreasing chemical reaction parameter.

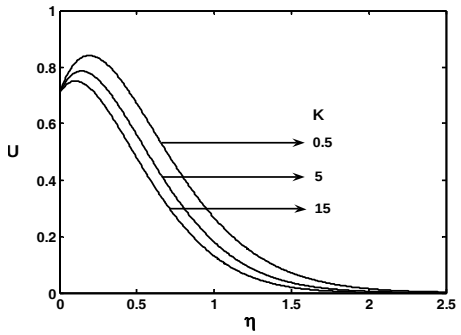

Fig. 6: Velocity profiles for different values of K

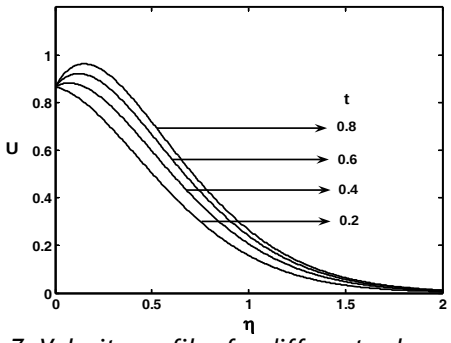

Fig. 7: Velocity profiles for different values of t

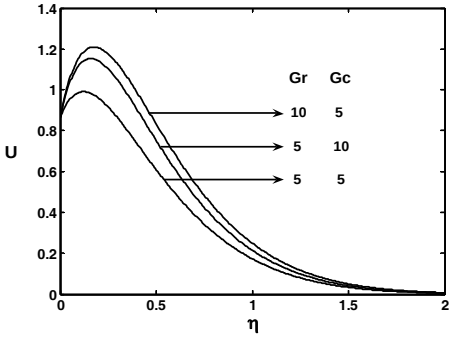

Fig. 8: Velocity profiles for different values of Gr, Gc

The effect of velocity profiles for different time ($t = 0.2,0.4,0.6,0.8$), $R = 10$, $M = 0.2$, $K = 2$, $Gr = Gc = 2$ and $\omega t = \pi/6$ are shown in Figure 7. In this case, the velocity increases gradually with respect to time t. The velocity profiles for different thermal Grashof number ($Gr = 5,10$), mass Grashof number ($Gc = 5,10$), $\omega t = \pi/6$, $K = 15$, $R = 5$, $M = 2$ and time $t = 0.8$ are shown in Figure 8. It is clear that the velocity increases with increasing thermal Grashof number or mass Grashof number.

CONCLUSION

The study of MHD and thermal radiation effects on flow past an oscillating infinite isothermal vertical plate, in the presence of chemical reaction of first order. The dimensionless equations are solved using Laplace transform technique. The effect of velocity, temperature and concentration for different parameters like ωt, M, R, K, Gr, Gc, Sc and t are studied. The study concludes that the velocity increases with decreasing phase angle ωt, magnetic field parameter M and chemical reaction parameter K. The trend is just reversed with respect to time t. As expected, the plate concentration increases with decreasing chemical reaction parameter.

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NOMENCLATURE

C' - species concentration in the fluid
C - dimensionless concentration
C_p - specific heat at constant pressure
D - mass diffusion coefficient
G_c - mass Grashof number
G_r - thermal Grashof number
g - accelerrated due to gravity
k - thermal conductivity
M - Magnetic field parameter
Pr - Prandtl number
R - Radiation parameter
Sc - Schmidt number
T - temperature of the fluid near the plate
t' - time
t - dimensionless time
u - velocity of the fluid in the x-direction
u_0 - velocity of the plate
U - dimensionless velocity
x' - spatial coordinate along the plate
y' - coordinate axis normal to the plate m
y - dimensionless coordinate axis normal to the plate
β - volumetric coefficient of thermal expansion
β^* - volumetric coefficient of expansion with concentration
μ - cofficient of viscosity
υ - kinematic viscosity
ρ - density of the fluid
τ - dimensionless skin-friction kg.
θ - dimmensionless temperature
η - similarity parameter
$erfc$ - complementary error function

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SIX SIGMA CONCEPT

ABSTRACT:
The concept of Six Sigma is a concept of quality company management. At the same time it is a clever way of managing a company or organizational parts of the company. It was created by General Electric, in aim to satisfy the needs of the client more successfully. Companies implementing Six Sigma concept in the first place put improving the client - customer satisfaction, resulting in reduced cycle time necessary for an almost perfect product / service to be produced and delivered to client. The success of the concept of Six Sigma implementation depends on the willingness of employees to participate in the same.
Applying the concept of Six Sigma results in permanent improvements in operations, results in excellent financial and non-financial results, and improved performance of the organization. Also, the company provides uplift above average and provide the best possible solution for all stakeholders: customers, employees, owners, society, etc.

KEYWORDS:
management, leading, clients, products, operations

INTRODUCTION

Six Sigma is a smarter way of running a company or department, created by Jack Welsh and Larry Bossidy, a director of General Electric's, in order to improve company's business quality in aim to satisfy the needs of the client more successfully. Six sigma puts the client on the first place by using different data available in order to achieve better results. Six Sigma action takes part in:

- *improvement of customer satisfaction (customer / user services and products),*
- *reduction of cycle time necessary to perform a product or service,*
- *reduction of errors during the delivery of products or services.*

With successful performance of the previously mentioned, companies achieve significant savings, retain satisfied clients, win new markets and create a good reputation and guaranteed quality of services / products.
To perform Six Sigma in the company means to achieve such progress in all parts of the process of creation or product / service, which means that the process and product are realized without any errors (defects). Also includes a full commitment to the management philosophy of perfection, focusing on the customer, improving processes and the law of value, instead of measuring sense. The aim of the concept of Six Sigma is that the whole companies adapt to the demands of clients - customers, markets and technologies, and that it can benefit all stakeholders - customers, employees and owners.

The Six Sigma concept differs from other concepts of quality management in the following:[1]

- *Six Sigma is focused on the client,*
- *Six Sigma provides a yield (return) on investment (eg, General Electric has achieved profit growth of 2 billion U.S. dollars in 1999 in comparison to 1998 - growth and profits of 2.4 billion U.S. dollars in 2000 year compared to 1999),*
- *Six Sigma changing mode of management.*

The essence of Six Sigma is that things should not be done with hard work, but smartly.Six Sigma can be defined as:

a) *statistical measure of realization of the process or product - Sigma is a sign of the standard deviation. As is well known "standard deviation is a measure that describes the dispersion of the whole population in the same units that are specific to the data base" (M. Cvetinović). [1]*

Sigma measure was developed to help: [2]

- *In the broadest sense, the measurement of customers - some customers of the company,*
- *a consistent way of measuring and comparing the various processes.[3]*

The first step in calculating Sigma is to understand what the client - the customer expects. Six Sigma

[1] Cvetinović (2009 : 53)
[2] Different definitions of management suggests that if the processes companies can not express in numbers, this means that the company's employees do not know much about it and that this can not manage.
[3] "The process is a set of interrelated or interconnected activities which converts the input elements into output elements (ISO 9000:2000). In practice, it is essential that the processes have their "owners" that clears the interrelationships, responsibilities and powers.

language requirements and customer expectations are called critics for the quality (CTQ).[4] Six Sigma purpose is to understand and assess how the process works on all theoretically possible customer demands. So, we use a measure of sigma values so that we could examine how a process works and all phases of the production process of service / product we give a way in which it can be measured.

In the beginning, acceptable sigma levels for the company were three or four sigma (99.9937% without defects in process). Over time it became clear that the six sigma level necessary to increase the efficiency of processes and achieve excellence in delivering value to interested parties. At the same time achieving six sigma levels indicates that this is a Best in class organizations.

Characteristics of such companies are: very (highly) satisfied customers, managers are determined, motivated employees, stable growth in market share, business results that rank company in the top in the domestic and international markets, and obtain an internationally recognized awards for business excellence / perfection.

b) aim to achieve almost perfect for improving implementation - applying Six Sigma goal is to help employees and processes to achieve production of a product / service without errors. Therefore, Six Sigma sets the target where the errors in the processes and products/services almost impossible. Application of Six Sigma provides a long-term achievement of the objectives of the company, through the realization of short-term attainable short-term goals set for the quality of products / services.

c) management system that achieves long-term leadership position and perform work on the world level. The essential difference between the concept of Six Sigma and similar management concepts is that a high degree of management involvement in monitoring the results and achievements of the implementation of Six Sigma. Six sigma management system is not owned by directors or management is left to managers. Ideas, solutions, improving or introducing new processes and improvements that result in six sigmi events occurring at the lowest levels of operations of the company (at the level of actors). Six Sigma companies are trying to give more responsibility to employees who work with clients.

Therefore, Six Sigma is a concept that unites the management and includes all employees. The benefit of Six Sigma is monetary and non-monetary. In the domain of non-monetary, it is important to emphasize that all employees at different levels of the company better understand its clients - customers, clearly setting processes and enhance the realization of products / services, standards implementation process and meet clients' demands are fair and significant, which leads to more efficient work of employees and a greater degree of satisfaction with completed work.

According to the above, we can conclude that the most important elements of the concept of Six Sigma:

- *sincere focus on customer - buyer ,or meeting client demands,*
- *manage the company based on data and evidence,*
- *processing the product / service opportunities and permanent improvement of technology and business processes,*
- *proactive management and management technology and business processes,*
- *non-limit cooperation in the production of products / services valuable to clients,*
- *expressed need for perfection and failure tolerance.*

It is important to emphasize that the concept of Six Sigma is not much new. The unification of these elements in the management process is new. Also, Six Sigma is a slow process because it should come up with the perfect product / service that fully meets the requirements of the client.

Successful implementation of Six Sigma concepts can achieve the following results: fulfillment of clients' requirements, achieving greater benefits for the owners of the company, reduced costs, better utilization infrastructure, stable organizational structure and staff satisfaction and successful motivation. It is very important to unite all employees in the company in order to accomplish processes, procedures and Six Sigma process implementation successfully .

WAYS TO INTRODUCE SIX SIGMA IN YOUR COMPANY

If your company decides to implement the concept of Six Sigma, it cannot be predicted what way it will have to pass. Also, companies organizations are different and these differences create variations in the application of the concept of Six Sigma.

There are three basic ways of introducing Six Sigma into the company:

1. *transformation of business - means a change in the organization, organizational culture and organizational climate in the work of the company, in order to meet the needs of clients and owners in a better way. Teams created for the business transformation process should analyze the different areas of the manufacturing process of products / services and to propose solutions or advice for changes. The mentioned teams carefully examine: how the company is placing the products / services, whether the sales process are effective, what is the interest of new potential customers, what are the critical objections to existing clients, what types of product/service defects appear as common problems, what kind of information systems are needed for companies' decision-making and where can great cost savings be expected.*

So, the focuses of business transformation are: customers, employees, all processes related to the implementation of products or services (including internal organization and strategic decisions) in order to increase the profits of the company. It is important

[4] CTQ – Critical to Quality

that the needs of the market and competition are outside the scope of application of Six Sigma.
If the company decides to put the implementation of this concept of Six Sigma then all parties concerned feel a change.[5]

2. *strategic improvement - the middle entrance, which offers the most opportunities for the company. Undertaking strategic improvements is limited to one or two key needs of the company, with teams that are focused on the great opportunities and disadvantages of the process of products / services realization. Also, project Six Sigma can be applied to a limited number of departments or sectors of the company.*[6]
3. *problem solving - is the easiest approach to the implementation of Six Sigma. This approach is intended for companies that constantly have the same problems. Various attempts at resolution have been without success. Therefore, they are trying to solve this problem by implementing Six Sigma. The concept of Six sigma analyzes problems and solutions better, based on the facts and understanding the causes and needs.*

This approach is good for companies that want to experience the benefits of implementing the concept of the Six Sigma without major changes in the organization. This approach or entrance, the Six Sigma, is useful because it focuses on the essential problems and faces with their cause, uses data and analysis rather than feelings.
It is important that any approach to the implementation of the concept of the Six Sigma has both good and bad sides. Success primarily depends on the implementation of the will and readiness of employees to take a very active part in the same. Depending on which way the company decides to implement the Six Sigma, the impact of Six Sigma on the employed in the company will also be important.

NEW ROLE OF MANAGEMENT AND EMPLOYEES

Since the company's management decided with what approach would it implement the concept of Six Sigma, the business is handed over to a group of business leaders, members of teams, team leaders and agents. Some employees will get the function called by belts from the martial arts skills, such as a black belt, green belt and master black belts.Other team members will have similar names.

Black belt Six Sigma represents the most important role of managers in the implementation of the concept of the Six Sigma. Owner of black belt is committed to improving the possibilities of change and their introduction in order to achieve better results. He must be a leader, inspirator, delegate, manager, coach and nurse to colleagues, and an expert in the tools to recognize the problems and improve or create processes and products / services.
Six sigma black belt managers usually work with a team that is dedicated to a particular project. Without a strong and tireless person with a black belt, six sigma teams are usually unsuccessful. They are usually chosen from the ranks of middle management or are already top managers, and they lead these teams to an average of two years, and in this period of time they carry out four to eight projects.
Master Black Belt Six Sigma is a manager or consultant, he mentors managers with a black belt working on different projects. In most cases the master is a true expert in analytical tools of Six Sigma, and often the starting point in technology or science, or is recognized in the profession that deals with the work [7]
In some cases, master black belt plays a mediator role in the organization change, or becomes a permanent coach for those who are preparing for black belt or can be involved in special Six Sigma projects. It is important, master black belt plays a key role in the pace of change, reduces costs and improves customer satisfaction.
Green belt Six Sigma manager is a person who is still operative participate in the process of realization of products / services and a member of the team or team leader. His/her role is to bring new ideas into the daily work of the company. Champion and / or sponsor is director, senior manager or a member of the executive board of the company, which begins and supports (sponsors) someone with a black belt or some other team. It is very important to have champions or sponsors. This role sends a message: Champion is a respectable person, who takes upon himself the responsibility of the project. The role of champion is:

- *To ensure that projects remains in the form of company goals, and if not, to change direction,*
- *To present the progress of each project team to other members of the Board,*
- *To acquire the necessary resources, such as time, money and other help for the team,*
- *To report on controls of the "toll booths",*
- *To negotiate in conflicts with other Six Sigma projects.*

It is important that the champion is usually at least experienced with the concept of the Six Sigma and is usually the weakest link in the execution of Six Sigma tasks, especially in the early stages. The leader of the implementation is the person who manages the entire

[5] Companies that have decided to implement Six Sigma approach to business transformation are: General Electric, Starwood Hotels, Bombardier, and 3M.
[6] Companise that have decided to implement Six Sigma approach to strategic improvement are: Johnson&Johnson, Sears, American Express i Sun Microsystems.
[7] Six sigma instruments are: exchange of ideas, affinity diagram, voting, the tree structure, process diagram, process map diagrams and the causes and consequences (fish skeleton). Instruments for collecting data are interviews, operational definitions, the voice of customers and tables. The instruments of analysis process and the data were: analysis of the process, valuable and worthless additional analysis and charts.
Instruments for statistical analysis are: tested for statistical significance, correlation and regression, and design of the experiment. Instruments for the implementation and management process are: process control methods, analysis of potential problems and failure analysis and impact analysis investors, the powerful field diagram, documentation processes, and balanced accounts and processes.

implementation of setting Six Sigma ideas. He/she is usually from the ranks of senior management of the company and directly contacts the executive committee and chairman of the company. Comes from the area of organizational areas of the company or has experience in business management and administration. As a black belt Six sigma managers, leaders of the implementation have a time-limited mandate. The ultimate goal of leaders is to introduce the implementation of Six Sigma thinking, tools and practices through the whole company, to achieve profits and benefits to clients - customers.

Six Sigma provides employees involved in the project, challenges and benefits, such as experience, meeting new colleagues, excitement and education.

DMAIC - THE MEANS ARE SIX SIGMA

The most important link in the implementation of Six Sigma are teams for improvement, problem solving and creation process. Teams are formed to solve organizational problems and use opportunities. The leaders of the teams managers are black or green belt. Teams consist of three up to ten members, who were operationally involved in a process that is the subject of the project. This indicates that the team is different. In the process of forming this team, it is important to have a process or model that is common to all in order the project to be implemented. DMAIC is a flexible process that enables the implementation of Six Sigma projects, which means: define, measure, analyze, improve and control. [8]

DMAIC team has its own life cycle, which consists of the following phases:

- *Determination and selection of the project - it is important to choose the important and achievable projects that provide benefit and the company and the client.*
- *Forming a team - the election of members and team leaders is very important. If any of the employees elected a member of the team, it means that it is conscientious person who has the power and the will contribute to the progress of the company.*
- *Setting the Charter - is an important document that provides a written guide to the problem or project. The Charter is the reason why the project is important, the goal, the basic plan, limits, roles and responsibilities. Also, it is important to emphasize that the Charter changes during the project.*
- *On going of team - the joint work on the project, this is usually four weeks.*
- *Implementation of the DMAIC and implementation of solutions - Teams are required to implement their own solutions and to teach groups of the company which will continue to take into account the success of improving the process. Teams are required to project plans, organize training and define procedures for their solutions. Also, they are responsible to providing them their operational functioning - and the accompanying results over a specified time.*
- *Submit a solution - When the solution is given to groups of companies that will use it, these teams do not work anymore.*

The Company will have the following benefits using the DMAIC model for solving the problems: quantification and measurement of problems, focusing on the customer, verification of the cause, quitting the old habits, risk management, measurement of income and maintenance changes.

Steps in the DMAIC model are:

- *defining the problem - the question is what will be the goal of the project be and what is that the client wants (CTQ).[9] This is the biggest problem for the team. The team meets with a number of open questions such as: What do they work? Why solve this problem? Who is the client - the buyer? What are the requirements of the customer - buyer? How to run the process now? What benefit would all interested parties have with the correction process or the product?*

When you answer these questions, DMAIC Charter can be found. The basic elements of the Charter are: business reason or purpose, the statement of capabilities and objectives, constraints and assumptions, the limits of the project, team members and roles, the initial plan. The most important task of team is to recognize who the client - the buyer is: internal or external.

Then follows the perception of what the customer wants. This task includes the voice of the customer - the customer (VOC).[10] Very often clients do not know what they want or have a problem to express what they want. However, they know very well to explain what they do not want and the team must listen carefully to the voice of the client - the customer and translate the client's language-specification to the language of the company.

Teams should use during project implementation only the tools that will help them. Also, they should place and lead the process simply. And if the selected instrument does not give the expected results, the team should try another instrument that can help.

We conclude that the definition of the problem consists of three steps: selection of the client request to be solved, creating project Charter and security processes (recommendation is the simplest one).

- *Measurement - has two main tasks:*

a. *to collect data to check and quantify the problem or opportunity,*
b. *to test facts and figures that provide information about the cause of the problem.*

Therefore, the measurement allows quantification of production or the consequences (the final result of a process), process (stages that can be monitored and

[8] DMAIC – Define, Measure, Analyze, Improve, Control

[9] CTQ – Critical to Quality

[10] VoC – Voice of the Customer

measured) and investments (resources that are invested in the process of change that would produce the product / service). Practical team must identify who is the ultimate goal (output) measurement, to develop a plan to collect data (what is measurable) and the establishment of the basic route of the process (how to measure them).

- *Analysis - used to be identified, confirmed (validation) and quantify the problem. The operative team includes details of the process, improving their understanding of the processes and problems and identifies the problem. Some common categories are the cause of the problem: methods, equipment, materials, measurement and results measurement, natural disasters and employees.*
- *Improvement - when identified the problem, the team finds a solution. This phase includes the identification of solutions, testing the implementation of identified solutions and consideration what the costs and the expected benefits of implementing each of the proposed solutions are, in order to choose the best and most practical solution. Having decided for the appropriate solution, the team also tests it in order to see which problems may occur in the further implementation.*

After successful completion of testing, the solution is handed over to a group in company that participates in the execution process. Also, the monitoring phase of implemented solutions continues in order to promptly respond in the future, or to keep the quality of products / services at a satisfactory level for the client.

- *Control - a step that prevents the return of the old process, which involves implementation of control mechanisms, preparation of documentation for the project taking over and the closure of the project. Operationally that means: establishing a monitoring process of the implemented project, preparing plans for possible solutions to problems that may occur, successful "sales" presentation to employees that the project will use in their daily work, ensuring management support for project implementation (all employees) and the smooth flow of information of consequences and investment to the management.*

Recognizing the above, we can add that the teams work by GRPI model, [11]which includes:

- *Objectives - purpose of forming the team and the expected results, defining project activities, identification of clients' needs, goals and delivered results (what is expected of the team),*
- *Roles - what role and responsibility the team has; what kind of authority and autonomy team members possess,*
- *Processes - which are the critical success factors, how the plans and activities of the company are set up ,what are the control mechanisms and how to perform the measurement within the company,*
- *Interpersonal relationships in the team - involve the appropriate operational arrangements (formal) between the team and employees of the company, as well as informal relations that exist between them. The energy that exists among the members is essential and should be constructive and positive, so that the results are better.*

Finally, we can conclude that the project Six SIGMA must be flexible and that the success of the implementation of Six Sigma project is in the hands of employees who will use this new process in their daily work.

CONCLUSION

Companies applying Six Sigma concepts in the first place put improving satisfaction of client - customer, which results in reduced cycle time necessary for an almost perfect product / service to be produced and delivered to the client.

The main factors of success of applying the concept of Six sigma are: leadership commitment, full commitment of the leaders of the Six sigma team, strategy integration with top management, business process frameworks, intelligent network of customers and markets, the real savings, income and profits, motivation and stimulus for all employees, infrastructure programs, corporate culture, etc.

The success of the concept of Six Sigma implementation depends on the willingness of employees to participate themselves in the same. Therefore, you should: learn the goals of Six Sigma (see "big picture"), prepare for chaos, start work in the context of the entire production process of products / services, take the opportunity to learn new features, avoid paranoia, expect changes and challenges, accept responsibility for their learning, be patient and not to surrender, and be willing to travel without end.

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[11] GRPI - Goals, Roles, Processes, Intepersonal

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ASSESSMENT OF SURFACE DEFECTS IN THE CONTINUOUSLY CAST STEEL

ABSTRACT:
The development of continuous casting to produce semi-finished products is now so far advanced that almost any grade of steel can be continuously cast, and in the most appropriate cross section for further shaping. High quality finished products can only be produced by using defect free slabs, blooms or billet. The removal of defects is either performed selectively by removing the specific defect. This paper, based on industrial research, refers to the possibility of defining and cataloguing the surface defects specific to the semi-finished products continuously cast, in order to discover the generating source and to take the proper measures to prevent and remedy them where appropriate. The industrial experiments were carried out over several months in a steel company, period when we searched the number and type of defects detected at the reception of the studied metallic material.

KEYWORDS:
steel, continuous casting, surface defects

INTRODUCTION

The continuous casting process, both in the technological aspect as well as on the plant parameters, was and remained a basic concern of all the specialists in the major steel-making companies. The world energy crises, the consumers' quality demands, the need to adjust prices to the market demand, were the main factors that stimulated the technological development and generalization of the continuous casting process in the last 60-70 years.

It is noticeable that our country showed the same trend, so that in 2000 the cast steel production represented 73.1% of the total steel production, noting that the total steel production in Romania has fallen sharply in recent years. The results of experiments, mostly applied in practice, are regularly presented at various international events, which constitute a solid data basis for documentation, implicitly leading to an increased efficiency of research in this field.

Concerns in the development of continuous casting technology, either theoretically or through industrial experiments, refers to the possibility of defining and cataloguing the surface defects specific to the continuously cast semi-finished products, in order to discover the generating source and to take the proper measures to prevent and remedy them where appropriate.

EXPERIMENTAL STUDY

The industrial experiments were carried out over several months in a steel company, period when we searched the steel quality level in continuously cast semi-finished products, determined by the number and type of defects detected at the reception of the metallic material we had studied. In Fig. 1, we presented the continuous casting installation of the company where the researches were conducted.

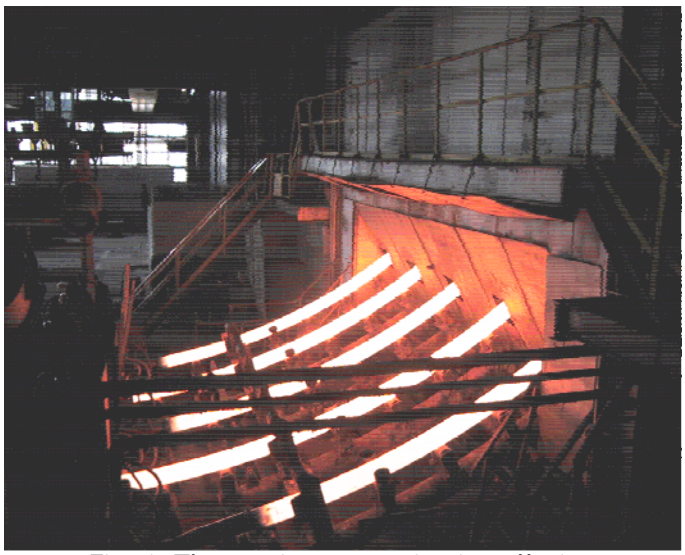

Fig. 1. The continuous casting installation

The steel is cast from the ladle into a tundish, which ensures a controlled flow in moulds, of appropriate form, water cooled. To prevent the sticking of the solidified crust, the mould oscillates in the casting direction with a higher speed than the casting speed, and into the mould is added a powdery lubricant. The mould is the essential technological component of the caster, which determines the shape of the profile cross section, realising the liquid-solid phase transformation, by a sudden and directed cooling, at the vertical casting into a water cooled double walled metallic cavity. At one strand, the cooling water flow differs from one dimension to another, its value ranging between 60-65 m^3h (at the mould for ϕ180 mm) and 110-125 m^3h (at the mould for bloom - 240 x 270 mm).

The strands are extracted and further cooled by using a direct water jet system. The purpose of the secondary cooling is to continue the cooling of the profile after leaving the mould, and to hurry the complete solidification of the cross section of the semi-finished product. The cooling in this area is achieved by direct pressure water spray, through nozzles, so that water is able to pass through the steam layer formed by evaporation, and to ensure the continuous and permanent contact with the metal. The sprinkling must ensure the adequate cooling afferent to a constant temperature drop, from the mould exit to the end of the secondary cooling zone.

The solidification of steel in the mould is achieved by the formation of crusts, whose thickness increases due to water splashing of the profile in the secondary cooling zone. The profile further extracted and straightened by passing through the drawing-straightening stands. The dummy bar *is separated from* the end *of the cast metal billet.*

The billet (completely solidified) is cut at predetermined lengths (5-8 m), with the flame cutting machine. The cut billets (blooms) are further moved on the roller table to the stoppers, from where they are taken over by transverse conveyors and carried on the cooling beds.

For the study, we selected only the heats used to cast steel billets Ø250 mm and Ø270 mm, respectively. For a more complete analysis, we took into account all the steel grades (carbon steel, low alloy steel, alloy steel) used to produce these two types of steel billets. The steel that is going to be continuously cast is primarily intended to obtain semi-finished products for tubes (Ø180 mm, Ø250 mm, Ø270 mm and Ø310 mm) and bloom (240 x 270 mm), for subsequent re-rolling. The share of continuously cast bloom of the total continuously cast steel is 50-60%, the balance being billets to be sent to another company (Fig. 2).

In terms of type, the steel that is going to be continuously cast is included in the following categories: general purpose steel, high quality carbon steel, low alloy steel and alloy steel, represented in Fig. 3.

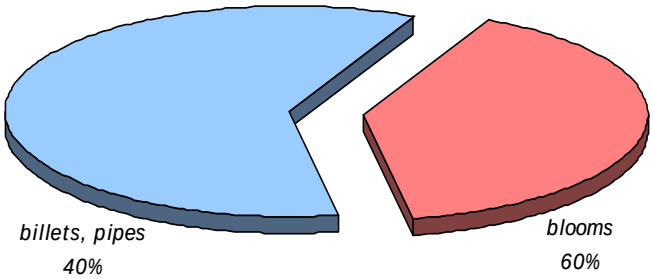

Fig. 2. Share of continuously cast bloom

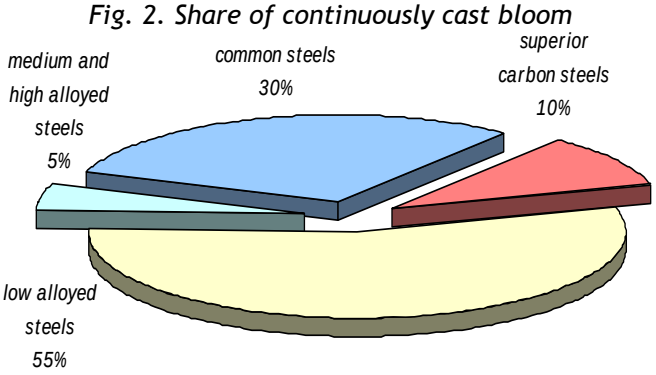

Fig. 3. Share of continuously cast general purpose steel, high quality carbon steel, low alloy steel and alloy steel

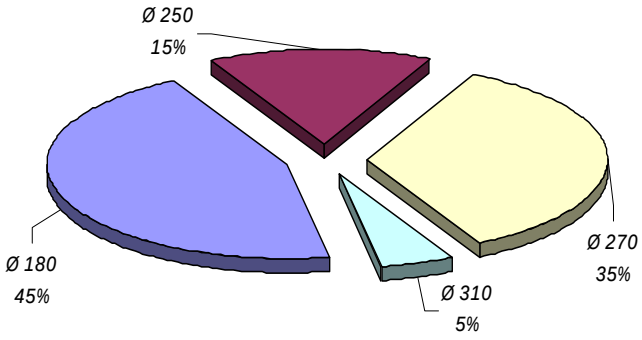

Fig. 4. Share of types & sizes

The data were taken from a batch of 55 hears of different steel grades, from which the Ø250 mm and Ø270 mm types were continuously cast. Currently, the types and sizes continuously cast (for billets) are: Ø180 mm, Ø250 mm, Ø270 mm and Ø310 mm, noting that Ø150 mm is not cast anymore because, from the quality point of view, a more competent product is cast now, which results through rolling at the Heavy Profiles Rolling Mill of the company. The share of types and sizes, calculated for the last 3 years, is presented in Fig. 4. The share of Ø310 mm billets is very low, because this size is continuously cast since September 2007, being still under the testing phase. The share of sizes and steel grades for billets differs from one month to another, depending on the beneficiaries' requirements.

The defects of material at the steel continuous casting appear during the solidification and cooling of the continuously cast semi-finished product, often leading to significant metal loss. To prevent such losses, the purpose of metallurgical technologies and constructive solutions is to find the causes of their occurrence, prevention and removal.

According to the literature, the defect can be defined as any deviation from the appearance, form, size, macrostructure or chemical properties provided in the technical standards or other normative documents in force. Defects are detected at the billets reception, by checking their surface quality on the inspection beds, or by checking the macrostructure of the test samples.

A defect is not always the result of a single case. Often, the defect is the result of multiple interacting causes, depending on a variable number of parameters. Similar defects, as "appearance", may have one or more different causes, and apparently different defects may have one or more common causes. Therefore, there are often found several defects on the same billet. The defects arising from the steel continuous casting can be classified as follows: surface defects, internal defects, form defects, mechanical defects and deviations from the prescribed chemical composition of steel.

RESULTS AND DISCUSSIONS

The share of the bloom, continuously cast in the company, represents approx 45-60%, the balance being billets for another company. The material defects at the steel continuous casting appear during the solidification and cooling of the continuously cast semi-finished products, often leading to important material losses. To prevent these losses, the purpose of metallurgical technologies and constructive solutions is to detect the causes of occurrence, prevention and removal.

According to the literature, we can define the "defect" as any deviation from the appearance, form, size, macrostructure and chemical properties provided in standards or other legal technical documents in force. The defects are found at the reception of billets, through visual inspection of their surface (on the inspection beds), or by checking the macrostructure of the test samples. A defect is not always the consequence of a unique cause. Many times, the defect is the result of the interaction of many causes that depend on a variable number of parameters.

Similar defects, as "appearance", may have one or more different causes, and apparently different defects may have one or more common causes. That is why several types of defects are often found on the same billet.

The cracks are openings found on the billet surface, with variable length and depth, which sometimes extend on the entire billet, on a strand or even on the full heat. The cracks are not always straight; they are sometimes interrupted and further continued in zigzag. Taking into account the direction on which they are formed, the cracks can be longitudinal, transverse or star types.

□ *Longitudinal cracks (Fig. 5). They form in the direction of extracting the strand from the mould (the bar that presents this type of defect is integrally rejected). They appear due to:*

- *the unevenly removal of the heat in the mould and, therefore, the uneven increase of the strand crust, causing transverse tensions that lead to the strand cracking if the crust is not strong enough (uneven primary cooling);*
- *turbulent flow of metal and a meniscus level variation in the mould;*
- *secondary cooling too intense or uneven;*
- *unequal, advanced wear of the mould that leads to a different thermal conductivity coefficient;*
- *high casting temperature (failure to obtain the required ΔT);*
- *great strand extraction speed;*
- *inappropriate behaviour of the casting powder.*

Fig. 5. Longitudinal cracks

□ *Transverse cracks (Fig. 6) - are rarely seen in round profiles they appear due to the tensions on the longitudinal direction of strand. If they are not deep, they are grinded (deviations within the permissible prescribed limits for diameter and ovality). The causes that give rise to transverse cracks are:*

- *the thermal stresses due to the uneven solidification of the crust and the additional stress due to turbulent flow in the meniscus;*
- *meniscus level variation;*
- *depth of oscillation mark, presence on the bottom of the oscillation mark of segregations which cool more slowly and weaken the austenitic grain boundaries;*
- *friction of the strand in the mould (at higher casting speeds, the melt flow between the mould wall and crust decreases, the edge friction increases with the viscosity of the powder used) or in the cylinder segments.*

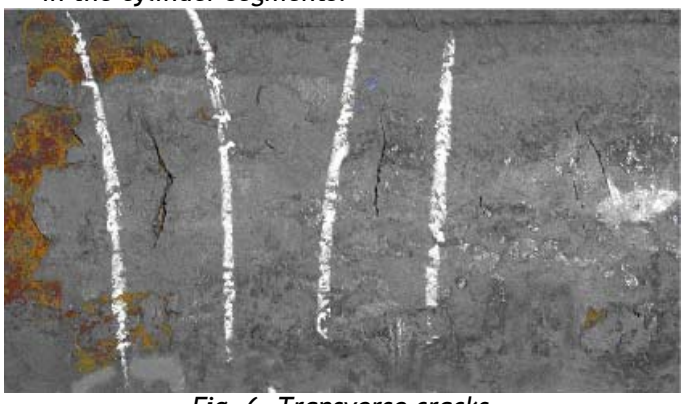

Fig. 6. Transverse cracks

- *Star cracks (Fig. 7) and those caused by fragility at high temperatures - are very fine, being visible only on scale free surfaces. For removing the defect, the surfaces are locally grinded (if the cracks are not too deep).*

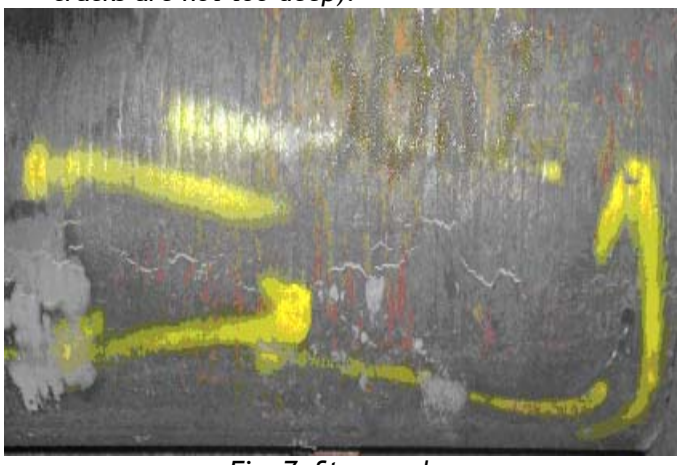

Fig. 7. Star cracks

The causes that give rise to star cracks are the intense local cooling, which induce local tensions, and the presence of copper at the austenitic grain limit. Some measures to be taken to remedy the star cracks are:

- *the correct adjustment of the spray nozzle holes and the right correlation between the spray flow and the casting speed (automatic flow control);*
- *providing a uniform layer (film) of melted casting powder between the strand and the mould;*
- *the cooling of the strand with a moderate intensity when it leaves the mould, to avoid the increase of the thermal stress and the development of cracks.*

- *Depressions are local deformations of the continuous cast strand surface, which can develop either in the strand drawing direction (longitudinal depressions) or along the oscillation mark (transverse depressions). Generally, the longitudinal depressions appear at the round billets made of peritectic carbon steel and have the appearance of shallow ditches oriented along the strand drawing direction. Sometimes, this defect is accompanied by the slag resulted from the powder used in the mould, being known as slag band.*
- *The longitudinal depressions (Fig. 8) occur due to uneven heat transfer in the mould, which caused due to:*

- *the unequal development of the marginal crust;*
- *the steel level fluctuation in the mould and a too large quantity of melted flux, located in the space between the mould wall and the strand;*
- *the turbulent steel flow at the sub-meniscus level;*
- *the uneven and advanced wear of the mould, which results in a different coefficient of thermal conductivity.*

They can be remedied by a slight, uniform and continuous cooling of the strand in the mould, by centring the casting jet in the mould; by controlling the fluctuations of the steel level in the mould, possibly using a mould with parabolic taper; by using a powder lubricant with suitable viscosity and melting rate; by minimizing the turbulence and surface agitation, optimizing the position of the input nozzle and its support; and by checking, before or after use, of the degree and uniformity of the mould wear.

Fig. 8. Longitudinal depressions

- *The transverse depressions (Fig. 9) are formed in the transverse direction and may cyclically occur in relation to the strand length. The width of the depressions may cover some oscillation marks, and the depth can reach several mm. The peritectic steels with low Carbon percent and high percent of Manganese and the stainless steels are sensitive to the formation of this type of defect, due to the much larger contractions occurred during solidification.*

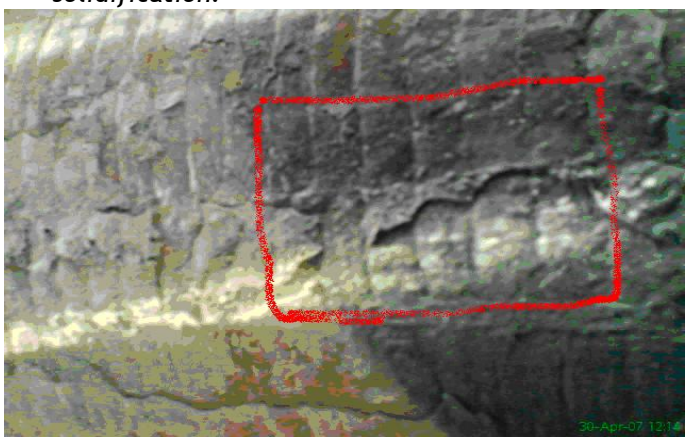

Fig. 9. Transverse depressions

The depressions precede the occurrence of the longitudinal shrinkage cracks and the marginal internal cracks (subcutaneous). The material that presents this type of defect is locally and cyclically grinded, to check the presence of subcutaneous fissures. The macro sample is taken.

The transverse depressions can be caused by the steel level fluctuation in the mould, by the too large quantity of melted flux, located in the space between the mould wall and the strand, and by the turbulent steel flow at the sub-meniscus level. They can be remedied by controlling the steel level fluctuation in the mould, by using a mould with parabolic taper, by using a powder lubricant with suitable viscosity and melting rate, by minimizing the turbulence and surface agitation, optimizing the position of the input nozzle and its support.

□ *Blowholes (Fig. 10) are cavities in the outer surface or in the subcutaneous zone of the billet, located at few tenths of millimetres from the stand surface. They have a diameter of 3 mm and a length (depth) that can reach up to 25 mm. Usually, they contain CO, relatively low H_2 and Ar, and they are often associated with inclusions.*

Fig. 10. Blowholes

If they are superficial and/or few, they are grinded (not to exceed the allowed dimensional tolerance after grinding). They are caused by:

- *insufficient steel deoxidation (presence of gases: hydrogen, nitrogen, oxygen);*
- *humidity of the casting powder;*
- *quality of the casting powder (% carbon, viscosity, basicity) - quantity and uniformity of its distribution;*
- *variation of the steel level in the mould, existence of moisture in the refractory lining of the tundish;*
- *the presence of argon entered in the mould during the injection of argon for filling the nozzle.*

The measures to be taken to remedy these defects could be:

- *sufficient deoxidation of steel by using dry materials and additives, protection of ladle and tundish;*
- *use of dry casting powder (and preheated, if possible);*
- *possibly choosing a casting powder compatible with the steel grade, temperature and casting speed (and, of course, a good correlation between the casting power quantity and the casting speed);*
- *controlling the steel level fluctuations in the mould, to prevent the steel to flow over the casting powder and to embed it, controlling the nozzle immersion depth, use of nozzles free of defects;*
- *avoiding the high casting temperatures;*
- *maintaining the argon debit below the critical value, to avoid the capture of argon bubbles by the meniscus and the development of slag foaming around the nozzle.*

□ *Interruptions in the physical continuity of the casting (Fig. 11). This defect is caused by a short interruption of the casting process, and it can be removed by shortening the bar that contains it. This defect occurs due to sudden changes in casting speed, caused by the variations of steel temperature in the tundish, by the variations of steel level in the mould, or by the variations of casting mode. The main remedial measure is to maintain a constant casting speed, by providing a narrow range of temperature variation in the tundish, by maintaining the steel level in the tundish within the prescribed limits and by using the casting automatic mode.*

Fig. 11. Interruption in the physical continuity of the casting

□ *Shrinkage cavity (Fig. 12) represents a gap of material, visible in the cross section at the end of a bar. It can be removed by cutting the end of the bar, and the defective portion is rejected. The causes that produce this defect are: high casting temperature, high extraction speed and intense secondary cooling.*

Fig. 12. Shrinkage cavity

The measures taken to remedy this type of defect are:

- *maintaining the ΔT within the established limits;*
- *a good correlation between the casting speed, ΔT and the cooling regime;*
- *reduction of the casting speed, reduction of the cooling intensity, maintaining the water flow at the established minimum limit.*

Analysing the factors that cause the occurrence of the defects in the continuous cast billets, it results that the maximum share is firstly represented by the casting parameters or, on the other hand, by the steel chemical composition and degree of purity. To meet

the required chemical composition and degree of purity, a large number of technological factors must be synchronized during the entire continuous casting, of which the most important are:

- *Steel chemical composition and degree of purity. As it is one of the main factors (it determines the drawing speed of the semi-finished product and prevents the occurrence of defects), the chemical composition of the steel that is going to be continuously cast should comply with the Euro norms updated for each steel grade, the chemical elements of the component ranging within specific limits prescribed by these standards in force. So, the Sulphur and Phosphorus contents shall be very low, being required to ensure a content of Sulphur < 0.015-0.020% (i.e. a value of the ratio Mn/S > 25-30), a content of Phosphorus between 0.020-0.025% and maximum 0.03% content of Copper.*

In the same time, the sum of these four elements must not exceed 0.067%, the observance of these restrictions leading to the reduction as much as possible of the tendency of fissure formation. In case of carbon, the values should be kept within very narrow limits and closer to the lower permissible limit for the respective steel grade. It is also required an advanced deoxidation of the steel with silicon, and the limitation of the aluminium content in steel (max. 0.007%), in order to prevent the deposition of Al_2O_3 inclusions in the hole of the casting funnel (where the steel enters in the protection tube) to avoid its obstruction and the occurrence of shrinkage micro-cavities in the continuous cast steel profiles.

An advanced degree of purity with low content of oxide inclusions in steel is obtained if the steel is deoxidised with aluminium during the treatment in the casting ladle, if we ensure all the required conditions to increase the buoyancy of the solid Al_2O_3 and to protect de liquid steel jet.

Following deoxidation with aluminium, it results inclusions of Al_2O_3 with higher draught capacity, i.e. with higher possibility to be retained in the slag created during the secondary metallurgy treatment, or in the tundish. The maximum size of non-metallic inclusions that remained in the liquid steel is determined by the time spent by the steel in the tundish, i.e. by the casting speed. A high level of steel in the tundish favours the flotation of these inclusions.

Of particular importance, in ensuring an adequate quality of the continuously cast semi-finished products, is the casting temperature, which normally should be as low as possible, because higher temperatures lead to the formation of columnar crystals (thus contributing to the trend of fissure formation), while low temperatures lead to a crystalline structure (more favourable in terms of metallurgy) due to the more extended globular zone.

However, a too low steel casting temperature can cause a transition to a pasty state that causes the clogging of the tubes, especially when starting the casting process. Therefore, the required temperature levels must be individually determined for the various groups of steel grades and, where possible, to establish the casting temperature for each heat.

We have to mention that the casting temperature should be with maximum 40-60°C higher than the liquidus temperature, because a higher overheating favours the occurrence of longitudinal cracks. We will also consider the temperature and the condition of the refractory lining of the ladle and tundish.

The experimental researches and the statistical calculations showed that the drawing speed decreases with increasing the section of the semi-finished product. Choosing a high drawing speed leads to the shortening of the casting duration and increasing of the installation productivity, but also to the decreasing of the marginal crust thickness and to the increasing of the mould height and the liquid steel cone length. To avoid these disadvantages, the cooling intensity should be increased, which would also facilitate the reduction of the transcrystallization zone. On the other hand, too much cooling intensity can cause the occurrence of internal fissures.

CONCLUSION

In conclusion, temperature control and adjustment is required in the mould. The main method to reduce the overheating consists of the introduction of consumable coolers. The value of the drawing speed must be equal to the speed of filling, and it is established in correlation with the diameter of the circle inscribed in the section of the semi-finished product, the height of the mould, the desired thickness of the marginal crust and the casting duration.

The experimental research and the statistical calculations showed that choosing a high drawing speed leads to the shortening of the casting duration (thus increasing the plant productivity), to the reduction of the marginal crust thickness, to the increase of mould height and to the increase of liquid steel cone length. To avoid these disadvantages, the cooling intensity should be increased, which would favour the reduction of the trans-crystallization zone. On the other hand, a too high cooling intensity may lead to the occurrence of internal fissures.

Moreover, from industrial experiments it was seen that the most frequent defects are the fissures (cracks), followed by the casting blowholes. Therefore, to obtain high quality and competitive semi-finished products, it is required to pay a special attention, during the entire manufacturing flow of billets (from liquid steel to the treatment in the ladle), to the steel protection against oxidation (before entering the mould), application of an optimum continuous casting technology (monitoring the steel behaviour in tundish and mould), and an appropriate arrangement of the continuously cast billets on the cooling beds, to prevent the bending of the steel bar under its own weight.

Also, the caster construction should meet certain technological requirements. To establish the optimum casting technology, we have to correlate all the factors that influence the physical-chemical-

metallurgical processes that occur at the interfaces mould-slag-liquid steel which, of course, have a great influence on the quality of the continuously cast steel.

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INFLUENCE OF EVAPORATION ON CONTACT ANGLES ON HYDROLYZED PET FOILS

ABSTRACT:
This contribution presents results from measuring contact angles on moderately hydrolyzed PET foils immersed in sodium hydroxide solutions of concentration 0% (distilled water), 2%, 4% and 6% at temperatures 20°C and 40°C. Contact angles and geometric parameters on these substrates were monitored as a function of evaporation time. After the evaporation course, four elementary stages have been evaluated, that allow determining advancing and receding contact angles and wetting behavior of these substrates.

KEYWORDS:
contact angle, contact angle hysteresis, drop dimension, evaporation, wetting

INTRODUCTION

Modification of solid surfaces is a very active field of research. By changing the surface composition we obtain a material with new surface properties [Semal et al., 1999].

One of the basic experiments for gathering information about surface properties of PET is the measurement of contact angles of water drops on it. The contact angles allow a simple and yet effective evaluation of the hydrophobicity of a low-energy surface such as polymers and are an important parameter in wet processing of solid substrates [Chau et al., 2009; Extrand and Kumagai, 1997]. Therefore the evaluation of contact angles θ of water on solid surfaces plays an important role in surface characterization [Shanahan and Bourgés, 1994].

In principle, a given pure liquid on an ideal (flat, homogenous, isotropic, smooth and rigid) solid in the presence of a given environment should give a unique value of equilibrium contact angle θ_e as determined by Young's equation (Eq.1):

$$\gamma_{SV} = \gamma_{SL} + \gamma_{LV} \cos\theta_e \qquad (1),$$

where γ represents the interfacial (or surface) tension and the suffixes define the interface. However in practice, it is rare for such a unique value of θ_e to be observed [Shanahan and Bourgés, 1994]. A surface which meets all the requirements of the Young's equation is referred to as an ideal surface. However, most practical surfaces are non-ideal and the measurable contact angle values on such surfaces are referred to as the apparent contact angle θ_{ap}. As a consequence this value is not unique but falls into a more or less wide interval between the advancing θ_a and the receding θ_r contact angle. The difference between them is called contact angle hysteresis (CAH) (Eq.2) [Chau et al., 2009].

$$\Delta\theta = \theta_a - \theta_r \qquad (2)$$

Hysteresis of contact angle is due to deviations of surface from ideal conditions [Erbil et al., 1999]. Interest in CAH is stipulated by the fact that CAH governs the wetting properties of the solid surface to a large extent [Bormashenko et al., 2008].

Indeed, several sources of wetting hysteresis are recognized, of which the major ones are considered to be either chemical (chemical attack, inhomogeneity of chemical compositions of the solid surface, swelling, dissolution, etc.) or physical (surface roughness, local adsorption, molecular orientation, solid strain near the triple line, etc.)

Analogous effects may also be observed when there is mass transfer due to evaporation of the liquid. A contact angle initially imposed in the advancing mode will diminish and tend towards a receding value when the liquid forming the meniscus starts to evaporate. Unless the atmosphere in the immediate vicinity of the drop is saturated in the vapor of the liquid, this transfer is inevitable and experiments conducted in non-equilibrium conditions may give erroneous values for θ_a. Although this complication is fairly obvious this complication in contact angle measurement, it seems to have been largely neglected [Shanahan and Bourgés, 1994; Monnier and Shanahan, 1995].

It is therefore important to evaluate relationship between contact angles (advancing and receding) and its variations during evaporation. Whole evaporation

simulates the conditions of advancing contact angle formation in initial phase and than slowly leads to formation of the receding contact angle when contact line is ruptured. The purpose of this contribution is therefore to examine behavior of sessile drop of water on hydrolyzed PET foils in mildest condition during the evaporation. It involves observation values of the contact angle and related changes of drop dimensions: contact diameter d and drop height h as a function of time t. Water drops were placed on different pretreated PET foils that simulate in this case surface roughness.

The morphology and surface roughness of these foils were evaluated by atomic force microscopy (AFM and SEM). Subsequently relationship between surface wettability (contact angles) and related changes of surface tension were evaluated. Results of surface roughness, wettability and changes in surface tension of these pretreated surfaces are presented elsewhere [Škvarla et al., 2010].

EXPERIMENTAL

Samples pretreatment. Samples of PET foils cut from post-consumer plastic bottles were used. The foil samples with the size of ca. 50×50 mm and without any preliminary cleaning procedure were immersed in a series of aqueous sodium hydroxide solutions with concentration of 0, 2, 4 and 6 wt% NaOH at temperatures 20 and 40 °C and stirred continuously for the period of 20 minutes. The NaOH-treated samples were taken out of the bath, rinsed with a large amount of distilled water to remove the remaining NaOH and air dried at 35 °C. The PET samples will be in the next text referred to as for example PET4/20 or PET2/40, meaning the PET surface pre-treated in 4 % NaOH at 20 °C or in 2 % NaOH at 40°C, respectively.

Contact angle goniometry. A sessile drop technique was used to measure the static contact angles of small water drops on the pretreated PET foil samples in air at ambient temperature. All of the measurements were carried out by the Krüss EasyDrop Contact Angle Measuring System, allowing the determination of shape and size of measured drops from their images. The evaluation of digitized video images and the calculation of contact angles were made with the Drop Shape Analysis (DSA1) software. The resulting contact angle values were obtained as averages of both left and right side contact angle of liquid drop every 10 second as well as drop dimensions. Evaporating time varying (from 420 s to 900 s) depending on volume of water drops (from ~4 μl to ~ 10 μl) and PET sample pretreatment. Drops were deposited on the substrate using microsyringe. During the experiment changes of sizes of contact angles θ and drop dimensions were monitored: contact diameter d and drop height h as a function of time t.

RESULTS AND DISCUSSION

Typically, the evolution of a sessile drop deposited on a polymer surface demonstrated four distinct stages. In stage I, contact diameter d remained almost constant in Fig. 1a, b and 2a, b and contact diameter d diminished and variable more rapidly at higher grade pretreatment (Fig. 1c, d and 2c, d). Drop height h diminished slightly and contact angle θ diminished quite markedly at all pretreatments. Initial contact angle θ_a decreased simultaneously with pretreatment (from ~ 84° to ~ 53°) at 20°C and (from ~ 82° to ~ 45°) at 40 °C.

In stage II contact diameter d, drop height h and contact angle θ decreased more rapidly than in stage I. In stage III was observed that both drop height h and contact diameter d diminished roughly in proportion, so that the contact angle stayed approximately constant (small plateau in Fig. 1a, b, c, d and 2 a). It is of interest to note that stage III was found to be totally absent at higher pretreatment at 40°C (Fig. 2b, c, d). Values of contact angle at aforementioned small plateaus in Fig. 1a, b, c, d and 2a may be taken effectively as a receding contact angle θ_r.

Stage IV corresponds to the final disappearance of the sessile drop. It was found to be exceedingly difficult to follow this stage, both the actual size of the sessile drops and the values of its contact angles being very small. Towards the end, θ tends to zero and, as a consequence its value is well below that corresponding to a classic receding contact angle θ_r. Stage IV is poorly understood and is probably influenced by anchoring effect of the triple line on surface heterogeneities. Differences of drop dimensions and contact angles on all of the examined samples in stage IV are caused by surface roughness induced by NaOH pretreatment, imbibitions of water into the pores and crevices of the surface or interactions between water and polar molecules.

For better visualization Fig.3 show dependences of the normalized contact angle θ^* on the normalized time t^* grouped together for triplets of water droplets evaporating on the PET surface pretreated in distilled water (a), 2% (b), 4% (c) a 6 % NaOH (d) at temperature of 20°C. Analogous dependences for PET surfaces pretreated at 40°C are presented in Fig.4. We can see immediately that the character of both dependences is changing when the polarity or hydrophilicity of the surfaces rendered by the hydrolysis increase (in the order a to d), irrespective of the size of drops.

Normalized values of contact angles and time were calculated according to relationships (Eq.3):

$$\theta^* = \frac{\theta_t}{\theta_i}, \qquad t^* = \frac{t}{t_f} \tag{3}$$

The normalized contact angle is defined as the ratio between the contact angle at time t θ_t and the contact angle at initial time θ_i. The normalized time is defined by the ratio between the time of each measurement t and the final time, when the drop has completely disappeared t_f [Cioulachtjian et al., 2010].

Analogous dependences of drops volume V on time t during evaporation on the PET surface pretreated in distilled water, 2 %, 4 % and 6 % NaOH at 20 °C (a) and at 40°C (b) are presented in Fig.5, irrespective of the size of drops. Volumes of drops were calculated from Eq.4:

$$V = \frac{\pi R^3}{3}\left(\frac{2-3\cos\theta+\cos^3\theta}{\sin^3\theta}\right) \approx \frac{\pi h}{6}\left(h^2+3R^2\right) \qquad (4)$$

where R is contact radius, θ is contact angle and h is height of drop.

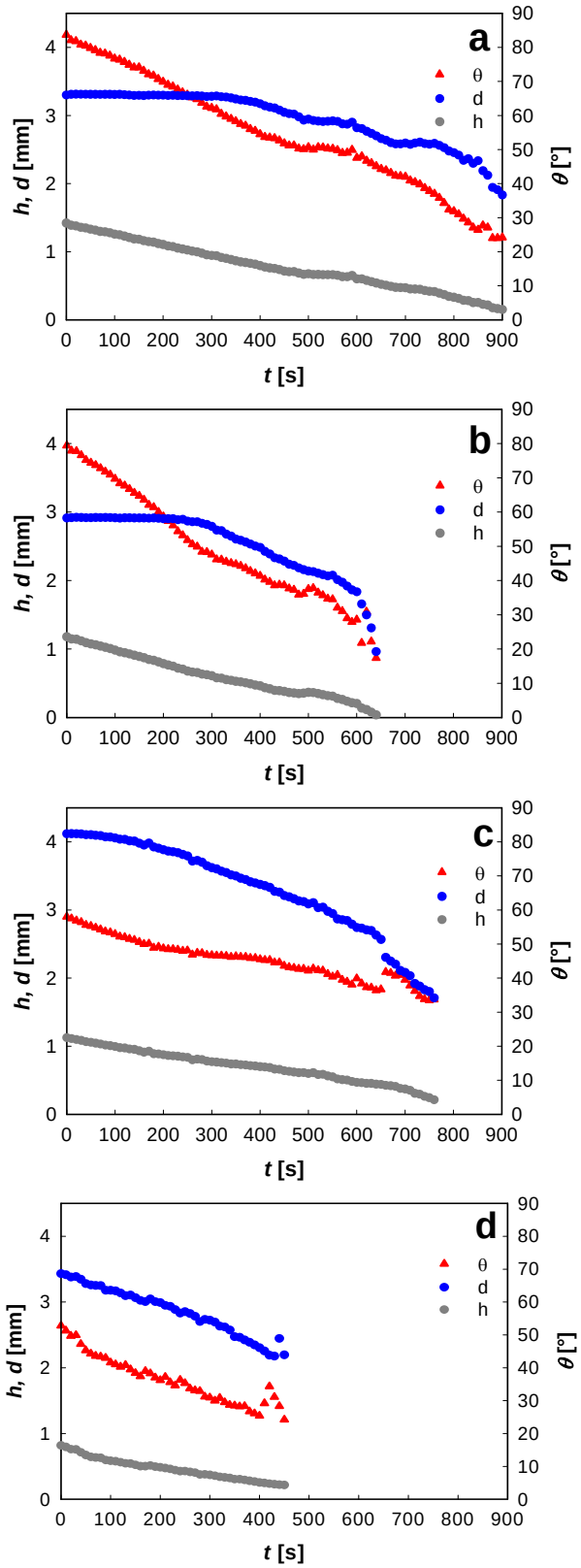

Figure 1. Contact angle (θ), contact diameter (d) and drop height (h) as a function of time (t) at 20 °C. Sample pretreatment: PET0/20 (a), PET2/20 (b), PET4/20 (c) and PET6/20 (d).

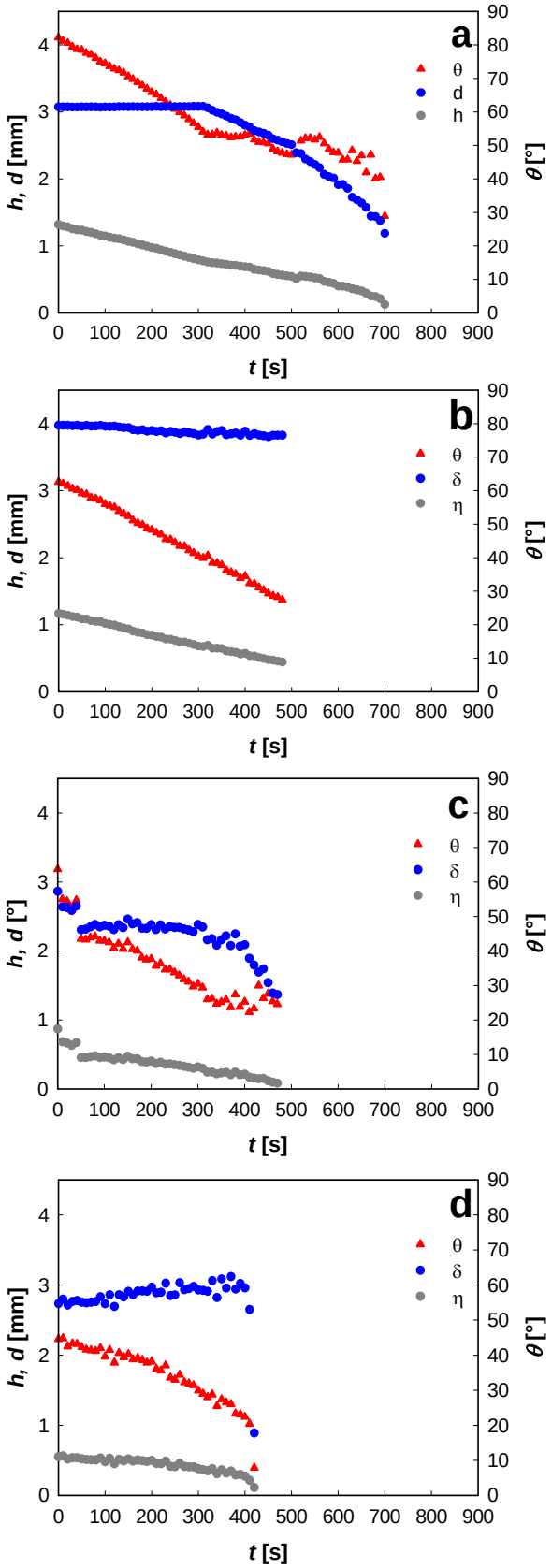

Figure 2. Contact angle (θ), contact diameter (d) and drop height (h) as a function of time (t) at 40 °C. Sample pretreatment: PET0/40 (a), PET2/40 (b), PET4/40 (c) and PET6/40 (d).

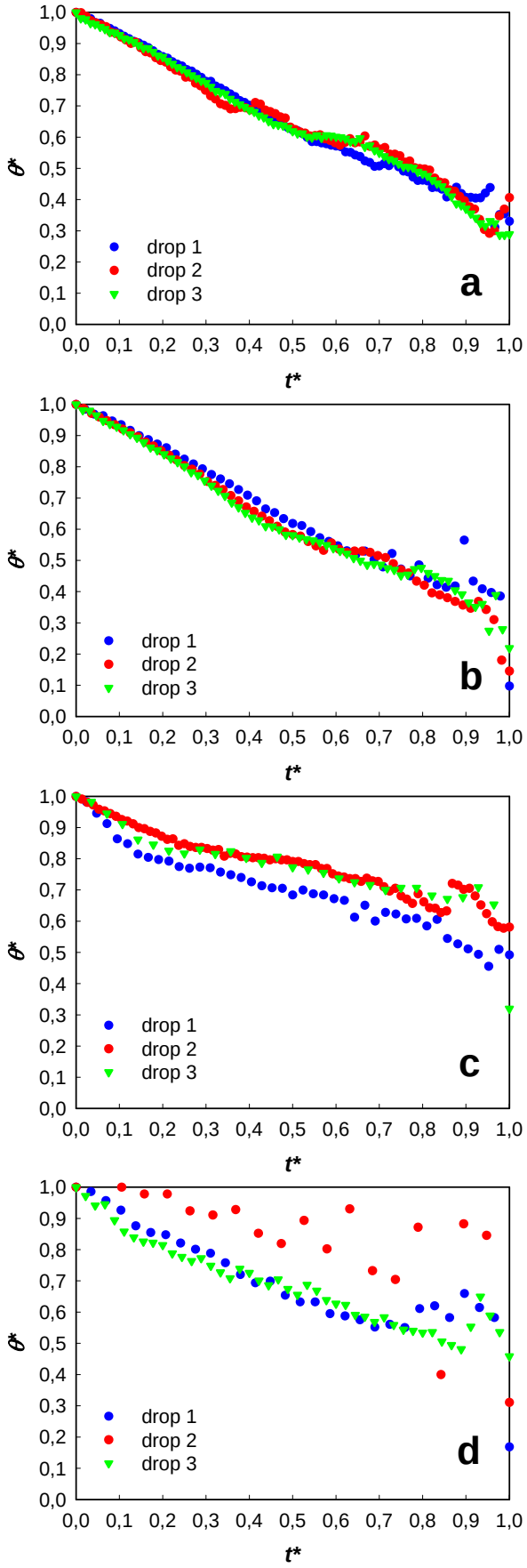

Figure 3. Dependence of the normalized contact angle on the normalized time of water droplets evaporating on the PET surface pretreated in distilled water (a), and 2 % (b), 4 % (c) and 6 % (d) NaOH solutions at 20°C.

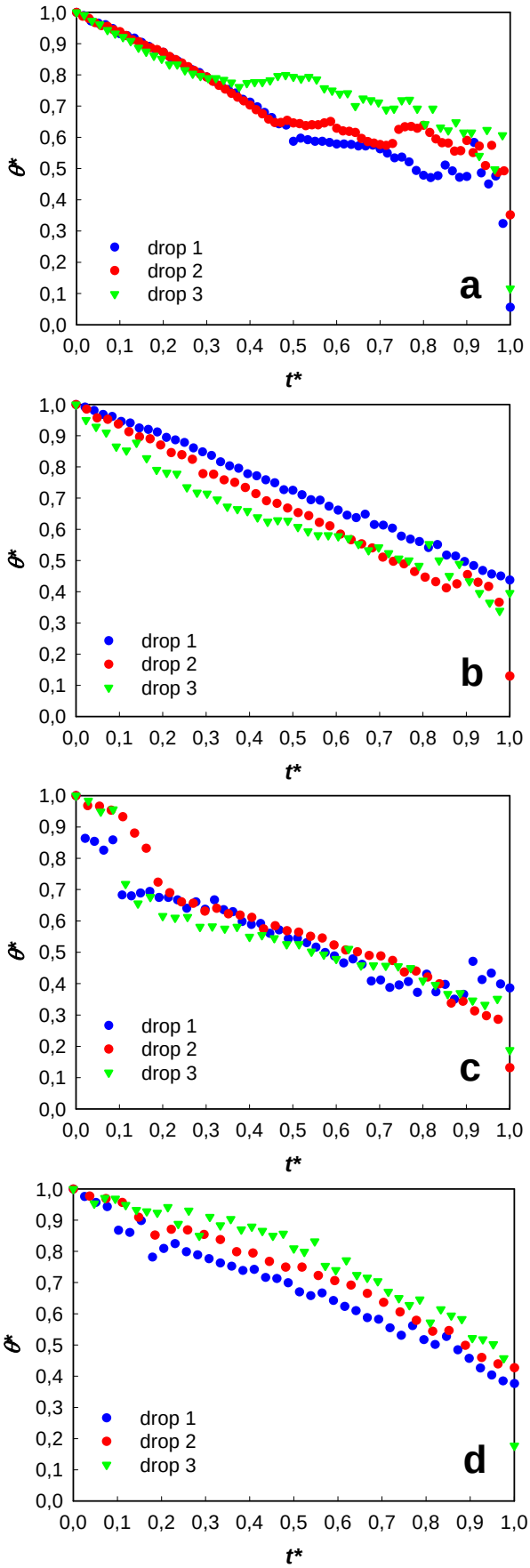

Figure 4. Dependence of the normalized contact angle on the normalized time of water droplets evaporating on the PET surface pretreated in distilled water (a), and 2 % (b), 4 % (c) and 6 % (d) NaOH solutions at 40°C.

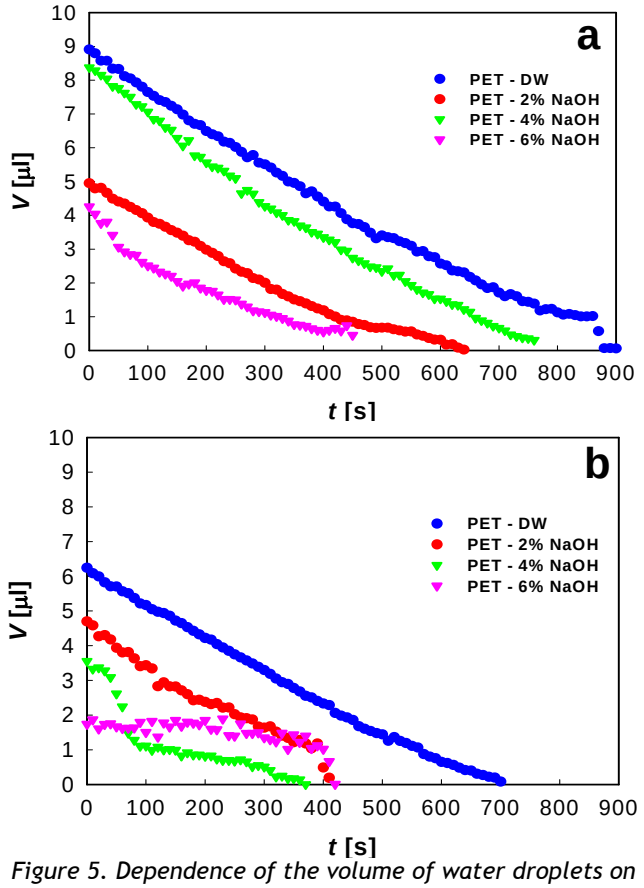

Figure 5. Dependence of the volume of water droplets on the PET surface pretreated in distilled water, 2 % NaOH, 4% NaOH and 6% NaOH solutions at 20 °C (a) and at 40 °C (b).

CONCLUSION

Sessile drops of water deposited on a solid surface of PET foils present an advancing contact angle only for a short period in air at ambient temperature. Initial contact angles decrease proportionally with pretreatment of PET samples as well as in course of evaporation when liquid evaporates from drop meniscus. During evaporation four basic stages were observed. Initially, drop height and contact angle decrease while contact diameter remains almost constant. Modest discrepancies of contact diameter we can see at higher grade of pretreatment (PET4/20, PET6/20 and PET4/40, PET 6/40).

Values of contact angles are between the initial advancing values and a receding contact angle; lower than the classic receding angle measured on equally pretreated PET foils (result not shown here) obtained by mechanical retraction of triple line.

The reasons for these lower values of receding contact angle are not absolutely clear, but it may be related to the fact that evaporation alone reduces the contact angle.

In stage III was observed that both drop height and contact diameter diminished roughly in proportion, so that the contact angle stayed approximately constant and produced small plateau (initial values of receding contact angles). Stage III is absolutely absent at higher pretreated PET samples.

Finally, the drop disappears and drop dimensions and contact angles tending to zero. This stage is very difficult clarify experimentally because it is probably caused by surface roughness of PET surface derivable from NaOH pretreatment (incipient alkaline hydrolysis) and other reactions taking place at PET surface (swelling, dissolution etc.).

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 4 [October-December]

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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

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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.

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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.

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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
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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.

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- MICROSTRUCTURE, PHYSICAL PROPERTIES, FAILURE, FRACTURE MICROMECHANISM
- APPLICATION OF PM MATERIALS UNDER COMPLEX STRESS AND EXPLOITATION CONDITIONS
- MODELLING
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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:

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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.

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Full paper submission: **September 30, 2011**
Notification: **October 10, 2011**
Final manuscript submission: **October 28, 2011**
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THE 4th INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND STRUCTURES – AMS '11

27 – 28 October 2011
Timişoara, ROMANIA

ORGANIZED BY:

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and ROMANIAN SOCIETY for BIOMATERIALS

IMPORTANT INFORMATION ABOUT THE CONFERENCE

Proceedings of AMS'11 will be published as separate edition in "Solid State Phenomena"
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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

- *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
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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. Fascicule 4 [October-December]

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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

CHAIRMEN AND ORGANIZERS:

Prof. T. E. Simos, Chairman
College of Sciences, Department of Mathematics, King Saud University, P. O. Box 2455, Riyadh 11451, Saudi Arabia and Department of Computer Science and Technology, University of Peloponnese, GR-221 00 Tripolis, GREECE, Member of the Presidium of the European Academy of Sciences, President of the European Society of Computational Methods in Sciences and Engineering (ESCMSE), Active Member of the European Academy of Sciences and Arts (EASA), Corresponding Member of the European Academy of Sciences (EAS), Corresponding Member of European Academy of Arts, Sciences and Humanities (EAASH).
E-mail: tsimos.conf@gmail.com, tsimos.conf09@gmail.com
Professor George Maroulis, Co-Chairman
Computational Quantum Chemistry Research Group, Department of Chemistry, Department of Chemistry, University of Patras, GR-26500 Patras, Greece

SCIENTIFIC COMMITTEE (In alphabetical order)

Dr. B. Champagne, Université de Namur, Belgique
Prof. S. Farantos, University of Crete, Greece
Prof. I. Gutman, University of Kragujevac, Serbia & Montenegro
Prof. P.Mezey, Memorial University of Newfoundland , Canada
Prof. Masayoshi Nakano, Osaka University, Japan
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.

CONTACT S

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CAR 2011 – INTERNATIONAL CONGRESS AUTOMOTIVE AND ENVIRONMENT

2 – 4 November 2011
Pitesti, ROMANIA

ORGANIZATORS:

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
Vice Rector - University of Pitesti
Congress Vice-Chairman
J.E. ROBERTSON
FISITA President
Scientific & Technical Committee
President
Acad. Prof. Dr. Eng. Nicolae PANDREA
Organizing Committee President
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Dean of Faculty of Mechanics and Technologie
University of Pitesti
Organizing Committee Vice President
Prof. Dr. Eng. Alexandru BOROIU
Head of Automotive Department
University of Pitesti
Logistics & Organisation
President
Prof. Dr. Eng. Florian IVAN
Congress Coordinator
Assoc. Prof. Dr. Eng. Adrian CLENCI

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

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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)

CONTACT S

Conference Chairman:
Prof. Nabil El Tayeb (BUE): nabil.eltayeb@bue.edu.eg
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EXPERIMENTAL FLUID MECHANICS 2011
22 – 25 November 2011
Jičín, CZECH REPUBLIC

CONFERENCE IS ORGANIZED BY:

Department of Power Engineering Equipment / Technical University of Liberec

AIMS & SCOPE

The conference will focus on obtaining an overview of projects under investigation, and experimental methods used in the field of fluid mechanics and thermodynamics. Its aim is to organize a network of young research workers who are interested in experimental, and also theoretical, work in the field of fluid mechanics and thermodynamics. The conference should contribute to creating the closer contacts and sharing experience in application of various experimental methods, preparation and implementation of experiments, processing of results and numerical simulations of experiments.

STEERING COMMITTEE

Petra Dančová (petra.dancova@tul.cz)
Václav Dvořák

SCIENCES COMMITTE

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Ladislav Skrbek
Charles University, Czech Republic
Václav Kopecký
TU Liberec, Czech Republic
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Eindhoven Univ. of Technology, The Netherlands
Kazimierz Perszynski
Univ. of Technology and Life Sciences in Bydgoszsz, Poland
Ludvík Prášil
TU Liberec, Czech Republic
Jan Hrubý
Academy of Science of Czech Republic
Magda Vestfálová
TU Liberec, Czech Republic

SCIENTIFIC AND TECHNICAL TOPICS

The conference will focus on obtaining an overview of projects under investigation, and experimental methods used in the field of fluid mechanics and thermodynamics. Its aim is to organize a network of young research workers who are interested in experimental, and also theoretical, work in the field of fluid mechanics and thermodynamics. The conference should contribute to creating the closer contacts and sharing experience in application of various experimental methods, preparation and implementation of experiments, processing of results and numerical simulations of experiments.

The main topics of the conference are:

- *Experimental methods used in fluid mechanics and thermodynamics*
- *Preparation and implementation of experiments*
- *Application of numerical simulation for preparation of experiments, comparison of the results obtained by numerical or analytical method with experiment*
- *Processing the results*
- *Experiments in the field of compressible and uncompressible fluid flow, stability of flow, heat and mass transfer, cavitation etc.*
- *Experiments and measuring carried out on power and regulating equipment.*

DEADLINES

- *Registration of the participants and delivering of abstract: 5th June 2011*
- *Author Notification of abstract acceptance: 17th July 2011*
- *Delivering of the complete text of the paper: 18th September 2011*
- *Author paper review complete and/or acceptance notification: 16th October 2011*
- *Submission of final paper: 1st November 2011*
- *Date of the conference: 22th - 25th November 2011*

CONTACT S

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THE 6th INTERNATIONAL CONFERENCE ON MANUFACTURING SYSTEMS – ICMS 2011
20 – 21 October 2011
Iaşi, ROMANIA

INVITATION:

Machine Tools Department from Machine Manufacturing & Industrial Management Faculty, "Gheorghe Asachi" Technical University of Iasi, organizes, since 2001, the International Conference on Manufacturing Systems.
The main purpose of the Conference is to create an academic forum for scientific debates regarding the manufacturing systems. Moreover, considering the structural and functional complexity of these systems and, also, their multiple connections to other industrial systems, the Conference is equally assigned to specialists in connected areas.
Because an engineer must achieve four basic functions - knows a technique, applies a technique, leads a team of specialists and creates a new technique - the papers included in 6th ICMS Conference will present results of applicative and fundamental researches in industrial/mechanical engineering, management and innovation.
We kindly invite you at the 2011 edition of our ICMS Conference, having confidence that it will come into a good occasion to better know each other, to exchange scientific opinions and to make new connections between the specialists in manufacturing systems.
Conference Proceedings will be published in ***"BULETINUL I.P.Iasi.", Machine Manufacturing Series, edited by the "Gheorghe Asachi" Technical University of Iaşi****. The journal is classified as* ***B+ category*** *by the National University Research Council (CNCSIS) of the Romanian Ministry of Education and Research and also indexed into* ***Index Copernicus Database*** *and* ***Ulrichsweb Database****.*
It will be a great pleasure for us to receive and publish your papers and also to welcome you in Iași on October 2011.

TOPICS:

Topics include, but are not limited to:
Abrasives; Assembly & Disassembly; Automation in Manufacturing; Automotive Industry; Autonomous & Adaptive Control Systems; Advanced Modeling Techniques; Agile Manufacturing; Artificial Intelligence in Manufacturing Systems; Agent-based Manufacturing Systems; Artificial Intelligence Methods for Manufacturing; AS/RS; Automated Manufacturing Systems; Biomechanics; Bioengineering Statics & Dynamics;
CAD/CAPP/PPC/CAM/CAQ/CAE; CAx-Technologies; CIM Collaborative Engineering; Computers in Manufacturing; Computational Methods & Optimization in Manufacturing; Concurrent Engineering; Cutting and Forming Tools; Control Strategies & Algorithms; Data Fusion Sensors in Manufacturing; Design Optimization; Design Automation Diagnosis & Performance Monitoring; Diagnosis & Performance Monitoring; Driving Systems; Decision Making Design;
Ecodesign in Manufacturing; Experimental Techniques; Expert Systems in Manufacturing; Fixtures; Flexible Manufacturing Systems; Fluid Processing Equipment; Forming Technologies; Fuzzy Control & Systems Genetic Algorithms; Gearing; Globalization & Technology; Grinding & Finishing; Hybrid Manufacturing Processes &

Systems; Hydro pneumatic systems; High Speed Machining; Human Computer Interaction/ Human Machine Interface;
Industrial Automation; Industrial Logistics; Industrial Robots; Industrial Cleaning & Surface Preparation; Industrial Machine Safeguarding; Innovation Strategies; Innovation Management; Intelligent & Smart Machining Systems; International Scientific, Technical & Academic Cooperation; Internet Solutions in Manufacturing; Inspection Tools & Instruments for Manufacturing; Knowledge-Based Technology; Lean Manufacturing; Learning/ Reasoning Systems; Learning Machine Tools;
Machine Tools; Machine Tools Accessories; Machine Tool and & FMS Control; Machine & Robot Applications; Maintenance & Repair; Management & Marketing in Manufacturing Systems; Manufacturing Technologies; Manufacturing Equipment & Components; Mechatronic Systems; Metal Forming Processing; Man-Machine Systems; Management Manufacturing; Manufacturing Process Control; Manufacturing Process Planning; Mobile Robots, AGV; Modeling, Modern Methods; Modeling & Computation in Bioengineering;
Network Technologies in Manufacturing; New Manufacturing Paradigms; Non-Conventional Machining; Optimal Design; PDM/PLM; Production Planning; Precision Engineering; Process Modeling & Monitoring; Prototyping; Process Control; Process Planning; Product Modeling; Production Engineering; Production Planning & Scheduling; Programming Quality Management; Prothetics;
Re-engineering; Reliability Assurance; Retrofitting; Rapid Prototyping; Reliability/Safety/ Stability; Reasoning Reliability; Robot Applications; Safety; Scheduling Self-Organizing Systems; Sensors & Actuators for Manufacturing Systems; Surface Generation;
Simulation in Manufacturing Systems; Transmissions; Teleoperation Tools in Manufacturing; TQM Trends in Manufacturing & Automation; Unconventional Technologies; Vibrations; Virtual Manufacturing; Vision Systems in Manufacturing.

SECTIONS

Machine Tools and Advanced Manufacturing Systems
Manufacturing and Process Equipment
Management, Quality and Innovation
Manufacturing Automation and Control Systems
Hydropneumatic and Electrical Systems
Biomechanics and Bioengineering

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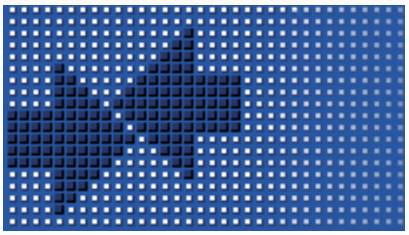

THE 6th SCIENTIFIC CONFERENCE 'ECONOMY AND EFFICIENCY – CONTEMPORARY SOLUTIONS IN LOGISTICS AND PRODUCTION – OiE 2011 – "Global supply chain, production and logistics in global networks", 16 – 18 November 2011, Poznan, POLAND

INVITATION:

We wish to cordially invite you to the 6th Scientific Conference 'Economy and Efficiency - contemporary solutions in logistics and production' organized by the Faculty of Engineering Management, Poznan University of Technology. The conference will be held on 16-18 November 2011.
The main objective of the conference is to present and exchange experience arising from research work on modern solutions applied in manufacturing, logistics and management.
The conference is a forum of exchange of the results of research and works conducted by science centers. We wish to put particular emphasis on the practical aspects of logistics, manufacturing and management. Our intention is to confront research results with actual problems faced by entrepreneurs.

ABOUT THE CONFERENCE

The 'Economy and Efficiency - contemporary solutions in logistics and production' Scientific Conference has been held annually since 2006.
The Conference is aimed at integrating the academic circles and fostering new solutions and concepts. The result of the scientific meetings is publications in reviewed scientific monographs and in the 'Logistyka' science magazine.
The result of the so-far held conference is several hundred of scientific publications by authors representing various science centers, which have been published in 16 books.
The Conference is always organised during the third week of November.

SUBJECT MATTER

The main topic of the OiE 2011 Conference shall be the "Global supply chain, production and logistics in global networks".
Global supply chains, international corporations, multi-national integrated production consortia have become highly sophisticated and complex systems. Their degree of integration and logistical operations require new, creative solutions for improving their effectiveness. Their business functions should be integrated on the transnational level and within the entire supply chain.
Global culture and the transnational market lead to the development of world brands. It is a challenge for production companies, their suppliers and subcontractors, as well as the enterprises operating in the distribution sector.

Many enterprises have adapted to the changes on the open market. They reproduce proven solutions and introduce their own organizational changes. International enterprises concentrate primarily on cost reduction, and pay less attention to constructing a long-term strategy. However, global business solutions resulted in the loss of control over flows within the supply chain and, consequently, added to the risk of operational and/or financial risks. It means that the international supply chains should be analyzed thoroughly so as to ensure that they are competitive at the global level.
Since the companies must compete on the global market, particularly in the scope of logistics, supply chain and production, the subsequent conference will be dedicated to these issues. The purpose of the meeting will be to attempt to find answer as to the position and role of modern logistics and production in the improvement of competitiveness of enterprises and entire supply chains within the global market.

TOPICS

The subject matter of the Conference includes:

1. LOGISTICS, including:
- *Logistic systems*
- *Modern logistic strategies*
- *Green Logistics*
- *Risks in Logistics*
- *Innovative IT Systems in Logistics (RFID, SOA etc.)*
- *Logistics and information systems (Technologies, exchanges)*
- *Designing and Sustainability*
- *New Structures for the Future*

2. SUPPLY CHAIN MANAGEMENT, including:
- *Value Co-Creation in Business Relationships and Networks*
- *The Role of Suppliers and Service Providers in Supply Chain*
- *Procurement and supply chains (purchasing and supply chain performance, purchasing/logistics relationships, purchasing of services, logistics outsourcing)*
- *Operations management and supply chains*
- *Strategy and supply chains (network governance and design)*
- *Sustainable supply chains*
- *Green Supply Chain Management*
- *Supply chains and inter-organizational relationships (collaboration, trust, contracts)*

3. MANUFACTURING, including:
- *Industrial Engineering*
- *Process Improvement, Lean Production*
- *Global and International Production Networks*
- *Zero waste production*
- *Operational Excellence*
- *Process Production Management*
- *Modeling, analysis, and simulation of manufacturing processes*
- *Rapid manufacturing technologies*

4. MANAGEMENT, including:
- *Managing Cultural Differences*
- *Developing the Global Organization*
- *Global Leadership*
- *International Management*
- *Global Management*
- *Global management competencies*
- *Cross-cultural management*
- *Multinational companies*
- *Knowledge management in global organizations*

INVITATION TO PUBLISH

We wish to invite everybody to publish scientific texts (conceptual, review, demonstrative and case studies) referring to the theory of logistics, manufacturing and management.
Works and scientific texts, following positive opinions from reviewers, will be published in the form of a reviewed book in English. Therefore, we kindly request your manuscript to be in the form of a chapter (consisting of subsections and captions), not of a typical lecture. Will you please allow for that when developing the text.
Selected papers will be published in a special issue of Research in Logistics & Production.

PROGRAMME COMMITTEE

Conference Chair:
Professor Leszek Pacholski
Conference Vice Chair:
Professor Marek Fertsch
Committee members:
Prof. dr. rer. oec. Ralf Berning
Prof. dr hab. Andrzej Bujak
Prof. dr Lau Hoong Chuin
Prof. Anatoly I. Fedorenko
Prof. dr hab. Stanisław M. Krawczyk
Prof. dr. Martin Ivan Lipičnik
Prof. doc. ing. Xenie Lukoszova
Prof. dr hab. inż. Anna Ławrynowicz
Prof. dr hab. inż. Edward Michlowicz
Prof. dr hab. Jan M. Myszewski
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Prof. dr hab. inż. Radosław Pytlak
Prof. Koichi Shintani
Prof. dr hab. inż. Jacek Szołtysek
Prof. dr hab. Jarosław Witkowski
Prof. dr hab. inż. Kazimierz Worwa
Prof. dr hab. inż. Magdalena K. Wyrwicka
Prof. dr hab. Ludmiła Zawadzka

IMPORTANT DATES

10.11.2011 – deadline for fee sending presentations
16-18.11.2011 – Conference Economy and Efficiency – contemporary solutions in logistics and production 2011

CONTACT S - CONFERENCE OFFICE OIE 2011

Ph.D. Eng. Katarzyna Grzybowska
POZNAN UNIVERSITY OF TECHNOLOGY
FACULTY OF ENGINEERING MANAGEMENT
CHAIR OF PRODUCTION ENGINEERING AND LOGISTICS
ul. Strzelecka 11
Poznań, 60-965
Poland
katarzyna.grzybowska@put.poznan.pl
http://fem.put.poznan.pl/

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UNIVERSITY POLITEHNICA TIMISOARA,
FACULTY OF ENGINEERING HUNEDOARA,
5, Revolutiei,
331128, Hunedoara,
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INTERNATIONAL SYMPOSIUM ON NANOMECHANICAL TESTING IN MATERIALS RESEARCH AND DEVELOPMENT

9 – 14 October, 2011

Lanzarote, Canary Islands, SPAIN

ABOUT ECI:

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.

ECI'S 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:

The novel field of miniaturized mechanical testing down to the nanometer length scale has evolved significantly in the last few years. The origin of most methods is based on nanoindentation testing - which is also called instrumented indentation testing - a well established technique in materials research although new developments still improve and extend the application field largely. Novel nano- and micromechanical methods include compression, tension and bending tests, thin film testing methods (e.g. bulge testing, thermal straining), different in situ testing techniques as for example micro-bending experiments combined with X-ray diffraction methods as well as fatigue and fracture experiments performed on a very local scale or on small

specimens to determine mechanical material properties. The samples are prepared by focussed ion beam technique, lithography, etching of thin film and composite structures or growth of micro/nano-objects (whiskers, rods, spheres,…).
Since always very small volumes are tested size effects are very important. Modelling of the mechanical behavior is of special importance to gain an improved understanding of the measurements and underlying deformation mechanisms in the various test methods. For example, discrete dislocation dynamics and molecular dynamics provide meaningful and quantitative insights into the deformation processes around nanoindentations and small scale samples
Applications of these nano- and micromechanical testing methods become more and more important in all fields of materials research like metals, ceramics, glasses, polymers, coatings, composites, and biomaterials and will improve our understanding of the complex mechanical behaviour. Next to the hardness which is classically measured in an indentation test nanoindentations and other methods allow way more properties to be measured. For example the visco-elastic behaviour or time dependent properties, phase transformations, fracture phenomena and toughness can be quantitatively evaluated. For many applications also the temperature dependence and other environmental influences are of high relevance. These nano- and micromechanical testing techniques will help in the development of design concepts for materials based on their local mechanical properties.
The conference will bring together all people working in the field of nano- and micromechanical testing in materials research. It will provide a forum for discussion of the latest activities in application of nano- and micromechanical testing methods. This conference will be a follow-up meeting to the ECI conference on Instrumented Indentation Testing (Fodele Beach, Crete from October 9 - 14, 2005) and Nanomechanical Testing (Barga - Tuscany, Italy from October 11 - 16, 2009

TOPICS

The major topics to be discussed are:
- ☐ *Fundamental studies in indentation testing (size effects, phase transformations…)*
- ☐ *FIB/lithography based nano- and micromechanical testing*
- ☐ *In situ techniques (synchrotron, electron microscopy…)*
- ☐ *Deformation mechanisms*
- ☐ *Modelling with focus on molecular dynamics, discrete dislocation dynamics and crystal plasticity*
- ☐ *Novel preparation methods for micro- and nanoscale objects*
- ☐ *Testing of nanostructures, thin films and coatings*
- ☐ *Fatigue and fracture testing*
- ☐ *Polymeric and biomaterials*
- ☐ *Testing of metals, ceramics and composites*
- ☐ *Testing at higher temperature and different environments*
- ☐ *Future directions*

COMMITTEES:

Conference Chair
Prof. Dr. Gerhard Dehm (Department Materials Physics, University of Leoben and Erich Schmid Institute of Materials Science of the Austrian Academy of Sciences, Austria).
(gerhard.dehm@mu-leoben.at)
Organizing Committee
Prof. George M. Pharr (Department of Materials Science and Engineering, University of Tennessee, USA)
Dr. Nigel M. Jennett (National Physical Laboratory, UK)
Dr. Johann Michler (EMPA, Laboratory Mechanics, Materials and Nanostructures, Switzerland)
Dr. Christian Motz (Erich Schmid Institute of Materials Science of the Austrian Academy of Sciences, Austria)
Prof. Sang Ho Oh (Department of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH), Korea)
Prof. Alexander Hartmaier (ICAMS and Ruhr-Universität Bochum, Germany)

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INTERNATIONAL CONFERENCE ON "DESIGN AND ADVANCES IN MECHANICAL ENGINEERING"

16 – 17 December 2011
Tamilnadu, INDIA

ORGANIZER:

Department of Mechanical Engineering
S.K.P Engineering College
Tiruvannamalai, Tamilnadu, India

ABOUT THE CONFERENCE

Department of Mechanical Engineering, S.K.P. Engineering College, Tiruvannamalai, India, is organizing an international conference on "Design and Advances in Mechanical Engineering". This conference will provide a platform in expressing application trends, progress and future course of computer aided engineering & simulation in Mechanical Engineering. The Conference will include plenary sessions, keynote lectures and technical sessions.

AIM & SCOPE:

The aim of this conference is to provide an interdisciplinary forum for engineers, researchers and student technocrats to discuss and promote research and technology transfer of design and advances in Mechanical Engineering. This conference is focused on fundamental research and computational tool related to design and advances in Mechanical Engineering and comes at an appropriate time when the whole world is moving towards innovation. The objective of ICDAAME-2011 is to establish an effective channel of communication among those in academia, industry and others concerned with computer aided engineering theories, methods, enabling technologies in mechanical engineering researches. The present conference will bring researchers, educators, professional engineers and technologists into a single forum in order to discuss & debate on the innovative and intelligent design of engineering products, processes, materials, mechanisms and other advanced systems. It is hoped that at the end of the conference there will be possible solutions and conclusions on the challenges emerging out of the theme.

TOPICS

The scope of the conference will be fulfilled through discussion of the papers on the following topics:
Product development: Product modeling, visualization techniques/ Concurrent product development/ Collaborative and distributed design/Rapid Prototyping/ Product life-cycle modeling and management/ Reverse engineering/ Sustainable product development
Design theory: Conceptual design/ Computational design synthesis/ Design for X (adaptability, reconfigurability, energy, life cycle, etc.)/ Emerging design theory and methodologies
Virtual design and development: Numerical modeling/ Finite element modeling, simulation and validation/ Computational fluid dynamics/ Rotor dynamics/ Multi-body dynamics/ Failure Prevention/Fatigue and fracture/ Bio-mechanics

Design optimization: Structural and topology optimization/ Multi-disciplinary optimization/Sensitivity analysis/ Artificial Intelligence/ Reliability, robust design/Simulation based design
Machine design: Theoretical and computational kinematics/ Mechanism analysis and synthesis/ Vibration and noise/Dynamics and control/Gearing and transmission system
Material and Machining process design: Design and application of biomaterials, ceramics, composites/ Process design and modeling: casting, forming, joining, conventional and unconventional machining/ Machine tools and cutting tools
Manufacturing system design: Modeling, simulation and optimization of manufacturing processes/ Lean, agile, reconfigurable manufacturing system/ Assembly line design/ Metrology and inspection/ Tolerance Analysis
Design of advanced system: Nano and micro system/ equipments/Robotics, mechatronic systems/ Material handling systems/ Vehicle design
Thermal and fluid system design: Thermal system/equipment design/Advanced IC engine/ propulsion/ Combustion modeling/ pressure vessels/ Micro-fluid systems/ Energy and energy conversion system

IMPORTANT DATES:

Acceptance of full paper	*October 15, 2011*
Registration (without late fee)	*October 31, 2011*
Conference dates	*December 16-17, 2011*

CONTACT:

Dr. M. Kannan
Organizing Secretary, ICDAAME-2011
Professor, Department of Mechanical Engineering
S K P Engineering College, Thiruvannamalai, Tamilnadu, India -606 611
Ph +91 (0)9600672664 E-mail: kannanju@gmail.com
Office Phone : +91 (0) 4175-252633/833
Fax :+91 (0) 4175-252643
Web :www.skpec.in

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ISYPMR - 2011

THE XIIIth INTERNATIONAL SYMPOSIUM "YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH" ISYPMR 2011

10 - 11 NOVEMBER 2011
Timisoara, ROMANIA

ANNOUNCEMENT

You are invited to participate at the XIIIth INTERNATIONAL SYMPOSIUM "YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH"
The Symposium will be organised by the Association for Multidisciplinary Research (ACM-V), University "Politehnica" of Timisoara and University "Eftimie Murgu" of Reșița under de aegis of Ministry of Education, Research, Youth and Sports.Specialists from Serbia, Hungary and Bulgaria will participate in the Symposium together with the Romanian specialists.

ORGANIZERS:

- NATIONAL R&D INSTITUTE FOR WELDING AND MATERIAL TESTING - ISIM TIMIȘOARA,
- ASSOCIATION FOR MULTIDISCIPLINARY RESEARCH (ACM-V),
- UNIVERSITY "POLITEHNICA" OF TIMISOARA
- UNIVERSITY "EFTIMIE MURGU" OF REȘIȚA, ROMANIA
- THE LOCAL COUNCIL OF TIMISOARA, TIMISOARA CITY HALL
- THE COUNTY COUNCIL OF TIMIS

under de aegis of:

- MINISTRY OF EDUCATION, RESEARCH , YOUTH AND SPORTS

GENERAL INFORMATIONS – AIMS:

The aim of the SYMPOSIUM is to create the framework for the presentation, debate and publication of the valuable scientific results obtained by both the young members of ACM-V and from other regions, beside those from SERBIA, HUNGARY and BULGARIA.
The Organization Committee propose that the XIIIth SYMPOSIUM to be one of high scientific level and quality.
The criteria for the papers' estimation by the Scientific Committee are:

- *interdisciplinary and multidisciplinary technical - scientific character*
- *high scientific level*
- *contribution brought to the solution of the proposed problem and/or development of the field.*

You are invited to participate at the XIIIth INTERNATIONAL SYMPOSIUM "YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH".
The participants are asked to fill-in and mail the Registration form to the Secretariat of the ASSOCIATION FOR MULTIDISCIPLINARY RESEARCH OF THE WEST ZONE OF ROMANIA (ACM-V) located at TIMISOARA, Bv. MIHAI VITEAZUL nr. 30 and also to mail an abstract of the paper in ENGLISH (200 words at the most) specifying the section.

MODEL FOR PAPER'S ELABORATION:

- *The paper should contain max. 6 pages, size A4 (with figures and tables included in the text, including bibliography), with an even number of pages;*
- *The paper should be edited on computer with Arial font, 12 pt. on size A4 with useful area of 24 cm × 16 cm (left, right and up 2.5 cm, down 3.0 cm);*
- *The pages should be numbered by pencil;*
- *The papers should be written in Word format;*

- *The title of the paper should be written with capital letters (14 pt. - Bold), centred;*
- *The paragraph title should be written with 12 pt. bold fonts and it might be centred.*
- *Graphic materials should be exposed on transparent slides or Power Point presentation,*
- *The presentation should take 10 minutes at the most*

The paper will be transmitted on CD and listed in one copy.

THE PROGRAM OF THE SYMPOSIUM:

The program of the Symposium contains:

□ ***Papers in Plenary Session** on the topic: **"Priorities of the European Scientific Research"***

□ ***Papers in sections** on the following topics:*

- *Technical Sciences*
- *Chemistry, Ecology and Environmental Protection*
- *Biology, Agriculture and Animal Science*
- *Health (human and veterinary)*
- *Social and Human Sciences. Economic Sciences*

An author can participate with two papers at the most.

DEADLINES:

*The deadline for mailing the abstracts, in which, it will be showed the personal contribution of the authors and the interdisciplinary character: **JULY 17TH 2010**. The Scientific Committee will analyze the abstracts and communicate to the authors until the **10th of SEPTEMBER 2010** which are the selected papers, with a view to the final elaboration.*

*The deadline for mailing of the complete papers, edited according to the annexed model and the CD until: **5TH OCTOBER 2010**.*

The publication in volume or on CD of the papers will be decided by the Scientific Committee following the analysis of the complete papers mailed in time, if these fulfill the technical-scientific criteria and the elaboration mode.

CONTACTS & INFORMATIONS:

Any correspondence should be addressed to the secretariat of the Symposium, located at the ASSOCIATION FOR MULTIDISCIPLINARY RESEARCH (ACM-V):
BD. MIHAI VITEAZUL NR. 30,
300222 TIMISOARA, ROMANIA
Tel. (+40) - 0256 - 491840
Fax (+40) - 0256 - 499149
Contact persons:
Lecturer Dr. Ing. Flaviu FRIGURA-ILIASA
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Lecturer Dr. eng. Cornelia Anghel
Tel. (+40) - 255 - 210227; (+40) - 0745 088222
Mr. Phys. Nicolae FARBAŞ Ph.D.
E-mail: nfarbas@isim.ro

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1st INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH AND ENTERPRISE SYSTEMS (ICORES)

Vilamoura - Algarve, PORTUGAL

4 - 6 February, 2012

SCOPE

The purpose of the 1st International Conference on Operations Research and Enterprise Systems (ICORES) is to bring together researchers, engineers and practitioners interested in the advances and applications in the field of operations research. Two simultaneous tracks will be held, covering on one side domain independent methodologies and technologies and on the other side practical work developed in specific application areas.
ICORES focuses on real world applications; therefore authors should highlight the benefits of Operations Research Methodologies and Technologies for industry and services, either in general or for particular applications. Ideas on how to solve business problems, using operations research methodologies and technologies, will arise from the conference. Papers describing advanced prototypes, systems, case studies, tools and techniques and general survey papers indicating future directions are also encouraged. Papers describing original work are invited in any of the areas listed below. Accepted papers, presented at the conference by one of the authors, will be published in the Proceedings of ICORES. Acceptance will be based on quality, relevance and originality. Both full research reports and work-in-progress reports are welcome. There will be both oral and poster sessions.
Special sessions, dedicated to case-studies and commercial presentations, as well as tutorials dedicated to technical/scientific topics are also envisaged: companies interested in presenting their products/ methodologies or researchers interested in holding a tutorial are invited to contact the conference secretariat.

CONFERENCE TRACKS

Each of these tracks is expanded below but the sub-topics list is not exhaustive. Papers may address one or more of the listed sub-topics, although authors should not feel limited by them. Unlisted but related sub-topics are also acceptable, provided they fit in one of the following main tracks:

1. METHODOLOGIES AND TECHNOLOGIES

- *Decision Analysis*
- *Optimization*
- *Management Sciences*
- *Data Mining and Business Analytics*
- *Information Systems*
- *Industrial Engineering*
- *Stochastic Processes*
- *Forecasting*
- *Dynamic Programming*
- *Linear Programming*
- *Inventory Theory*
- *Simulation*
- *Queuing Theory*
- *Game Theory*
- *Mathematical Modeling*

2. APPLICATIONS

- PROJECT MANAGEMENT
- SCHEDULING
- NETWORK OPTIMIZATION
- SUPPLY CHAIN MANAGEMENT
- ROUTING
- LOGISTICS
- ENERGY AND ENVIRONMENT
- AUTOMATION OF OPERATIONS
- MAINTENANCE
- GLOBALIZATION AND PRODUCTIVITY
- RESOURCE ALLOCATION
- DECISION SUPPORT SYSTEMS
- OPTIMIZATION IN FINANCE
- RISK MANAGEMENT
- SECURITY
- OR IN TELECOMMUNICATIONS
- OR IN HEALTH
- OR IN TRANSPORTATION
- OR IN GOVERNMENT
- OR IN EDUCATION

PAPER SUBMISSION:

Authors should submit an original paper in English, carefully checked for correct grammar and spelling, using the on-line submission procedure. The initial submission must have between 3 to 13 pages otherwise it will be rejected without review. Please check the paper formats page so you may be aware of the accepted paper page limits.

The guidelines for paper formatting provided at the conference web ought to be used for all submitted papers. The preferred submission format is the same as the camera-ready format. Please check and carefully follow the instructions and templates provided. Each paper should clearly indicate the nature of its technical/scientific contribution, and the problems, domains or environments to which it is applicable. Papers that are out of the conference scope or contain any form of plagiarism will be rejected without reviews. Please read INSTICC's ethical norms regarding plagiarism and self-plagiarism.

PAPER SUBMISSION TYPES:

Regular Paper Submission

A regular paper presents a work where the research is completed or almost finished. It does not necessary means that the acceptance is as a full paper. It may be accepted as a "full paper" (30 min. oral presentation) , a "short paper" (20 min. oral presentation) or a "poster".

Position Paper Submission

A position paper presents an arguable opinion about an issue. The goal of a position paper is to convince the audience that your opinion is valid and worth listening to, without the need to present completed research work and/or validated results. It is, nevertheless, important to support your argument with evidence to ensure the validity of your claims. A position paper may be a short report and discussion of ideas, facts, situations, methods, procedures or results of scientific research (bibliographic, experimental, theoretical, or other) focused on one of the conference topic areas. The acceptance of a position paper is restricted to the categories of "short paper" or "poster", i.e. a position paper is not a candidate to acceptance as "full paper"

MODEL FOR PAPER'S ELABORATION:

All papers accepted for the conference, whatever the presentation format, will be published in the proceedings under an ISBN reference, on paper and on CD-ROM support, as long as the camera-ready submission, registration and copyright document have been received.

*There are **three types of paper for the Conference**, namely:*

- *Full Papers: Papers allocated 30 minutes for oral presentation (including discussion). These papers are assigned a 10-page limit in the conference proceedings.*
- *Short Papers: Papers allocated 20 minutes for oral presentation (including discussion). These papers are assigned a 6-page limit in the conference proceedings.*
- *Posters: Papers presented as poster are assigned a 4-page limit in the conference proceedings.*

*There are **three types of paper for the Workshop**, namely:*

- *Full Papers: Papers allocated 30 minutes for oral presentation (including discussion). These papers are assigned a 10-page limit in the conference proceedings.*
- *Short Papers: Papers allocated 20 minutes for oral presentation (including discussion). These papers are assigned an 8-page limit in the conference proceedings.*

□ Posters: *Papers presented as poster are assigned a 6-page limit in the conference proceedings. If absolutely needed, it will be allowed to increase the total number of pages by a maximum of 4 extra pages. However, for each excess page the author will have to pay an additional fee. Let us emphasize that the total number of pages will be considered after the paper is correctly formatted according to the template.*

The author who has an accepted paper, irrespective of the paper type (full paper, short paper or poster), must be registered as a speaker. No other registration type will be accepted.

THE PROGRAM OF THE SYMPOSIUM:

The program of the Symposium contains:

□ ***Papers in Plenary Session** on the topic: **"Priorities of the European Scientific Research"***

□ ***Papers in sections** on the following topics:*

- *Technical Sciences*
- *Chemistry, Ecology and Environmental Protection*
- *Biology, Agriculture and Animal Science*
- *Health (human and veterinary)*
- *Social and Human Sciences. Economic Sciences*

An author can participate with two papers at the most.

IMPORTANT DATES:

*Conference date: **4-6 February, 2012***
*Regular Paper Submission: **September 6, 2011** (extended)*
*Authors Notification (regular papers): **October 14, 2011***
*Final Regular Paper Submission and Registration: **October 27, 2011***

ICORES Secretariat:

Address: Av. D. Manuel I, 27A, 2º esq.
2910-595 Setúbal - Portugal
Tel.: +351 265 100 033
Fax: +44 203 014 8556
e-mail: icores.secretariat@insticc.org
Web: http://www.icores.org/

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THE 2nd CONFERENCE OF THE YOUNG RESEARCHERS FROM TECHNICAL UNIVERSITY OF CIVIL ENGINEERING, BUCHAREST YRC 2011
17 – 18 NOVEMBER 2011, Bucharest, ROMANIA

ANNOUNCEMENT

We, the young researchers from The Technical University of Civil Engineering of Bucharest, have decided that the moment has come for our first conference.
Our ambition is to offer to the people that wish to take part a scientific and collegial framework to share the concern regarding the research activity and the results obtained. We believe that this kind of event is required for our University. Firstly it will enable us to get to know each other better and to become aware of our presence as a young research community. This event will also represent a good exercise for our young PhD colleagues, who will have the opportunity to present their papers.
The manifestation will allow the quick publication of the best articles at least in the UTCB magazine "Mathematical Modelling in Civil Engineering" (the well known Romanian magazine of CNCSIS - B+ category) or abroad in a international magazine, for this reason our wish has been to organize this event in English language.
We are also warmly welcoming young researchers from other Universities or Research Institutions to open new possibilities of collaboration.
The conference addresses young PhD students, young postdoctoral researchers and young research teams engaged in civil engineering and related fields.
All authors of papers submitted for scientific evaluation must be aged no more than 35 years old.

SCIENTIFIC COMMITTEE

Prof.dr.ing. Anton ANTON
Prof.dr.ing. Virgil PETRESCU
Prof.dr.ing. Loretta BATALI
Prof.dr.ing. Radu VACAREANU
Conf.dr.ing. Vlad IORDACHE
Conf.dr.ing. Alexandru ALDEA
Conf.dr.ing. Aurel SARACIN
Conf.dr.ing. Ionut RACANEL
Conf.dr.ing. Anton DAVIDESCU
Conf.dr.mat. Ion MIERLUS-MAZILU

PAPER SUBMISSION:

The conference addresses young PhD students, young postdoctoral researchers and young research teams engaged in civil engineering and related fields.
All authors of papers submitted for scientific evaluation must be aged no more than 35 years old.

PAPER SUBMISSION TYPES:

Dear Author, please follow the instructions given below:

- *Use the pre-formatted instructions_autor.dot (word - file) to prepare your own paper. This template also includes instructions and formatting details for finalising your camera-ready manuscript. Do not change any of the formatting in the template.*
- *The length of your manuscript must not exceed ten pages.*
- *Filename of your manuscript must be in the form n_n.doc where n_n is your name.*
- *The file must be saved as a Microsoft Word 2003 document file.*
- *The manuscript file must be sent as an e-mail attachment to the conference coordinator.*
- *The camera ready manuscripts must be submitted by 01 AUGUST 2011 at the latest.*

Language: The official language of the Conference will be English.

IMPORTANT DATES:

Sending the papers in extenso until: ***01 AUGUST 2011***
YRC 2010: NOVEMBER, 17-18 2011

CONFERENCE VENUE:

The conference will take place in the amphitheaters of The Tehnical University of Civil Engineering of Bucharest
9:00, Amfiteatrul Radu Priscu (II7), Faculty of Hydrotechnics
Address:
B-ul Lacul tei, No. 122-124, Sector 2
020396, Bucharest,
ROMANIA

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XVIII INTERNATIONAL SCIENCE & ENGINEERING CONFERENCE "MACHINE-BUILDING AND TECHNOSPHERE OF THE XXI CENTURY"

September 12 – 17th 2011
Sevastopol, Donetsk, UKRAINE

ANNOUNCEMENT

Dear colleague,

International Union of Machine-Builders, Donetsk National Technical University and a number of leading companies of Ukraine, Russia, Belarus, Romania, Poland and other countries will host the XVIII international science and engineering conference MACHINE-BUILDING AND TECHNOSPHERE OF THE XXI CENTURY, taking place in the city of Sevastopol on September 12-17th 2011.

The aim of the conference is to exchange the science and engineering information, define new engineering and technologies development and creation forward-looking ways develop joint research programmes, establish business contacts and commercial links in this area. It was last year that scientists and leading specialists from the Ukraine, Russia, Belarus, Moldova, Turkmenistan, Poland, Romania, Great Britain, Germany, Yugoslavia, and other countries took part at the conference. That promoted the development of promising links and forming of the traditions of joint discussion of important problems. The work of the conference under discussion will be aimed to consolidate scientists, leading experts, managers of the industrial companies in order to promote the process of machine-building and technospher further development under the economics, which is being globally changed. The International Union of Machine-Builders (IUMB) congress will be organized in the frames of the event. Any person willing to enter the IUMB and represent it in his or her own country or region is encouraged to become the IUMB member in Sevastopol.

The Organizing Committee proposes you to take part at the conference and instruct your institution's specialists to deliver reports or read communications.

THE MAIN TOPICS OF THE CONFERENCE

1. *Practice and prospects of creation and application of progressive technologies. Integration technologies. Assembly in mechanical engineering and instrument making. Abrasive and vibroabrasive technology.*
2. *Manufacturing processes mechanization and automation. Advanced equipment.*
3. *Complete automation of manufacturing preparation and control. The technosphere economic problems.*
4. *Progressive tools and instrument materials design and application.*
5. *The products and technical systems quality management. The products surface layer engineering.*
6. *Modern problems of machine-building and machine parts.*
7. *Modern problems of materials engineering, processes and material science in machine-building. Firm coverings and hardening technologies in machine-building. Nanostructured materials and Nanotechnologies.*
8. *Complex technical systems modelling and calculation.*
9. *Special equipment and technosphere technologies. The technosphere environment problems.*
10. *Modern problems of engineering education. Eurointegration in education.*

It is allowed to advertise and present firms and companies in the frames of the conference.
Ukrainian, Russian, English, French and German are the official languages of the conference.

THE CONFERENCE PROCEEDINGS:

The papers presented to the conference are planned to be published on the language of the original in the Conference or DonNTU Proceedings. The volume of the manuscripts should be up to four full pages. To become the conference participant and for your paper to be included into the Conference Programme, and for the proceedings to be published on time you should send the following:

- *the application form;*
- *the payment provement (cash order copies or the receipt);*
- *the advertisement texts in two copies;*
- *the CD disk with the paper.*

THE ORGANIZING COMMITTEE ADDRESS:

Donetsk National Technical University, The Machine-Building Technology Department, The Conference Organizing Committee, 58, Artyom Street, Donetsk 83001, Ukraine.
☎ *Tel./Fax: +38 062 3050104, +38 062 3010805;*
Mobile tel.: +38 050 6202396
✉ *E-mail: tm@mech.dgtu.donetsk.ua or mntk21@mail.ru*
http://donntu.edu.ua/ukr/7/konf/sevastopol/about.htm
http://iumb.donntu.edu.ua;
http://www.dgtu.donetsk.ua
Prof. Alexander Mikhaylov - the Conference Organizing Committee Chairperson
Mr Nikolaj Golubov - the Conference Academic Secretary
Mr Aleksey Lahin - the Conference Technical Secretary

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THE 7th INTERNATIONAL SYMPOSIUM "MECHANICAL AND INDUSTRIAL DESIGN IN MECHANICAL ENGINEERING""

24 - 26 May 2012,
Hotel Marina, Balatonfüred, HUNGARY

ANNOUNCEMENT – INVITATION

Dear colleagues,
We kindly invite You to join the 7th International Symposium "KOD 2012" which will take place on 24th and 26th May 2012 in Hotel Marina in Balatonfüred, HUNGARY.The basic goals of this symposium are:

- *to assemble famous investigators and practitioners from faculties, scientific institutes and different enterprises or other organizations,*
- *to enable presentation of new knowledge and exchange of practical experience in mechanical engineering, industrial design and shaping, and*
- *to propose theoretically developed and practically tested solutions for improving the quality of products in mechanical engineering in order to achieve the highest possible position on the international market.*

PAPER SUBMISSION

*Abstracts (with paper title, names of the author and coauthors with addresses and contacts) should be submitted **before December 31st 2011.** Final text papers prepared according to given instruction should be submitted **before April 1st 2012**.Accepted abstracts will be printed in Symposium proceedings - book of abstracts and final text papers will be reviewed and published in journal Machine Design, Vol.4 (2012).*
The number of papers is limited. One person can sign two papers at the most, but only one paper as the first author. We kindly ask authors to prepare text of abstracts and papers for journal according to the requirements and suggestions given into instructions.
*The official language of the symposium is **English**.*

ORGANIZERS:

University of Novi Sad, Faculty of Technical Sciences, Novi Sad
Slovak University of Technology in Bratislava, Faculty of Mechanical Engineering, Bratislava
ADEKO - Association for Design, Elements and Constructions, Belgrade
Chairmen of organizing committee:
Siniša KUZMANOVIĆ
Faculty of Technical Sciences, Novi Sad
Miroslav VEREŠ
Faculty of Mechanical Engineering, Bratislava
Chairmen of Scientific committee:
Vojislav MILTENOVIĆ
Faculty of Mechanical Engineering, Niš
Milosav OGNJANOVIĆ
Faculty of Mechanical Engineering, Belgrade
Ladislav GULAN
Faculty of Mechanical Engineering, Bratislava

SCIENTIFIC COMMITTEE:

ORGANIZING COMMITTEE:

MAIN TOPICS:

Participants of Symposium KOD 2012 contributed to the understanding of design building relationships across multidisciplinary design domains including engineering and product development, innovation, management, complexity, human behaviour and system design. The Symposium will provide an excellent opportunity for researchers to exchange ideas as well as discuss and identify current problems in the area product design, developing and management regarding to its:

- ☐ FUNCTION,
- ☐ PURPOSE,
- ☐ STRUCTURE,
- ☐ SIZE,
- ☐ MATERIAL,
- ☐ MASS,
- ☐ ERGONOMICS REQUIREMENTS,
- ☐ WORKER PROTECTION MEASURES,
- ☐ AESTHETIC DEMANDS,
- ☐ PRODUCTION VOLUME,
- ☐ DELIVERY DATE,
- ☐ QUALITY,
- ☐ RELIABILITY,
- ☐ OPERATING LIFE,
- ☐ EFFICIENCY,
- ☐ PRICE,
- ☐ PRODUCTION METHOD,
- ☐ ASSEMBLING,
- ☐ NUMERATION,
- ☐ TESTING,
- ☐ CONSERVATION,
- ☐ PACKAGE,
- ☐ STORAGE,
- ☐ TRANSPORTATION,
- ☐ DECONSERVATION,
- ☐ MOUNTING,
- ☐ HANDLING,
- ☐ EXPLOITATION,
- ☐ SERVICE,
- ☐ MAINTENANCE,
- ☐ HYGIENIC REGUIREMENTS,
- ☐ REPAIR,
- ☐ ATMOSPHERIC INFLUENCE,
- ☐ BIOLOGICAL FACTORS,
- ☐ RECYCLING,
- ☐ EKOLOGY,
- ☐ UNEXPECTED BREAKDOWNS,
- ☐ SPECIAL DEMANDS,
- ☐ PERSONAL DEMANDS.

IMPORTANT DATES:

*Abstracts submission deadline **31.12.2011***
*Notification of acceptance of the abstracts **01.02.2012***
*Final paper submission deadline **01.04.2012***
*Confirmation the acceptance of the papers **20.04.2012***
*Payment of the Registration fee and Final programme **10.05.2012***
*Registration **24.05.2012***

CORRESPONDENCE ADDRESS:

KOD 2012 - Faculty of Technical Sciences
21000 Novi Sad, Serbia
Trg Dositeja Obradovica 6
www.kod.ftn.uns.ac.rs
E-mail: kod@uns.ac.rs
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tel: +381 21 485 2358; +381 64 153 22 67; +381 64 190 31 04

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5th INTERNATIONAL CONFERENCE ON ENTREPRENEURSHIP, INNOVATION AND REGIONAL DEVELOPMENT – ICEIRD 2012 – REGIONAL DEVELOPMENT FOR UNLEASHING GROWTH THROUGHOUT SOUTHEASTERN EUROPE

28 – 29 May 2012
Sofia, BULGARIA

CALL FOR PAPERS

The Faculty of Mathematics and Informatics and The Faculty of Economics and Business Administration Sofia University is pleased to announce the5th International Conference on Entrepreneurship, Innovation and Regional Development

SCOPE OF THE CONFERENCE

With acceleration of technological development and adoption and greater market competition, innovation is a prerequisite for enterprise survival. Innovation activity encompasses both manufacturing and service sectors.
The objective of the conference is to gather together decision makers (government, ministries and state agencies), innovation experts (universities, research and development centers, technology transfer centers, start-up centres) and practitioners (SMEs, business incubators and business support organisations) to generate discussion and exchange on the potential of entrepreneurship promotion and innovation to national and regional competitiveness.

CONFERENCE TOPICS:

Authors are invited to submit abstracts on the following topics:

- REGIONAL SYSTEMS OF INNOVATION, COMPETITIVENESS AND DEVELOPMENT
- REGIONAL INNOVATION STRATEGIES, INNOVATIVE CITIES AND REGIONS
- KNOWLEDGE TRANSFER AND INFUSION, TECHNOLOGY TRANSFER
- GREEN ICT AND SUPPLY CHAINS
- COLLABORATIVE AND INTELLIGENT SYSTEMS OF INNOVATION, VIRTUAL INNOVATION ENVIRONMENTS
- INNOVATIVE SUPPLY CHAINS, NETWORK COLLABORATION AND JOINT VENTURES
- BUSINESS INTELLIGENCE MANAGEMENT
- PATENTING, RESEARCH AND DEVELOPMENT IN SMES
- E-TECHNOLOGY ADOPTION AND SEMANTIC WEB SERVICES
- KNOWLEDGE ECONOMY/INTEGRATION, INNOVATIVE COMPANIES AND CLUSTERS
- BIOTECHNOLOGY DIFFUSION
- UNCERTAINTY AND RISK IN INNOVATION
- PREDICTIVE ANALYTICS AND RISK ASSESSMENT
- ENTREPRENEURSHIP AND SMES' COMPETITIVENESS
- OUTSOURCING AND OFF-SHORING
- SOCIAL BUSINESS AND INNOVATION
- SERVICE INNOVATION

- *INSTITUTIONALLY AND RESEARCH DRIVEN INNOVATION*
- *CURRENT THEMES, CHALLENGES AND RESEARCH IN SOCIAL ENTREPRENEURSHIP*
- *BENCHMARKING OF ENTREPRENEURSHIP AND INNOVATION BEST PRACTICES IN THE REGION*
- *ICT-ENABLED INNOVATION AND NEW BUSINESS CREATION*
- *WOMEN'S ENTREPRENEURSHIP - TRENDS AND GOOD PRACTICES*

Authors are also encouraged to submit papers in other related areas. The official language of the Conference is English.

POST-CONFERENCE:

Selected high quality papers will be recommended for publication in the following peer-reviewed journals (Inderscience Publishers):
1. International Journal of Innovation and Regional Development.
2. International Journal of Enterprise and Network Management
3. International Journal of Logistics Economics and Globalisation

IMPORTANT DATES:

Submission of abstract: ***17 October 2011***
Notification of acceptance: ***21 November 2011***
Submission of full papers: ***06 February 2012***
Notification of acceptance: ***05 March 2012***
Submission of camera-readypaper: ***26 March 2012***
Early registration ***02 April 2012***
Late registration ***10 April 2012***

SUBMISSIONS:

Authors are invited to submit a full paper 6 - 10 pages. Submitted papers will go under blind review by at least two referees. The Conference proceedings, including all papers presented will be published as a SEERC book edited by the Conference Chairpersons

CONTACTS:

Chairpersons
Assoc. Prof. Dimitar Y. BIROV
The Faculty of Mathematics And Informatics
Sofia University, Bulgaria
Prof. George S. CHOBANOV
The Faculty of Economics and Business Administration
Sofia University, Bulgaria
Prof. Panos H. KETIKIDIS
CITY College
An International Faculty of the University of Sheffield

INFORMATIONS:

4TH INTERNATIONAL CONFERENCE ON ENTREPRENEURSHIP, INNOVATION AND REGIONAL DEVELOPMENT
FACULTY OF MATHEMATICS AND INFORMATICS,
FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION,
SOFIA UNIVERSITY
Sofia, 28-29 May 2012
contact: iceird2012@fmi.uni-sofia.bg

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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.*

AUTHORS & AFFILIATION

1. NAME SURMANE 1ST AUTHOR
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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