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Review process & Editorial Policy

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is dedicated to publishing material of the highest engineering interest, and to this end we have assembled a distinguished Editorial Board and Scientific Committee of academics, professors and researchers.

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering publishes invited review papers covering the full spectrum of engineering. The reviews, both experimental and theoretical, provide general background information as well as a critical assessment on topics in a state of flux. We are primarily interested in those contributions which bring new insights, and papers will be selected on the basis of the importance of the new knowledge they provide.

The editorial policy of ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is to serve its readership in two ways. Firstly, it provides a critical overview of the current issues in a well-defined area of immediate interest to materials scientists. Secondly, each review contains an extensive list of references thus providing an invaluable pointer to the primary research literature available on the topic. This policy is implemented by the Editorial Board which consists of outstanding scientists in their respective disciplines. The Board identifies the topics of interest and subsequently invites qualified authors. In order to ensure speedy publication, each material will be report to authors, separately, thought Report of the Scientific Committee. For an overview of recent dispatched issues, see the ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering issues.

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering encourages the submission of comments on papers published particularly in our journal. The journal publishes articles focused on topics of current interest within the scope of the journal and coordinated by invited guest editors. Interested authors are invited to contact one of the Editors for further details.

The members of the Editorial Board may serve as reviewers. The reports of the referees and the Decision of the Editors regarding the publication will be sent to the corresponding authors.

The evaluated paper may be recommended for:

- Acceptance without any changes – in that case the authors will be asked to send the paper electronically in the required .doc format according to authors' instructions;
- Acceptance with minor changes – if the authors follow the conditions imposed by referees the paper will be sent in the required .doc format;
- Acceptance with major changes – if the authors follow completely the conditions imposed by referees the paper will be sent in the required .doc format;
- Rejection – in that case the reasons for rejection will be transmitted to authors along with some suggestions for future improvements (if that will be considered necessary).

The manuscript accepted for publication will be published in the next issue of ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering after the acceptance date.

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering accept for publication unpublished manuscripts on the understanding that the same manuscript is not under simultaneous consideration of other journals. Publication of a part of the data as the abstract of conference proceedings is exempted.

All the authors and the corresponding author in particular take the responsibility to ensure that the text of the article does not contain portions copied from any other published material which amounts to plagiarism. We also request the authors to familiarize themselves with the good publication ethics principles before finalizing their manuscripts.

Manuscripts submitted (original articles, technical notes, brief communications and case studies) will be subject to peer review by the members of the Editorial Board or by qualified outside reviewers. Only papers of high scientific quality will be accepted for publication. Manuscripts are accepted for review only when they report unpublished work that is not being considered for publication elsewhere.

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Aims & Scope

General Aims:

ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING is an international and interdisciplinary journal which reports on scientific and technical contributions.

ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING publishes invited review papers covering the full spectrum of engineering. The reviews, both experimental and theoretical, provide general background information as well as a critical assessment on topics in a state of flux. We are primarily interested in those contributions which bring new insights, and papers will be selected on the basis of the importance of the new knowledge they provide.

Topical reviews in materials science and engineering, each including:

- surveys of work accomplished to date
- current trends in research and applications
- future prospects.

As an open-access journal ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering will serve the whole engineering research community, offering a stimulating combination of the following:

- Research Papers - concise, high impact original research articles,
- Scientific Papers - concise, high impact original theoretical articles,
- Perspectives - commissioned commentaries highlighting the impact and wider implications of research appearing in the journal.

ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING encourages the submission of comments on papers published particularly in our journal. The journal publishes articles focused on topics of current interest within the scope of the journal and coordinated by invited guest editors. Interested authors are invited to contact one of the Editors for further details.

Every year, in three issues, ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING publishes a series of reviews covering the most exciting and developing areas of engineering. Each issue contains papers reviewed by international researchers who are experts in their fields. The result is a journal that gives the scientists and engineers the opportunity to keep informed of all the current developments in their own, and related, areas of research, ensuring the new ideas across an increasingly the interdisciplinary field.

ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING exchange similar publications with similar institutions of our country and from abroad.

Audience:

Scientists and engineers with an interest in the respective interfaces of engineering fields, technology and materials, information processes, research in various industrial applications. It publishes articles of interest to researchers and engineers and to other scientists involved with materials phenomena and computational modeling.

About us:

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is an international and interdisciplinary journal which reports on scientific and technical contributions and publishes invited review papers covering the full spectrum of engineering.

Every year, in four online issues (fascicules 1 - 4), ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering [e-ISSN: 2067-3809] publishes a series of reviews covering the most exciting and developing areas of engineering. Each issue contains papers reviewed by international researchers who are experts in their fields. The result is a journal that gives the scientists and engineers the opportunity to keep informed of all the current developments in their own, and related, areas of research, ensuring the new ideas across an increasingly the interdisciplinary field.

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering has been published since 2008, as an online supplement of the ANNALS OF FACULTY ENGINEERING HUNEDOARA – INTERNATIONAL JOURNAL OF ENGINEERING.

Now, the ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is a free-access, online, international and multidisciplinary publication of the Faculty of Engineering Hunedoara.

Coverage:

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is a good opportunity for the researchers to exchange information and to present the results of their research activity. Scientists and engineers with an interest in the respective interfaces of engineering fields, technology and materials, information processes, research in various industrial applications are the target and audience of ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. It publishes articles of interest to researchers and engineers and to other scientists involved with materials phenomena and computational modeling.

The journal's coverage will reflect the increasingly interdisciplinary nature of engineering, recognizing wide-ranging contributions to the development of methods, tools and evaluation strategies relevant to the field. Numerical modeling or simulation, as well as theoretical and experimental approaches to engineering will form the core of ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering's content, however approaches from a range of environmental science and economics are strongly encouraged.

ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering appear in four issues per year and is open to the reviews, papers, short communications and breakings news inserted as Scientific Events, in the field of engineering.

General Topics:**ENGINEERING**

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- BIOMATERIALS

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- MODELING & OPTIMIZATION
- FOUNDATIONS & METHODS

Invitation:

We are looking forward to a fruitful collaboration and we welcome you to publish in our ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering. You are invited to contribute review or research papers as well as opinion in the fields of science and technology including engineering. We accept contributions (full papers) in the fields of applied sciences and technology including all branches of engineering and management.

Submission of a paper implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis) that it is not under consideration for publication elsewhere. It is not accepted to submit materials which in any way violate copyrights of third persons or law rights. An author is fully responsible ethically and legally for breaking given conditions or misleading the Editor or the Publisher.

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We are very pleased to inform that our journal ACTA TECHNICA CORVINIENSIS – BULLETIN of ENGINEERING is going to complete its four years of publication successfully. In a very short period it has acquired global presence and scholars from all over the world have taken it with great enthusiasm. We are extremely grateful and heartily acknowledge the kind of support and encouragement from you.

ACTA TECHNICA CORVINIENSIS – BULLETIN of ENGINEERING is seeking qualified researchers as members of the editorial team. Like our other journals, ACTA TECHNICA CORVINIENSIS – BULLETIN of ENGINEERING will serve as a great resource for researchers and students across the globe. We ask you to support this initiative by joining our editorial team. If you are interested in serving as a member of the editorial team, kindly send us your resume to redactie@fih.upt.ro.



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Content of FASCICULE 2 [APRIL-JUNE]

- 1. Tamás KULCSÁR, Imre TIMAR – HUNGARY**
SURFACE FINISH ANALYSIS OF WEAR ON TRIBOLOGICAL FACILITY

ABSTRACT: Today, optimization is one of the main tasks in design work to develop functional and economical satisfying products. The paper demonstrates an overview of mathematical based optimization methods and views their applications in the field of design work. The substantial task of the engineers is to solve technical problems considering several material types, technological, economical, legal, conditions combining with ecological and human-related restrictions. The solutions have to fulfill all the given and formulated requirements, otherwise it has to reach an optimum value when the designer applying the methodology of the structural design. The necessary resources during the lifetime of the product, like the material and energy consumption, and also the product development related costs and time are important factors we have to reduce, and have to find the optimal solution while keeping the demanded quality level of the product. Changing the variables of such an optimizing problem the model will result a reduction of the mass or the manufacturing cost or the shape or the material properties of the product and in the end of the process we can reach the minimum value of the optimization task.

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- 2. Maja LUTOVAC, Goran FERENC, Vladimir KVRGIĆ, Jelena VIDAKOVIĆ, Zoran DIMIĆ – SERBIA**
ROBOT PROGRAMMING SYSTEM BASED ON L-IRL PROGRAMMING LANGUAGE

ABSTRACT: Contemporary robot languages should be simple for usage, compact, portable and easily integrated into complex production systems. L-IRL (Lola Industrial Robot Language) is a robot Programming Language that was initially Pascal-based programming language. Further development is intended to add new characteristics such as portability and to become easy to learn and use. L-IRL is programming language based on the procedural paradigm and it is basis of the offline part of the robot programming system. Developed Graphical User Interface of offline part provides user friendly usage. New language parser is formed as LR(1) type parser (parser that reads input from left to right) and written with tools such as Bison and Lex with the C++ programming language. The proposed solution gives logical and functional separation between different phases of parsing and compiling. L-IRL is using XML as one of the main communication tools between different elements of the system. XML is used as meta language for system specification file and as object code of the compiler so that new software solution is more compact and portable.

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MANADO WATERFRONT DEVELOPMENT CONCEPT AS SUSTAINABLE CITY OF TOURISM

ABSTRACT: Urban waterfront development is a well established urban phenomenon in developed countries based on certain concepts and principles. It enhances urban design, quality of life and economic development of cities. The urban waterfront development in developing countries has produced a varied experience. This Paper looks at a recent coastal development in Manado City, North Sulawesi, Indonesia for its development of urban public spaces, commercial developments and its integration with urban development policy of the city. Manado has a coastal border area that extends from coast to coast Malalayang Maasing down the coast and on Bunaken, Manado Tua island and the island Siladen, which now throughout this protected area has been transformed into a total cultivated area with several activities such as: coastal border area districts Malalayang to district authorities other than the area that was already there are also added to the reclamation of new land currently used as a commercial area consisting of shops / malls, hotels and luxury housing. The development of the project will not enhance the quality of urban life and add aesthetic appeal but it reflects certain physical, economic and social problems.

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- 4. Ján DEKAN, Stanislav MÓCIK – SLOVAKIA**
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ABSTRACT: Image of nowadays technological development of machine production is the constant acceleration. This increase in production and parts are increasing demands for quality manufactured products. These are closely linked to the state of machine. For several technical indicators level machine plays an important role of task accuracy. Machining accuracy is affected by a number of uncertainties and variations arising in the carrier system of the machine (elastic and thermal deformation of the supporting bodies, deformations in stationary and mobile connections), the mechanisms for the executive members, in the control system in measuring systems, the tools, plant the workpiece itself. The accuracy of machine tool is determined by its accuracy executive members of the labor movements and their relative position at work. This accuracy can be verified by one of the diagnostic systems, which is presented below. This article discusses about the technical diagnostics of the machine tool. Measuring five axial circular interpolations at milling machine using a diagnostic QC 20W Ballbar from Renishaw. The measurement will be evaluate by automatic analyse from Renishaw company, which is one of the original software components.

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- 10. Giovanni BELINGARDI, Jovan OBRADOVIC – ITALY**
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- 12. Nuruddeen USMAN – NIGERIA**
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- ABSTRACT:** Information and Communication Technology infrastructure provides a wide platform for exchanging data, coordinating activities, sharing information, and supporting globalization of businesses, all based on powerful computing and networking technology. However, quantity surveying firms appears to make sluggish progress towards effective Information and Communication Technology implementation for its unique features which distinguish it from other industries, it remain weak and data cannot be exchange efficiently, especially in the developing countries like Nigeria. The objective of this paper is to conceptually synthesize the attitude towards ICT acceptance for construction cost management. Therefore, this study reviews the causes and impact of sluggishness in the usage of information and communication devices for a sustainable construction cost management. It found that human and organizational culture is among the major cause of the slow acceptance of the Information and Communication Technology devices for construction cost management, whereby, it affects the selection and usage of the devices.
- 13. Ala'a M. DARWISH – IRAQ**
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Also, ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering, Fascicule 2 [April–June] includes two scientific papers presented in the sections of INDUSTRIAL SYSTEMS 2011 – IS '11, organized in Novi Sad, SERBIA (14 – 16 September 2011). The current identification numbers of papers are #5, respectively #10, in the content list.

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MATHEMATICAL OPTIMIZATION IN DESIGN – OVERVIEW AND APPLICATION

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ABSTRACT: Today, optimization is one of the main tasks in design work to develop functional and economical satisfying products. The paper demonstrates an overview of mathematical based optimization methods and views their applications in the field of design work.

KEYWORDS: optimization, mathematics, methods, applications

INTRODUCTION

The substantial task of the engineers is to solve technical problems considering several material types, technological, economical, legal, conditions combining with ecological and human-related restrictions. The solutions have to fulfill all the given and formulated requirements, otherwise it has to reach an optimum value when the designer applying the methodology of the structural design [1].

The necessary resources during the lifetime of the product, like the material and energy consumption, and also the product development related costs and time are important factors we have to reduce, and have to find the optimal solution while keeping the demanded quality level of the product. Changing the variables of such an optimizing problem the model will result a reduction of the mass or the manufacturing cost or the shape or the material properties of the product and in the end of the process we can reach the minimum value of the optimization task.

OPTIMIZATION PROBLEM AND THEIR DESCRIPTION

The mathematical description of an optimization problem requires us to apply an appropriate model which has limited number of parameters (design variables). These variables have to be relevant to describe the most important characteristics of the design problem.

MATHEMATICAL DESCRIPTION

Any kind of optimization problem can be formulated to find the appropriate set of the design variables in the multidimensional parameter space, which can optimize the main objective function. Generally the minimum (or maximum) of the objective function $f(\mathbf{x})$ in an n -dimensional, Euclidean space R^n is to be searched. The result of the optimization can be illustrated thus by one point or a vector in this solution space. In the mathematical notation the optimization problem can generally be represented, as:

$$\begin{aligned} \min f(\mathbf{x}), \mathbf{x} \in R^n; \\ 0 \leq g_j(\mathbf{x}), j=1,2,\dots,m; \\ 0 = h_j(\mathbf{x}), j=m+1,\dots,p; \end{aligned}$$

where $\mathbf{x}=[x_1, x_2, \dots, x_n]^T$ the vector of the unknown quantities, $g_j(\mathbf{x})$ and $h_j(\mathbf{x})$ the restriction constraints, which can be represented mathematically as equations and/or inequations, m and p are integer numbers.

Frequently the objective function in the optimizing problem is the pure mass of the product, or it is a cost (material and production cost), some special cases it is the stiffness of the part [2], or the number of tool changes in the production process [3].

The optimization variables can be geometrical dimensions of the construction [4], when the geometry and the material of the part is fixed [5]. The restrictions depend on the different tasks and can be e.g. frames (building) space, firmness, deformation, stabilities and different kind of manufacturing restrictions.

LOCAL AND GLOBAL MAXIMUM AND MINIMUM

The majority of the optimizing procedures usually supply local optimum solution, but it is possible, that these local optimum points are also global ones.

In the case of a local optimum is reached, the solution point will be a better starting point (start vector) for further calculation in order to reach the global optimum solution.

In the case when we are interesting to find the global optimum solution, than it is a possible strategy to use different starting vectors, and to perform the optimization process several times. However we have to remark, that a global optimum solution will exist only in a convex space of the design variables.

THE ROLE OF THE RESTRICTIONS

The optimum solution can be found quite easily (by differentiating the objective function) when the optimization problem has no restrictions.

Other cases, when the variable space is limited by different restrictions, it is more difficult to find the location of the optimum solution. The linear optimization problem with restrictions seems an important special case of the optimization tasks. This case both the main function and all the restrictions are linear functions of the design variables [6].

The restrictions formulated with equations are handled more simply, than the restrictions expressed by inequations. In the majority of the optimization tasks the possible range of the design variables is limited by one or more restriction functions. For the solution of optimization problems with restriction equations the Lagrangian multiplier method was used [7]. Also a lot of algorithms were prepared for the optimization problems with inequation restrictions.

OPTIMIZATION PROCEDURE

The major cases of technical problems the objective function as well as the restriction functions are nonlinear functions of the design variables, so the optimization problem can be handled by the methods of nonlinear optimization. One of the most well-known nonlinear optimization methods is the sequential unconstrained minimization technique [8]. The essence of this method is transferring the problem with restrictions into a problem without restrictions. A designer often meets optimization tasks with several objective functions during the product optimization process. The optimization task with several target functions represents an aggravation of the optimization problem. Because of the various application possibilities an intensive development can be observed last years.

In the case of a large number of optimization problems the variables may take only discrete values. This kind of problems is called discrete optimization problems. This discrete optimization procedure will calculate the optimal value of a main function when the design variables can be selected from a discrete, so called material variable range [9].

Recent years the evolutionary algorithms are used frequently as optimization procedures in the case of component and product optimization (mechanical components) [10].

Evolutionary algorithms are stochastic search methods, which are based on the principles of the biological evolution. Three optimization directions of the evolutionary algorithms were developed independently from each other: the evolutionary programming, the evolution strategies and the genetic algorithms. All these methods use the variation and selection operations as the basic elements of the evolution process, but they differ in the development of these elements [11]. The usage of

these algorithms will increase in the coming years due to the various application possibilities. The calculation of the actual restriction values (e.g. shifts, tensions, etc.) can be computed in many applications only by numeric methods.

For example in [12] there are some optimization samples of a wrench, flange, etc. on the basis of a FEM-Models. The optimization with the help of the finite element method is a widely used technique [13].

TECHNICAL OPTIMIZATION PROBLEMS

A lot of optimization problem will combine technical and economical requirements against the product or the component, so functional and economical requirements must be equally considered. When specifying the technical and economical approach, product and process optimization is defined. The product optimization can be specified further:

- product optimization,
- topology optimization,
- form optimization,
- dimension optimization,
- material optimization and
- process optimization.

During the topology optimization the arrangement of geometrical elements of a product can be determined (dimensions and position) with the optimizing procedure. The topology optimization is an everyday task of technical designers. He has to design a component (as a part of a product) so that available space mustn't exceed, it has to keep the outside loads, and the minimum material expenditure can be achieved at the same time [14]. For the topology optimization task a typical sample is the optimizations of a trust units (Figure 1).

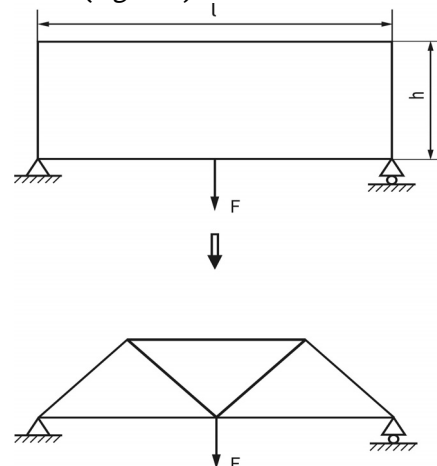


Figure 1. Topology optimization in the case of optimization a trust unit

During the beam unit optimization the topology optimization is an effective design tool, because it is possible to develop light and at the same time rigid beam units [15]. The consumption of time necessary for the development can be clearly reduced [16]. As an initial geometry, the results of the topology

optimization can be usually used for the dimension and form optimization process. A goal of the form optimization is to determine the optimal geometry of a component - under given boundary conditions - regarding defined quality criteria (Figure 2).

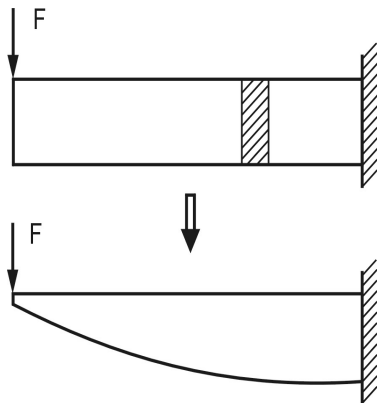


Figure 2. Form optimization of a beam

Objective function and restrictions are selected according to the nature of the tasks [17]. Restrictions such as displacement and tensions generally cannot be computed analytically, but it is possible generate them numerically e.g. with the method of the finite elements. For the solution of form optimization problems also variation principles can be used in special cases.

In the case of dimension optimization often the dimensions of cross sections are computed [18]. In the cross-sectional optimization problems mainly displacements, tensions or natural frequencies are determined (Figure 3). An example of this class of optimization problems is the calculation of optimal dimensions of mechanical components or the optimization of the isolation thickness of pipelines.

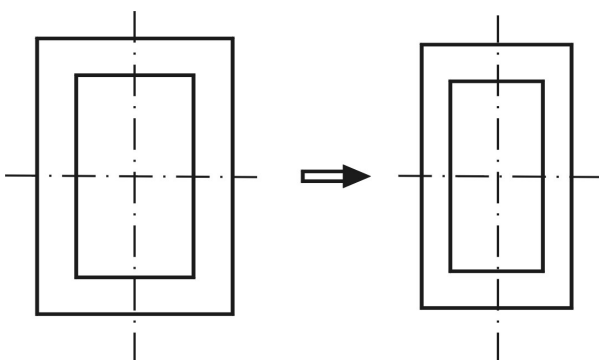


Figure 3. Dimensional optimization sample of a rectangular section

During the material optimization have to find the optimal structure of the materials [19] e.g. how to arrange the structure of composite layers (Figure 4) or how to arrange the fiber strips in fiber-reinforced materials.

The material optimization basically is a topology optimization, however in the variable space is a microscopic solution area.

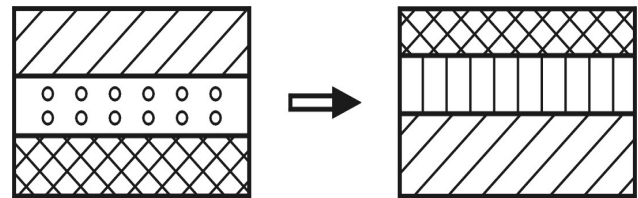


Figure 4. Material optimization sample of a composite structure

The process optimization was developed in technology and economics in the last decades very rapidly, and the theory was based on the discipline „Operation’s Research“. The technical processes in the production were completed with the disassembly or the recycling, the technological processes with the equipment technology (Figure 5) or economic processes in the economic science models.

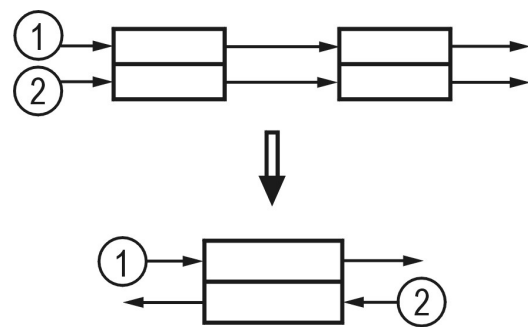


Figure 5. Process optimization in the heat transfer technology

OPTIMIZATION OF A TRUST STRUCTURE

We can find several samples for optimization for trust structures in the literature. Most of the cases two major problem type exists:

- the topology of the structure is fixed, so the cross sections of the beams are the unknown quantities,
- the overall topology of the structure is variable, so we have to find also the optimal overall geometry.

The calculation of a fixed topology trust structure is presented. (Figure 6) The method of solution is based on [20].

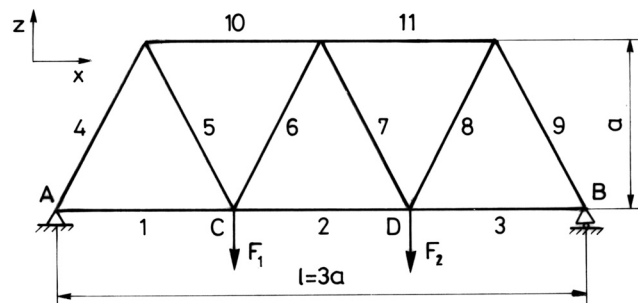


Figure 6. Topology of a trust structure
Unknown quantities: the size of the square shaped cross section beams (11 datas in this case).

Objective function: the total mass of the trust structure and the displacements of the C and D points will be selected as main functions (multiobjective

optimization). The displacements of the nodes were calculated with weight factors. Restrictions: the maximum limits of the nodes C and D will be set. $w_{Cmax} \leq w_{allow}$; $w_{Dmax} \leq w_{allow}$. The stresses of the independent rods of s trust structure is tension or compression. The maximum tension stresses in all of the 11 rods must not exceed the allowable value. $\sigma_{imax} \leq \sigma_{allow}$. In the case of the compressed rods another possible failure, the buckling exists, so the forces (N_i) in the individual rods must be smaller than the limit value ($N_{ib,Rd}$) calculated under the EUROCODE 3 standard, so, $N_i \leq N_{ib,Rd}$.

Table 1. The results of the optimization of a trust beam

Weight factors	Optimal cross sections [mm ²]	Mass [kg]	Displacement of node C [mm]	Displacement of node D [mm]
$w_1 = 0,995$ $w_2 = 0,0025$ $w_3 = 0,0025$	$A_1 = 98;$ $A_2 = 180;$ $A_3 = 83;$ $A_4 = 1001;$ $A_5 = 218;$ $A_6 = 34;$ $A_7 = 373;$ $A_8 = 185;$ $A_9 = 915;$ $A_{10} = 851;$ $A_{11} = 772.$	59,3	4,56	3,24
$w_1 = 0,0025$ $w_2 = 0,5975$ $w_3 = 0,4$	$A_1 = 1110;$ $A_2 = 2083;$ $A_3 = 968;$ $A_4 = 2509;$ $A_5 = 2553;$ $A_6 = 354;$ $A_7 = 374;$ $A_8 = 2141;$ $A_9 = 2169;$ $A_{10} = 2249;$ $A_{11} = 1943.$	231,3	0,66	0,44
$w_1 = 0,0025$ $w_2 = 0,995$ $w_3 = 0,0025$	$A_1 = 1254;$ $A_2 = 2090;$ $A_3 = 813;$ $A_4 = 2801;$ $A_5 = 2775;$ $A_6 = 774;$ $A_7 = 771;$ $A_8 = 1832;$ $A_9 = 1866;$ $A_{10} = 2506;$ $A_{11} = 1622.$	240,0	0,60	0,54

The multiobjective optimization task was solved by a so called weight method, where the different objective functions were multiplied by such weight coefficients where the sum of the weight factor is 1. The nonlinear optimization problem was solved for the case of: $a=1,5$ m, $F_1 = 45$ kN, and $F_2=27$ kN. The results are collected in the Table 1, based on [21]. It is clear, how the optimum is moving when the weight factors were changed. While the w_1 factor approaching 1, the role of the mass-related objective is increasing. This case the optimizing process will be a simple mass-minimum optimizing task. The result will be a minimum mass truss structure with relatively big node displacement values. If we will increase the weight factors of the C and D node's displacement, the importance of decreasing these displacements will

bigger and of course the optimization process will result a bigger mass, more rigid structure (the second row of the table). If we are intending to reduce the displacement one of the nodes, the corresponding weight factor has to be increased. It can be observed in the third row of the table, that increasing the w_2 weight factor, the displacement of node C will reduce, and the total mass as well as the displacement of node D will increase.

OPTIMIZATION OF THE INSULATION LAYER'S THICKNESS OF A PIPELINE

Calculation of the optimal thickness of an insulation layer has a quite high importance because of the valuable material cost in the investment phase as well as the heat loss cost in the operation phase of a heat pipe system. General case widely used the one-layer insulation, but special cases when high temperature fluid is transported, it is more beneficial to use two-layer insulation system. The insulating materials resisting against the high temperature are relatively expensive ones, but others for lower temperature are cheaper.

The inner insulating material was cork layer; the outer material was polyurethane foam. The PUR material can be applicable up to 130 °C. We cannot find so many papers optimizing the two layer insulating systems in the literature, because of the problem can be handled only with the nonlinear methods. The main goal of this optimization task to find the minimum of an objective function contain the cost of the heat loss and the insulation investment cost. When calculating the insulation task, we have to know the temperature distribution. Frequently only numerical methods are suitable to calculate this temperature field.

It is presented an optimum calculation for a two-layer's insulation system. (Figure 7) The task is to determine the optimal thicknesses (h_1, h_2) of the insulation layer's, while the target cost function – consisting the material costs and the heat loss costs – must be minimum [22].

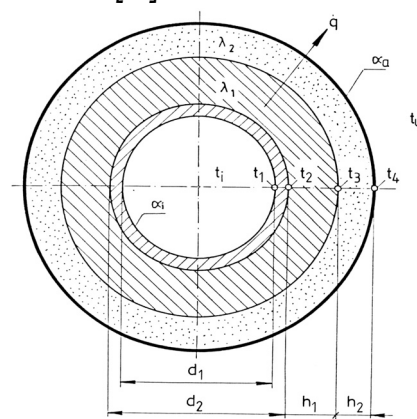


Figure 7. Cross section of two layer insulated heat pipe Unknown quantities: the thicknesses of the inside and outside insulation layers (h_1, h_2).

Objective function: contains the material costs of the pipe, the material costs of the two insulating layers, and the cost of heat loss.

Restrictions: it is necessary to limit the allowable heat loss from different point of view.

($q \leq q_{allow}$). The contact temperature between the two insulation layers (t_3) have to be restricted, because of the relatively low heat resistance of the PUR material ($t_{allow}=130\text{ }^\circ\text{C}$

$t_3 \leq t_{allow}$. The t_3 temperature can be calculated from the fact, that the same heat quantity is transferred for all the layers. Also it is necessary to restrict the temperature of the outside surface (t_4), it has to be bigger, than the outside ambient temperature (t_u). So $t_u \leq t_4$.

The presented sample task calculates a pipe transporting 5 bar pressure steam. The calculation was performed on a 10 m long straight session of the pipe system. The allowable heat loss was $q_{allow} = 75\text{ W/m}$. (Figure 8) The results for the optimum thicknesses (h_{1opt} , h_{2opt}) is presented as a function of the temperature of the steam flow. We can see, that the optimal thickness of the inner insulating layer is independent from the steam (t_i) and outside (t_u) temperature, we have only one optimum value h_{1opt} for that. The reason of this behavior that the other restriction, for the temperature between the two insulating layer is the active restriction. As for the optimal thickness of the outer insulating layer (h_{2opt}) will changing with the different inner/outer temperatures.

This calculation resulting, that it is possible to determine the optimal sizes of the insulation with the correctly formulated objective function and the appropriate restriction conditions [22]. This way the reduction of the material and heat loss costs is possible. This model is also suitable for the calculation of the one layer insulation task, and also for the calculation of a spherical tank with the appropriate modification of the equations [23].

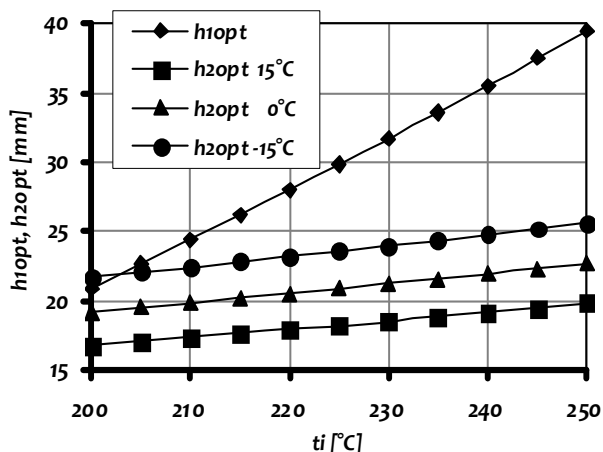


Figure 8. The optimum thickness for the insulating layers vs. the steam temperature

CONCLUSIONS

Mathematical optimization methods are generally applicable in the case of technical and economic problems. The optimization problem in general case is to build up a suitable model: to set up the target function(s) and to formulate the restrictions as mathematical functions or conditions. With the adequate formulation of the optimization problem the functional and economic characteristics of the products and/or the components as well as the processes can be improved fast and effectively.

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ROBOT PROGRAMMING SYSTEM BASED ON L-IRL PROGRAMMING LANGUAGE

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ABSTRACT: Contemporary robot languages should be simple for usage, compact, portable and easily integrated into complex production systems. L-IRL (Lola Industrial Robot Language) is a robot Programming Language that was initially Pascal-based programming language. Further development is intended to add new characteristics such as portability and to become easy to learn and use. L-IRL is programming language based on the procedural paradigm and it is basis of the offline part of the robot programming system. Developed Graphical User Interface of offline part provides user friendly usage. New language parser is formed as LR(1) type parser (parser that reads input from left to right) and written with tools such as Bison and Lex with the C++ programming language. The proposed solution gives logical and functional separation between different phases of parsing and compiling. L-IRL is using XML as one of the main communication tools between different elements of the system. XML is used as meta language for system specification file and as object code of the compiler so that new software solution is more compact and portable.

KEYWORDS: L-IRL, robot language, XML

INTRODUCTION

The main aim is to create a programming language that is simple and easy to use and at the same time compact and portable. L-IRL (Lola Industrial Robot Language) is programming language based on the procedural paradigm. L-IRL is the basis of the offline part of the robot programming system. It is a Pascal-based programming language with syntax and some functional modifications. The further developments of L-IRL were to obtain more compact, portable solution so that the programming language can be easily to learn and use. More details about existing and previous versions of L-IRL can be found in [3, 6].

Aside from basic elements which exist in other programming languages L-IRL contains specific structures and language constructs based on DIN 66312 standard. Special language constructs proposed by the standard are special geometric data types, geometric expressions and move statements which are used for robot movement control. Currently defined robot movements are PTP (Point to Point) movements and movements along mathematically defined paths (CP movements) as well as approximate PTP and CP motions. Currently present mathematically defined paths are line and the circle. By specifying parameters of the move statement it is possible to change path, speed, and acceleration, orientation of the end-effectors and other characterizes of the movement.

Language parser is developed using software tools Lex and Bison which generate lexical and syntax analyzer of the source code. In previous version, parser and compiler were developed using recursive descent approach. In this version of L-IRL parsing is based on

LALR (Look Ahead Left to Right) algorithm which is directly incorporated into Bison. Using these software tools together with methodologies of the object oriented programming, efficient structural and logical refactoring of the source is achieved. RapidXML parser for C++ was used for parsing and generating XML code.

Offline programming system is a development environment of the language compiler for robot programming in an L-IRL programming language. GUI of the offline part of robot control system combines review of the robot system specifications, editor, whose input is a program written in a robot language L-IRL as well as graphical representation and simulation of motions robot's end-effectors.

For its main use, robot programming, handling many language's constructs such as: dynamic arrays, parallel executions blocks and system variables definition using XML is simplified. Portability is enabled by developing interpreter and object code compiler based on XML. After generation, it is sent on to the real-time parts of the system [2, 4]. Real-time part of the system is control system based on Real-Time Linux platform on which is set OROCOS open architecture software system, designed specifically for creating applications of this type.

GRAPHICAL USER INTERFACE OF THE OFFLINE PART OF THE ROBOT PROGRAMMING SYSTEM

In Figure 1 is given the appearance of a graphical user interface of the offline part of the robot programming system, through which the user enters a program, written in an L-IRL Programming Language, and generates as output another program with the same meaning but written in a XML.

Left part of the main window (Figure 2) contains information about the robot system specification. It includes the ability to create a new variable, to change the value of the already defined variables and to delete variables from the system specifications.

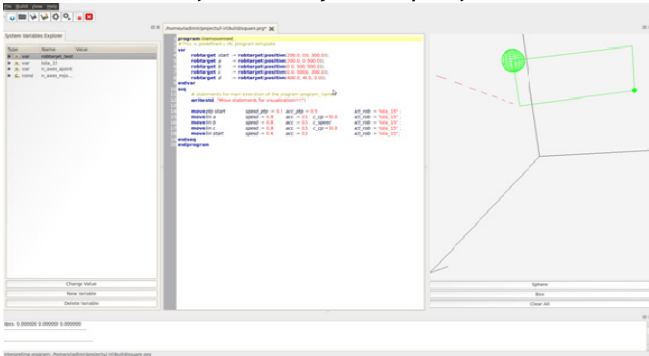


Figure 1. Graphical user interface of the robot programming system offline part

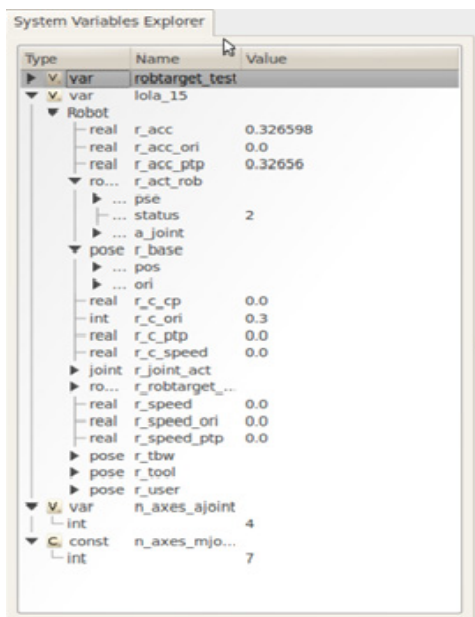


Figure 2. System specification

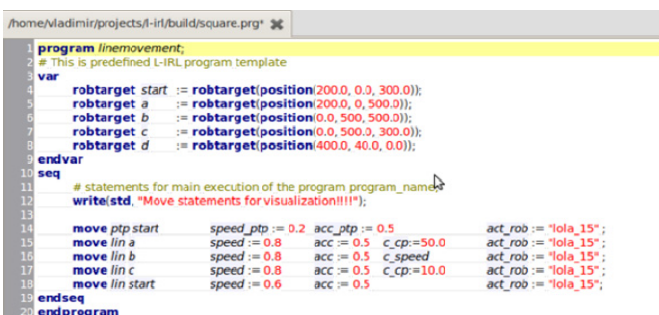


Figure 3. Editor of the robot programming system offline part

Main window (Figure 3) takes as input program written in L-IRL programming language. Program continue to compiles and the output is the program written in XML which have exactly the same values of parameters and gives same information like as input. Right part of the graphical user interface (Figure 4) presented the simulation of robot movements and graphical representations of successive positions of the robot end-effectors. Before starting the robot, it is

important to check the program written in language L-IRL which contains various commands of robot motion and to prevent the execution of programs that contains errors in the given path or position that may damage the system or robot or made unwanted movement.

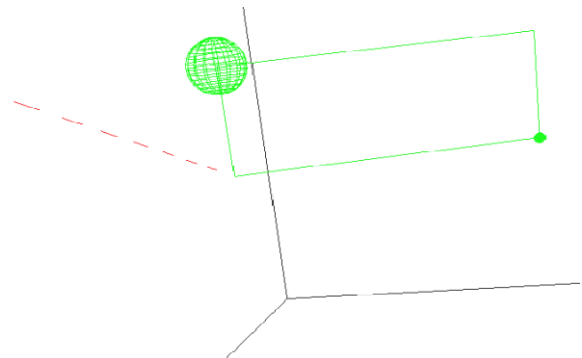


Figure 4. Graphical representations of robot movements

L-IRL LANGUAGE PROGRAM STRUCTURE

L-IRL is procedural language with rigid syntax and every program obeys certain structural rules. Program written in L-IRL robot language includes the following sections [3, 6]:

- Part for linking with extern files – import something
- Part for declaration of constants
- Part for declaration of user defined types
- Variable declaration part
- Part for defining procedures and functions
- Main execution block.

L-IRL language defines standard data types (bool, int, real, char, string) and geometric data types:

- Position - describes the position in millimeters of the coordinate system in space relative to the reference coordinate system. It is given with three real numbers that describe the coordinate values of x, y and z directions
- Orientation - given with three real numbers that describe the orientation angles in degrees of the coordinate system in space relative to the reference coordinate system
- Pose - consists of components pos and ori, which are position and orientation type, respectively
- Mainjoint - describes position and orientation of the end effectors in robot coordinates (internal coordinates)
- Addjoint - defines the additional axis of the robot
- Joint - consists of components m_jonit and add_joint, which are mainjoint and addjoint type, respectively
- Robtarget - describes the position and orientation of the end effectors and the status of the robot axes

Derived data types, such as records or arrays, can also be defined. Expressions in L-IRL are typical expressions built from operators, variable/constant access and other conventional. Several types of statements are available in L-IRL such as assignments, conditional branches (if and case), loops (for, while and repeat), function and procedure blocks; L-IRL contains previously defined functions and procedures (@ - homogeneous transformation, inv - inverse homogeneous transformation, sin, cos, etc.)

L-IRL contains robot motion statements (move statements) and statements that manage parallel execution (wait, signal, etc) The move instructions consist of parameters for determining the type of path (PTP – point to point, LIN - linear or CIRCLE), the target point (and an additional secondary in a circular motion), speed and name of the robot. There are optional parameters that can be specified as (ACC, ACC PTP, C ORI, C, speed, speed, etc.), which define the characteristics of the movement. [3].

DTD AND SYSTEM SPECIFICATION

System specification

System specification file contains information about the number and names of the robots that participated in robotic operations. System specification file is used for describing behavior of certain built-in structures of the language and also to represent system variables of the program in execution, like position of robot, speed, acc, etc. System specification file – syssspec.xml is written in XML.

Beside the source code in L-IRL language, in order to interpret and compile the source code, system specification file needs to be present in the execution folder. Compiler translates source code of the program in L-IRL together with system specification file into XML based object code.

Besides compiler of L-IRL, this file is using bay the robot controller, which updates the system variables values when program is executing.

DTD – Document Type Definitions

System specification file – syssspec.xml is written in XML which is defined by special syntax rules i.e. Meta language. Since this file can be changed by L-IRL programmer it is necessary to define rules of the XML syntax used in this file. Approach used for describing the rules of the XML syntax is called Document Type Definitions [1] or DTD.

A document type definition provides a list of the elements, attributes, notations, and entities contained in a document, as well as their relationships to one another. DTDs specify a set of rules for the structure of a document. DTDs can be included in the file that contains the document they describe, or they can be linked from an external URL. Such external DTDs can be shared by different documents and Web sites or

other software. DTDs provide a means for applications, organizations, and interest groups to agree upon, document, and enforce adherence to markup standards.

XML BASED OBJECT CODE

XML is one of the main communication tools between different elements of the robot programming system. After generation of the XML object code on the offline part of the system, it is sent on to the real-time parts of the system [2, 4].

Abstract syntax tree (AST) matches DOM tree of the XML object code document. Interpretation of the object code by real-time virtual machine is achieved by traversing a DOM tree of the XML document and executing statements and expressions coded within tree nodes. This way the resulting object code has same semantics as source code of the program.

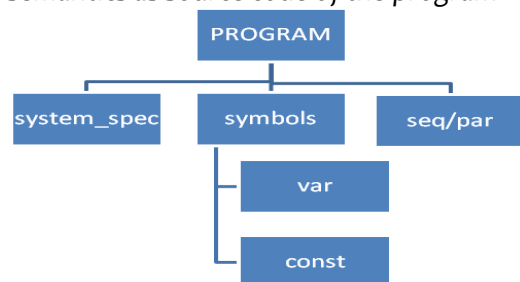


Figure 5. Object code basic structure

Basic structure of the object code is divided in three basic parts. Object code starts with root node <program> which has three child nodes (Figure 5):

- <system spec> - part which matches content of the system specification file,
- <symbols> - part which provides information about defined symbols and
- <seq> or <par> - part which defines sequential or parallel main execution block.

Each of these nodes defines separate section of the generated XML object program file. Node <system spec> defines section of XML object file that contains content of the system specification file. Content of this node is defined in compilation phase by adding the root node of the system specification file to the root node of object program. Second node <symbols> defines section which contains definitions of variables, constants, procedures and functions. Third child node of the root node, defines section which contains translated statements, jump statements, etc. Element <seq> defines sequential execution of the main execution block while <par> defines parallel execution of the main execution block. Syntax check of the object code is enabled with the use of XML Schema. This way the syntax check is same as validation of the object code using XML Schema validation.

Basic Statements

Basic statements of the object code are statements which define structure of generated XML file.

Generated XML file has node <program> as root node. As mentioned earlier, root node has three child nodes: <system spec>, <symbols> and <seq> or <par>. Each of these nodes defines separate section of the generated XML object program file. Node <system spec> defines section of XML object file that contains content of the system specification file. Content of this node is defined in compilation phase by adding the root node of the system specification file to the root node of object program. Second node <symbols> defines section which contains definitions of variables, constants, procedures and functions. Third child node of the root node, defines section which contains translated statements, jump statements, etc. Element <seq> defines sequential execution of the main execution block while <par> defines parallel execution of the main execution block.

Jump Statements

In order to generate object code for some statements (loops, if statement,) labels need to be defined. Labels define target address for jump instructions and they are defined with tag: <label>. Unconditional jump instruction is defined with tag <jmp>. As required attribute, jump instruction takes value of the target label. Conditional jump is performed with the instruction <jmpif>. Similar to unconditional jump instruction, label value has to be provided in the form of attribute. Jump condition is provided as a child node of the <jmpif> node.

Special Statements

Move statements are provided with special syntax for defining all move parameters. They are defined with tag: <move>. They are provided with special syntax due to define parameters that represent all necessary information for robot movement control. They consist of parameters for determining the type of path - PTP, LIN, CP which is followed by data of geometric type describing the target and, if necessary, extra point of the path. With these parameters, there are additional parameters (ACC, ACC PTP, C ORI, C SPEED, SPEED etc.) that are used optionally and they define the characteristics of the movement [3].

Using XML is a simplified representation of dynamic arrays, parallel execution units, functions and procedures as well as the definition of system variables. Developing interpreter and object code compiler based on XML enables portability. XML is used to represent the specification of the robot, as well as for representing object code that is the main way of communication between different parts of the system for robot control.

CONCLUSIONS

This paper introduced a new approach for designing and developing offline part of the robot programming

system with special emphasis on development of interpreter and compiler. The new version is more compact and portable. Graphical user interface provide simple usage and programming environment. One use of XML as object code is shown in this paper. XML code is generated using RapidXML parser for C++. Further work is focused on development of real-time virtual machine which interprets XML object code.

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MANADO WATERFRONT DEVELOPMENT CONCEPT AS SUSTAINABLE CITY OF TOURISM

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ABSTRACT: Urban waterfront development is a well established urban phenomenon in developed countries based on certain concepts and principles. It enhances urban design, quality of life and economic development of cities. The urban waterfront development in developing countries has produced a varied experience. This Paper looks at a recent coastal development in Manado City, North Sulawesi, Indonesia for its development of urban public spaces, commercial developments and its integration with urban development policy of the city. Manado has a coastal border area that extends from coast to coast Malalayang Maasing down the coast and on Bunaken, Manado Tua island and the island Siladen, which now throughout this protected area has been transformed into a total cultivated area with several activities such as: coastal border area districts Malalayang to district authorities other than the area that was already there are also added to the reclamation of new land currently used as a commercial area consisting of shops / malls, hotels and luxury housing. The development of the project will not enhance the quality of urban life and add aesthetic appeal but it reflects certain physical, economic and social problems.

KEYWORDS: Manado, waterfront city, sustainable city, Indonesia

INTRODUCTION

Entering globalization era, Indonesian economic developing need to be advanced, because it can invited new investor and hoped its will develops the advantage area. One of this is waterfront area including coast, river and lakes. Developing of waterfront area was being the new tendency of city facilities development, especially in big city that has obstacle in land and has a big potency on water. Manado City is a city that place in Manado bay (Figure 1), and by geographic city distribution equal with water and Manado bay. One of this distribution project shore reclamation that hopes to be a new business area that could to rise up Manado city's economic, except to empower Manado as waterfront city.



Figure 1. Manado City

So many conflict that occur resulting from this developing coast area, it's because of so many interest from every aspect, include environment aspect,

another city facilities aspect and integration aspect between developing area and existing area. By considering interest conflict, so developing coast area need a whole observation, to bridge the present interest conflict. In this paper is emphasized to overview of idea to develop waterfront area. From this idea, it's hope that could give any input about support application of sustainable developing waterfront area. The purpose of this paper is to analyze the reclamation development concepts that must be considered in the development of reclamation in Manado. These concepts must be developed and designed in this project so that construction can be reclaimed and environmentally sustainable.

RESEARCH METHOD

Research method is doing observation to literature study from any sources. Collecting data by taking picture and sketch so we can revisualization the result that's hope can answer any problems (Tungka, 2008). The identification data is descriptive in waterfront area. Location research focus is business district area or Boulevard Street on Business (Figure 2)

RECLAMATION IN COASTAL OF MANADO CITY

Reclamation of coastal to be a very interesting discussion, particularly related to the effects of land use. After the city government in 1990 stated that the position of Manado city is a gateway into the Pacific. Manado is strategically located in the Asia-Pacific, within located in situated on the border between the Philippines, Republic of Palau and the Pacific Ocean.



Figure 2. Boulevard Street



Figure 3. Manado Reclamation Area

Distance from Manado to Davao City, Philippine is about 390 km and to Republic of Palau (Pacific Ocean) is about 750 km. Manado there is also direct flights to Singapore, the Philippines and Taiwan or to other countries directly without going through Jakarta and also there is a ferry boat crossing Manado-Davao. It is so that investors are given the opportunity to invest in this area. The limited land is not result in the development of the region's development. Barriers caused the government to be able to continue to occur in various ways to open the area or land for investment activities. The form of Manado city is also unique in Manado bay. The spread of the city that also follow this bay causing the elongated shape of the city follow the coastline of Manado bay. One suggestion is that by making reclaimed coastal Manado City. It is seen from the geographical shape of Manado City has long coast line as far as 5.9 km, and about 30 percents of the population lives in coastal Manado. Area of Manado is 15,659 hectare and area of reclamation is 67 hectare (BPN, 2010) for the first step construction. Reclamation was built in 1996 until 2000 and still constructing. Manado population numbered 417,700 (BPS, 2010) with a ratio of as many as 201,730 male population and female population of 215,970. Most residents have jobs Manado in trade, services and construction. A total of 97,625 working in the field of trade and services, 19,855 in transportation and communications and construction of as many as 22,290, making a total of 139.770 inhabitants or as much as 33 percent in the field of urban development. Manado has a coastal border area that extends from coast to coast Malalayang Maasing down the coast and on Bunaken, Manado Tua island and the island Siladen. It is now throughout this protected area has been transformed into a total cultivated area with several activities such as: coastal border area districts Malalayang to district authorities other than the area that was already there are also added to the reclamation of new land currently used as a commercial area consisting of shops / malls, hotels and luxury housing (Figures 3, 4 & 5).



Figure 4. Stores and home office on the reclamation Area



Figure 5. Mall On the Reclamation Area

DEVELOPMENT URBAN

Regional development is achieving regional development goals which include aspects of growth, equity and sustainability of the dimensionless location in space and related socio-economic aspects of the region (Anwar, 2005). According to Todaro (2009), development should also increase the income-oriented economy. According successful development was indicated by three core values namely the development community's ability to meet basic needs, increased self-esteem as a human society, and the increasing ability of people to choose (freedom from servitude), which is one aspect rather than human

rights. It is why Todaro that reinforce the sense that a very large development is not just how to raise people's income every year our other features. Economic development could be understood as the activities undertaken to improve a country's economy and living standards of its people. With the scope of the above, then economic development is generally defined as a process that causes an increase in income per capita population of a country in the long run which is accompanied by improvement of the institutional system (Todaro, 2009). According to Arshad (2006), development should affect income per capita. Income per capita is often used as indicators of development for differences level of economic progress among the developed countries against developing countries (NSB). Accordingly, the income per capita but may give an idea about the rate of growth of welfare in different countries can also describe the change of style welfare distinction that has been going on between various countries. Understanding the history and development strategy has undergone a change, stems from the development strategy that emphasizes economic growth, then growth and employment opportunities, growth and equity, the emphasis on basic needs, growth and environment life, and sustainable development. Development approach today is more focused on aspects of sustainability that aims to maximize human welfare through economic growth and efficiency of capital usage limited and resource constraints and technological limited (Munasinghe, 1995).

THE CONCEPT OF MANADO SUSTAINABLE COASTAL AREA

Some observation aspect that could help success of developing coast (Figure 3) area is:

1. Theme

By the theme, developing coast area has a unique that can be different from another coast area. Theme can be taking from specific ecologic, climate, history or culture from this area. The even function of this coast area equal with another coast area by the climate and local condition could influences planning model. Special design reclamation for Manado is design with nature. Boulevard Street was built with follow the shape of seascape and built break water also.

2. Image

Create image for coast area, water is the main object, so another facilities and service for example recreation, sport medium, home facilities, even restaurant will give specific beauty visual, so coast area can make an beautiful and attractive environment image. In Manado, this aspect have hard challenge because of another bad image that has been inherent in waterfront area, include image of Sario River and Tondano River be the place for collect trash and another bad things.

EXPERIENCE

Waterfront area has capable to give a excite experience and special ability that based on characteristic and feature of special water. Give access to water and its play area, conservation to flora and fauna live, to enrich facilities that have connection to control water character like channel, pool water control, etc.

FUNCTION

This aspect describe that developing coast area have to give it's good function like policy of achieve accessibility, park circulation that could fill necessity even in busy condition, to facilitate and to pleasure foot walker, give a wonderful experience for visitor, to make the ecologic area fill the requirement along with appropriate facilities (occupying, recreation, sport, shop etc) and attracting all the time. By now, the reclamation of Manado bay has focused on business and services aspect. It's could be see by shop center on every reclamation area. Some mall/ shopping center that we can met in some reclamation are, like Bahu Mall, Boulevard's Mall, Manado Town Square, Mega Mall and Marina Plasa shopping center. These business areas will be interested for tourism area.

TO CONSTRUCT PUBLIC OPINION

To avoid any interest conflict by the public, so developing of coast area should have confirmed by clear and transparency and complete (theme, image, function, cost, ticket, AMDAL), so society can understood about benefit of developing coast area. By the participation of another side, it's can get any support from society, its means that effort to realization of developing coast area. So many public opinion in construct reclamation on Manado Bay which is made a help make a decision of plan design.

ENVIRONMENT ASSESSMENT (AMDAL)

It needs to be emphasized that developing of coast area must be aim to protect the environment even to use unproductive area. By this reason observation to environment effect from developing waterfront area must be done accurately. This has been benefit to solve the problem and to avoid negative effect that could be rise for the environment. Reclamation case in Manado city has so many communities reaction for the access that can be rise from this project. Specialty about manage the waste, also. Waste is so important because it have solid and liquid. Have to design with carefully and good planning.

TECHNOLOGY ASPECT

Using and implementation of technology even to choosing substance that will be used, especially relation with waterfront area, bund area, tackling waste, control of water, etc, need to appropriated with water character and location. It is so important

because can influences of security and rely on development for long time.

EXPENSE

Expense aspect has to give attention because involves fund's problem, even control fund problems. Things that involve in this problem like monetary government's law even with the community response has to account because this things could influenced long life project.

ORGANIZING

Organizing of coast area must be done by a professional, recall the complexity of the problems that must be handled, begin with organizing facility in good condition, make a promotion so attract to visitor, till doing some coordination with institution involved, even with government and private agencies.

THE MAIN ASPECT IN DEVELOPING COAST AREA

Some principal aspect that need to be noticed and consider to make any plan to coast area, include : climate, wind direction, ocean flow, water characterized, annual flood, flooded area, Topography, Seascape, Land structure, Landscape, Vegetation, Etc. In planning developing coast area is uniting community territories with nature life, so that area being preservation area so with to support economic of this area. Organizing of arrangement space has noticed. Generally reclamation area in Manado City is business and service area. Separate from community's territory by Boulevard streets, can be arbiter between residence area and business area.

ENVIRONMENTAL IMPACT

On the reclamation activities, land use and exploitation as a result of coastal reclamation depends on the operators. In connection with this concept of development should be directed to the concept of lasting development. Means development must consider the compatibility between man and nature and the importance of future generations. Legal protection is defined as operating patterns of consumers and producers to run properly so people can enjoy the benefits of adequate utilization of its natural resources. The use of natural resources must be arranged in such a way that provides benefits to each generation. This is a critical note on the implementation of coastal reclamation. The coastal reclamation can provide positive and negative effects on coastal communities and marine ecosystems. These effects can be short term and long-term, depending on the type of impact and the ecosystem and the communities in coastal reclamation areas and surrounding areas. The positive impact of coastal reclamation activities, among others resulted in the quality and economic value of coastal areas is increasing, reducing considered less productive land, the increase in the area, protect the shoreline from

erosion, the breeding habitat of water and power absorption. The negative effects of coastal reclamation activities in the environment include physical effects such as changed oceanography, coastal erosion, sedimentation, turbidity of the water, marine pollution, changed soil water regime, increasing the potential for flooding and inundation of coastal areas. Biological effects, like disturbed mangrove ecosystems, coral reefs and diversity of nature although the field is decreasing. Besides the beach reclamation activities will also result in socio-economic changed such as difficulty of the public entering the area and loss of livelihood of coastal fishermen. Thus the coastal reclamation activities must be implemented carefully and through a very thorough study involving related stakeholders. There are having impacts of land reclamation positive and negative in the community and development in Manado City. Always positive Impacts related to economic life, socio-economic, socio-cultural, while the negative impacts on the environment and religion seriously enough highlighted by the experts. Impacts in detail will be submitted in two parts, directly visible positive impact associated with the Employment Management and economic growth. In the beginning before the reclaimed coastal community livelihood activities focused on professional workers and fishermen, because the area is generally occupied by the laborers who work in development activities in the City of Manado. Occurrence of impact on coastal reclamation work field where population expansion began in the commercial sectors and services.

POSITIVE IMPACTS

Population, especially the younger generation began to be adsorbed in the service sector and trade especially in coastal reclaimed area was created as the business 'Boulevard on Business' at Manado coastal. Increase the employment of the impact on people's income increases. Other positive impacts of the reclaimed coastal areas opened many rural people came to seek employment Manado. It is profitable for the local community from the illegal occupancy requirements and the employee continues to rise. Many turned to the room rental, retail shops and the workers who worked in the trade and services on the boulevard area would significantly influence the economic growth of urban society.

Other positive impact of involve increasing the selling price of the land. With the occurrence of reclaimed, the land sale prices have increased due to the need for more land is needed a good feeling and by entrepreneurs and rural communities want to have a T that came home to stay. The increase in selling price of land is of course the effect on the community. The changed of pattern land ownership continue to occur

as land prices increase. The positive impact of direct support by increasing the amount of effort and product efforts and the emergence of various efforts in the vicinity of a good reclamation project the grocery store, small shops, and culinary dining houses. This impact on the workforce in trade and services sector as a result of reclaimed coastal areas opened as the Boulevard, and known as the Boulevard on Business.

The other impacts of a rise in taxes and taxes provided the merchants to the city government. In the real impact of the reclamation activities not only impact on society, but the city government, an increase of Revenue District (PAD). Request permission effort, erecting a building permit, permission of course the location is very profitable as a result of the city government held reclaimed. In the field of direct taxation was increasing motor vehicle parking tax to consumption tax, where services, entertainment, health, and various businesses continue to enrich and increase the income of Manado City. The emergence of a hotel, a café in the vicinity of coastal reclamation is very influential to increase people's income and Manado City Government. Especially in coastal reclaimed area grows a good pub and discotheque entertainment.

The positive impacts of the guidelines that reclamation activity to make the area a "boulevard on business" highly qualified as highly profitable extended Manado city government. The value of the land sale and the continuing rise is directly related to the impact of land use and ownership of community land. With the occurrence of reclaimed and inclusion in the City of Manado investor would result in increased demand for land requirements. This is a growing impact on the selling price of land in the boulevard (area reclaimed the beach). With the increase in selling price is of course an impact on improving living standards and welfare of the community as a result of the occurrence increase income.

NEGATIVE IMPACTS

Increasing environmental pollution is a negative impact of the reclaimed beach, let alone most of the activity development of both pre construction and construction is not carried out a study with real environmental impact analysis. Not effective implementation of environmental impact analysis (AMDAL) in the coastal reclaimed area to clarify the environmental crisis from further negative impacts do reclaimed coastal Manado City. Continue to occur as a result of the environmental crisis reclaimed beach activities are legal problems in the field of environmental law. Coastal reclamation activities that damage the environment is happening because of

legal factors, especially in the areas permission not forward aspect of the environment. Indonesian environment as an ecosystem that consists of a variety of areas, each as a substance that covers the social aspects of cultural, economic, and physical, with a pattern different trends between the subsystems of each other, and with the support of different environments. Coastal reclamation activities have not been arranged in such a way that still impact on the environment. Coastal reclamation activities of any kind must be based on the competitive environment closely related support in improving coordination and balance subsystem, which also means improving the performance of the subsystems.

The importance of the rule of law (law enforcement) in the areas of environment requires every citizen to follow every direction of the law related to environmental problems. There is no serious environmental handling in coastal reclamation activities are common symptoms of the negative impacts of development on the environment. The collaborative evidence is that the news about environmental damage often appears in the newspaper. Coastal sea water everywhere was much polluted. Coastal sea water does not meet the clean and healthy environment, while the sea water into the ground. Various prevention of environmental pollution continue to just run, while the development of regulation and the tools of law looks very static environment. In addition, the legal position (standing) for the plaintiffs are still very weak. Environmental crisis as a result of coastal reclamation is a serious problem that should be addressed by the government to further development occurred. It is a balance between positive and negative impacts.

Other negative impacts are associated with socio-cultural and religious problems. With the occurrence of business on the boulevard on reclaimed coastal areas to the emergence of powerful new culture of western cultures that are harmful for development of society, especially the younger generation. This negative impact is felt in the social and economic life of people who are lives in reclamation area.

CONCLUSIONS / SUMMARY

Manado City condition as city bay is great potency to develop by professional, but keep look at another technical things that have been describe previously. Coastal reclamation is the process of recover from the loss of or a condition that is less useful, and attempts to make the land eligible for building.

Coastal reclamation can also be addressed within the framework of the process of cleaning an area that suffered environmental damage that can be used for human needs, such as building for enrich development.

Therefore, development should be directed to the tourism and economic development at coastal reclamation Manado. The use of integrated coastal area is one of the development concepts to the attention of sustainable, because the orientation of business conducted over reclamation areas.

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MEASUREMENT OF CIRCULAR INTERPOLATION SPECIFICITY AT MILLING MACHINE

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ABSTRACT: This article discusses about the technical diagnostics of the machine tool. Measuring five axial circular interpolations at milling machine using a diagnostic QC 20W Ballbar from Renishaw. The measurement will be evaluate by automatic analyse from Renishaw company, which is one of the original software components.

KEYWORDS: circular interpolation, accuracy, errors

INTRODUCTION

Image of nowadays technological development of machine production is the constant acceleration. This increase in production and parts are increasing demands for quality manufactured products. These are closely linked to the state of machine. For several technical indicators level machine plays an important role of task accuracy. Machining accuracy is affected by a number of uncertainties and variations arising in the carrier system of the machine (elastic and thermal deformation of the supporting bodies, deformations in stationary and mobile connections), the mechanisms for the executive members, in the control system in measuring systems, the tools, plant the workpiece itself. The accuracy of machine tool is determined by its accuracy executive members of the labor movements and their relative position at work. This accuracy can be verified by one of the diagnostic systems, which is presented below.

DIAGNOSTIC SYSTEM QC20W- BALLBAR

It is used to measure the geometric errors of machine tools where the detection of inaccuracies caused by its own control system or units of the motion mechanism. The basis is the exact linear sensor ball ended at both ends (Fig. 1).

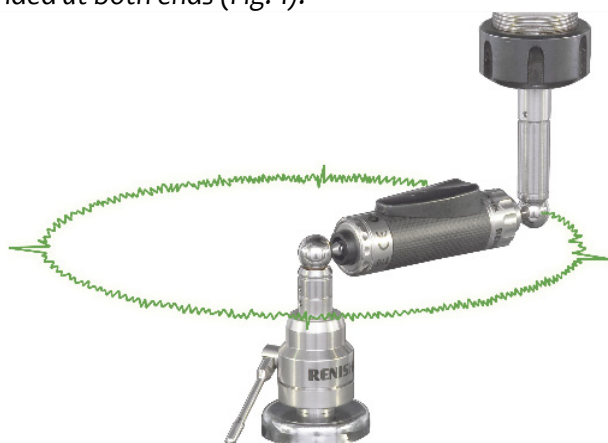


Figure 1. Diagnostic system QC20W (2)

When measuring the balls magnetically clamped to precise magnetic plates. One of them is clamped in the machine spindle and the second magnetically clamped to the machine table. With this arrangement is capable of measuring ballbar even small changes in the programmed radius circularpath.

Subsequently, the machine moves two circular arcs in the direction and opposite direction of the clockwise. Before the scan is carried out starting and ending arc due to stabilization of the task force running the machine tool. Measured data are used to calculate the total value of accuracy in accordance with various international standards or protocols of Renishaw.



Figure 2. Accessories QC20W (1)

Accessories for this diagnostic system (Fig. 2) can be set for testing lathes and testing kit for small radius.

MEASURING OF CIRCULAR INTERPOLATION

It was the measurement of circular interpolation accuracy for machine tools DMG HSC 105 linear. This machine is located in the centre of excellence 5-Axis Machining of Materials Technology Faculty in Trnava. Drawing on it's axis portal milling machine construction.

In Table 1 are some technical specifications of this machine.

Table 1. Technical parameters of maschine

Paths travel	
Axis X	1100 mm
Axis Y	800 mm
Axis Z	600 mm
Axis b	+10° - 110°
Axis c	360°

To measure has not been used extension kit therefore radius of a circle arc was 200 mm. Option is used to extend ballbar 50,150,300 mm (diameter curves 300,500,800 mm).

The test site was in the middle of the desk that is to say that the place is most commonly used. The above evaluation of measurements is using a Renishaw own methodology, which allows automatic diagnosis to 15 specific positioning errors of the machine. Errors, which were found during the performance measurements, are briefly characterized.

PLANE X-Y

The first measurements took place in the plane of the desk (XY). Control program was created by 180° arc starting and end due to a steady speed of movement of labour and machine units measuring and 360° arc in the opposite direction (CCW) and direction (CW) clockwise. Feed rate was 1000mm.min-first In Table 2 are the measured data and Figure 3 shows the shape of circular arcs.

Table 2. Values of positioning errors

Error	Deviation
Perpendicularity	-14,8 $\mu\text{m.m}^{-1}$
Straightness Y	-1,4 μm
Server belatedly X	► -0,7 μm
Server belatedly Y	◄ 0 μm
Straightness X	1,1 μm

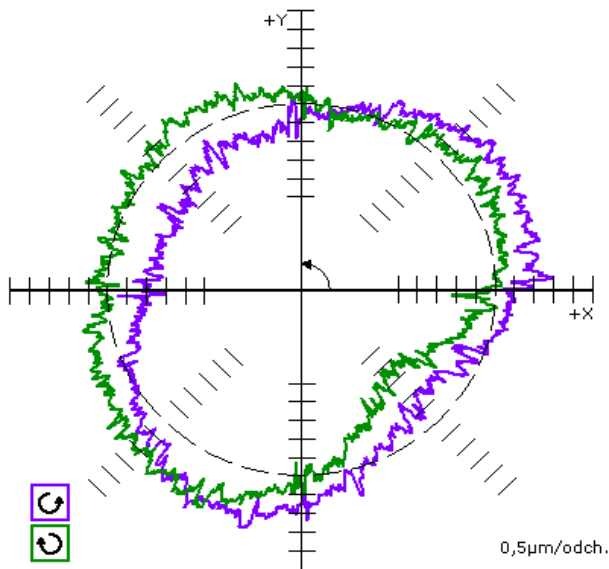


Figure 3. Shape of circular arcs in the plane X-Y

Squareness error

Graf has an oval shape with a deformation of the diagonal. As shown in Figure 4 perpendicularity error value represents the angle between two axes of the plane of the test that is less than 90°. Negative perpendicularity error indicates that the angle between the positive directions of the axis is less than 90°. This angle is greater than 90° when the positive error of perpendicularity.

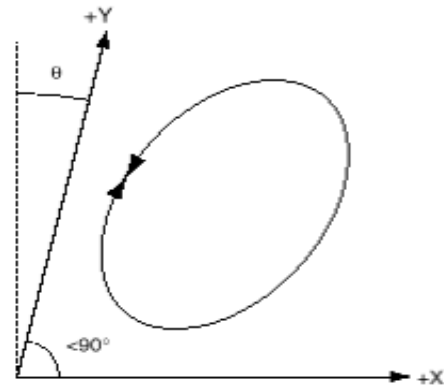


Figure 4. Squareness error (3)

Straightness error

Listened diagnostic software je an arc between the top and seat at the axis in length equal to the diameter of the test circle. On Figure 5 shows the error straight line Y-40µm.

Server belatedly

This is reflected by short peaks starting on the axes. When you move the axis in one direction, and has a turning point and move in the opposite direction, it may instead be continuous turnover to a momentary stop. On figure 6 is an example of reverse peaks at axe X and Y, these peaks define point where (up, down, left, right), are peaks located on an arc.

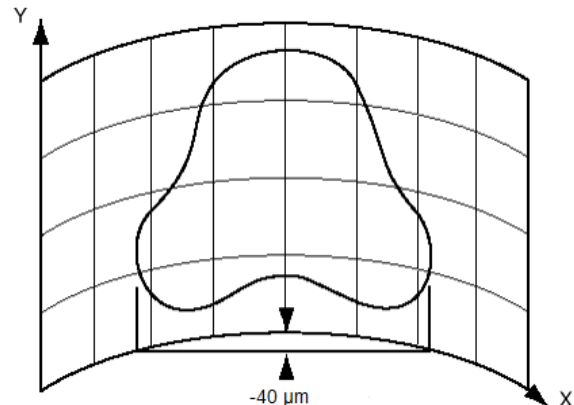


Figure 5. Straightness error (3)

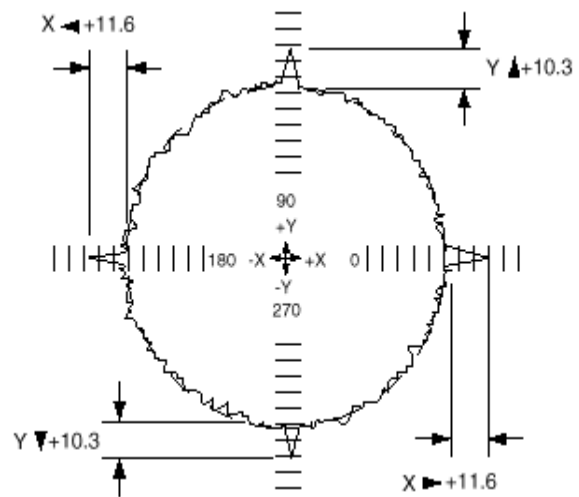


Figure 6. Reverse peaks (3)

PLANE Y-Z

Measurement in the Y-Z plane also took place in two directions. Potential arcs were measured only with size 220° due to collision-free state. The starting and ending arc have size 2° and feed rate was also $1000\text{mm}\cdot\text{min}$. In Table 3 are the measured data and Figure 7 shows the shape of incomplete circular arcs.

Table 3. Values of positioning errors

Error	Deviation
Perpendicularity	$-20,3 \mu\text{m}\cdot\text{m}^{-1}$
Server divergence	$0,04 \text{ ms}$
Server belatedly Z	$\blacktriangle 0,4 \mu\text{m}$
Amplitude of cyclic error Z	$\uparrow 0,2 \mu\text{m}$
	$\downarrow 0,4 \mu\text{m}$
Transverse clearance Z	$\blacktriangle -0,2 \mu\text{m}$
	$\blacktriangledown -0,1 \mu\text{m}$

Server divergence

Graf has an oval shape with deformation at diagonal (fig. 8) at 45° or 135° . Server divergence happens in case of divergence amplification interpolated axes. Value is the time in milliseconds indicating overtaking of one servopower axis to the second axis.

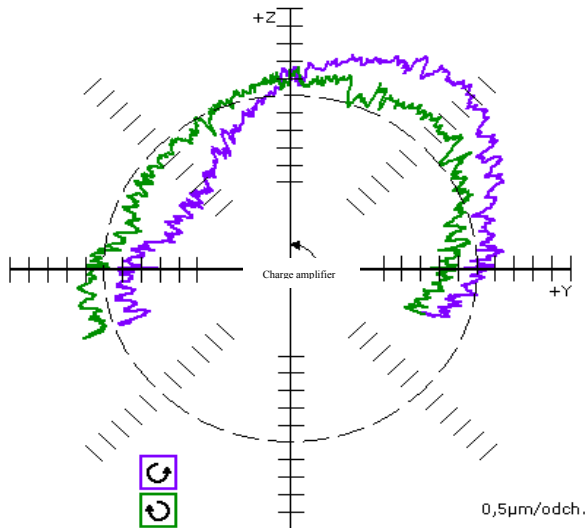


Figure 7. Shape of incomplete circular arcs in the plane Y-Z

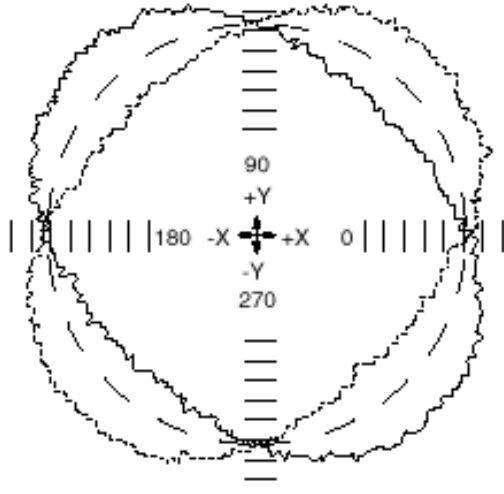


Figure 8. Server divergence (3)

According to table 4 it is possible to determine what is a mutual divergence between the axes.

Table 4. Mutual overtaking of axes

Tested plane	Measured value	Axes
XY	+	Y foreruns X
XY	-	X foreruns Y
ZX	+	X foreruns Z
ZX	-	Z foreruns X
YZ	+	Z foreruns Y
YZ	-	Y foreruns Z

Transverse clearance Z

Is clearance (side) at guideway in the machine. This causes a change in the direction orthogonal movement axes of the machine.

Amplitude of cyclic error

On Figure 9 shows a graph of the cyclic error whose frequency and amplitude of the graph changes. Cyclic error is displayed on this chart, only the Z-axis, where Dz is the wavelength in the axial direction Z. The values are between the amplitude peaks of cyclic errors in the axis of the movement direction indicated by arrow. \uparrow determines where increasing positive forward movement in a position to determine positive and \downarrow downward movement in the reverse position.

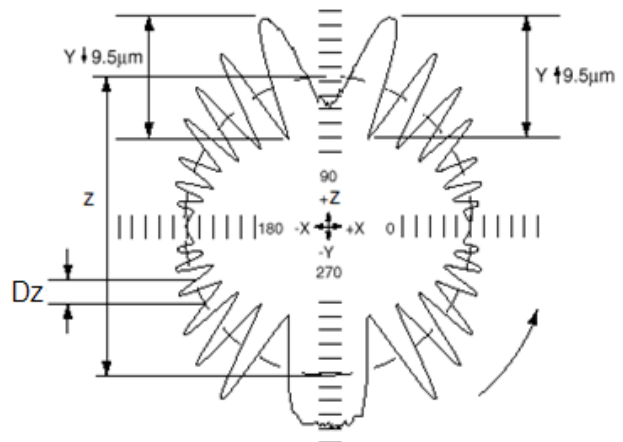


Figure 9. Cyclic error

PLANE Z-X

Measurements of the Z-X plane have the same parameters as in the measurement Y-Z plane. In Table 5 are the measured data and Figure 10 shows the shape of incomplete circular arcs.

Table 5. Values of positioning errors

Error	Deviation
Perpendicularity	$4,7 \mu\text{m}\cdot\text{m}^{-1}$
Transverse clearance Z	$\blacktriangle 0,4 \mu\text{m}$
	$\blacktriangledown 0,5 \mu\text{m}$
Server belatedly Z	$\blacktriangle 0,4 \mu\text{m}$
Amplitude of cyclic error Z	$\uparrow 0,3 \mu\text{m}$
	$\downarrow 0,4 \mu\text{m}$
Transverse clearance X	$\blacktriangleright -0,0 \mu\text{m}$
	$\blacktriangleleft -0,3 \mu\text{m}$

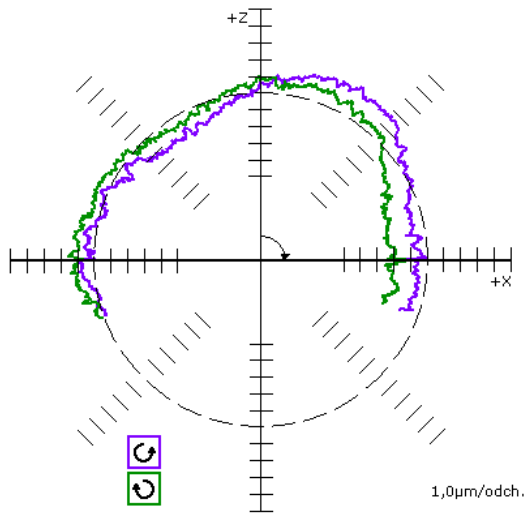


Figure 10. Shape of incomplete circular arcs in the plane Z-X

CONCLUSIONS

The aim of this article was to present diagnostic system QC20-W ballbar from Renishaw and its practical use in measuring the accuracy of circular interpolation five axis of milling machine. Measuring software identifies the type of error (geometric errors, dynamic errors clearance) and sorts them according to seriousness.

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CONTINUOUS INNOVATIVENESS SUPPORTED BY INTEGRATED COMPUTER-BASED AND PLM SOLUTIONS

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ABSTRACT: Motivating product designers and research groups to think “outside the box” is of special interest for companies and research centres willing to remain competitive even in times of crisis. It is proven that those leaders which realized that the continuous innovativeness is a result of in-crossed creativity support and sustained quality are more prepared for changes and bring their companies to success. Innovation management has significantly changed towards approaches that support innovation process especially the early phases in which creativity is more than needed. Approaches towards Product Lifecycle Management are changed also. In the advent of Web.2.0 these approaches have become increasingly computer-based enabling access to large user communities evolving into open or semi-open Enterprise 2.0 platforms. The parallel development of tools that could support innovative (creative) thinking based on off-line so-called Classical methods and IT solutions which claim to be collaborative and support idea generation brings to doubts about the choice of most suitable solutions. On the other side, companies are more eager to use solutions which can follow the different business processes including product lifecycle and that can aid their innovative capacity by being closer to customers. In this research an integrated solution is suggested that includes ideation and collaborative tools cross-used with PLM solutions which could support continuous innovativeness. Existing concepts and approaches on computer-based solutions for innovation and PLM are presented, with a focus on the “creative” phases such as product design that elevates the success of the products. The overview is made with a scope to underline the necessity of integration of the pragmatic aspects of creativity into solutions having features recognized with literature and test analysis that could support mainly creative thinking and knowledge sharing in companies.

KEYWORDS: Web 2.0, PLM, Collaboration, Creativity, Innovations

INTRODUCTION

To succeed today companies must be more effective at Product Lifecycle Management (PLM) which covers all phases from initial ideation to marketing and eventual retirement of the product. Two factors are identified to play a major role in the product success: the quality of execution of pre-development activities and a well-defined product and project prior to development phase [2]. Pre-development activities are: idea generation and enrichment, opportunity analysis, identification, idea selection and concept definition. In the PLM these activities are more connected to the design phase not excluding the idea and knowledge exchange between Research and Development (R&D) and other departments. The innovative process begins with a creative impulse from the ideas generated by industrial designers [17] for which a free access to data, information, idea exchange and discussion as well as idea protection is required. The company should be ready to provide the transformation of their ideas from initial inspirations to marketplace success stories. With the advent of Web 2.0 and especially Enterprise 2.0 companies are given an opportunity to capture, protect, share and collaborate on their new ideas and innovation – based projects whether with internal groups or external partners. Researches have shown that in the arrival of

Web 2.0, knowledge workers are more willing to use methods and tools which are social and provide open access to data and information [9].

The parallel development of pragmatic approaches [16] towards creative thinking and IT solutions which claim to support communication, collaboration, idea generation and knowledge sharing brings to confusion about most suitable tool. This means that creativity researchers mainly streaming from social sciences have to work hand-in-hand with the IT solution developers.

In order to give a starting direction about which solutions and which features are needed to support innovative thinking especially in the design phase we analyse several existing concepts and approaches on computer-based solutions that could be used in the early phases of the innovation process including design activities.

As a beginning an overview of the recognized computer-based systems for collaboration and their characteristics is given, evolving into more holistic platforms. Then a description is made of a computer-based solution that supports individual creativity and an example of PLM solution.

According to literature and test analysis we give roadmap to the features of an integrated computer-based platform which can support idea generation

and enrichment, design, capturing, idea sharing and discussion, and rating, as a part of the continuous innovativeness and PLM.

THE HISTORY OF COMPUTER - BASED SYSTEMS FOR COLLABORATION

Organizations invest many financial resources on technologies and on implementation of computer-based solutions such as decision support systems, collaboration systems, data flow etc. Unfortunately very few experiments are made with respect to the impact of creativity resulting from the use of group support solutions including computers and web - based platforms [5].

For more than a quarter of a century research has been conducted on group support systems (GSS) [6]. They are defined as: “A set of techniques, software and technology designed to focus and enhance the communication and decision making of groups” [12, p.357], and treated as solutions that could overcome the process losses during group meetings. GSS were meant to support a variety of tasks following a similar sequence of events. The early systems from the 80s were designed to support system analysts and users in the constricting of information systems [13]. Later on they were used as support methods for almost every meeting. The participants on the meeting used their computers to give comments and the results were integrated and displayed on a large screen in the front of the room. In that way the communication between the participants was assumed to be eased and ideas more easily exchanged. In the years that followed these meetings were also supported by more internet enabled applications such as Groove, MSN Messenger, Yahoo, Chat, ICQ, Lotus Notes and other Web applications to enable members to communicate [13] and to support meetings with geographically distributed members. On the other side there was a significant interest on decision making and idea sharing accomplished by computer networks [15]. Computer - based tools which supported idea generation primarily were based on the brainstorming face-to-face method [12] and are called Electronic Brainstorming Systems (EBS) [15]. Electronic Brainstorming Systems have received significant attention by researchers. There was an optimistic belief that computer - based brainstorming systems will overcome the problems of inefficiency and low productivity in idea generation group meetings [7], [8].

Facing with the fast changing economy companies started to require and search for computer - based solutions not only for group meetings support but also that could foster their knowledge management activities and collaborations. A new social technologies embedded in the so called “Web 2.0” has

appear on the market. These technologies were originally used to describe consumer technologies that enable groups to organize and share information and media called Enterprise 2.0 [4]. According to Eastwood (2009): “Enterprises quickly caught on the value of these easy to use tools for capturing and sharing ad hoc information that may be otherwise not documented”. IT enterprises had to respond to the requirements of their customers with solutions that contain features for collaborative working across regions, knowledge capture, and community and brand building outside the firewall (Oracle company, 2008). This led to a creation of new and improved, more holistic tools called Social Enterprise Applications that would enable the “next wave of knowledge worker productivity” (term coined by Oracle company [14]).

The use of the technologies associated with Web 2.0 has implicated the opportunity for companies to literally think “outside the box” by searching for new product ideas outside the organization.

COMPUTER – BASED PLATFORMS AIMED TO SUPPORT CREATIVITY

Some IT vendors together mainly with psychologists and sociologists developed computer – based solutions which can help individuals in the creative thinking process. For example simple solutions are developed that provide the use of (collaborative) mind maps (e.g. Mindmeister.com) and brainstorming features for creative decision support, or based on the logic of existing methodologies (e.g. TRIZ [1]) or Lateral thinking [3]). With a closer observation of all those solutions it was noticed that features that support group interaction and idea generation activities are minimized or even excluded completely which make these solutions partially creativity supportive. Also many of these solutions offer only use of analytical tools which is in line with the tendency of the creators to support the analytical thinking rather than creative.

From the existing computer-based systems for collaboration only few solutions include idea generation phase and even fewer are capable for Open Innovation. One of these solutions is Neurovation platform which is developed as a result of a research project from 2005 with an overall aim to combine innovation and knowledge management on a psychological and neurophysiologic basis in order to improve the innovative capability of organisations in the long run. Based on the findings obtained in the course of the research project as well as on the insights from existing literature a focus has been made in favour of the first phase of an innovation process so called “Fuzzy Front End”, in particular the idea generation activity. The computer-based

platform is based on tests made on persons given different challenges which aim to provoke creative thinking [11]. Neurovation.net allows an individual to use different challenges – tools (Figure 1) which provoke his/hers creativity, to draw and memorize ideas and associations, to make them visible through the “idea pool” and to be discussed and rated by other users of the platform [10].



Fig.1. The creativity tools on Neurovation.net

The platform has two target users: employees in companies and external users. With its use there are two beneficiaries also: the employees/ individuals who can establish their ideas, communicate with others about the quality of the idea before realization (with the stakeholders, partners, product consumers) and be awarded for the same; and consumers who are given an opportunity to improve or change products and even become innovators with a successfully soled idea [10].

Neurovation was tested by a group of experts in a course of doctoral research [9] with an aim of identifying the additional expectations of such “ideation” platforms which could aid in the early phases of the innovation process. In a two day workshop the use of the computer - based ideation solution was compared with an off-line creativity (ideation) technique. The reason of comparative use of tools was not the number of developed ideas only, as usually measured by many creativity scientists, but the differences between the steps and the presentations of the use of the tools to be identified. The results were analysed according to five group criteria [9]:

- the interface – including the simplicity of the use of the tools, the dynamics, graphics, etc.
- teamwork – available places and spaces for teamwork, supporting tools:
- leadership – the need of leadership or only moderator in both cases;
- structured problem-solving opportunity – whether and in which manner the tools support successive idea development and even analysis, and
- time – which ideation phases need more time, which method provide more effective idea generation and development, which method and tool need less learning time etc.

Even at the beginning a very positive comments about the use of solutions supporting creative thinking (ideation) were received. The literature of creativity lists thousands of experiments and tests where off-line techniques known as classical are used. They all represent a never ending enthusiasm of individuals to be challenged to show their creativity and originality which lead to innovations.

The tests of the Neurovation showed the same tendency and enthusiasm. The test group was given real cases for which new ideas were expected to be developed. Even though in the time of the tests held Neurovation was under another development stage, which meant more close upgrade of the features of the tools for group use rather than individual, the participants of the test were more willing to use computer - based solution of that kind rather than off - line classical technique only. This is because they were able to establish their ideas not only ad-hock but using their knowledge and analytical skills. The role of the leader when using computer - based solution was minimized which contributed ideas not to be influenced by authorities and to be more original. When it comes to structural problem - solving with Neurovation several features were identified as important for the same to be provided. Even in group idea generation a mutual working area was required where ideas can be shared and captured by all participants. The use of other tools such as CAD, Mindmaps, MS Project with which ideas and designs could be presented with technical drawings, maps and to track the evolution of the project, was seen as necessity. The participants had several remarks on the rating system such as involvement of expert groups or customers. Within the final phase of the development of ideal solution an access to patent offices and external data bases of existing products were required also which would aid in avoiding duplicates. The test made with Neurovation.net showed that individuals respond very positively on the design which supports:

- arena where members can argue their knowledge – a blog where ideas can be publicly or privately argued;
- space for socialization – the users can discuss and can share pictures and information;
- the idea generation can be made in group and individually;
- free information exchange is provided with the external environment;

The participants positively reacted on the knowledge that their idea can be protected, according to their choice it can be publicly shown or hidden and by that it can be decided whether to be marketed and sold to companies.

EXAMPLE PLM SOLUTIONS

With the analysis of the existing product management and innovation management platforms a lack of existence of integrated solution that would aid the ideation phase as well as idea capturing, design, protection, rating, collaboration and knowledge sharing is identified.

Teamcenter SIEMENS PLM one of the most selling solutions in the world is an IT solution which connects people throughout the lifecycle with a single source of product and process knowledge. It includes end-to-end solutions from: bill of materials management, community collaboration, compliance management, content and document management, engineering process management, enterprise knowledge foundation, formula, package and brand management, lifecycle visualisation, maintenance, repair and overhaul, manufacturing process management, mechatronics process management, portfolio, program and project management (ex. Figure 2). Through Teamcenter PLM the company is given an opportunity to create, share, manage, follow data and documents for different product projects and collaborate by changing it.

Teamcenter PLM is a platform on which the company can design its processes, design products and follow their development. In each phase an idea generation is required as well as collaboration in which ideas are not only exchanged but improved, discussed, upgraded, compared with the needs of the market, the best practices and the future expectations. This collaboration need in Teamcenter is resolved by data and document sharing which can be accessed individually. Every change is made separately by every user without a possibility of simultaneous group work, except if the group is in one room and are looking at one desktop.



Figure 2. Example of interface of Teamcenter

The possibility of design is given through NX (ex. Figure 3) product which can be introduced with Teamcenter which offers the industry’s broadest suite

of integrated, fully associative CAD/CAM/CAE applications.

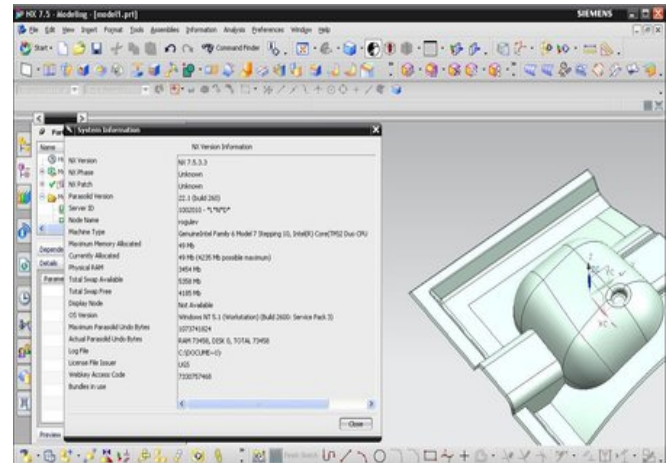


Figure 3. NX interface

NX offers: industrial design and styling, package design, electromechanical systems design, mechanical simulation, electromechanical simulation, tooling and fixture design, machining, engineering process management, inspection programming, mechatronics concept designer. All these activities require collaboration and exchange of ideas and knowledge between the designers on a high level. This does not mean that only data and drawings should be exchanged but also discussions of ideas, requirements from the customers etc.

SUGGESTED FEATURES OF SOLUTIONS FOR CONTINUOUS INNOVATIVENESS

As seen from the architecture of some PLM solutions there is a lack of communicational and ideation “space” important for the success of the entire product. In the architecture of the solutions we suggest a small attention on the collaborative part in which individuals especially designers would be given an opportunity not only to develop ideas and drawings based on trial-and-error but “space” in which they can stimulate their creative thinking, they can share their ideas with some created community (external and/or internal), ideas can be rated, designed in a mutual way and selected as best solutions. For this to be provided according to the literature and test analysis several additional features has been identified that should be included in the platforms such as PLM. The suggested features of a solution which will support continuous innovativeness are:

- Existence of Ideation tools – such as stimulations of pictures, photos, music, videos, people, etc.;
- Discussion arena – blogging system, virtual meeting room etc.;
- Socialization space – a space for sharing written ideas, drawings, pictures etc.;

- Rating mechanism – with the possibility of creating internal or external communities a rating system which can be used by the community to evaluate different suggested ideas is recommended. The rating system should be transparent with predefined rating scale.
- Rewarding mechanisms – established motivation mechanisms for good idea published online by the users;
- Design and decision making tools – CAD/CAM/CAE, CATIA, conceptual maps etc.,
- Access to product or patent data-bases from where the users (product developers) can “learn” whether their ideas are innovative or not
- Access to expert knowledge sources such as scientific journals, white papers, market analysis etc., from where the users can improve their knowledge and be up-to-date with the newest scientific researches.

The existence of these functionalities presents an integrated computer-based solution that would support the idea generation, enrichment, sharing and selection in line with the time schedules of development of product projects.

CONCLUSIONS

The innovation process is a process which includes several phases from idea generation to commercialization. A company willing to be successful and profitable has to find ways to support innovative thinking continuously involving different methods, tools and techniques no matter of its size and history. It is evident that as the market requirements are growing the innovation approaches are changing, making companies more open and much more customer oriented. Today most of the tools which support innovation activities are computer – based differing one from another from the purpose, target user groups, impact on the innovation process as well as on the human resources. In this paper we focused on solutions that might influence the basic activity of the innovation process and its outcome – the idea generation. Beside the numerous questions and views that might be discussed on this topic a brief overview on the needs of the companies and their employees of solutions which include creative (innovative) thinking was given in this paper.

The purpose of the IT solutions is to fasten the process from idea to launch of the product. Activities that are connected with the separate phases of the product development should be integrated into a “smart” solution that will guide the user through all phases. The lack of many IT solutions dedicated on the innovation process or at least product management is

that they exclude the phase where the human has the most important impact on the success of the product – the initial phase (ideation, or creative phase). Sociology and psychology scientists and researchers suggest a use of ideation tools which will help in matching the idea with the production processes in a successful product. Test analysis of the use of computer-based platforms aimed at ideation phase show that for the development of a successful and innovative product several features are needed. Users expect from a computer - based platform to provide more space for idea generation, development, discussion and even rating of ideas individually and in group. It has been shown that only idea generation and document flow virtually does not guarantee any success, any activity should be left to be described, elaborated, changed, designed, and even rated until is chosen. These features might be included very successfully in PLM solutions such as PLM Teamcenter and NX. The integrated features into such platform will provide more open and user-friendly platform in which the user will have an opportunity to collaborate and create creative collaborative to networking space. On the other side a creation of idea data bases and idea following will be provided too. With this kind of computer-based systems a continuous innovativeness will be supported successfully.

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THE USE OF IR-RA SPECTROSCOPY TO STUDY THE THERMAL DEGRADATION OF POLYVINYL ACETATE FILMS

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ABSTRACT: To determine the optical constants of polymer films can be used both external specular reflection spectra and internal reflection spectra. The transmittance values measured in IR reflection-absorption (RA) spectra can be used to determine the optical constants of dielectric films laid on solid substrates. To obtain the optical constants of polymers films laid on steel we used dispersion analysis. In this case, the optical constants are obtained from IR spectrum recorded at a single incidence angle. Using dispersion analysis offers the advantage of processing a large volume of data. The IR spectra of PVAc film deposited on steel recorded after its heat treatment, shows the appearance of a thermal degradation process of polymer.

KEYWORDS: Reflection-absorption, optical constants, IR spectra, dispersion analysis

INTRODUCTION

The study of reflection spectra of surface films deposited on solid media allow to determine the thickness and optical constants of these: the refractive index n and absorption index k .

The reflection of radiation on solid surfaces or transmission is expressed by its complex reflection $\tilde{r} = |\tilde{r}| \exp(i\theta)$ and transmission $\tilde{t} = |\tilde{t}| \exp(i\theta)$ coefficients. They depend on the complex refractive index of the film $\tilde{n} = n - ik$ and the angle of incidence φ_0 . The reflectance, denoted R , is the ratio of reflected radiation intensity I_r and incident radiation intensity I_0 , and is the square of the complex reflection coefficient: $R = r^2 = |\tilde{r}|^2$. The transmittance, denoted T , is the ratio of transmitted radiation intensity I_t and incident radiation intensity I_0 and is the square of the complex transmission coefficient $T = t^2 = |\tilde{t}|^2$.

To determine the optical constants of polymer films can be used both external specular reflection spectra and internal reflection spectra.

Figure 1, the reflected radiation contains two components: one reflected by air-film interface (I_r intensity) and one reflected by film-metal interface (I_t intensity), after having twice crossed the polymer film.

The reflectance due to reflection at the air-film interface has values of about 5% because the values of refractive indices of polymers in the infrared region are less than 1.5. Meanwhile the reflectance at the polymer-metal interface has values over 99%. Thus, the radiation intensity reflected at the polymer-metal interface and twice crossing the polymer film is about 95% of incident radiation intensity, and almost 20 times greater than the beam directly reflected at the air-polymer interface.

Therefore, this spectrum is a reflection-absorption (or transreflectance) spectrum, and is similar in terms of quality of transmission spectrum of the polymer film. This spectrum can be processed to obtain the optical constants n and k corresponding to the complex refractive index $\tilde{n} = n - ik$ [7].

The two optical constants can be obtained either from the reflectance measurements at two angles of incidence or using the whole range of reflectance spectrum values at one angle of incidence [5]. In the second case, Kramers-Kronig analysis of the recorded spectrum is used [10,11].

The dispersion analysis is another way to obtain the optical constants of thin films deposited on metal surfaces. It is more flexible than Kramers-Kronig analysis and can be applied to more complicated geometry of the spectrum.

Dispersion analysis is based on building an appropriate model for dielectric function and calculating the optical properties corresponding to this model. The

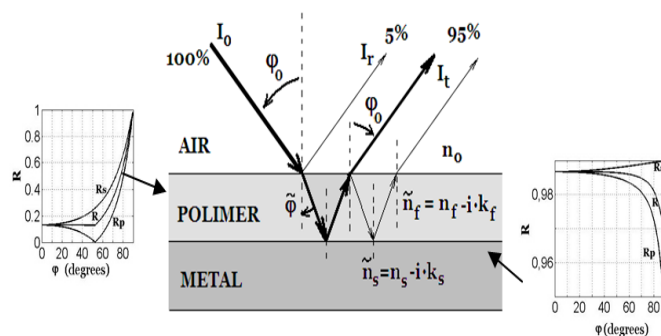


Figure 1. Specular reflection of radiation on thin films deposited on metals

For the specular reflection on thin polymer films (with thicknesses less than $2\mu\text{m}$) deposited on metals, as in

best known is Drude-Lorentz model [6, 9, 12] which defines the electric permittivity:

$$\varepsilon(\nu) = \varepsilon_{\infty} + \sum_j \frac{\nu_{pj}^2}{\nu_{0j}^2 - \nu^2 - i\gamma_j \nu} \quad (1)$$

It describes the optical response of a set of harmonic (damped) oscillators. In this relation, ε_{∞} is so-called "high-frequency dielectric constant", which represents the contribution of all oscillators at very high frequencies (compared to frequency range under consideration). The parameters ν_{pj} , ν_{0j} and γ_j are the "plasma" frequency, the transverse frequency (eigenfrequency), and the line-width (scattering rate), respectively of the j -th Lorentz oscillator. For the proposed model, from permittivity, we can calculate all optical quantities such as reflectance R and transmittance T . The spectrum of these theoretically calculated quantities is compared with those experimentally determined. The model parameters are continuously adjusted to fit the theoretical values with experimentally measured data. In case of reflection-absorption spectra the theoretical transmittance and experimental transmittance spectra are compared. The fitting parameters process stops when the differences between theoretical and experimental spectra are minimal.

Suppose, we have a set of N experimental data points $\{\nu_j, T_j, \sigma_j\}$ ($j = 1, \dots, N$) that we want to fit. Here, ν_j is the light frequency, T_j is the transmittance, and σ_j is the data error bar. For a set of M internal parameters, the values $T = T^{\text{model}}(\nu, p_1, \dots, p_M)$ are calculated based on the model.

The so-called Levenberg-Marquardt algorithm is used to minimize the value:

$$\chi^2 = \sum_j \left(\frac{T_j^{\text{exp}} - T_j^{\text{model}}(\nu_j, p_1, \dots, p_M)}{\sigma_j} \right)^2 = \chi^2(p_1, \dots, p_M) \quad (2)$$

Fitting process stops when the stopping criterion is met [8].

EXPERIMENTAL

Thin films of polyvinyl acetate (PVAc) were obtained by spraying a polymer solution on the surface of a steel metal sample. Low concentration of polymer in the solvent allowed us to obtain thin films with thickness less than $2\mu\text{m}$. After evaporation of the solvent the IR reflection-absorption spectra at 20° incidence angle was recorded.

The metal sample coated with polymer film was then heated to a temperature of 80°C for 30 minutes to complete removal of the solvent. After the sample heat treatment we recorded IR reflection-absorption spectrum again. The metal surface used as substrate for the polymer film was obtained by grinding and polishing.

The IR reflection-absorption spectra were recorded using a specular reflectance device for UR-20 spectrograph.

The reflection-absorption spectra were processed using the program RefFIT [8] to obtain the optical constants of polymer film.

RESULTS AND DISCUSSION

The IR reflection-absorption spectra recorded at 20° degrees incidence angle are shown in Figure 2. The spectral range $500 \div 1800\text{ cm}^{-1}$ containing the absorption band at 1732 cm^{-1} corresponding to $\text{C}=\text{O}$ stretching vibration is presented [3].

The reflectance R and hence the transmittance T values depend very least on the angle of incidence, as observed in Figure 1. Because of this, reflection-absorption spectrum at 20° degrees angle of incidence is very similar to the transmission spectrum for normal incidence.

Since the surface film thickness is less than $2\mu\text{m}$, interference fringes in spectra recorded are not present [6]. For the same reason the spectrum recorded is one of reflection-absorption (transflectance).

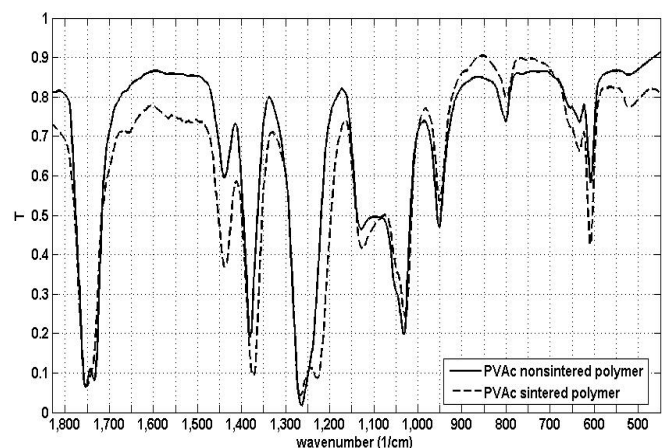


Figure 2. Reflection-absorption spectra at 20° incidence angle for a PVAc film deposited on polished steel

The IR spectra of PVAc film deposited on steel recorded after its heat treatment, shows the appearance of a thermal degradation process of polymer, which is its depolymerization.

The depolymerization process produces monomer units containing unsaturated $\text{C}=\text{C}$ bonds. This is confirmed by increased of the absorption band at 1647 cm^{-1} characteristic for stretching frequency of $\text{C}=\text{C}$ bond [2,3].

During thermal degradation is also possible to remove the acetic acid. This is highlighted by the change of vibration frequencies of $\text{C}=\text{O}$, $\text{C}-\text{O}$ and $\text{C}-\text{C}-\text{O}$ bonds. Thus, instead of stretching vibration frequencies of the $\text{C}=\text{O}$ bonds at 1724 cm^{-1} and 1739 cm^{-1} there is a single band at 1752 cm^{-1} .

Instead of the absorption band at 1241 cm^{-1} , corresponding to vibration frequency of C-O bond appear two absorption bands at 1234 cm^{-1} and 1266 cm^{-1} . They correspond to C-O bonds in the acetate group linked to the macromolecular chain or partially released. Also, there is a decrease in the intensity of the absorption band at 1124 cm^{-1} corresponding to the vibrations of C-C-O bonds [3].

The spectra obtained can be processed to obtain the optical constants n (refractive index) and k (absorption index). We used 1381 points and 55 parameters in the fitting process.

To improve the accuracy of the dielectric function we used simultaneously the fitting process of reflection-absorption spectra recorded at a 20 degrees incidence angle and the refractive index of PVAc value $n_f = 1.4665$ [1].

The refractive index spectrum obtained by dispersion analysis of reflection-absorption spectrum for PVAc deposited on steel is shown in Figure 3.

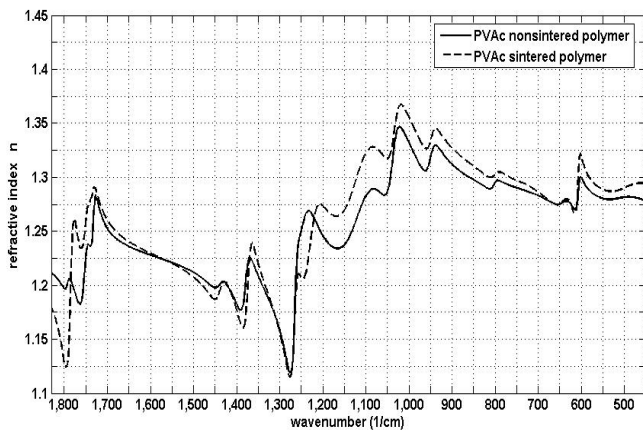


Figure 3. Refractive index spectra for PVAc deposited on steel obtained by dispersion analysis

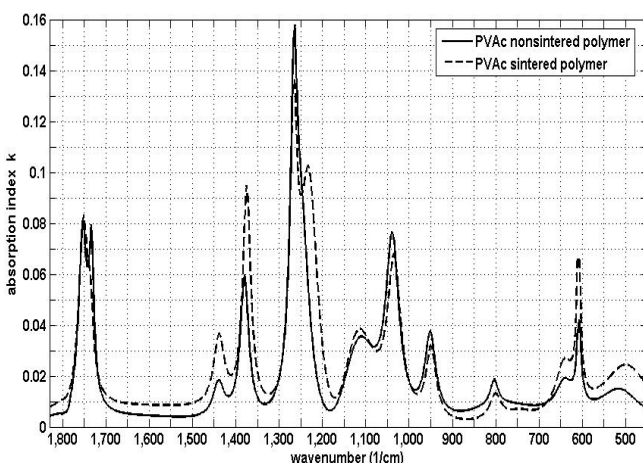


Figure 4. Absorption index spectra for PVAc deposited on steel obtained by dispersion analysis

The absorption index (extinction coefficient) k has a spectrum very similar to the absorption spectrum. The absorption coefficient spectrum of PVAc film deposited on steel is shown in Figure 4. The values of the absorption coefficient are low. The polymer can be

considered to be almost transparent in infrared. In this spectrum, the absorption bands do not show deviations from the positions of the absorption bands in reflection-absorption spectrum.

Main frequencies of absorption bands of PVAc spectrum obtained by dispersion analysis of the reflection-absorption spectrum were presented in Table 1 and compared with those given in the literature [3]. It is noted that in general the spectral bands in the experimental reflection-absorption spectrum are slightly shifted to higher frequencies than those in the literature, which correspond to the transmission spectrum. These shifts were assigned to the influence of the refractive index on the reflectivity, coupled with the significant changes in refractive index in the region of the anomalous dispersion.

Table 1. The main spectral bands obtained by the dispersion analysis of the reflection-absorption spectrum of PVAc film in comparison with the literature [3]

Assignment	Transmission spectrum literature ^[3]		Reflection-absorption spectrum experimental			
	Intensity	ν_0 cm^{-1}	before treatment		after treatment	
			ν_0 cm^{-1}	k	ν_0 cm^{-1}	k
$\nu(\text{C}=\text{O})$	very intense	1739	1753	0.0810	1752	0.0831
$\nu(\text{C}=\text{O})$	very intense	1724	1734	0.0796		
$\delta(\text{CH}_2)$ δ_a (CH_3)	intense	1433	1439	0.0186	1439	0.0368
$\delta_s(\text{CH}_3)$	very intense	1374	1380	0.0598	1375	0.0949
$\nu(\text{C}-\text{O})$	very intense	1241	1264	0.1580	1266	0.1362
	very intense				1234	0.1027
$\nu\text{C}-\text{C}-\text{O}$	intense	1124	1129	0.0356	1114	0.0387
	intense	1047	1039	0.0766	1036	0.0682
$\rho(\text{CH}_3)$	intense	927	952	0.0378	950	0.0321
$\nu(\text{CO}-\text{CH}_3)$	medium	796	802	0.0188	800	0.0134

CONCLUSIONS

The IR reflectance spectra for thin films (with thickness less than $2\mu\text{m}$) are reflection-absorption spectra. The recorded size is the transmittance. Appearance of the reflection-absorption spectra is very similar in terms of quality to the transmission spectrum of the polymer.

The IR spectra of PVAc film deposited on steel recorded after its heat treatment, shows the appearance of a thermal degradation process of polymer, which is its depolymerization.

The dispersion analysis of reflection-absorption spectra is more accurate and easier than Kramers-Kronig analysis. The Kramers-Kronig analysis is used especially for thick surface films or for bulk materials. Simultaneously fitting for several types of information about the film surface leads to accurate values of optical constants n and k .

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ENHANCEMENT SLOPE DESIGN USING MINERALOGY TREATMENT

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ABSTRACT: The application of mixed soil by natural local material in slope construction is a novel technique. It is possibility of development new materials to satisfy slope safety requirements, in this regard mineralogy of different natural soils have been considered, and affect of mixed soil matrices in the identified slope behavior analyzed. The result of investigation revealed this method is fast, economic, trustable and easiest way of slope construction and it is due to understanding of soil mineralogy in geotechnical engineering, and the factor of safety has direct correlation with soil angle of friction and cohesive as well as unit weight.

KEYWORDS: Local Material, Numerical Analysis, New Material

INTRODUCTION

To increase safety of any structure and improve of soil foundation, experiments in laboratory and in situ applications along with computer modeling could lead to find economical constructed slope, and also it is standard method of starting construction activities for better understanding of material characteristics in the body of earth structure.

It has been reported on a generic earth fill dam model and investigates, probabilistically, downstream and upstream slope stability, as significant limit states governing the long-term performance. Specific variables that define failure modes are identified and their probabilistic models defined [1]. There is an investigation on the south west area of Cyprus which has a long history of slope instability problems. The location and extent of these landslides has been influenced by ground morphology, geological structure and the presence of weak rocks and cohesive soils [2]. It is presented slope and embankment analysis by some methods including Finite Element (FE) and Limit Equilibrium (LE) were used for evaluation failed slopes at Talaimai location of the Rajshahi City [3]. There is a scientific research on determine the mechanism of internal soil erosion resistance to soil slope instability. A laboratory study has been carried out to characterize the soil internal erosion resistance to slope instability due to rainwater infiltration and the effect of percentage of course to fine-grained soils composition [4]. It has been studied of the development in geotechnical engineering and the advancement in the earth moving machineries enabled the construction of high earth and rock-fill dams. The flexibility of the materials provides excellent seismic stability to the structure. It could be evaluating the stability analysis of zoned dam with different materials and hydraulic properties of the construction materials [5]. A study has been conducted, it is revealed slope instability causing

landslides, and a major geologic hazard, and it is a risk common to most regions. Among all categories of landslides, shallow slope failures which affect many hill slopes and earthwork projects and pose the most costly maintenance problem, to overcome to these problems Live Pole technique for soil improvement in shallow slope failures has been suggested [6]. The experiments are conducted in the Geo-technical Engineering Laboratory of S. J. College of Engineering, Mysore. In the present experiments, several models have been developed to improve red soil mechanical characteristics. It is to study slope construction from local and economical materials in the Mysore city of India, the six types of soils along with the two types of gravel and sand have been selected to evaluation of characteristics of 31 mixed soils under loose dry condition and out of these 5 models as per their characteristics have been selected for future investigation.

METHODOLOGY AND EXPERIMENTS

It is quite clear a mixed soil characteristic is totally different from individual soil. Earth slopes are formed for railway formation, highway embankment, earth dam, canal banks and many earth structures. In slope construction from mixed soil for increasing slope stability, employee of different types of soil with proper percentage is best option, in this regard 31 mixed soil types from red plastic soil and black, green, dark brown, yellow and light brown non plastic soils, sand, and two types of gravels 2 mm, 4.75 mm developed, and also from previous investigation (Table 1) safe bearing capacity, angle of friction, unit weight and cohesive of mixed soils sample for computerize model have been used, the Geo-Slope software in identification of models behavior employed and the result of these modeling research work by interpretation of mixed soil types characteristics evaluated. And the XRD results of six soil samples used as starting materials for mixture.

Table 1. Mixed soil models [7]

Sl. No	% of Red Soil	% of Sand	% of Gravel 4-75 mm	% of Gravel 2 mm	% of Black Soil	% of Green Soil	% of Dark Brown Soil	% of Yellow Soil	% of Light Brown Soil
1.	100	0	0	0	0	0	0	0	0
2.	55	45	0	0	0	0	0	0	0
3.	55	0	45	0	0	0	0	0	0
4.	55	0	0	45	0	0	0	0	0
5.	55	15	15	15	0	0	0	0	0
6.	55	0	0	0	45	0	0	0	0
7.	55	0	0	0	0	45	0	0	0
8.	55	0	0	0	0	0	45	0	0
9.	55	0	0	0	0	0	0	45	0
10.	90	0	0	0	2	2	2	2	2
11.	80	0	0	0	4	4	4	4	4
12.	70	0	0	0	6	6	6	6	6
13.	60	0	0	0	8	8	8	8	8
14.	50	0	0	0	10	10	10	10	10
15.	70	0	0	0	10	10	10	0	0
16.	70	0	0	0	10	10	0	10	0
17.	70	0	0	0	10	10	0	0	10
18.	70	0	0	0	10	0	10	10	0
19.	70	0	0	0	10	0	10	0	10
20.	70	0	0	0	10	0	0	10	10
21.	70	0	0	0	15	15	0	0	0
22.	70	0	0	0	15	0	15	0	0
23.	70	0	0	0	0	0	0	15	15
24.	70	0	0	0	15	0	0	15	0
25.	70	0	0	0	15	0	0	0	15
26.	70	0	0	0	0	15	15	0	0
27.	70	0	0	0	0	15	0	15	0
28.	70	0	0	0	0	15	0	0	15
29.	70	0	0	0	0	0	15	15	0
30.	70	0	0	0	0	0	15	0	15
31.	55	0	0	0	0	0	0	0	45

RESULTS AND DISCUSSION

One of the ways in overcoming in the shortage of land in the urban area is improvement of soil properties by grouting, compaction, excavation, replacement of new soil and mitigation of soil by nailing etc, those this method have been adopted by the geotechnical engineering but mixing soil method from local material is new technique could be improve if knowledge of this method properly developed. To feasible evaluation of mixed soil technique in slope construction, four mixed soil types those have better than red plastic soil characteristics to construction of slope has been selected (table 8), it is for application analysis of mixed soil capability in construction industry. At the time of earthquake, soil liquefaction results appeared in the form of ground failure, differential settlements, slides, soil foundation deformation, and reduction of soil bearing capacity. It is a major cause of earth structure collapse [Fig 1]. The peaks have been indexed and minerals present in the soils were identified by use of the standard D-spacing and mineral intensity (Table 2-7 and Fig 2.a-f). The important minerals present in the soils are quartz, muscovite, biotite, carbonates and fluorapatite. Clay minerals like illite, saponite, sauconite, pyrophyllite,

orthochamosite, brucite, clinochlore, nacrite, odinite, amesite, chamosite, cancrisilite, chamosite and orthochamosite were also present as minor constituents, only the red soil has considerable amount of clay minerals, where as the remaining other soils have meager concentrations. The mixed soil model mineralogy and morphology are the main factors at play in level of soil bearing capacity, foundation strength and stress sustainability [7].

Table 3 indicated of 31 mixed soils characteristics which are soil moisture content, angle of friction, cohesive, unit weight and safe bearing capacity and table 9 mentioned of slope characteristics constructed from mixed soil, these are factors of safety, total resistance moment, total activating moment, total resisting force and total activating force. This novel technique of soil mixing could successfully applied in some areas of urban in improvement of structure foundation and earth structure as well as seismic mitigation. The slope from mixed soil designed to satisfy bearing capacity and economic criteria and achieving of best factor of safety.

The results of these computerize modeling [Table 4 and Fig 3-4] revealed soil angle of friction, cohesive and unit weight have positive correlation with total activating force and moment, it is due to mechanical soil characteristics, it appeared in earth structure construction and could be accurate verify by finite element analysis, this is led to understanding of slope stability requirement. One of the methods in slope stability improvement is application of mixed soil technique, it is quite clear by this technique in slope design and analysis easy can achieve to the economic and fast slope construction whit acceptable factor of safety.

In the soil composite, angle of friction with the cohesive and unit weight of the soil could be equality important in the slope stability, this is occur due to slope shape, soil nature and slope load sustainability as well as pore water pressure characteristics and all these factors came from soil mineralogy and morphology. There is good agreement revealed between the results of mixed soil and slope construction modeling due to understanding soil mixed behavior, and the results find slope displacement, deformation, collapse, settlement and level of pore water pressure could be controlled if mixed soil technique properly identified and applied. Soil mixed has a significant effect on improvement of slope bearing capacity, if slope is very sensitive in settlement, in this case application of mixed soil method could mitigate slope settlement, and more complex and precise slope behaviors of the soil could be analysis. Therefore, the effects of the factor of safety can be taken into consideration as part of the

analysis. The effect of soil characteristics and slope geometry on the stability of a slope can also be studied when the all parameters is combined.



Figure 1. Landslide at Sau Mau Ping in 1976 [8]

Table 2.a XRD data of red soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	19.96	0.471	4.4447	742	26
2	20.92	0.306	4.2428	739	26
3	22.10	0.329	4.0189	350	12
4	26.70	0.329	3.3360	2919	100
5	28.04	0.329	3.1796	864	30
6	28.76	0.353	3.1016	331	12
7	33.26	0.353	2.6915	333	12
8	35.02	0.400	2.5602	340	12
9	35.82	0.424	2.5048	464	16
10	36.60	0.306	2.4532	465	16
11	49.66	0.376	1.8343	405	14
12	50.22	0.353	1.8152	846	29

Table 2.b XRD data of black soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	20.800	0.282	4.2670	2297	25
2	26.580	0.282	3.3508	9312	100
3	27.80	0.259	3.1974	668	8
4	29.320	0.306	3.0436	676	8
5	36.500	0.306	2.4597	699	8
6	39.400	0.353	2.2851	672	8
7	40.260	0.306	2.2382	429	5
8	42.400	0.329	2.1301	806	9
9	50.080	0.329	1.8199	1316	15

Table 2.c XRD data of yellow soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	9.500	0.376	9.3020	891	7
2	12.160	0.400	7.2725	1033	8
3	18.740	0.376	4.7312	573	5
4	20.900	0.400	4.2468	3549	27
5	24.400	0.353	3.6450	887	7
6	26.680	0.376	3.3385	13545	100
7	28.660	0.376	3.1122	895	7
8	32.660	0.376	2.7396	7551	56
9	35.880	0.400	2.5007	1336	10
10	36.600	0.376	2.4532	1082	8
11	39.500	0.400	2.2795	796	6
12	43.000	0.376	2.1017	3763	28
13	46.840	0.400	1.9380	1131	9
14	50.180	0.400	1.8165	1327	10

Table 2.d XRD data of light brown soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	19.880	0.447	4.4624	567	10
2	20.880	0.282	4.2509	1201	21
3	22.080	0.259	4.0225	646	11
4	26.680	0.282	3.3385	5937	100
5	27.420	0.282	3.2500	801	14
6	27.980	0.306	3.1862	2708	46
7	36.600	0.282	2.4532	658	12
8	41.780	0.353	2.1602	512	9
9	50.160	0.306	1.8172	697	12

Table 2.e XRD data of dark brown soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	9.460	0.424	9.3412	746	29
2	10.520	0.376	8.4023	1147	44
3	18.440	0.400	4.8075	735	28
4	24.660	0.400	3.6072	1770	67
5	25.300	0.353	3.5173	525	20
6	26.400	0.424	3.3732	663	26
7	27.220	0.376	3.2734	617	24
8	28.520	0.376	3.1271	1882	72
9	30.960	0.424	2.8860	2646	100
10	35.260	0.400	2.5433	1090	42

Table 2.f XRD data of dark green soil [7].

Peak No	2theta	Flex Width	D-Value	Intensity	I/I _o
1	20.880	0.306	4.2509	433	15
2	21.960	0.329	4.0442	1138	40
3	23.680	0.447	3.7542	683	24
4	24.380	0.353	3.6480	567	20
5	26.620	0.353	3.3459	2573	89
6	27.880	0.565	3.1974	2910	100
7	29.780	0.447	2.9976	1214	42
8	30.360	0.353	2.9417	1027	36
9	30.900	0.329	2.8915	489	30
10	35.440	0.353	2.5308	1301	45
11	42.220	0.612	2.1387	529	19
12	51.480	0.329	1.7737	419	15

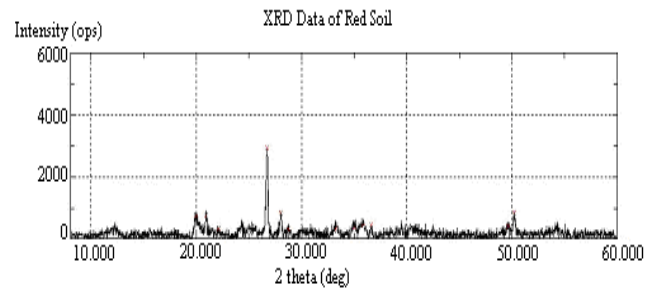


Fig.2.a. XRD Data of Red Soil [7]

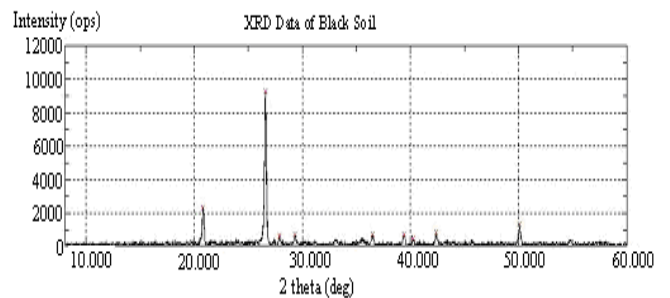


Fig.2.b. XRD Data of Black Soil [7]

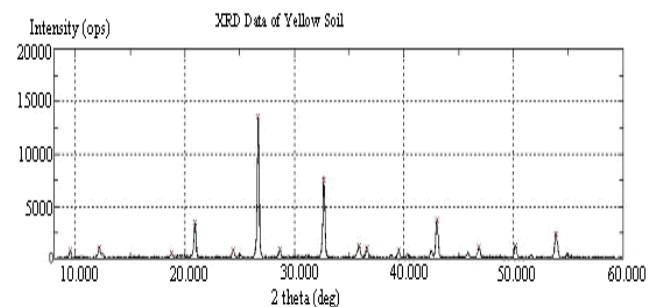


Fig.2.c. XRD Data of Yellow Soil [7]

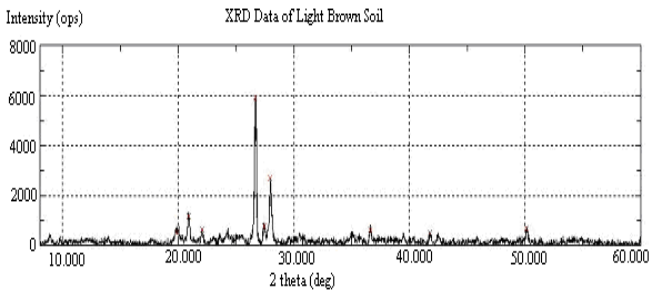


Fig.2.d. XRD Data of Light Brown Soil [7]

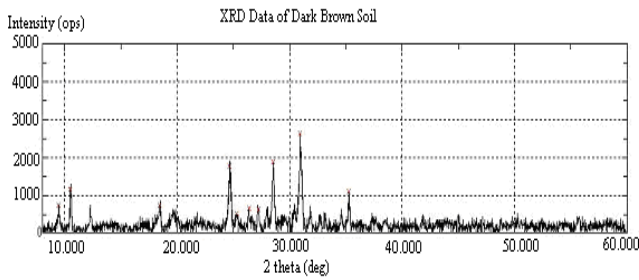


Fig.2.e. XRD Data of Dark Brown Soil [7]

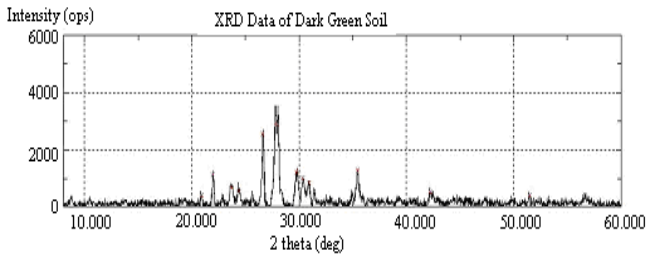


Fig.2.f. XRD Data of Dark Green Soil [7]
Table 3 Experiments Results When Soil Is in Loose 0% Moisture Condition [9]

Sl. No	Model No	Zero % Moisture Content	γ (KN/m ³)	Φ Degree	C (KN/m ²)
1	1	0	11.808	38	0
2	2	0	12.54	35	10
3	3	0	13.93	36.5	14
4	4	0	12.71	42	0
5	5	0	13.32	42	0
6	6	0	11.5	37	12
7	7	0	12.11	36	0
8	8	0	13.26	32	0
9	9	0	11.38	35	0
10	10	0	10.29	37	4
11	11	0	10.9	36	0
12	12	0	12.35	33	0
13	13	0	11.5	35	0
14	14	0	12.72	36	0
15	15	0	11.5	35	0
16	16	0	11.93	33	0
17	17	0	12	35	0
18	18	0	12.11	37	0
19	19	0	11.02	35	0
20	20	0	11.51	31	12
21	21	0	12.42	35	0
22	22	0	11.81	35	8
23	23	0	13.32	34.5	0
24	24	0	11.51	33	0
25	25	0	12.72	34	0
26	26	0	14.05	34	0
27	27	0	12.11	32.5	0
28	28	0	12.72	37	0
29	29	0	12.72	34	6
30	30	0	13.02	35.5	0
31	31	0	11.2	37	0

Table 4. Analytical Result of Slopes in Morgenstern-Price Method

Model No	Factor of Safety	Total volume (M ³)	Total Mass (Kg)	Total Resistance Moment (KN. M)	Total Activating Moment (KN. M)	Total Resisting Force (KN)	Total Activating Force (KN)
3	1.939	234.44	3265.7	45887	23664	1933	999.37
6	1.844	275.44	3171.3	42075	22821	1689.3	916.44
5	1.71	154.64	2059.8	28084	16426	1241.6	728.59
4	1.689	154.64	1965.4	26471	15674	1169.2	694.81
1	1.435	154.64	1826	20899	14562	922	644.85

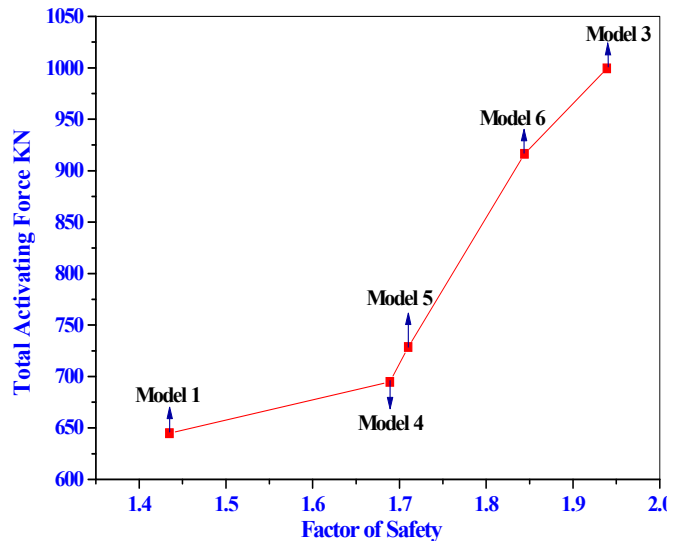


Figure 3. Total activating force vs. Factor of safety

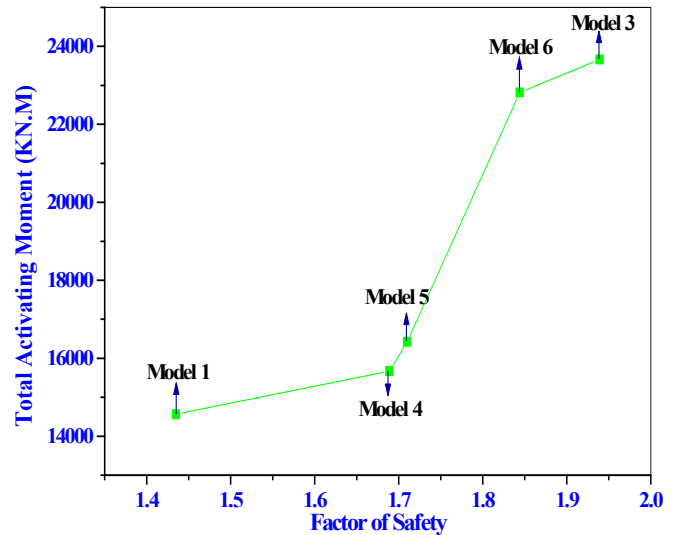


Figure 4. Total activating moment vs. Factor of safety

CONCLUSIONS

- The structure modeling is a step of any construction activities and it is fast, economic, trustable and easiest way of slope stability evaluation, and it is achieved if soil mixture mineralogy identified
- Soil angle of friction, cohesive and unit weight have positive correlation with slope factor of safety

- To achieving acceptable factor of safety, it is needed present of high level of soil angle of friction and cohesive as well as unit weight
- If the soil angle of friction, cohesive and unit weight increased simultaneously it will have best influence in controlling slope factor of safety, if any of these three be weak could not be observed acceptable of factor of safety, it could be suggested if a mixed soil is weak in cohesion to improved of that should amended with pure clay mineral, and to increase of angle of friction could use of angular soil in development of mixed soil and to modification of unite weight could use of soil consist of heavy mineral

NOMENCLATURE

Φ [°]	= Friction Angle
C [kN/m ²]	= Soil Cohesivity
OMC %	= Optimum Moisture Content %
SBC [kN/m ²]	= Safe Bearing Capacity
γ [kN/m ³]	= Unit Weight
F	= Safety Factor = 3

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EFFECT OF EARTHQUAKE OF STEEL FRAMES WITH PARTIAL RIGID CONNECTION

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ABSTRACT: The present study is aiming to evaluate the seismic performance of moment resisting steel frames with partial rigid connections considering elasto-plastic behavior of girder to column connection under the effect of earthquake loadings. The frame performance prediction and evaluation procedure is mainly based on the nonlinear dynamic analysis considering both geometrical and material nonlinearities. The current paper investigates the effects produced by some earthquake records on steel moment resisting frames considering both SDOF (SINGLE DEGREE OF FRADOM) system and MDOF (MULTI DEGREE OF FRADOM) system. Statistical analyses are performed to characterize the response of such frames by obtaining comparable results that allow the determination of the behavior factor for each frame (Q- factor) which expresses the degree of damage for each frame. The results summarized in terms of base shear-top displacement relationships considering different earthquake records and at P.G.A. (Peak Ground Acceleration) level 0.35G (0.35 from ground acceleration levels). Finally the values of the Q-factor for each frame and the comparison of such values with respect to the current seismic provisions were outlined.

KEYWORDS: Earthquake, Moment resisting frames, Girder to column connection, behavior factor

INTRODUCTION

In 1997 studding the composite beams for steel structural for partial rigid connection between concrete and steel beam duo to monotonic load [1]. A column design curve only in steel structural for slender sections was established by applying a reduction factor, Q, to the LRFD column design curve for monotonic load without effect of earthquake [2].

Similar to the Euro-Code3, the Egyptian Code based on the allowable stress design, ASD and LRFD accounts for local buckling of slender plate elements for steel frame by applying the effective width concept [3,4].

Many design approaches have recently been proposed as a basic philosophy for designing steel structures. In general, the E/Q resistant design philosophy states that structures should be designed to resist low intensity earthquakes with no damage [5,6] (structural elements and nonstructural element), medium intensity earthquakes with a minor damage level and high intensity earthquakes with a significant damage to both structural and non structural element and with out over all or partial collapse in order to avoid loss of life.

For such a purpose, in order to resist destructive earthquakes, structures should be designed to give a significant dissipative energy during E/Q actions. Also, they shall be designed so that they can undergo inelastic deformations during earthquakes. In general, prediction of seismic response of a steel moment resisting frame is a problematic matter, due not only to the large number of factors that affect on its performance but also due to the basic complexity of its physical behavior.

In addition, the lack of knowledge in interpreting the MRF (Moment Resisting Frames) characteristics and the variability of the nature of ground motions that may happen in the future, create a big importance in studying the behavior of such frames [7].

However, in the case of seismic loading, there has not been until recently any provisions that may judge the performance of these frames under the unexpected time histories of Earthquakes. Also, structural failures observed in the beam to column connections [8] earthquakes have exposed the weakness of the prevalent design provisions and construction procedures for steel moment frames and shows the need for new methods for evaluation of the frame performance and design [9]. Introduction to the European Research Projects in Support of Eurocode 9 [10].

This paper presents a study for three different steel moment resisting steel frames in order to investigate the seismic behavior of steel moment resisting frames under the effect of Earthquake record at P.G.A equal 0.35 G.

STRESS STRAIN RELATIONSHIP FOR STEEL

For simplicity, the uniaxial monotonic idealized stress-strain relationship for structural steel elements is considered to be bilinear curve shown in Figure 1.

Whereas this is adequate for static design purposes, the use of nonlinear constitutive reversible relationship should be used for dynamic analysis.

Figure 2 shows the stress-strain relationship for idealized bilinear reversible constitutive model. The important features of a nonlinear constitutive model for steel structures are cyclic hardening softening and mean stress relaxation.

Where, f_s is the steel stress; f_y is the specified yield strength of steel; ϵ_s is the steel strain and ϵ_y is the steel yield strain.

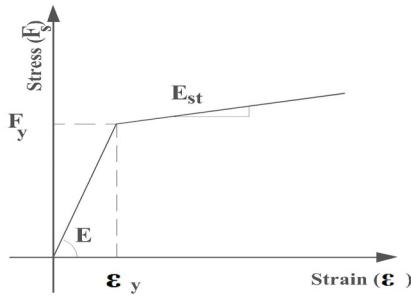
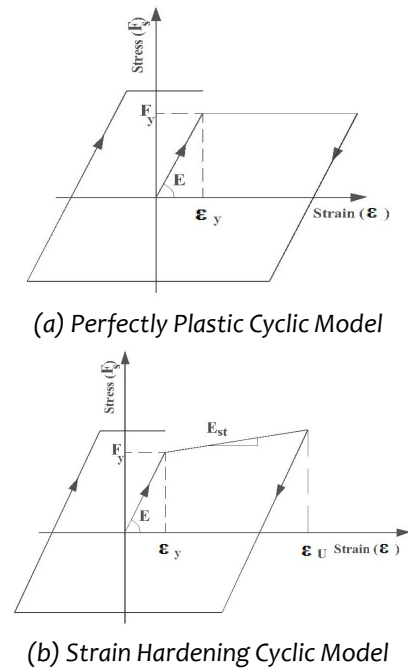


Figure 1. Idealized Stress-strain curve for steel



(a) Perfectly Plastic Cyclic Model

(b) Strain Hardening Cyclic Model

Figure 2. Perfectly Plastic and Strain Hardening Cyclic Model

STIFFNESS

Stiffness can be defined as the property used to quantify and control the deformation of an element or connection under the effect of a certain force. There are some parameters that affect the stiffness of steel element including local buckling of elements such as overall buckling of the structural elements, lateral torsion buckling and P-Δ effect.

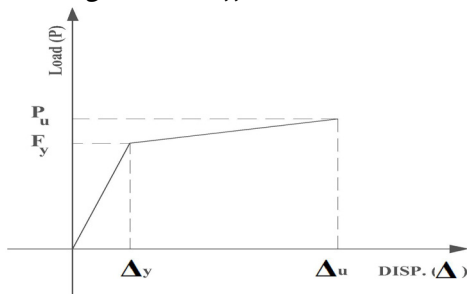


Figure 3. Load-Displacement relationship for monotonic loading

Figure 3 shows a relationship between load and displacement for a steel structural element subjected to monotonic increasing load. For design purposes, the real response may be approximated to an idealized bilinear relationship, where P_y is defined as

the yield load of the element. The slope of the idealized linear elastic response (first part of the curve) represents the elastic stiffness of the element $\{K_e = P_y / \Delta_y\}$.

The slope of the idealized plastic response (second part of the curve) represents the hardening stiffness of the element $\{K_p = (P_u - P_y) / \Delta_u - \Delta_y\}$. Also, Figure 4 shows the real idealized response for load displacement relationship under the effect of cyclic load. Generally, under the effect of the cyclic loading, the structural elements stiffness will subject to degradation of their stiffness due to the fatigue phenomena.

DRIFT CRITERIA

The main definition for the structure drift is the lateral displacement of that structure due to vertical and horizontal loads.

There are two kinds of the structural drift that should be controlled within the effect of earthquake. These include inter-story drift and overall drift.

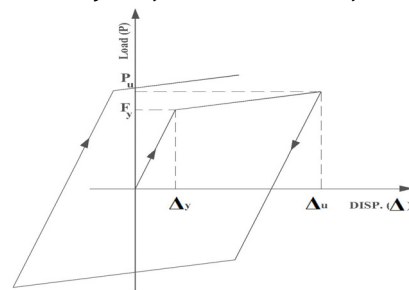


Figure 4. Load-Displacement relationship for cyclic loading

RESPONSE SPECTRA

The response spectrum for a damped single degree of freedom system can be defined as a plot of the max. peak response of that structure at various frequencies or periods and damping ratios for a specific ground motion. For a given earthquake record and a given percentage of critical damping the spectrum graph shows related quantities such as acceleration, velocity and displacement for a complete range or spectrum of building period. Figure 5 shown an acceleration response spectra for three records earthquake [10,11,12].

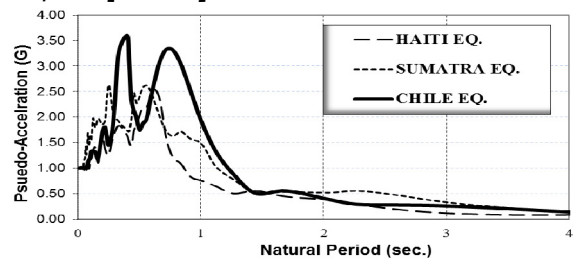


Figure 5. Response spectra for earthquake records

EVALUATION OF THE DUCTILITY FACTOR (μ)

In this paper the factor that was considered to express the damage of the frame due to E/Q loading is the global behavioral factor (Q-factor) which is based mainly on the ductility factor of the frame (μ).

The method of evaluation of the ductility factor is mainly based on the nonlinear dynamic analysis of the

frame and from the analysis the relationship between both shear and top displacement is plotted. From this relationship the maximum loop is adopted to calculate the parameters of the ductility factor as shown in Figure 6 for the figure the ductility factor can be given as follows:-

$$\mu_n = \frac{E_n}{P_y \cdot X_y} + 1 \quad (1)$$

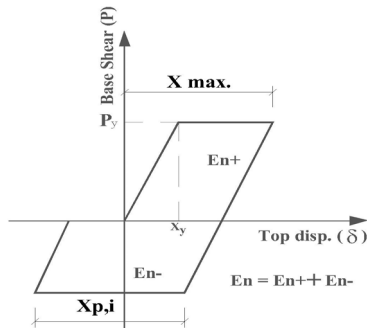


Figure 6. Lateral drift- Base shear relationship (Max. excursion) where, E_n =total max. hysteresic energy= $E_n^+ + E_n^-$ P_y and X_y are as given by Figure 3.

Also the Q-factor for moment resisting steel frame can be computed as given by Euro code 8 as: $Q=5.0 \cdot \mu$ which expresses the elastic behaviour of the frame under the effect of seismic actions.

DESCRIPTION OF ANALYZED FRAMES

Three steel frames were designed to investigate the seismic response of moment resisting frames. These frames were shown in Figure 7, in which the span length and interstory height were respectively, 5.0 and 3.3 m except for the ground floor in which the interstory height is 4.0 m. Dead and live loads per unit length of beam are 2t/m' and 0,8 t/m, respectively. The frames have been designed according to instructions provided by Eurocode8 and Eurocod3 [10] for dissipative structural behavior, by assuming the behavior factor proposed for high ductility class frames and adopter class one steel profiles. The masses of each floor have been evaluated based on the dead load only.

All frames have pinned supports, critical damping ratio considered 5%, ground acceleration level considered for all earthquake records is 0.35 G. Each frame made of mild steel with yield stress, $f_y= 2400 \text{ kg/cm}^2$, ultimate strength,

$f_u=3600 \text{ kg/cm}^2$, strain hardening ratio, $\epsilon=1\%$, young's modulus, $E=2100 \text{ t/cm}^2$, and passion's ratio=0.3

The nonlinear spring element was chosen to represent the beam to column connection in which the M-φ curve data, representing the rotational stiffness for the end plate connection were taken [9].

The analysis methodology for evaluating the seismic response for MRF is the nonlinear dynamic analysis considering both geometric and material nonlinearities. The analyses have been conducted using the software program COSMOS/M in which the

acceleration time histories for different Earthquake records were used.

BEAM COLUMN ELEMENT MODEL

It is known that, a two dimensional beam column element has three modes of deformation (axial deformation, flexural rotation at both ends). In program Cosmos/M the element used to represent the beams and columns elements, is Beam 3D element which has the following characteristics:

- a- Two-node line element
- b- Each node has 6 degree of freedom
- c- Shape of element section used is symmetric section
- d- Material nonlinearity is modeled using the Von-Misses elastoplastic model with kinematic hardening
- e- Geometric nonlinearity is considered using large displacement formulation.

EARTHQUAKE RECORDS

Three different earthquakes have been chosen to study the dynamic response of the considered frames. The chosen ground records include Chile EQ., 2010, Sumatra EQ., 2010, and Haiti EQ., 2010 [11,12,13]. Fig5 shows the response spectra for these records scaled to 1.0 G. And table 1 shows the characteristics of the three chosen earthquake records.

Table 1. Summary of the ground motions characteristics

Property Earthquake	P.G.A (cm/sec. ²)	P.G.V (cm/sec.)	Duration of strong mot.	Time of P.G.A (sec.)
Haiti	375.87	15.07	4.68	2.35
Sumatra	518.06	42.90	3.80	6.97
Chile	636.02	106.92	6.05	4.77

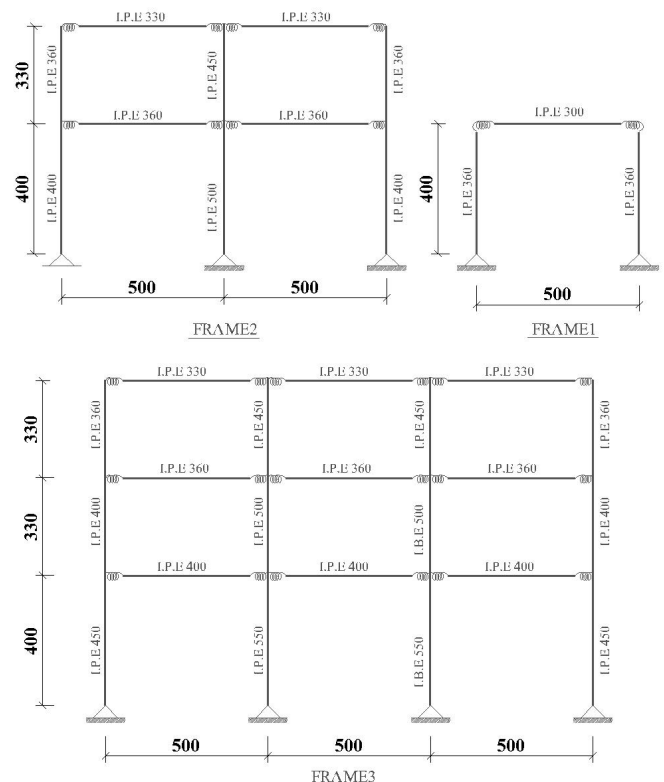


Figure 7. One, two, and three stories frames

NUMERICAL RESULTS

As it was described in the previous section, the parameter which will be used for assessing the damage of the steel moment resisting frame is the behavioral factor for the frame which will be computed from the bigger loop of the base shear-top displacement hysteretic behavior of the frame. Figures 8 to 10 show the base shear-top displacement relationships for the analyzed frames considering different E/Q records and at P.G.A=0.35G. Table 2 show the values of the Q-factor for the analyzed frames and considering different E/Q records (three earthquake records) [11,12.13]. It is noted from the analysis of the results that the values of overall behavior factor are more conservative than those given by Eurocode 8 or UBC, 1997[10].

Table 2. Values of the Q-factor for the studied frames at P.G.A., 0.35G

Frame No.	CHILE 2010	SUMATRA 2010	HAITI 2010
1	3.380	2.871	4.343
2	4.054	3.132	4.859
3	4.217	3.260	5.091

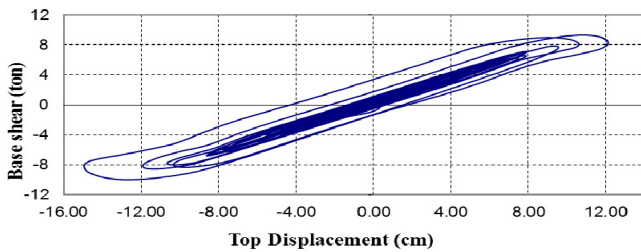


Figure 8. Lateral drift-base shear relationship for the frame 1, considering SUMATRA EQ. at P.G.A, 0.35G

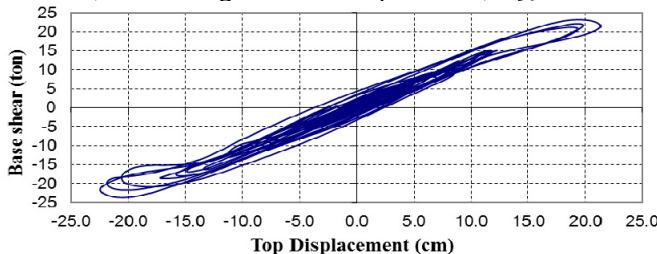


Figure 9. Lateral drift-base shear relationship for the frame 2 considering SUMATRA EQ. at P.G.A, 0.35G

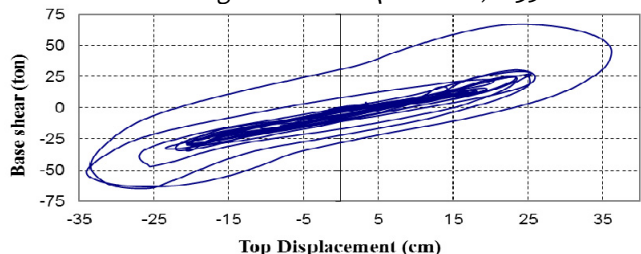


Figure 10. Lateral drift-base shear relationship for the frame 3 considering SUMATRA EQ. at P.G.A, 0.35G

CONCLUSIONS

This paper presents the results of extensive deterministic analysis performed on both SDOF and MDOF systems of moment resisting steel frames under repeated E/Q ground motions. The analysis demonstrated that the reputation of seismic events at short time may lead to damage of the frames which

was assumed when the maximum inner story drift reaches to 4% of the story height. From the analyses of the results the following conclusions can be summarized:

- Some acceleration ground motions cause more inelastic deformations than other for the same frame and at the same P.G.A level which indicates that damage parameters (as behavior factor) can not be accurately specified as recommended by different provisions.
- The global performance of the steel MRF is strongly depending on the inelastic behavior of its beam to column connections.
- The behavior factor for SDOF system is lower than that of MDOF system.
- The behavior factor values calculated are near to those proposed by different seismic codes.

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[13.] HAITI earthquake, Location (HAITI) 12 JANUARY 2010, Magnitude 7.0



NEW KNOWLEDGES AT MACHINING OF IMPROVING HIGHSTRENGTH GRAPHITE CAST IRON BY DRILLING

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ABSTRACT: High fortification of the machined surface of ADI (Austempered Ductile Iron) cast iron can significantly affect its functional properties. This article deals with problems of selected ADI samples, their production and use. On the basis of experimental tests has been identified its machinability, the cutting process during drilling, and also mutual comparison of nodular and grey cast iron, which will further intensify and extend current knowledge of these problems.

KEYWORDS: ADI cast iron, drilling, machinability

INTRODUCTION

The relatively new construct material ADI alloy (ADI – Austempered ductile iron) have a special properties It is a bainite cast iron which we have from heat treatment (isothermal improving) of graphite cast iron with spherical graphite (nodular cast iron). ADI cast iron offers combination of simple properties like steel have. If conditions are fulfilling the ADI cast iron seems like steel for improving for example 42 CrMo4 (15 142), with its properties.

USING OF ADI CAST IRON

ADI cast irons are more low density like steel at same strength, have good wear resistance, elasticity, good sliding conditions and run into good characteristics of internal damping. This is why ADI is rivalrous to steel for forging, improving and steel cast iron.



Figure 1. Single-throw crank-shaft of Volkswagen engine 1,8T material EN-GJS-600-3 (www.lam.mw.tum.de)

Substitute of steel with casting from ADI is still the most frequent mood of application to reduce the manufacturing costs that means saving money or increasing life of workpieces (fig.1).

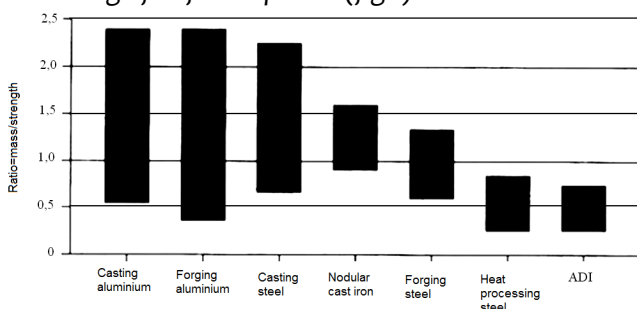


Figure 2. Comparison of material's conditions

If we know ratio between relative mass and slip line of ADI cast iron as against aluminium, steel and nodular cast iron are advantages at using ADI cast iron (fig.2). ADI cast iron are manufactured by isothermal improving, what is process of thermal treatment and it significantly impacts their mechanical properties (tab.1).

Table 1. Mechanical properties of ADI materials according to DIN EN 1564 (BECHNÝ, 2003)

Mark	Number	Rm (MPa)	Rp _{0,2} (MPa)	A5 (%)	HB
EN-GJS-800-8	EN-JS1100	800	500	8	260 to 320
EN-GJS-1000-5	EN-JS1110	1000	700	5	300 to 360
EN-GJS-1200-2	EN-JS1120	1200	750	2	340 to 440
EN-GJS-1400-1	EN-JS1130	1400	1100	1	380 to 480

The properties of ADI are appointed for conditions of higher and high working strains (BECHNÝ, 2003).

EXPERIMENTALLY MEASUREMENT

It was drilled fifteen not continuous holes to prepared samples (fig.4) (drilling to full material) at five cutting conditions. The diameter of drilled holes was $D = 6,8$ mm and deep was $h = 2xD$. For experiment was used machine CNC – tripleaxle milling machine STAMA 325 and a tool GÜHRING 5518 DIN 6537 L91x6,8 mm – PVD TiAlN (fig.3).

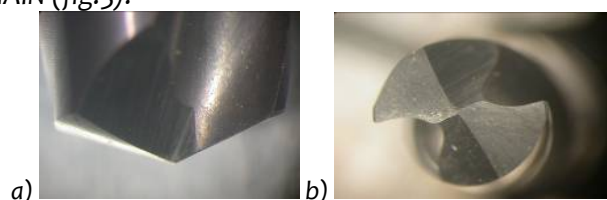


Figure 3. Photos of drilling tool a) back plane P_p , b) working reference plane P_r

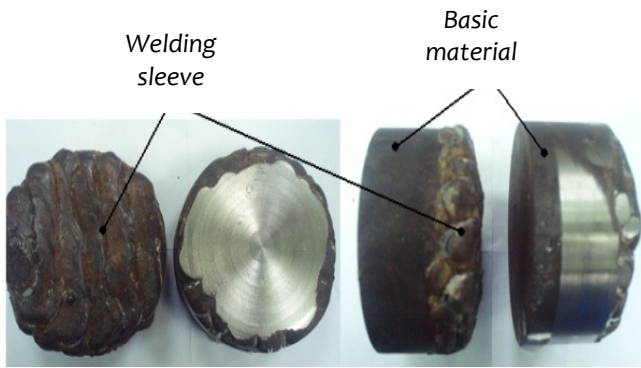


Figure 4. Used samples and their modification to experimentally measurements

Characteristic of used samples and their treatment:

LLG – gray iron:

SRE – without thermal treatment,

SNI – without thermal treatment, on the one side we were surfacing by welding nickel electrode - E-S 723: chemical composition C-0,9%, Si-0,9%, Mn-0,6%, Fe 3,5%, Ni->92%,

LGG – nodular cast iron:

GRE – without thermal treatment,

GPL - sample without thermal treatment on the one side we were surfacing by welding stuffed electrode - RD 592/L13: chemical composition; C-3,98%, Si-3,65%, Mn-0,79%, Cr-0,08%, Ni-0,95%, Cu-0,79%, Mg-0,087%, P-0,06%, S-0,018%,

GTS 1 – sample with thermal treatment at electric furnace with 910 °C temperature, time 30 min. and cooling at salt bath to 410 °C during 90 min., on the one side we were surfacing by welding stuffed electrode - RD 592/L13: chemical composition; C-3,98%, Si-3,65%, Mn-0,79%, Cr-0,08%, Ni-0,95%, Cu-0,79%, Mg-0,087%, P-0,06%, S-0,018%,

GTS 2 – sample with thermal treatment at electric furnace with 850 °C temperature, time 30 min. and cooling at salt bath to 410 °C during 90 min., on the one side we were surfacing by welding stuffed electrode - RD 592/L13: chemical composition; C- 3,98%, Si- 3,65%, Mn-0,79%, Cr-0,08%, Ni-0,95%, Cu-0,79%, Mg-0,087%, P-0,06%, S-0,018%,

ADI cast iron:

ADI TS1 – sample with thermal treatment at electric furnace with 910 °C temperature, time 30 min. and cooling at salt bath to 410 °C during 90 min., on the one side we were surfacing by welding stuffed electrode - RD 592/L13: chemical composition; C-3,98%, Si-3,65%, Mn-0,79%, Cr-0,08%, Ni-0,95%, Cu-0,79%, Mg-0,087%, P-0,06%, S-0,018%,

ADI TS2 – sample with thermal treatment at electric furnace with 850 °C temperature, time 30 min. and cooling at salt bath to 410 °C during 90 min., on the one side we were surfacing by welding stuffed electrode - RD 592/L13: chemical composition; C-3,98%, Si-3,65%, Mn-0,79%, Cr-0,08%, Ni-0,95%, Cu-0,79%, Mg-0,087%, P-0,06%, S-0,018%.

EXPERIMENTALLY MEASUREMENT OF TANGENTIAL COMPONENT OF F_o AND M_k (T)

Experiments were completed on eight samples, where we measured influence of cutting conditions to tangential component of cutting force F_o and torque M_k (T) (fig.5). Measured values were paced to graphs (fig.6, 7).

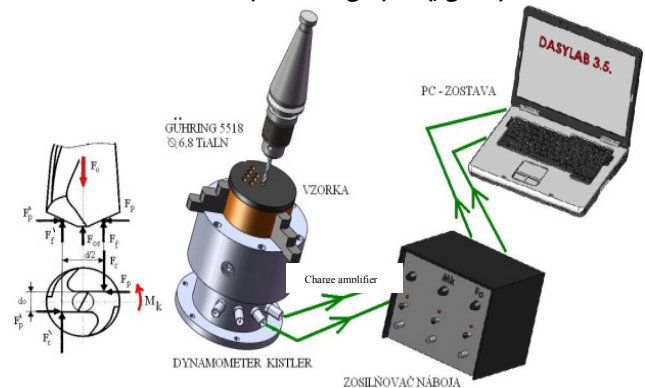


Figure 5. Model of cutting forces measurement at drilling

The result from graphic files is that maximum values of F_o and M_k were measured at sample GPL. Minimum values were measured at samples SNI and SRE (fig.6 and 7). We find out at comparison of F_o and M_k ADI TS1 and ADI TS2 samples that sample ADI TS1 had lower F_o , in some cases by up to 37.8% and less torque M_k up to 27.8% compared with the ADI TS2.

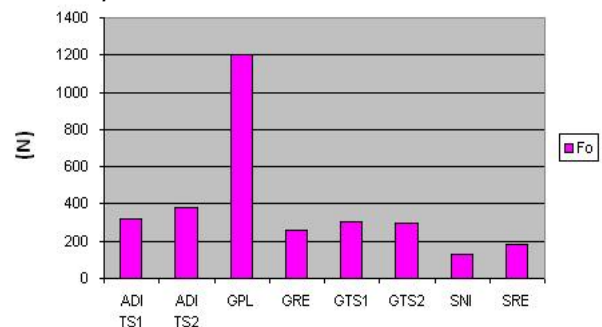


Figure 6. Example comparison of F_o [N] at each sample

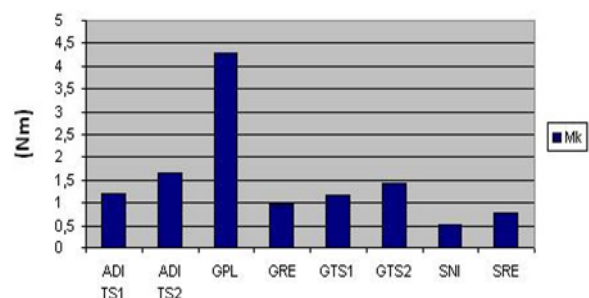


Figure 7. Example comparison of M_k [N.m] at each sample

EXPERIMENTALLY MEASUREMENT OF THE INSTANTANEOUS DEPLETED POWER

The measurement consists in two sections. In first one was measured instantaneous depleted power at idle, that means it was pasted path of machined area without material removal. In second one was measured instantaneous depleted power at load during of machining sample surface (fig. 6, 7).

The graphical results show that the maximum instantaneous value of received power was measured for a sample of the GPL, where the average value in

conditions $v_c = 150$ (m/min), $v_f = 491$ (mm/min), $n = 7021$ (r/min) = 653. Minimum values were measured at SRE, where the average value of received power in conditions $v_c = 100$ (m/min), $v_f = 140$ (mm/min), $n = 4681$ (r/min) = 510.8 W.

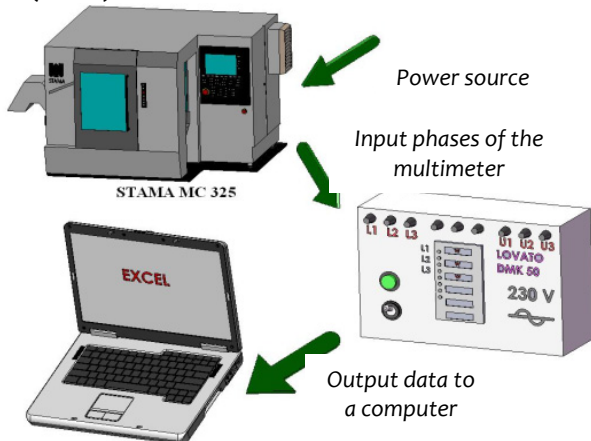


Figure 8. Scheme of measurement of the instantaneous depleted power



Figure 9. Comparison of power active components at idle and at load in drilling one hole

When compared to the reciprocal waveforms of samples ADI TS1 and ADI TS2 (Fig. 10), we found that the sample TS1 ADI had a lower value of received power at the cutting conditions $v_c = 70$ (m/min), $v_f = 229$ (mm/min) $n = 3276$ (r/min) of 7,4%; $v_c = 100$ (m/min), $v_f = 140$ (mm/min), $n = 4681$ (r/min) of 4,5% and $v_c = 150$ (m/min), $v_f = 491$ (mm/min), $n = 7021$ (r/min) of 8,9% compared with the ADI TS2.

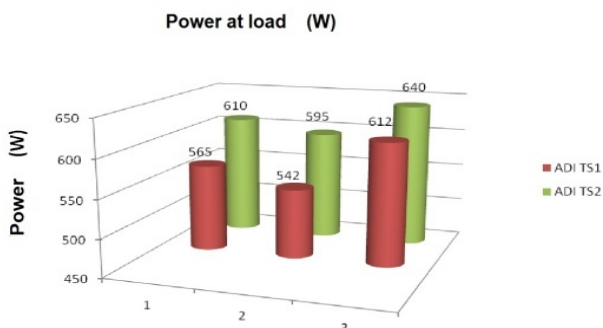


Figure 10. Total comparison of the instantaneous depleted active power at load in conditions: 1- $v_c=70$ (m/min), $v_f = 229$ (mm/min), $n=3276$ (r/min); 2- $v_c=100$ (m/min), $v_f = 140$ (mm/min), $n=4681$ (r/min), 3- $v_c=150$ (m/min), $v_f = 491$ (mm/min), $n=7021$ (r/min)

From economic view is measurement of instantaneous depleted active power very important. It is factor,

which impacts the choice of technological process, cutting material and also choice of machined material. Since finances are nowadays an important factor in production, we must not forget indicators, such as the instantaneous depleted power.

CONCLUSIONS

Machinability of these cast irons significantly worse particularly high hardness and a higher percentage of silicon, which acts abrasive on the tool. Based on this knowledge and material characteristics were carried out experiments which allow to more identify machinability and cutting process for drilling in ADI cast iron.

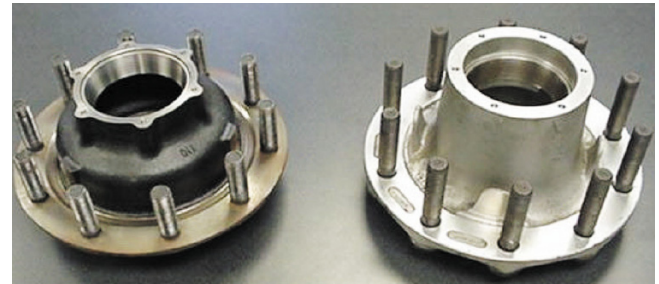


Figure 11. Comparison of the hub of a motor vehicle on the right side ADI design, on the left side solution of aluminium alloy (www.claasguss.de)

Research ADI cast iron contributes to continuous improvement of the manufacturing process and reduce production costs by using these cast irons as a compensation of steel forged parts and also as a compensation of aluminium alloys (fig.11), and casting from the ADI cast iron is about 2% lighter and 20% cheaper.

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IMPLEMENTATION OF ADVANCED COMMUNICATION SYSTEMS AND DISTANCE LEARNING CONCEPT AT POLITECNICO DI TORINO WITHIN THE UNIVERSITY EDUCATION PERSPECTIVE

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ABSTRACT: New dimension and possibilities for teaching and education in all fields are offered by the use of information and communication technologies (ICT) and e-learning systems. The introduction of these systems will improve, supplement and aid traditional teaching methods and will also enable the beginning of different teaching and learning processes that are less limited in space and time. This offers also new insight into subjects that are not possible with traditional methods. The Centre for e-learning activities and the multimedia production and testing (CELM) at Politecnico di Torino, aims to be the institutional reference for the coordination of support activities in the area of technology and multimedia training. The Centre puts the particular emphasis on skills in e-learning and open and distance learning and on the activities related to the release and testing of multimedia technologies. This paper is presenting the use of high technology communication systems at Politecnico di Torino, implemented with the purpose of improved university education. Also, the multidisciplinary working systems, communication models, multimedia and video production, videoconferencing systems and special services for disabled, are briefly described.

KEYWORDS: communication technology, e-learning, videoconferencing systems

INTRODUCTION

Modern society relies on efficient education with greater output for less money, and these demands can be satisfied through implementation of eLearning in education system. The use of eLearning in education provides easier access to lectures, making them more flexible and more widely available to students from geographically distant locations. Also, it provides numerous services to academic community and third parties in region. The particular dedicated centres which are primarily focused on eLearning in higher education are targeting both teaching staff and students.

The benefits the teaching staff will have from eLearning are:

- eLearning permits lecturers to develop materials using the world-wide resources of the Web.
- Allows lecturers to communicate information in a more engaging fashion than in text-based distance education programs. eLearning offers a wide-range of text, diagrams and images with video and sound, including virtual reality technology that in the future will improve the effectiveness of the approach even further.
- Allows lecturers to access at any convenient time and from any convenient place.
- Allows lecturers to package essential information for all the students that will access. Lecturers can then concentrate themselves on high level activities.
- Retains records of discussion and allows for

later reference through the use of threaded discussion on bulletin boards.

- Generates more personal gratification for lecturers through quality student participation.
- Reduces travel and accommodation costs.

The students will benefit from eLearning in the following ways:

- eLearning fosters interaction among students and instructors. Interaction stimulates understanding and the recall of information.
- Accommodates different learning styles and fosters learning through a variety of activities that apply to different learning styles.
- Fosters self-paced learning whereby students can learn at the rate they prefer.
- Makes convenient for students to access at any time and from any place.
- Reduces travel time and travel costs for students.
- Encourages students to browse information through hyperlinks to sites on the worldwide Web and there by find information relevant to their personal situations.
- Allows students to select learning materials, or to be directed to content that meets their level of knowledge, interest and what they need to know to perform more effectively in their particular activity.
- Provides context sensitive help (Electronic performance support systems) to computer users and helps them complete tasks on-the-fly.
- Develops knowledge of the Internet that will

help learners throughout their careers.

- Encouraging students to take responsibility for their learning and succeeding builds self-knowledge and self-confidence

CeLM, Centre for e-Learning and Multimedia at the Politecnico di Torino, is divided into sections of competence and production experience, with high-profile areas that cover some of the professional strategic communications and dissemination of educational, scientific and research content. The Centre has the following purposes:

- To promote and coordinate the development of e-learning and open and distance learning within the University, providing the necessary services and organizational support
- Work in close collaboration with other organizations, both Italian and foreign, operating in the field of e-learning and multimedia communication, even within national and European Community projects.
- Enhance the professionalism and expertise in the field of corporate communication, interpersonal communication, multimedia and interactive complex media systems.
- Develop and support in terms of technology and organizational activities related to institutional marketing, promotion and image promotion and communication of events and their design.
- To promote the use of multimedia technologies within the Politecnico.
- Provide assistance to teachers in the planning and teaching in the creation and preparation of materials for e-learning.

The interest areas of the centre multidisciplinary competence are: communication, multimedia production, services, special activities dedicated to disabled persons.

THE COMMUNICATION ACTIVITIES OF THE CENTRE FOR E-LEARNING

The **communication facilities** are divided into three main services, namely: OndeQuadre, Monitor Style and Polistream.

OndeQuadre is the web radio of the Politecnico, born to support internal community of the university: teachers, administrative staff and students. This radio is providing information, service and culture conveyed through entertainment and music. It is posed as a real amplifier of the voice, the potential and vitality of the University as a unique communication tool designed for students and by the students. Through the website link, users can access to the live streaming radio content.

OndeQuadre provides news, interviews and insights direct spread of the main events organized by the

Politecnico and media partners for some of the main cultural events in Piedmont, which provides coverage with special broadcasts, podcasts and blogs.

Furthermore, the **MonitorStyle** takes care of delivering content through a network of monitors located throughout the university, providing a real means of communication for the Politecnico. The program consists of some fixed program, in which the School, the Departments, Centres and Services and external partners can give information their potential users. It is provided an interaction with the users through a series of items to which anyone can send its contribution. Last news service is also provided.

Finally, **Polistream** is born as an archive of documentary videos, produced by operators and related to the facilities at the Politecnico di Torino, available for free in streaming video and audio in the internet environment. This archive is saving the events related to the institutional life of the university such as the academic year inauguration ceremonies, the public parts of the Academic Senate meetings, conferences and conventions, seminars and hosted cultural events which are sort of a special interest and transmitted by live audio-video network.

THE MULTIMEDIA ACTIVITIES OF THE CENTRE FOR E-LEARNING

CeLM deals with video and **multimedia productions** in the area of cultural communication and training. The Centre is one of the pioneers in the creation of courses for teaching and learning. Activities include the design of integrated graphics and video material, direction and video documentation of conferences and events, the design and implementation of scientific and cultural documentaries, as well as institutional and promotional videos. The production centre features advanced hardware and software, and professional installation of two modern rooms, one designed for chroma key full-digital and one analogue. CELMA is able to follow the various project phases - design, production and post-production - making use of established professionals, and to articulate the complexity of the project according to customer requirements.

The provided **service** of the centre is mostly based on distance learning concept and videoconferencing activities. The **distance learning courses** constitute a valid and proven alternative to traditional ones. It is found an increasing interest by those who wish to resume their university studies, as well as by those who need retraining or continuing education. CeLM (in collaboration with the IT department) manages the operation of educational records. This service is making available an e-learning platform integrated into the Educational Portal of the recordings of lectures held in the classroom. The final scope is the production of material and services in digital format

and their distribution channels through computer accessible from anywhere and at any time, reducing time and space constraints in such a way that students can more easily and quickly use university services and therefore increase the efficiency of the services themselves.

These recordings are one of the tools provided to students enrolled at Politecnico, but are made available to students enrolled in special courses. In particular, since the academic year 2010/2011, the courses to which it is guaranteed to be available in streaming on-line, are both from bachelor and Master of Science level at the departments of Mechanics, Computer Engineering and Electronics.

Videoconferencing, in its most basic form, is the transmission of synchronized image (video) and speech (audio) back and forth between two or more physically separate locations, simulating an exchange as if the two (or more) participants were talking each other in the same physical location. This is accomplished through the use of cameras (to capture and send video from your local endpoint), video displays (to display video received from remote endpoints), microphones (to capture and send audio from your local endpoint), and loud speakers (to play audio received from remote endpoints).

To make easier the attendance at meetings is one of the simplest yet most popular uses of videoconferencing. For meetings that already regularly take place and require face-to-face communication, videoconferencing can substitute for the actual physical presence of remote participants (Figure 1). This reduces travel costs as well as travel time and makes meeting attendance more convenient. It can also make meetings more likely to occur. Frequent and/or ad hoc meetings that might not have been scheduled due to travel costs and timing can be enabled via videoconferencing and enhance the sense of teamwork among people at different locations but working on the same project. Videoconferencing provides remote participants with much of the face-to-face familiarity that comes with physical presence, including elements of facial expression, body language, and eye contact. So it is evident the advantages with respect to the phone conference, that are also used quite often, where the participants are not visible to each other. If videoconferencing is readily available on individual desktops, the cohesive effects of this enhanced communication can be even greater. Collaborative work can then be enhanced further through the integration of videoconferencing with collaborative electronic tools (data transfer, shared whiteboards, and shared applications.)

Distance education often comes to mind first when considering the former situation, but several other

existing types of communications can also be enhanced or extended. These include organizational and cross-organizational meetings, counselling, foreign language and cultural exchanges, and telecommuting. Communication is already occurring in each of these applications, but could be made more compelling, more effective, or less expensive through the use of videoconferencing.

Point to Point Call: Group to Group

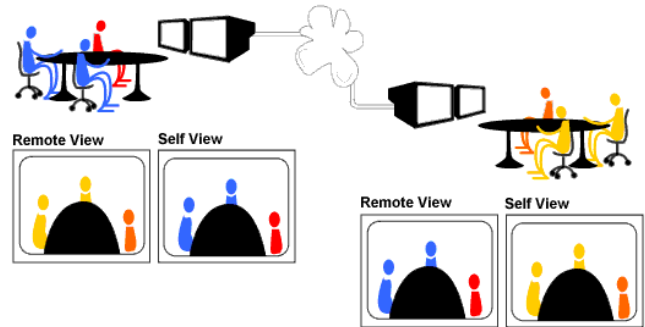


Figure 1. Group to group videoconference session concept

CeLM provides a consolidated and articulated service of videoconferencing (audio / video) and interactive (streaming) to support teaching, research and institutional events, such as:

- lessons for traditional degree programs and distance learning studies to the campuses and various centres;
- lessons for master of science courses at Italian and foreign universities;
- thesis defence for the students who will achieve the double title "Italian-foreigner degree";
- interaction between students of different universities, both Italian and foreign;
- presentation of the training of the Politecnico of Turin to the high school institutions located throughout the country;
- seminars and conferences with Italian and foreign universities;
- coordination meetings of national and international projects

Finally, **services for disabled students** are also the target of the centre work. Some students with disabilities need support in terms of hardware / software, to use a PC and obtain a good autonomy in the study. For over 10 years CeLM, faced with specific cases, is able, after a careful study of verbal and mobility skills of the student, to propose a suitable IT solution through the use of assistive technology in order to solve the problems caused by disability. As part of this project, CeLM faced so far with two types of disability, visual and motor respectively, is proposing solutions and interventions targeted at different types.

In the frame of the same idea, the Laboratory for Information, Support and Access for the Disabled - LISAD was born as a computer lab equipped for disabled students of the Politecnico di Torino, who have the opportunity to use a proper space, laboratory services and a wide range of technological aids. This laboratory has developed a long series of interventions aimed at making the services more accessible to students enrolled on degree courses in distance and with particular attention to those who are in conditions of disability. Arise in this context also the design and implementation of the new web site in an accessible version. Web accessibility refers to the ability to use content and services independently of the disability and hardware and software availability. To achieve this, they follow the guidelines for Web Content Accessibility multimedia standard, WCAG 1.0, WAI - W3C trying to reach a level of compliance equal to the Double-A (AA WCAG 1.0). The development process was not limited only to the respect of technical requirements, but took into account the knowledge of the real problems and needs of users which are targeted, and research and field testing of technologically innovative solutions to resolve them. These elements have helped to characterize the web site of the new degree courses in distance.

THE OTHER ACTIVITIES OF THE CENTRE FOR E-LEARNING

Beside previously mentioned activities, the CeLM is also dedicated to other projects that are supporting the idea of sustainable education at Politecnico di Torino. The center produced the web site "IELTS Speaking Practice," according to the needs expressed by the CLA (Language Centre), designed to practice the English language in the form of exercises and listen to argument content varies, all supported by a dedicated vocabulary accompanied by audio recording of the words. The main purpose is to allow students who must be certified by the English language test IELTS (International English Language Testing System) to practice a path similar to the perception expressed during the exam. By the use of this service, the students are able to:

- practice listening of the questions that will meet during the IELTS exam;
- try to answer the questions that are asked during the session of the IELTS test;
- check their pronunciation and vocabulary, the correct use of terms;
- independently evaluate and improve the level of their skill aimed with IELTS.

CONCLUSIONS

Distance learning concept exploits interactive technologies and communication systems to improve the learning experience, also by use of modern

videoconferencing communication systems. It has the potential to transform the way of teaching and learning across the board and it can raise standards, and widen participation in lifelong learning. It cannot replace teachers and lecturers, but alongside existing methods it can enhance the quality and reach of their teaching, and reduce the time spent on administration. Implementing the eLearning solution will involve a complex mix of technical and "soft" skills training, systems integration and content development and customization that will make possible a truly ambitious education system for a future learning society.

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GLOW DISCHARGE OPTICAL EMISSION SPECTROSCOPY OF CARBONITRIDED LAYERS

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ABSTRACT: The aim of the present work is to investigate the possibility of applying glow discharge optical emission spectroscopy while building the profile of nitrogen and carbon distribution in carbonitrided layers. 25CrMnSiNiMo steel and Armco-iron have been carbonitrided in low-temperature plasma in ammonia and argon medium. The results show that increased amount of carbon is observed both in the combined zone and in the diffusion zone of the carbonitrided layer. It has been established that after carbonitriding of 25CrMnSiNiMo steel and Armco-iron at $t=550\text{ }^{\circ}\text{C}$, $P_{\text{NH}_3} = 280\text{ Pa}$, $P_{\text{Ar} + 18\% \text{ CO}_2} = 120\text{ Pa}$, $\tau = 4\text{ h}$, the most gradual change of the distribution of nitrogen and carbon is achieved in the carbonitrided zone of the layer.

KEYWORDS: carbonitrided layers, low-temperature plasma, GDOES analysis

INTRODUCTION

Since the beginning of the 1970s glow discharge sources have been used predominantly in the field of investigating alloys. The scientific literature suggests a great number of applications based on glow discharge spectrometers, not supposed so far, including polymeric mass-spectrometry, sensitive assessment of nano-materials, as well as analysis of very thin ($<0,1\text{ }\mu\text{m}$) layers [1, 2, 3, 4]. The glow discharge optical emission spectroscopy (GDOES) is an atomic emission process for carrying out deep profile analysis. It combines pulverization and atomic emissions in order to enable an extremely fast and sensitive analysis. The plasma is generated in the chamber by applying voltage between the anode and the cathode with the availability of argon under low pressure. The ionized argon atoms cause pulverization in the area of the sample. The deposited atoms are excited in the plasma and radiate photons with characteristic wave lengths.

The glow discharge is initiated by the application of high enough voltage between two electrodes in contact with inert gas (typically Ar). The potential difference (250-2000V) leads to inert gas decomposition which results in forming positively charged ions and free electrons. The relative potential of the cathode (-) and the anode (+) leads to originating an electrical field and the positively charged ions are accelerated until they reach the cathode surface. The products of the pulverizing process are atoms and small particles from the cathode material, as well as ions and secondary electrons. The positive Ar^+ ions, derived from the glow discharge plasma, are focused onto the sample. The energy of the ions and the intensity of the irradiation can be different. As a result from the ion irradiation the surface of the sample erodes due to the ion

pulverization and the pulverized atoms cross into the gas phase.

The atoms, freed from the sample, are excited by the plasma, chiefly due to the electron collisions and become a source of characteristic radiation detected by the spectrometer. If the surface erosion percentage is known, the time, depending on the intensity of the characteristic elementary radiation line, measured experimentally, can be converted into quantitatively distributive profile of the element in the volume of the sample [2].

The GDOES investigations are carried out by means of a glow discharge source and an optical spectrometer. They enable performing a deep profile of the chemical composition of a solid material layer. For the purposes of the analysis of the solid material layers argon ions are forced into the glow discharge plasma on the cathode combined sample surface. As a consequence of an impulse exchange of argon ions, mostly atomic particles are detached from the surface of the sample. The positive argon ions are derived from the glow discharged plasma, and then they are focused and directed towards the sample. The atoms, freed from the sample, are excited in the plasma, mostly due to the electron collisions and they become a source of characteristic radiation, detected and analyzed by the spectrometer.

The GDOES is usually used for defining surface coatings, hidden connections, and deep profiles. The technique suggests quick, reliable and economically effective decisions. It suggests additional information for the rest of the surface analysis methods [3].

The aim of the present work is to investigate the possibility for defining the nitrogen and carbon distribution in depth of a layer, formed in low-temperature plasma in a medium of ammonia and argon.

METHODOLOGY OF INVESTIGATION HEAT TREATMENT

The following materials have been chosen for the investigation: Armco-iron and construction steel alloy - 25CrMnSiNiMo. The chemical composition of the above materials has been tested by means of equipment for automatic analysis “Spectrotest” and given in Table 1.

Table 1. Chemical composition of the investigated materials

Materials	Chemical elements, weight percentages				
	C	Si	Mn	Cr	Ni
Armco-iron	0.02	0.01	0.07	0.02	0.03
25CrMnSiNiMo	0.24	1.45	1.28	0.87	1.36
Materials	Chemical elements, weight percentages				
	S	P	Mo	V	
Armco-iron	0.002	0.002	0.02	-	
25CrMnSiNiMo	0.002	0.002	0.12	-	

Samples, sizing 15 x 15 x 10 mm, have been made from the materials; 25CrMnSiNiMo steel has been thermally treated to hardness 35HRC, and the hardness of the Armco-iron is 75HB. Treated this way, the samples have been then grinded to surface roughness $R_a = 0.63 \mu\text{m}$. Afterwards they have been ion nitrided and carbonitrided in an installation for nitriding “Ion-20” under the modes, given in Table 2. Ammonia (NH_3) and corgon (82 % Ar u 18% CO_2) in different percentages have been used as saturating gases. The temperature of treatment for both processes – nitriding and carbonitriding – is 550°C.

Table 2. Modes and results from the ion carbonitriding and the nitriding of the samples from 25CrMnSiNiMo–steel and Armco-iron

№ mode	τ [h]	P_1 NH_3 [Pa]	P_2 corgon [Pa]	P total [Pa]	25CrMnSiNiMo		
					$HV_{0,1}$	δ_{tot} [μm]	$\delta_{c,z}$ [μm]
1	2	360	40	400	940	160	5
2	6	360	40	400	860	290	8
3	6	200	200	400	920	240	8
4	2	200	200	400	890	150	5
5	4	280	120	400	930	210	9
6	4	400	-	400	1072	250	10

№ mode	τ [h]	P_1 NH_3 [Pa]	P_2 corg on [Pa]	P total [Pa]	Armco-iron			
					$HV_{0,1}$	δ_{tot} [μm]	$\delta_{c,z}$ [μm]	U [V]
1	2	360	40	400	430	260	6	470
2	6	360	40	400	420	340	7.5	470
3	6	200	200	400	440	330	7	415
4	2	200	200	400	370	210	6	415
5	4	280	120	400	480	280	7	435
6	4	400	-	400	415	290	6	530

GLOW DISCHARGE OPTICAL EMISSION SPECTROSCOPY

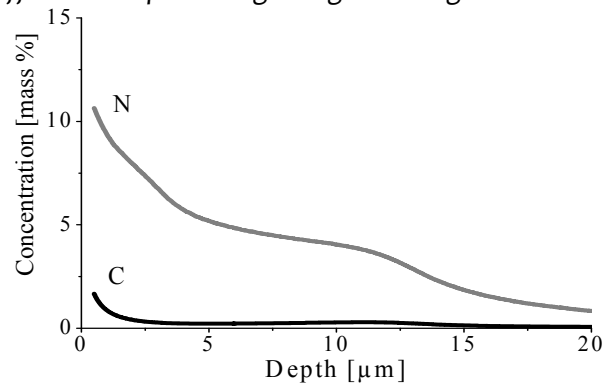
The process of defining the distribution of nitrogen and carbon in the nitrided and carbonitrided samples has been realised by means of the GDOES device GDA – 750, vom Spectruma-Analytik GmbH. The parameters of the glow discharge plasma are as follows: current - 20 mA, voltage - 800 V, plasma density - 10^{10} - 10^{11} cm^{-3} , electron temperature 0.1 - 0.5 eV and plasma volume 15 cm^3 . The turbomolecular pump (56 l s^{-1}) works constantly. The basic pressure is 10^{-6} Pa . The surfaces are polished beforehand in order to achieve

congestion in the plasma sector of the GDOES device. The standardizing of the device has been carried out with a sample containing 7 weight per cents of nitrogen and 1 weight per cent of carbon.

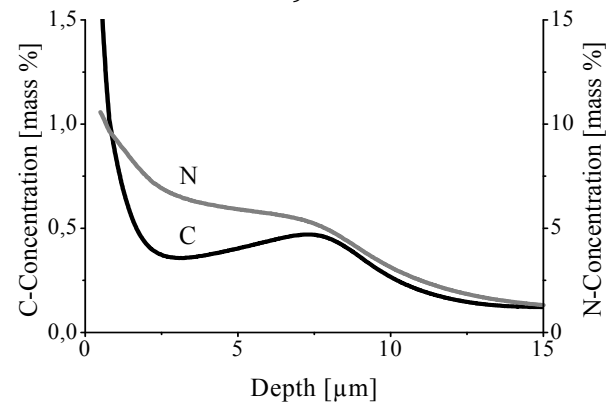
RESULTS FROM THE ANALYSIS AND THE INVESTIGATIONS

25CrMnSiNiMo STEEL

After nitriding under the mode 6 (Table 2) a layer is formed in 25CrMnSiNiMo steel with micro-hardness of 1072 $HV_{0,1}$, total thickness of 250 μm and combined zone thickness of 10 μm . The distribution of the diffused in depth nitrogen is given in Figure 1.



a) after nitriding of 25CrMnSiNiMo steel at: $t = 550 \text{ }^\circ\text{C}$, $P_{\text{NH}_3} = 400 \text{ Pa}$, $\tau = 4 \text{ h}$



b) after carbonitriding of 25CrMnSiNiMo steel at: $t = 550 \text{ }^\circ\text{C}$, $P_{\text{NH}_3} = 360 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 40 \text{ Pa}$, $\tau = 6 \text{ h}$

Figure 1. Carbon (C) and nitrogen (N) concentration in depth

From Figure 1a it can be noted that the concentration of the nitrogen in the nitrided layer has not changed (0,25%) at the border of the basic material and the combined zone (8.7 μm). This can be explained by the fact that during the process of nitriding carbon has diffused from the core material out to the surface. The pulverization on the surface and the obtained concentration gradient of the carbon are prerequisites for diffusion of carbon into the surface at the initial phase of the process of nitriding. The nitrogen concentration on the surface of the combined zone reaches 11,1%. After the process of ion nitriding the curve of nitrogen and carbon distribution in the nitride zone of the layer changes gradually.

When, except for ammonia, 10% corgon is introduced into the chamber in addition, (Table 2, mode 2), a

carbonitrided layer with lower total thickness (290 μm) and combined zone thickness (8 μm) than they are in the nitrided layer is obtained.

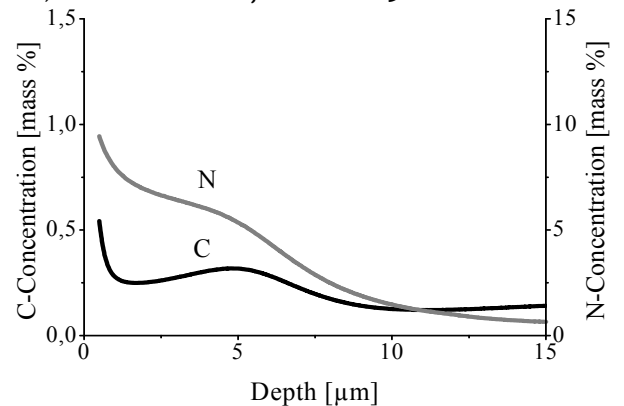
It can be noted that after carbonitriding in the media of 90% NH_3 + 8.2% Ar + 1.8% CO_2 at 400Pa pressure, a layer with lower micro-hardness, total thickness and combined zone thickness, than after the process of nitriding, is obtained. This is probably due to the availability of argon in the saturating medium, which, owing to its bigger atomic mass, has strong pulverizing action. With the high coefficient of pulverization the length of the free run of the pulverized atoms is bigger and the possibility for backward diffusion of the nitrogen and carbon is lower. Lower concentration of nitrogen (10%) and higher content of carbon by nearly 50% is obtained in the combined zone of the carbonitrided layer, compared to the nitrided one – Figure 1b.

It can be seen from Figure 1b that the concentration of carbon (0,48%) has increased at the border between the basic material and the combined zone, while under the carbonitride zone gradual change of the carbon content has been observed. This can be explained by the simultaneous saturation of the surface both with nitrogen and carbon, where part of the nitrogen atoms is replaced by the carbon ones.

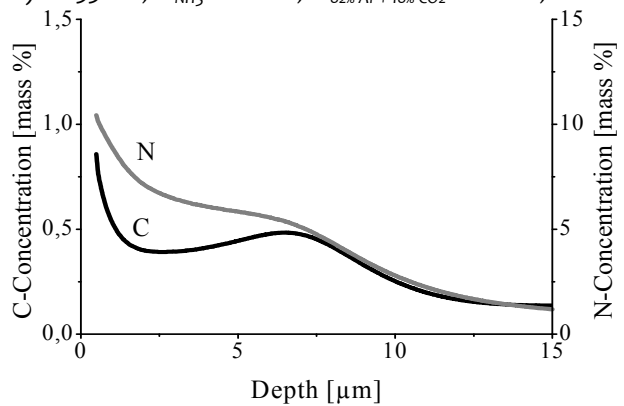
With the increase in the argon pressure ($P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 200 \text{ Pa}$, Table 2, modes 3 and 4) in the gas medium, after carbonitriding of 25CrMnSiNiMo steel, carbonitrided layers are formed, having lower micro-hardness (890 – 920 $\text{HV}_{0,1}$), total thickness (150 – 240 μm) and combined zone thickness than under the rest of the modes of treatment. This is due to the increased activity of pulverization, as the amount of argon in the gas medium is higher – 41%. The higher degree of pulverization leads to decreasing the probability for collisions between the atoms and ions, as a result of which lower amount of nitrogen and carbon is delivered to the surface. Lower concentration of nitrogen (20%) and increased content of carbon with nearly 20% is obtained in the combined zone of the carbonitrided layer in comparison with the nitrided one – Figure 2.

It can be seen from Figure 2a that at the end of the combined zone of the layer, at 5 μm depth, slight increase of the carbon up to 0,3 % is observed, while at the beginning of the combined zone the carbon is over 0,5 %. The concentration of the nitrogen in the carbonitrided zone decreases sharply, reaching at the end of the combined zone the level of 4.9 %, while the nitrogen on the surface is 9.1%. With prolongation of the time of carbonitriding from 2 to 6h (Table 2, mode 3) the micro-hardness and the combined zone thickness increase. Significant increase in the concentration of carbon in the combined zone can be

seen from Figure 3, where it achieves the level of 0,81% on the surface and slightly decreases at the end of the zone – down to about 0,5%. The distribution of the nitrogen in the carbonitrided zone decreases gradually. At the border between the diffusion zone and the combined zone the nitrogen concentration is 5.8 %, while on the surface it is 10.5%.



a) $t = 550 \text{ }^\circ\text{C}$, $P_{\text{NH}_3} = 200 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 200 \text{ Pa}$, $\tau = 2 \text{ h}$



b) $t = 550 \text{ }^\circ\text{C}$: $P_{\text{NH}_3} = 200 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 200 \text{ Pa}$, $\tau = 6 \text{ h}$

Figure 2. Distribution of carbon (C) and nitrogen (N) in depth after carbonitriding of 25CrMnSiNiMo steel

After carbonitriding of 25CrMnSiNiMo steel under the 5th mode of treatment from Table 2 in the gas medium of 70% NH_3 + 24,6 % Ar + 5,4 % CO_2 at 400 Pa pressure, a layer is obtained with total thickness 210 μm , maximum micro-hardness 930 $\text{HV}_{0,1}$ and combined zone thickness 9 μm . The distribution of the nitrogen and carbon in depth of the carbonitrided zone changes gradually, staying almost the same up to 7,5 μm – Figure 3.

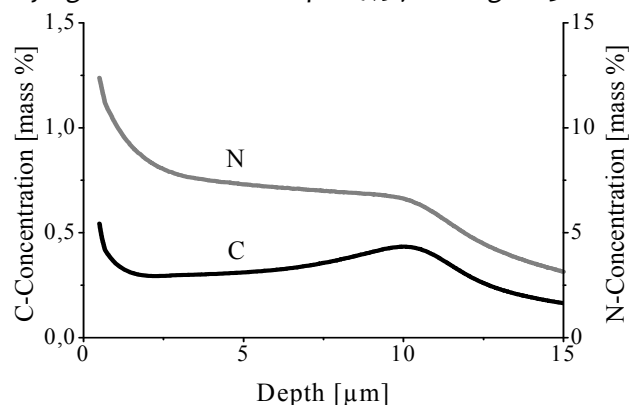


Figure 3. Distribution of carbon (C) and nitrogen (N) in depth after carbonitriding of 25CrMnSiNiMo steel at: $t = 550 \text{ }^\circ\text{C}$, $P_{\text{NH}_3} = 280 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 120 \text{ Pa}$, $\tau = 4 \text{ h}$

Significant increase in the concentration of carbon at the beginning of the combined zone can be seen from Figure 3, where it reaches the level of 0,52% and slightly decreases at the end of the carbonitrided zone, going to about 0,48 %. The distribution of the nitrogen in the carbonitrided zone changes gradually and its concentration at the end of the combined zone reaches the level of 7%, while at the beginning of the combined zone it is about 12,2 %. Under this mode of treatment the highest level of nitrogen concentration 12.2 % is achieved in the combined zone and the most gradual change of the content of nitrogen and carbon in the formed layer occur in comparison to all the other modes of ion carbonitriding of 25CrMnSiNiMo steel.

ARMCO-IRON

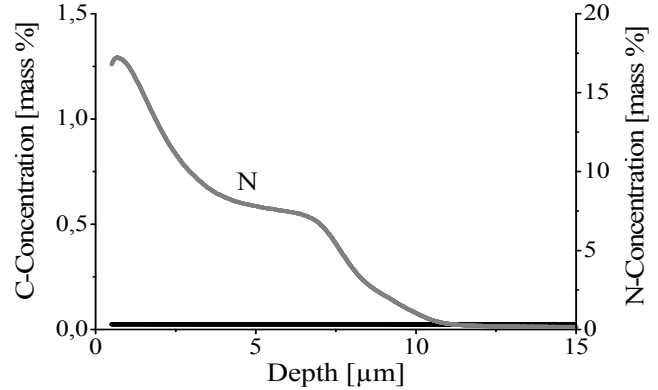
After nitriding of Armco-iron under the 6th mode of treatment from Table 2 a layer with micro-hardness of 415HV_{0,1}, total thickness of 290 μm and combined zone thickness of 6 μm is obtained. It can be noted from Figure 4a that the concentration of carbon in the nitrided layer has not changed at the border between the basic material and the combined zone. No increase of the carbon concentration on the surface of the layer is observed. The nitrogen concentration on the surface of the combined zone reaches 17,1%. After the process of ion nitriding the curve of the nitrogen distribution in the nitride zone does not change gradually.

Under the modes of nitriding 25CrMnSiNiMo steel is with higher micro-hardness but lower total thickness of the layer and thicker combined zone than Armco-iron. This is explained by the content of alloying constituents in the steel, which take part in forming the nitrides and hardening the surface layer. They inhibit the diffusion of nitrogen in depth, as a result of which thinner layers with thicker combined zones are obtained.

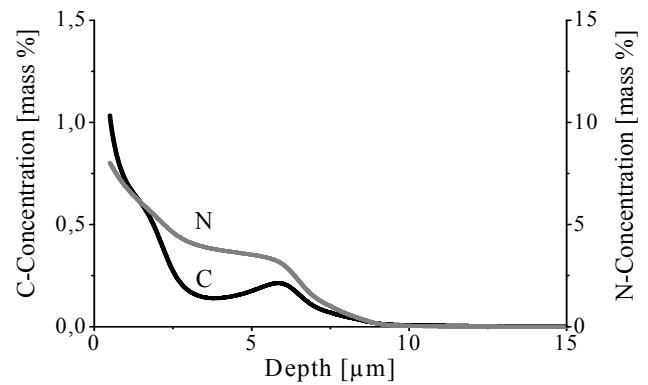
In Armco-iron carbonitriding under the 4th mode of treatment (50%HN₃ + 41% Ar + 9 %CO₂) from Table 2 a layer with surface micro-hardness of 370HV_{0,1}, total thickness of 210 μm and combined zone thickness of 6 μm is obtained and the distribution of nitrogen and carbon in depth of the carbonitrided zone is given in Figure 4b.

From Figure 4b it can be seen that at the end of the combined zone at 6 μm depth slight increase of the carbon content to 0,24 % is observed, while at the beginning of the combined zone the carbon content reaches 1 %. The figure shows that the distribution of carbon in depth of the combined zone is sharp to 3 μm depth with concentration of 0,20 %. At the end of the carbonitrided zone the carbon concentration increases to 0,24 %. The nitrogen distribution change in the carbonitrided layer goes gradually. At the end of

the combined zone (6 μm) its concentration reaches 3.4 %, while at its beginning the concentration is 8.3%.

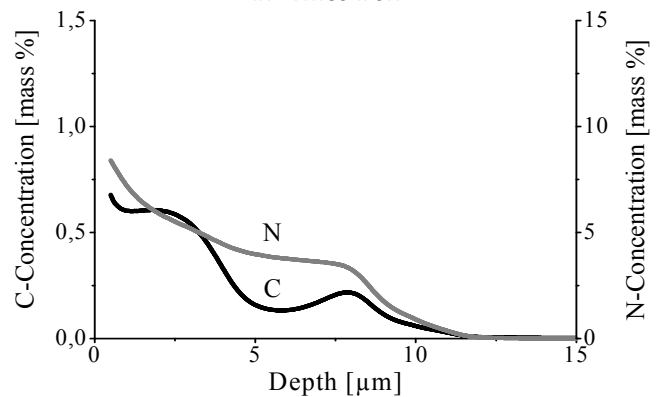


a) after nitriding $t = 550^{\circ}\text{C}$, $P_{\text{NH}_3} = 400 \text{ Pa}$, $\tau = 4 \text{ h}$

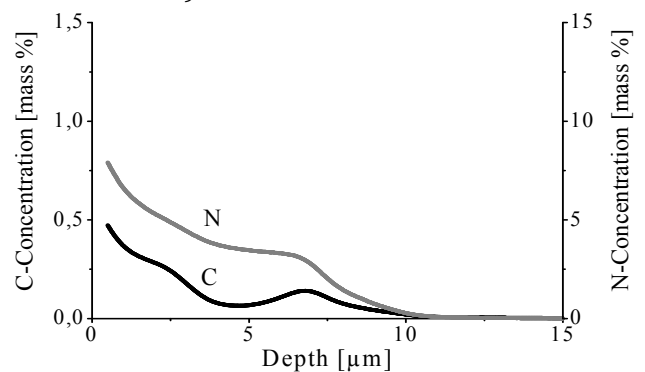


b) after carbonitriding $t = 550^{\circ}\text{C}$, $P_{\text{NH}_3} = 200 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 200 \text{ Pa}$, $\tau = 2$

Figure 4. Distribution of carbon (C) and nitrogen (N) in Armco-iron



a) after carbonitriding at: $t = 550^{\circ}\text{C}$, $P_{\text{NH}_3} = 280 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 120 \text{ Pa}$, $\tau = 4 \text{ h}$



b) after carbonitriding at: $t = 550^{\circ}\text{C}$, $P_{\text{NH}_3} = 360 \text{ Pa}$, $P_{82\% \text{ Ar} + 18\% \text{ CO}_2} = 40 \text{ Pa}$, $\tau = 2 \text{ h}$
Figure 5. Distribution of carbon (C) and nitrogen (N) in Armco-iron

After ion carbonitriding of Armco-iron under the 5th mode (70%HN₃ + 24,6% Ar + 5,4 %CO₂) from Table 2, a layer with the highest surface micro-hardness 480HV_{0,1} is obtained, in comparison to all the other modes of treatment, which can be explained by the distribution of carbon and nitrogen in the carbonitrided zone - Figure 5a.

The figure illustrates that in depth of the combined zone increased carbon concentration of up to 0,68 % on the surface is observed, while it stays almost constant (0,65 %) at 3 μm depth. After that, at 6 μm, sharp decrease of the carbon content is observed, together with its increase (0,25%) at the end of the carbonitride zone of the layer.

The distribution of nitrogen in the carbonitride zone goes up gradually reaching 8,5 % on the surface, while at 3 μm depth it is 5.1%. It can be noted that under this mode of carbonitriding the nitrogen and carbon concentration changes more gradually and this concentration is higher in depth of the carbonitrided zone of the layer.

Figure 5b illustrates the distribution of carbon and nitrogen in Armco-iron after carbonitriding at: t = 550 °C, P_{NH₃} = 360 Pa, τ = 2 h, P_{82% Ar + 18% CO₂} = 40 Pa, mode 1, Table 2.

Under this mode of treatment a layer with surface micro-hardness of 430HV_{0,1}, total thickness of 260 μm and combined zone thickness of 6 μm is obtained. The concentration of carbon in depth of the layer is relatively low and reaches 0,48 % on the surface, while at 4,3 μm from the surface it has the lowest value (0,16%). At the end of the combined zone the concentration slightly increases (0,21%).

The distribution of nitrogen in the carbonitrided zone goes up gradually, reaching on the surface the level of 8.1 % and decreasing to 3.9 % at 4,3 μm from the surface. Under this mode of carbonitriding the carbon and nitrogen concentration changes gradually; however, their concentration is lower in depth of the combined zone than it is under the 5th mode of treatment from Table 2.

It can be noted that when in the process of carbonitriding the saturating medium contains bigger amount of CO₂ (9%), on the surface of Armco-iron combined zone with highest carbon concentration 1% is formed (mode 4, Table 2), while at (1.8 %) content of CO₂ the concentration is the lowest - 0.48%.

From the modes of carbonitriding of Armco-iron under consideration the most uniform distribution of nitrogen and carbon in depth of the layer is observed under the 5th mode from Table 2. The active role of argon for delivering carbon and nitrogen on the surface of the treated material is worth mentioning. As a result of its bigger atomic mass, argon has strong

pulverizing action. With the high coefficient of pulverization the length of the free run of the pulverized atoms is bigger and the possibility for backward diffusion of carbon and nitrogen is lower. By changes in the pressure, as well as in the content of argon in the saturating medium, the backward diffusion of nitrogen and carbon can be regulated, thus making it possible to obtain layers with different features and properties.

On the basis of the conducted glow discharge optical emission spectral analysis of samples from Armco-iron and 25CrMnSiNiMo steel it is necessary to note that under all modes of ion carbonitriding carried out in ammonia and corgon medium layers are formed with concentration of carbon in the combined zone, which, for the 25CrMnSiNiMo steel is within 0.6 % - 1.4 %, while for Armco-iron it is between 0.45% and 1%.

CONCLUSIONS

1. It has been established that the glow discharge optical emission spectroscopy can be used for investigating carbonitrided layers formed in low-temperature plasma in ammonia and corgon medium.
2. It has been proved that after carbonitriding of the investigated materials at t=550 °C, P_{NH₃} = 280 Pa, P_{82% Ar + 18% CO₂} = 120 Pa, τ = 4 h the most gradual change of the carbon and nitrogen content in the carbonitrided zone of the layer occurs.
3. Increased amount of carbon has been found both in the combined and in the diffusion zone of the carbonitrided layer.

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INDOLENT DISPOSITION TOWARDS ICT ACCEPTANCE AMONG PRACTISING QUANTITY SURVEYORS IN NIGERIA

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ABSTRACT: Information and Communication Technology infrastructure provides a wide platform for exchanging data, coordinating activities, sharing information, and supporting globalization of businesses, all based on powerful computing and networking technology. However, quantity surveying firms appears to make sluggish progress towards effective Information and Communication Technology implementation for its unique features which distinguish it from other industries, it remain weak and data cannot be exchange efficiently, especially in the developing countries like Nigeria. The objective of this paper is to conceptually synthesize the attitude towards ICT acceptance for construction cost management. Therefore, this study reviews the causes and impact of sluggishness in the usage of information and communication devices for a sustainable construction cost management. It found that human and organizational culture is among the major cause of the slow acceptance of the Information and Communication Technology devices for construction cost management, whereby, it affects the selection and usage of the devices.

KEYWORDS: Information and Communication Technology, Cost Management

INTRODUCTION

Information and communication technology is a combination of information technology and communication technology. ICT is used as a general term for all kinds of technologies which enable users to create access and manipulate information. In other words, Information and communication technology, involves all aspect of information technology which is the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information. While communication technology is a way of exchanging messages or information via electronic systems between individuals or groups such as telephones, e-mail, radio, television, video, and electronic data interchange.

In addition, a study conducted on 115 construction industries that adopted the use of technological innovations in Nigeria shows that it enhanced the quality of services of the firm (Musa et al., 2010). But, with all these benefits that ICT offers, quantity surveyors are not taking serious action towards advanced adoption of ICT. In addition, clients have been demanding for executing projects within budgeted cost and completion at estimated time, likewise, firms are seeking for strategies and tools to improve the quality of their services (Akintoye, 2001). Thus, information and communication technology (ICT) had been identified as a sustainable technological strategy used in the technological advanced nations to achieve this goals. However, quantity surveying firms had been using ICT for their services since 1980s (Ayeni, 1989), but the usage is at the basic stage only typing, printing, phone calls, using Microsoft word and excel and the likes, no

advancement into the usage of sophisticated software's because of their negative perception and fraudulent activities. According Musa et al. (2010) is now close to two decades of continuous adoption and use of the technological innovation in work practices of the firms, yet its effects on service delivery have not been empirically established. It is admissible to review the root of the inactive attitude towards the acceptance of information and communication technology for sustainable construction cost management. The objective of this paper is to conceptually synthesize the attitude towards ICT acceptance for construction cost management.

QUANTITY SURVEYING IN NIGERIA

A quantity surveyor is a qualified professional responsible for drawing up bills of quantities and advising the client on contractual and financial matters. Ashworth and Hogg (2002) define quantity surveyors as those that cost design, and produce procurement and construction document.

Professional Quantity Surveyors in Nigeria are practicing under the umbrella of the Nigerian institute of Quantity Surveying (NIQS). The Nigerian institute of quantity surveyors was founded in 1969, and then operated under the lands perpetual succession Act to which it was registered in 1970.

The regulated and other professions (miscellaneous provisions) Act 1978 recognised quantity surveying profession as one of the scheduled professions while the degree No. 31 of 1986 gave legal backing and recognition to the quantity surveying profession, and also set up the Quantity surveyors registration board of Nigeria (QSRBN) to regulate the profession.

In addition the vision and mission statement of the Nigerian institute of quantity surveyors are: the vision is to be the profession in Nigeria responsible for total cost and procurement management, for the achievement of client’s objectives in all types of capital projects and developments, from conception to commissioning and maintenance, in all sectors of the economy, for the attainment of sustainable national development and goals. While the mission statement is promotion of quantity surveying principles of construction economics, costs, procurement and management as sine qua non for effective delivery of all types of capital projects and developments from conception to commissioning and maintenance in all sectors of the economy. Likewise, among the aims and objective of the institute are:

- To promote the science and practice of the quantity surveying profession in all its ramifications.
- To provide a platform or forum for meeting and discussing matters of mutual interest to quantity surveyors in Nigeria.
- To undertake research study and to collate information from any quantity surveying bodies from any part of the world on the latest development and technologies in the practice of quantity surveying and make available such information to its members.
- The maintenance of the highest standards of discipline and professional conduct. Thus, all aforementioned vision, missions up to the aims and objectives of establishing quantity surveying profession is toward effective accomplishing client’s objectives and sustainable cost management, but achieving these purposes has been affected by so many traditional or cultural aspects. According to Aje and Awodele (2007) is “a professional trained, qualified and experienced in dealing with problems relating to construction cost, management and communication in the construction industry”. Then, Oke et al. (2010) state that the problem lies in the management of construction projects which entails cost and communication. This should be the area of concern to Nigerian quantity surveyors in discharging their duties since a well-managed project is always a well delivered project. Furthermore, the business of the construction worldwide has seen an emerging demand for construction projects which embody whole life value and performance, excellent design and functionality; and which are delivered within budget, on time and defect-free, but this encompasses dealing to a large extent with information. According to Musa et al. (2010)

practicing quantity surveyors are to ensure that resources are utilized to the best advantage of the society by providing financial management for projects and cost consultancy services to the clients, designers and contractors during the construction process. Also, Nigerian institute of quantity surveyors (NIQS) (1998) state that they are more concern with the financial probity in the conceptualization, planning and execution of development new and refurbishment works. They listed the major services of consultancy practice in project development chain to include:

- preliminary and final budget estimate;
- contract documentation and procurement;
- contract administration;
- cost modeling and final accounts.

Table 1: Stages of work and Quantity Surveying services

S/NO	Stage	QS Services
1.	Conceptualisation/ Inception	Clients outline requirements (initial cost indication)
2.	Determination of general requirement (scope, user’s requirements, special features)	Budgetary Planning
3.	Revision and amendments to schemes and final designs	Cost Plan
4.	Delivery of production drawing	Contract documentation
5.	Tender evaluation/Appraisal of client	Tender reporting and representation of client
6.	Review of work method/sequence	Cost check and control, cost/value control
7.	Verification of defects	Final costs from finalized accounts
8.	Commissioning	Conclusion of Accounts

Source: Anyadike (2001)

All these cannot be achieved without efficient and effective transmission and dissemination of information. The practicing quantity surveyor is expected to source for data (market survey) both internally and externally, process the data to decision-friendly and disseminates it at appropriate time to users at various stages of construction process. Therefore, construction business needs to manage information and exchange it both between their employees and with their suppliers and clients. Oyediran (2005) asserted that there has been some rapid progress in the application of ICT in commerce particularly in financial services, this is because of the seamless communication nature of ICT, and the construction industry has been sluggish in adoption of ICT despite the amenability of its process to IT operations. This sluggishness can be traced to conservativeness of the industry, high degree of

fragmentation in both the procurement process and production systems, absence of management driven IT strategy (Cartidge, 2002).

But according to Svidt and Christiansson (2006) lack of actual knowledge of cost savings when using information and communication devices makes the industry practitioners not willing to use it. However, the only way to succeed is through full implementation of ICT (Ahuja et al. 2009). Hence, construction industries are reluctant to adopt information and communication technology because some of their daily practicing activities were not taken into consideration by the ICT devices (Lofgren, 2007).

DISCUSSIONS

In Nigeria today, there is still no flexibility in choosing methods for cost management because of what people are custom to, the same method that was used in the olden days is still in place but in a modified version. That is why is very difficult for people to change very easily, the following factors are among the ones that influenced the adoption of ICT devices for construction cost management by practicing quantity surveyors.

1. Supplanting

This is the act of taking the place of another, as through force, scheming, strategy, or the like. It is very common in construction industry, because the job is not sufficient for the entire professionals to strive on. The little that is available, all and sundry will rush to get their shares from it. This might lead to killing or using charms against each other in order to survive.

This can be controlled using ICT devices, whereby the person that qualified to do the job will be contacted online, be given some codes and password that be only used by him to access the information and report back through the same procedure, then e-payment can be issued.

2. Mismanagement of funds and resources

This is another factor that is affecting quantity surveying practice in Nigeria. The money allocated for the execution of a project are diverted to personal accounts by contractors, while the professionals are given token amount of money to produce the necessary documents that can show the work is either partially completed or fully completed.

This kind of transaction makes the contractors as well as the professionals does not have interest in ICT usage. Thus, this type of transaction can be monitored and control by the application of ICT devices in the management of all capital projects. ICT devices can easily capture and store any type of transaction on its data base without any fear or favour.

3. Organizational unethical attitude

Quantity surveyors exercise their own skills and judgments; also they are accountable to the client and bound by their professional code of ethics. But, contractors on the other hand are keen to make a profit, and hence their actions inclined to business ethics. Each profession has its own interests which are often divergent and competing in nature.

Their diversity can be a source of conflicting ethical standards and practice which may affect quality performance and accountability to clients and customers. The uniqueness of the sector and the need to perform accountability among all participants can be fully effective when ICT devices are employed.

4. Bureaucracy

This refers to all rules and procedures followed by government departments and similar organizations, which are complicated and cause long delays. It is generally claimed that the public organization is more bureaucratic than the private due to the ownership, funding, and control. Bureaucratic rule has negative effect on modern organizations. Rules and procedures are essential elements to govern the operation of an organization.

However, if there are excessive rules and procedures which do not serve any functional purpose, they become red tape where resources are wasted to comply with these rules and procedures. Adoption of intranet and extranet can ease all this bureaucracies.

5. Individual's unethical behavior

The following attitudes are conducted by officers in charge of projects either in public or private sectors (Alutu, 2007):

- Contractors are given vital information on a contract by paying agreed sum of money to officials of the awarding organization.
- A contractor must include a “kickback” in his tender or else he will not win the contract.
- Contract officers (engineers, quantity surveyors, etc.) have a vested interest on the jobs they are advising on, so they favor their firms.

This signifies that there is an urgent need for a strategy that can control all sorts of unethical attitudes which is the full implementation of ICT usage by all private and public sectors; so that face to face contacts that seek for kickbacks are avoided.

6. Software applications

Regarding the extent to which software is a contributing factor to the poor implementation of ICT. Software could discourage project information sharing when different applications are used or when data is imported into a different file format, poor communication among professionals especially on the location of information on the data base, data standards are not compatible due to poor information

sharing between pre-contract and post-contract activities. Incompatibility between difference disciplines of the design team discourages ICT usage.

7. Network problem

In this case fault from internet providers may render the network inaccessible at an urgent time, rendering the whole related work force redundant. These kinds of services make the professionals to be frustrated and abandon the use of ICT.

8. Lack of soft skills for professional’s interaction

This item is depicting that how professionals are interacting with each other has effect especially based on soft skills such as people management, communication and integration management, team building and management, culture and industry norms and the like. If professionals cannot deal with these soft issues, it becomes difficult for them to use the ICT to share information.

9. Traditional method remained

Some professionals said traditional aspects of quantity surveying must remain un-automated like taking off quantities. The traditional aspects are important to learn, but harder to share information with others, thus it is ought to be improved by using ICT.

10. Lack of Management Support

The management of firms seems not to be providing the necessary leadership for strategic computerization of quantity surveying services; they felt that computerization is not necessary. That is why support of the management is very weak and weak IT strategy (Oyediran and Odusami, 2004; Oni, 2003).

In general, according to some researchers like Oladapo (2006) the following factors are the one that constraints the acceptance of ICT devices:

- a) Insufficient/erratic power supply,
- b) Job sizes and fees not enough for ICT,
- c) High cost of hardware/software,
- d) Fear of virus attack,
- e) High rate of obsolescence of software/hardware,
- f) Inadequate ICT content in construction,
- g) Scarcity of professional software,
- h) High cost of engaging computer staff,
- i) Lack of management desire and appreciation of ICT,
- j) Security,
- k) Low return on investment in ICT,
- l) Personnel abuse, and
- m) Fear of ICT making professionals redundant.

In addition, Rezgui et al., (2004); Brewer et al. (2005); Pasupathinathan and Pieprzyk (2008); asserted that the reasons for the relatively low adoption of ICT are as follows: issues relating to the legal ramifications of electronic communications, vague security framework, and issue of trust. Furthermore, organizational and human issues have been

highlighted as the key factors affected the use of technologies in the construction sector (Olukayode and Adeyemi, 2011). Likewise Oyediran and Odusami (2005) state the following factors as those that are responsible for the slow acceptance of ICT by quantity surveyors:

Table 2: Factors Affecting the Use of Computer by Quantity Surveyors

Group of Affecting Factors	Elements of the effect
Operational Inhibitors	Rate of virus attack leading to loss of data, and associated problems.
	The rate at which software becomes out-dated and require up dating.
	Durability of clones (locally assembled computers) Branded computers are not replaceable
Educational problems	QS training institutions are not equipped/positioned to give computer education to their students
	There is no tailor-made QS training by private computer school trainers
	Management of organizations rarely give in-service training to Q. S staff
	Software education is poor Capacity to Q. S educators are low
Return on investment	Inadequate job order to encourage investment in computer
	The cost engaging computer literate is high
	Fees are not paid to justify computerization of PCMS
Management attitude	Management is not willing to computerize PCMS
	Management does not see the need to computerize
Myth factors	It makes other professionals to encroach on QS jobs
	QS believes computer training and usage is for the coming generation
	It is capable of creating unemployment for QSs

Source: Oyediran and Odusami (2005)

Unless the professional quantity surveyors adapts to the rapidly changing demands of its services, it is in danger of losing its leading role in providing services to its key markets (Matipa et al. 2009).

BENEFITS OF INFORMATION AND COMMUNICATION TECHNOLOGY

Many researchers come-up with the benefits that they think is as a result of the adoption of information and communication technology. To some ICT reduce the time for data processing and communicating information, and to improve communications for effective decision making and coordination among construction participants (Peansupap and walker, 2005), to enhance construction productivity (Liston et al. 2000).

This is possible because the internet-based tools of ICT allow communication between even remote users and enables them to share files, comment on changes and posts requests for information (De lapp et al., 2004).

In addition, Oladapo (2006) in Oyediran and Akintola (2011) states the following as advantages of using ICT; makes professionals jobs easier, facilitates decision making, saving in operating cost, improve public image of users, gives users competitive advantage, enhances productivity, saves time, and improve document presentation. While, Olukayode and Adeyemi (2011) presents that reduction of workload, enhances efficiency through transaction cost savings and reduced direct procurement costs, transparency, accountability, ease of use, and speedy exchange of information, are among the benefits of ICT. Likewise, Uwaifo and Omede (2006) enumerate the following elimination of duplication in data entry operations, improvement in the control of operations, error reduction in data handling operations, improvement in the speed of operations or services, increased range and depth of service, reduction in staff costs, and improve staff morale and prestige.

CONCLUSIONS

This study investigates the factors affecting acceptance of information and communication technology devices for practicing quantity surveyors in Nigeria. The literature search has revealed the aforementioned factors as among those that slow down the acceptance of ICT, and they can be group into two which can either be human (individual) or organizational culture that cause each of the factors. For the practicing quantity surveyors to reap the above mentioned benefits, computing power (information and communication technology) is inevitable in the cost management of any construction industry, because it increase the speed to capture, analyse and share data to facilitate decision making. Therefore, it is recommended for the practicing quantity surveyors to conduct holistic investigations by considering all relevant factors, so that a best solution can emerge to solve the challenges.

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DOUBLING THE WATER QUANTITIES IN IRAQI MARSHES BY CHANGING ITS TOPOGRAPHY – ENGINEERING SOLUTION FOR A POLITICAL, SOCIAL AND ENVIRONMENTAL DEBATE

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ABSTRACT: The Garden of Adan, which is now known as the Iraqi marshes, is suffering from the lack of water. In the nineties of the twentieth century it was desiccated for political reasons. In the timeframe between 2003 and present date, efforts of re-flooding it to its original area of 20,000 square kilometers were jammed to restore only one third of this area with a poor quality of water. Global climate change and water developing projects in the surrounding countries, Turkey, Syria and Iran had severely violated Iraqi water shares required to supply this area. The environmental destruction in this wetland is not only reflected upon the vanishing of its wildlife but extended to force its inhabitants to flee. In addition to highlighting this Iraqi catastrophe, the aim of this research is an attempt to save a considerable amount of fresh water by the use of the physical phenomena concerning the evaporated water quantity with respect to the surface area. Tests have been done for models of soil totally/ partially covered with water to figure out the amount of water that can be saved by the retardation of the evaporation process. The reduction of the amount of evaporated water with respect to its surface area showed that 50% of water can be saved, if the top surface area of water was reduced to 30% of its original area. Changing the marshes topography by deepening 30% of its area and filling, with the same excavated soil, the remaining 70% might restore it to its original size and environment.

KEYWORDS: Iraqi marshes, Global change, lack of water, Evaporation, Surface area, restoring wetlands

INTRODUCTION

[1] About 20,000 square kilometres of swamps in the southern part of Iraq are called Marshes. These marshlands were created during ancient times when there was a huge quantity of water flowing through the famous two Mesopotamian Rivers, the Tigris and Euphrates. Marshes were the best natural regulator for repetitive floods in these rivers. Moreover, marshes were considered as a great natural wildlife area with high potential of eco-tourism. The region is thought to be where the Garden of Adan was located. In the nineties of the twentieth century, large portions of marshes were dried for political reasons to force groups of insurgents inhabiting this area to flee away.

[2] Fig 1 shows marshes extent in 1985 and in 2000.



Figure 1. Marshes extent in 1985 and in 2000

[3] Marshes were drained and shrank to a-tenth of its original size. Re-flooding efforts after 2003 have restored one-third the original size (with poor water quality due to salinity and pollution), resulting in a wet coverage of an area of only 8,000 square kilometres. Desiccating this area was not easy; it consumed a lot of efforts, time and money to change water paths, construct dikes and burn reeds leaving this area look like a scorched landscape see Fig 2.

The deteriorating marshy environment altered the natural routes of migratory birds that took refuge in this area during their annual migration to complete its life cycle. [4] Fish stocks were reduced to a terrifying level, transforming Iraq from being a producer to an importer. The residents of marshes whom were self dependent upon fishery activities and rearing water buffalo became dependable poor immigrants in their country.

In 2003 a political change happened, one of its concerns was to restore Iraqi marshes as it was. Many national and international meetings, conferences and projects were directed to the rehabilitation of marshes. Till now a limited actual success has been reached due to the emerging of a new factor that is the reduction of water quantities flowing through the providing rivers.

Iraqi rivers which were known of their destructive floods were heavily dammed in the countries of their origin. Turkey, Iran and Syria have built large dams in their territories across the supplying tributaries of both of Tigris and Euphrates. [5] In Turkey alone, by

2006, 208 large dams had been constructed. In total 579 dams have been completed and put into service for irrigation, hydropower and flood control. Almost 210 dams are under construction. The total water holding capacity of all Turkish dams is 651 km^3 .



As it was



After draining

Figure 2. Iraqi Marshes before and after desiccating

[6] The discharge of Tigris, before control by modern dams, was estimated at Baghdad of a maximum annual average flow of 70.4 km^3 . While the observed average annual flow of Euphrates across the Turkish Syrian border was 29.8 km^3 . The ancient shares of Iraqi water were severely violated for the benefit of the mentioned countries. Turkey unilaterally guaranteed that it will allow $500 \text{ m}^3/\text{s}$ water flows ($15.75 \text{ km}^3/\text{year}$) across the border to Syria, but no formal agreement has been obtained so far on sharing of Euphrates water. Unfortunately, neither Iraqi politicians nor international organizations could do anything to solve this Iraqi disaster.

The climate global change towards the increase of heat had augmented the problem more and more. [7] The average maximum temperature degrees during June, July and August are more than 40°C (up to 60°C as a maximum) with an average sunlight of not less than 11 hours per day and an average relative humidity of less than 14%.

The annual rainfall in marshy areas which was 5–8 cm became less year after year due to the climate change. More increase in heat means more evaporated water which increases the problem to the extent that fresh water had been transformed to a salty solution enough to killing fish and blind cattle.

Most of the media, reporters and politicians are talking about the future water wars. According to the writer experience, any inexperienced person can start a dispute but even the most wise men find it difficult to stop it or to estimate how much will it cost. Therefore, there is a real need to look for reasonable and practical solutions for this catastrophe.

The most remarkable topographic feature of Iraqi marshes is its flatness without variation of more than 2m. For 400km, from north to south, the slope is a mere 0.01% and an average water depth of 1m. In this research an engineering solution has been proposed and an elementary test has been performed aiming to figure out the possible procedure that can be followed to save what can be saved for restoring Iraqi marshes from being dried again.

One of the physical phenomena stated that; the evaporation process is increased by three factors Temperature, wind velocity and surface area. While the first two factors are natural and difficult to be changed, the third factor of the surface area is considered as the only factor which can be adapted to reduce the water loss by evaporation.

The surface area of water is decisive regarding evaporation; any quantity of water if sprayed over infinite area will require no time to be evaporated, while the same water quantity can be totally saved if it flows through a sealed pipe.

The expected saved water quantities can be added to the existing water to contribute in reducing the results of the problem. To have an idea about the wasted water by evaporation in the Nile river basin which has a similar problem, [8] The United Nations Food and Agriculture Organization (FAO) estimates that 68 km^3 of water is evaporating each year in Sudan, a quantity that is greater than the amount of water flowing in the Nile.

The same Organization declared that 10 km^3 of water is lost each year due to evaporation in Aswan reservoir in Egypt, an amount of water that is equal to 20% of the flowing water in this country. This example is mentioned to delineate the extent of the problem and because there is no official data about the lost quantity of evaporated water in Iraq.

According to an approximate calculating program set by [8] the evaporated water quantity from the existing surface area of Iraqi marshes is more than 20 km^3 each year.

MATERIALS USED

The following materials and tools were used to perform the test:

- Clay soil having the proportions of 82%clay, 12%sand and 5%silt with 1percent of organic impurities. This type of soil is typical in the marshes area.
- Three steel pans with inner dimensions of 100x100x10cm. One of them was modified as shown in Fig 3.
- Scale.

TESTING PROCEDURE

Three steel pans with inner dimensions of 100x100x10cm were used. The first and the third pans were filled with clay soil to a depth of 5cm. enough water was added to the extent that all the soil became fully saturated. Both pans contained exactly the same amount of fully saturated soil, this was checked by weight.

The flat top surface of the soil in the first pan was covered with 10 kg of water having 1cm depth. While The soil in the third pan were completely excavated along two edges for 5 cm width in the bottom, then a slop of 1 vertical: 2 horizontal was used leaving the top soil surface in the middle of the pan having the dimension of 64 x100 cm and higher by 1.5 cm compared with the original flat surface, see Fig 3.

This change in geometry did not require any additional soil because of equating the quantities of soil cut and fill as shown below;

Volume of excavated soil equals:

$$100 \times \text{Areas of abed and ghij} = \frac{5+15}{2} \times 5 \times 2 \times 100 = 10000 \text{ cm}^3$$

Volume of filling soil equals:

$$100 \times \text{Area of defg} = \frac{70+64}{2} \times 1,5 \times 100 = 10050 \text{ cm}^3$$

Then the same quantity of 10 kg of water was poured to fill the spaces along the two sides of the elevated soil. The top surface area of the water was equal to 30% compared with that of the first pan.

The second pan was fabricated by metal to have the same shape of the third pan and its contents but without soil. The reason for including the second pan was to compare the amounts of evaporated water, having the same free upper surface areas of 30x100 cm. Also, to show the amount of evaporated water through the soil in the third pan. Again the second pan was filled with 10 kg of water which gave a rise of 5 cm.

The average temperature during the test was 23°C. The reduction of weight for the two samples was recorded till the vanishing of the added water of 10 kg for the first pan, see Table 1.

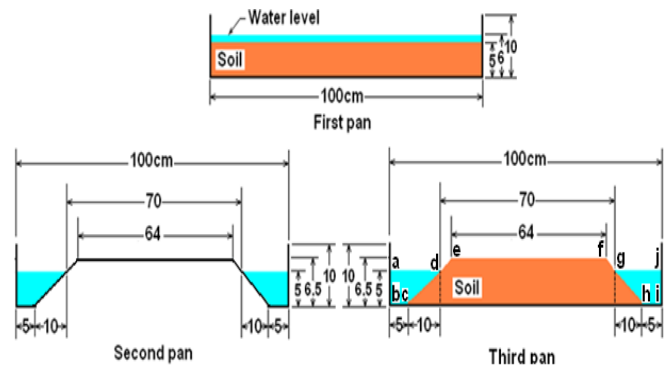


Figure 3. Same quantities of water with different top surface areas

Table 1. Weight of evaporated water measured with time

Time (h)	12	24	36	48	60	72	84	96
Pan #1*	1.1	2.4	3.3	4.3	5.9	7.1	8.5	10
Pan #2*	0.5	0.8	0.9	1.1	1.5	1.8	2.9	4.1
Pan #3*	0.6	0.9	1.1	1.3	1.7	2.2	3.7	4.98
Time (h)	108	120	132	144	156	168	180	192
Pan #1*								
Pan #2*	5.2	6	6.5	6.9	6.7	8	8.7	9.5
Pan #3*	6	7.2	7.7	8.3	8.8	9.6	9.9	10

* Weight of evaporated water (kg)

TEST RESULTS

It is difficult to assess the exact amount of the evaporated water from Iraqi marshes. Surface area, air temperature and humidity, wind velocity, water temperature, and the soil/ plants properties are all factors affecting the evaporation process. [9] Suggested that; if all the variables were the same there is an approximate direct relation between the quantity of evaporated water and its surface area. That means 70% of the water can be saved by reducing 70% of the surface area.

Test results showed that; if 70% of the surface area is reduced, the amount of the evaporated water will be reduced by 59%. That what was happened to pan #2 after four days, it lost 4.1 kg of water compared with 10 kg for the full surface exposure of pan #1. Pan #3 which had 30% free water surface area and 70% of soil surface, lost about half (49.8%) of its water compared to pan #1. The increase of 8.8% of the evaporated water in pan #3 was due to evaporation through soil top surface area.

Based upon this physical reality, if Iraqi marshes topography can be altered by reducing the top surface area of its water, probably its water quantities can be doubled. The increase of water quantities in Iraqi marshes might make it possible to expand it to its

original area and to skip unnecessary wars. Moreover, the saved water will certainly reduce water salinity to a comfortable level for Marshes inhabitants and to its wildlife species.

CONCLUSIONS

The following conclusions can be derived:

- 1- A reduction of 59% of the evaporated water can be saved by reducing the top surface area of the water by 70%.
- 2- A reduction of 50% of the evaporated water of a submerged land can be saved by dividing the top surface area into 30% of water and 70% of soil.
- 3- Water evaporated through wet soil is 12.5% of the water quantity evaporated directly from a free water surface.
- 4- Adapting the Iraqi marshes topography by cutting soil to deepen 30% of its area and filling, with the same quantity of soil, the

remaining 70% might double its water quantities.

- 5- Iraqi marshes (the garden of Adan) could restore its historic area, wild life and environment by changing its topography.

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RESEARCH OF TITANIUM MATERIALS USED IN MEDICINE

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ABSTRACT: Metallic materials, for example, stainless steel, titanium and its alloys, and tantalum are widely used for medical implants in trauma surgery, orthopaedic and oral medicine [1]. Nowadays, at oral medicine used to use titanium implants for their nonallergenic and good mechanical properties. This work deals with identification and intensification of cutting conditions at machining these materials and defines their machinability based on cutting forces and chip shape.

KEYWORDS: machinability, biocompatible materials, biomedicine.

INTRODUCTION

The material for dental implants is required to be biocompatible, mustn't be toxic and also shouldn't cause allergic reactions. It must have high ultimate strength R_m and yield point R_p with desirable low density and low modulus of elasticity E [2]. A problem in the course of the development of metallic biomaterials represents not only their actual or potential toxicity but also their allergenic potential [3]. Sensitivity of the population to allergens dramatically increases. An allergy on metals is caused by metallic ions, which are released from metals by body liquids. Commercial pure cpTi (Tab.1) stays the preferred material for dental applications (Fig. 1). It is desirable to increase its other mechanical properties without using even potentially toxic or allergenic elements preserving its low value of modulus of elasticity [2].

Table 1: Chemical composition of Ti based on ISO 5832 – 2

Quality	C [%]	Fe [%]	H [%]	N [%]	O [%]	Ti [%]
Gr 2	max. 0,08	max. 0,3	max. 0,015	max. 0,03	max 0,25	to 100
Gr 4	max. 0,08	max. 0,5	max. 0,015	max. 0,05	max 0,4	to 100

MACHINABILITY OF TITANIUM SAMPLES

Medical device manufacturers face tough challenges. Their customers are demanding ever smaller, more complex parts produced with extraordinary accuracies from hardmachining materials such as titanium. During the machining of titanium materials is very important the correct choice of cutting material, tool geometry, cutting conditions and cutting environment.

The Department of Machining and Manufacturing Technology, University of Zilina, supported by the grant agency VEGA, on the basis of developments and the progress of new materials and increasingly demanding requirements for accuracy, we started by identifying the basic technological conditions of machining titanium by turning, using a replaceable cutting edges of hard metal (Fig.3, Tab.2), and intensification of cutting conditions on machining

cylindrical samples of commercially pure titanium with a diameter $d = 4$ and 5 mm (Fig.2).

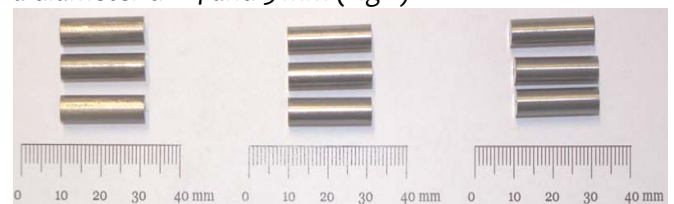


Figure 2. Intensification of cutting conditions on machining cylindrical samples of commercially pure titanium with a diameter $d = 4$ and 5 mm
a) TiGr2 b) TiGr4 c) TiGr5

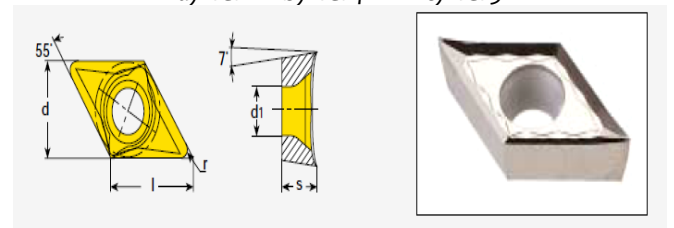


Figure 3. Replaceable cutting edge DCGT 070204

Table 2: Dimensional parameters of the cutting plate DCGT 070204

DCGT 070204	l	d	s	d1	r
	7,75	6,35	2,38	2,8	0,4

EXPERIMENTAL MEASUREMENTS

In the experimental measurements were used dry environment. After evaluating the results, kinetic, dynamic and microgeometric machinability and also machinability in terms of chip shape showed that the most appropriate cutting conditions for turning titanium samples at a constant speed $n = 2200 \text{ m} \cdot \text{min}^{-1}$, are $a_p = 0,2 \text{ mm}$ (depth of cut) $f = 0,035 \text{ mm}$ (feed).

Static values of cutting force elements for both of cutting edges with increasing feed were rising. The biggest impact on the size of elements of cutting forces was the depth of cut a_p . Replacing the edge did not significantly affect the value of static force elements (Fig. 4, 5). Dynamic machinability of considered material did not depend on the type of cutting edge.

Compared to the reference material (TiGr2) the material TiGr4 shows the class better and TiGr5 equally machined (Fig. 6).

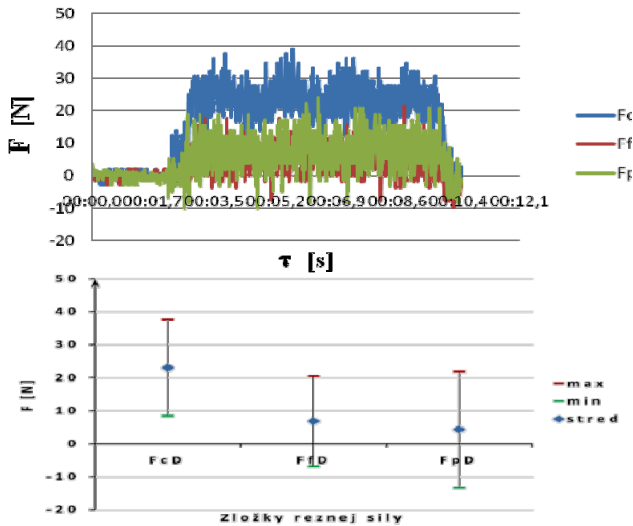


Figure 4: An example of cutting forces waveform elements, with the cutting conditions: $a_p = 0,2$ mm, $f = 0,035$ mm, the material TiGr4 and also their dynamic elements.

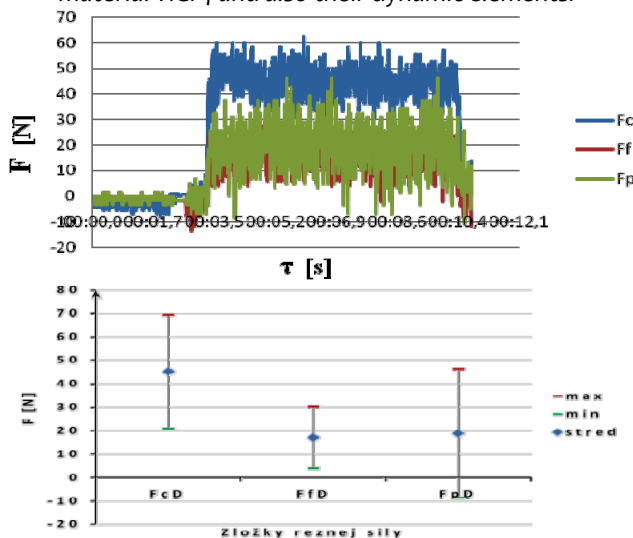


Figure 5: An example of cutting forces waveform elements, with the cutting conditions: $a_p = 0,6$ mm, $f = 0,035$ mm, the material TiGr2 and also their dynamic elements.

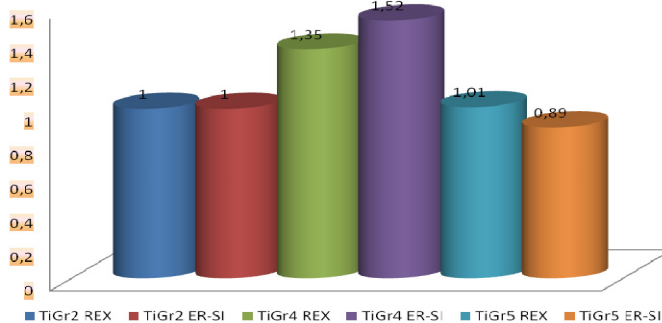


Figure 6: Graphical representation of the dynamic machinability of compared materials.

In point of view of cutting material was designated as suitable cutting plate DCGT 070204 ER-SI (polished), which is much more resistant to thermal shock in the cutting zone and has a greater wear resistance of 70-80% as a cutting plate DCGT 070204 REX (coated). The cutting edge DCGT 070204 ER-SI, as regards the shape of chip, in all experiments was appropriate than plate DCGT 070204 REX. This is thanks to the polished

surface, which causes more resistance material, and the better chip removal.

CONCLUSIONS

Commercially pure titanium is a hardmaching material and need to be searching long time to get satisfactory results. Our research is at beginning, but from the present results indicate that the most appropriate cutting conditions for turning titanium samples at a constant speed $n = 2200$ m.min⁻¹, are $a_p = 0,2$ mm (depth of cut) $f = 0,035$ mm (feed). The cpTi grade4 have the best machinability from the searching grades and cutting edge DCGT 070204 ER-SI is more suitable for machining these materials.

On the basis of a grant from the Grant Agency VEGA Department of machining and manufacturing technology attempt to identify the cutting parameters in nanostructured titanium as well as in commercial pure titanium and compare them with each other, and thus continue to research materials for dental implants.

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GENERAL DIRECTIONS OF DEVELOPMENT IN DIGITAL FORENSICS

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ABSTRACT: Digital forensics is essential for the successful opposition of computer crime. It is associated with many challenges, including rapid changes in computer and digital devices, and more sophisticated attacks on computer systems and networks and the rapid increase in abuse of ICT systems. For a forensic investigation to be performed successfully there are a number of important steps that have to be considered and taken. Since digital forensics is a relatively new field compared to other forensic disciplines, there are ongoing efforts to develop examination standards and to provide structure to digital forensic examinations. This paper provides an overview of the expected global directions of development in digital forensic investigations, as well as the actual trends in this area.

KEYWORDS: digital forensics, forensic process, development, solutions

INTRODUCTION

The digital age is characterized as the wide-ranging application of computer technology as a way that enhances former possibilities. The usage of computer systems as a tool in private, commercial, educational, governmental, and other facets of modern life has improved the productivity and efficiency of these entities. At the same time, the introduction of computers as a criminal tool has enhanced the criminals' ability to perform, hide, or otherwise aid unlawful or unethical activity. In particular, the mass use by the general population, coupled with apparent anonymity, seems to encourage computer crimes. These "cyber-crimes" are not necessarily new form of crimes, but rather classic crimes exploiting computer power and accessibility to information. They are a consequence of excessive availability and user proficiency of computer systems in malicious hands. In order to locate, catch and prosecute criminals involved in digital crime, investigators must implement consistent and precisely defined forensic procedures.

Over the past years, computer forensics has come to the foreground as an increasingly important method of identifying and prosecuting computer criminals. Prior to the development of sound computer forensics procedures and techniques, many cases of computer crime were left unsolved. There are many reasons why an investigation might not lead to a successful prosecution, but the predominant issue is one a lack of preparation: tools and skills required to successfully gather digital evidence.

Digital evidence or electronic evidence is any probative information stored or transmitted digitally and a party to a judicial dispute in court can use the same during the trial [3].

Digital evidence includes computer evidence, digital audio, digital video, cell phones, digital fax machines

etc. Individuals attempting to investigate suspicious activity may also lack the financial resources or tools to conduct such an investigation adequately and ensure that the evidence is indisputable in all circumstances. Moreover, there are instances when all of the above have been adequately put in place, but, due to a lack of training and correct procedure, the evidence collected can be disputed.

As a result, computer forensics seeks to introduce cohesion and consistency to the wide field of extracting and examining evidence obtained from a computer at a crime scene. It is particularly important that the extraction of evidence from a computer is performed in such a way that the original incriminating evidence is not compromised.

DIGITAL FORENSICS

Digital forensics is a relatively new science. Derived as a synonym for computer forensics, its definition has expanded to include the forensics of all digital technology. While computer forensics is defined as "the collection of techniques and tools used to find evidence in a computer" [1], digital forensics has been defined as "the use of scientifically derived and proven methods toward the preservation, collection, validation, identification, analysis, interpretation, documentation, and presentation of digital evidence derived from digital sources for the purpose of facilitation or furthering the reconstruction of events found to be criminal, or helping to anticipate unauthorized actions shown to be disruptive to planned operations" [2]. Some authors make a clear distinction between computer and digital forensics. Yet, for the purposes of this paper, no real distinction is made.

Digital forensics can be defined in other, more general ways. For instance: digital forensics is the application of computer investigation and analysis techniques in the interests of determining potential legal evidence

[4]. Or: extracting evidence from computers or other digital devices [5].

Digital forensics has become prevalent because law enforcement recognizes that modern day life includes a variety of digital devices that can be exploited for criminal activity, not just computer systems. While computer forensics tends to focus on specific methods for extracting evidence from a particular platform, digital forensics must be modeled in such a way that it can encompass all types of digital devices, including future digital technologies. Unfortunately, there is no standard or consistent digital forensic methodology, but rather a set of procedures and tools created based on the experiences of law enforcement, system administrators and hackers. This is problematic because evidence must be obtained using methods that are proven to reliably extract and analyze evidence without bias or modification.

COMPUTER FORENSIC PROCESS

According to [6], computer and network forensics methodologies consist of three basic components:

- Acquiring the evidence while ensuring that the integrity is preserved.
- Authenticating the validity of the extracted data, which involves making sure that it is as valid as the original.
- Analyzing the data while keeping its integrity.

The U.S. Department of Justice published a process model that consists of four “traditional” phases [7]:

- Collection (Acquisition) - involves the search, recognition, collection and documentation of the evidence.
- Examination - This phase is designed to facilitate the visibility of evidence, while explaining its origin and significance. It involves revealing hidden and obscured information, as well as the relevant documentation.
- Analysis - This looks at the product of the examination for its significance and probative value to the case.
- Reporting (Presentation) - This entails writing a report outlining the examination process and pertinent data recovered from the overall investigation.

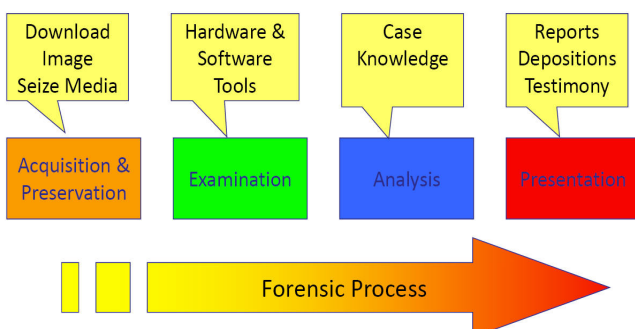


Figure 1. “Traditional” Digital Forensic Process

The Digital Forensics Research Workshop (DFRW) is another significant participant in developing the forensics process. The unique aspect of DFRW is that it is one of the first large-scale consortiums led by academia rather than law enforcement. This is an important distinction because it will help define and focus the direction of the scientific community towards the challenges of digital forensics. The DFRW has worked to develop a forensics framework that includes such steps as “identification, preservation, collection, examination, analysis, presentation, and decision” [2]. Based on this framework, the scientific community may further develop and refine this model.

A computer forensic framework can be defined as a structure to support a successful forensic investigation. This implies that the conclusion reached by one computer forensic expert should be the same as that of any other person who has conducted the same investigation [8].

Starting from the previous forensic protocols, there are common steps that can be abstractly defined to produce a model that is not dependent on a particular technology or electronic crime. The basis of this model is to determine the key aspects of the aforementioned protocols as well as ideas from traditional forensics. This proposed model can be thought of as an enhancement of the DFRW model since this is where it originates from. The abstract digital forensics model proposes a standardized digital forensics process that consists of the following components [9]:

- Identification: which recognizes an incident from indicators and determines its type.
- Preparation: which entails the preparation of tools, techniques, search warrants, and monitoring authorizations and management support.
- Approach strategy: it develops a procedure to use in order to maximize the collection of untainted evidence while minimizing the impact to the victim.
- Preservation: which involves the isolation, securing and preservation of the state of physical and digital evidence.
- Collection: that entails the recording of the physical scene and duplicate digital evidence using standardized and accepted procedures.
- Examination: which involves an in-depth systematic search of evidence relating to the suspected crime.
- Analysis: which involves determination of the significance, reconstructing fragments of data and drawing conclusions based on evidence found.
- Presentation: this involves the summary and explanation of conclusions.
- Returning evidence: this ensures physical and digital property is returned to the proper owner.

In accordance with digital forensic analysis methodology [10], three processes are essential: preparation/extraction, identification and analysis.

For the realization of mentioned processes the following forensic techniques are used:

- Post – mortem analysis: file system, registry, event logs, recovery of deleted files
- Live analysis: volatility – system date, time, running processes, network connections, users logged on, open files, full memory dump
- Network analysis: traffic analysis
- API analysis: API commands, data processed
- Forensic readiness

DIRECTIONS OF DEVELOPMENT IN DIGITAL FORENSICS

Digital forensics has been forced to adapt to actual fields in digital crime. For instance:

- Identity theft
- Internet fraud
- Financial crime
- Money laundering, gambling
- Hacking, network intrusion
- Theft of intellectual property and piracy
- Robbery
- Child pornography
- Homicide, harassment and stalking
- Terrorism

In the past, when someone was suspected of a computer crime or act that was in conflict with corporate policy, the typical process would be to seize the hard disk after hours, take a bit stream image, analyze the disk and create a report (“traditional” forensics). This is becoming an increasingly difficult process. More and more companies now have a global presence with offices spread around the world. These distributed networks have numerous PCs attached to them.

Thus the new trend in digital forensics is to use the corporate network to immediately respond to incidents. It allows capturing and analyzing volatile data, including active network sessions and running processes. It even allows seeing what ports and IP addresses these processes are communicating with.

It is far better to see what is actually happening as opposed to trying to piece it together after the fact from fragments found across the drive. More and more sophisticated users hide their activities by using specific programs and then using cleansing software to erase any Internet history on the hard drive. Although the proxy server will still show network entries, it does not capture enough information to be useful. By using a product for “live” investigations one can track exactly what is being said and to whom.

This leads to the latest trend in digital forensics - online digital forensics over the network. From the moment when someone becomes suspected for

irregularly using the computer resources, the control of proxy servers starts for network traffic. Once this traffic begins has to take a look at a specific machine in real time. In this way it is possible to dump and analyze the memory and find out a number of key information, such as the content of the e-mails, what is in the Internet cache files at the time and the IP addresses of other machines that may be in communication.

A positive fact is that all of this can be done even if the machine is located in another country. Other features include the ability to traverse the registry of the target machines in a live state. Files can also be acquired over the network.

The only downside is in case of running on a slow network, it can be difficult and time-consuming to acquire the entire drive. The theory is that it is possible to narrow the search considerably by doing an online analysis, and through this analysis to find out what exactly is looked for. Then the evidence related to the crime can be acquired.

Forensic investigations may also be realized in LAN and WAN resources in the enterprise. Whether responding to an urgent need for examination across a corporate WAN or functioning as a forensic service permanently attached to a corporate security equipment, investigation tools have been developed to address forensic-grade data harvesting and reporting in widely dispersed environments. Enterprise forensic tools often possess the capability to investigate live systems remotely and analyze volatile memory contents and network metrics as well as local machine activities in situ [11].

There are two market-leading products with two different implementation strategies: Encase Enterprise (by Guidance Software) and LiveWire (by WetStone Technologies). Both accomplish the same result in that they both have the ability to dump, search and analyze memory and the files on the remote computer (data acquisition, file recovery, indexing/search and file parsing), however LiveWire does it without the need for the program to be running on the machine being analyzed.

Features (EnCase) [12]:

- Acquire data from disk or RAM, documents, images, e-mail, web mail, Internet artifacts, Web history and cache, HTML page reconstruction, chat sessions, compressed files, backup files, encrypted files, RAIDs, workstations, servers, and with Version 7: smart phones and tablets.
- EnCase produces an exact binary duplicate of the original drive or media, then verifies it by generating MD5 hash values for related image files and assigning CRC values to the data. These checks and balances reveal if and when evidence has been

tampered with or altered, helping to keep all digital evidence forensically sound for use in court proceedings or internal investigations.

- Recover files and partitions, detect deleted files by parsing event logs, file signature analysis, and hash analysis, even within compounded files or unallocated disk space.

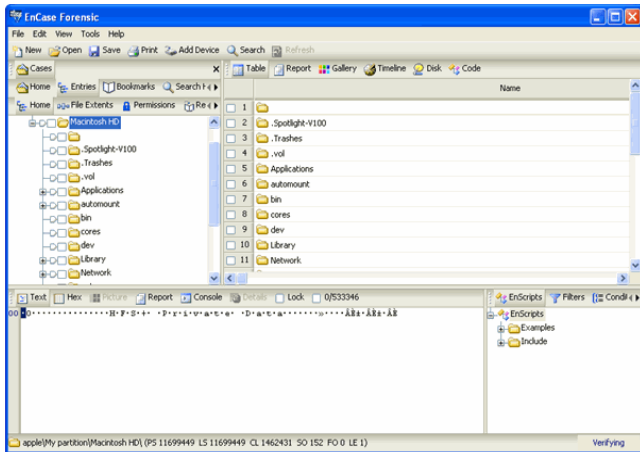


Figure 2. EnCase Screenshots

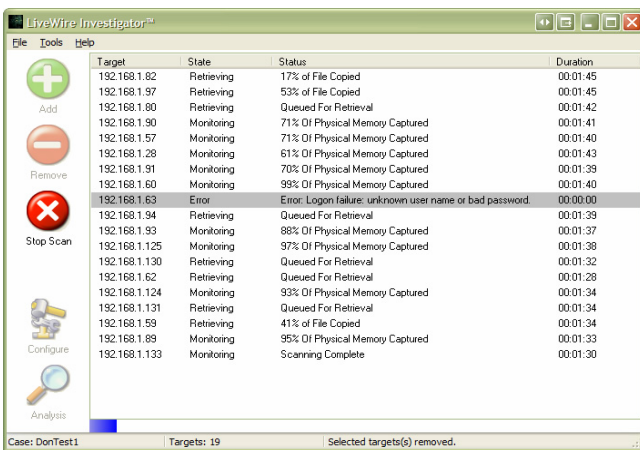


Figure 3. LiveWire Screenshots

With Encase Enterprise a service must previously be installed and running on the machine in order to allow for the machine to be accessed. This makes the deployment in the corporation not only complex, since any service must co-exist with other services; it also makes it very costly.

With LiveWire no such service needs to be running, making it extremely useful for a forensic consultant to go on site, bring their laptop with them, attach to the network and forensically acquire both the memory and the hard drive information of any computer on the network, including servers. All that is required is an administrator user ID and password of the machine being targeted. This makes LiveWire extremely useful, easier and far more cost effective.

Features (LiveWire) [13]:

- Live network investigation
- Live forensic discovery and triage of simultaneous target systems
- Acquire system information

- Physical memory imaging
- Remote screen shot
- Active port mapping
- Windows service discovery
- File system blueprinting
- Installed software cataloging
- Network state and open connections
- Intelligent file acquisition and safeguarding
- Dynamic indexing and analysis
- Dissection of recent user activities (web, messaging, applications)
- Automatic collection of most relevant and timely file system, registry and network connectivity actions
- Structured reporting capabilities to increase investigator productivity
- Automated time stamped audit trail

There is also a growing trend to encrypt the data stored on hard drives, particularly portable computers like laptops and notebooks. Although forensic examiners have some tools to get past these encryption schemes, they are not always successful. A live investigation allows using calls to the operating system of the target machine to extract and decipher the data.

With increasingly complex network infrastructures geographically dispersed across the globe, “live” investigations are the trend we are heading towards.

NETWORK AND HARDWARE CHALLENGES

Intensive technological development of ICT has led to the formation of various network and hardware challenges in the context of digital forensics. Some of them are:

- Network
 - Gigabit networks provide similar (if not faster) access speeds than local hard drive.
 - Centralized storage presents an acquisition challenge since often items of interest will not be stored on the target computer.
 - Storage of several gigabytes becomes cheaper.
- Hard Drive
 - Hard drive sizes continue to grow, but I/O access speeds are not keeping up. As a result acquisition and data processing continues to be more and more time consuming.

FUTURE DIGITAL FORENSICS SOLUTIONS

In the field of digital forensics, over many years of practical experience, the following development trends (expectations) of adequate solutions were identified:

- In the field
 - Better tools with triage capability for the first responders.
 - Windows Explorer based tools will continue to be used in the field.

- Identify encryption before pulling the plug.
- Plug and play bootable USB devices
- Identify data stored remotely.
- Imaging technology
 - Data stored in a hybrid of logical and physical formats
 - The file item becomes the atomic unit rather than the drive.
 - Data reduction techniques to reduce the size of the image.
 - Selective logical imaging of user data.
- In the laboratory
 - Forensics data mining tools are front ends for large SQL database.
 - Distributed grid data processing architecture
 - Data mining searches performed via index engines.
 - Multi-user model - Investigators, examiners, paralegals, work in the data at the same time sharing files, notes, bookmarks, etc.
 - Heavy emphasis on e-mail and Internet artifacts
 - Emphasis on timelines
 - Emphasis on data visualization

CONCLUSIONS

Each year, there is a constant increase in the number of digital crimes worldwide. As technology evolves, software improves, and computer users become more qualified, the crimes they commit are becoming more sophisticated. Law enforcement is in a perpetual struggle with these criminals to limit their opportunities. Part of this intention includes developing tools that have the ability to systematically search digital devices for pertinent evidence. As more and more devices become digitalized, tool development should also progress to include these, as well. In parallel with technological development, it is necessary to ensure the development of adequate forensic methodology which must be applicable to all current digital crimes, as well as any unrealized crimes of the future. This paper aimed to identify some of the most important directions of development trends and forensic solutions. Also, through two popular market products, the overview of actual forensic trends is presented. It may be noted that live analysis in real-time prevailed over traditional post-mortem analysis, and that network environment investigation became increasingly dominant condition for forensic software.

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NEW TRENDS IN DETECTION OF BACK-CORONA DISCHARGES IN PLATE-TYPE ELECTROSTATIC PRECIPITATORS

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ABSTRACT: Current voltage characteristics are the main tool to control the operation of the ESP fields and to detect the back Corona. The collecting efficiency of an ESP depends on the large number of parameters. An important parameter is the current emitted from the discharge electrodes and collecting plates. Generally, the higher secondary current the better are collecting performances. Some parameters, like back Corona discharges, high resistivity fly ash reduce the collecting performances of the ESP. The paper presents some new methods detection of back-Corona discharges in plate-type electrostatic precipitators.

KEYWORDS: electrostatic precipitators, negative Corona, back Corona discharge

INTRODUCTION

An important un-dust device is plate-type electrostatic precipitator (ESP). It is used in power plant, cement, steel and glass industries. In classical design, a d.c. high voltage (up to 100 kV) is used to generate the Corona effect through discharge wires. The electrons bombard the dust particles from the gas, and after a period of time the particles have negative charges, that are moved toward collecting plates, where the particles are collected [1].

In an ESP a negative applied voltage between a discharge wires (connected at negative polarity) and a collecting plates (connected at positive polarity) produce a negative Corona at discharge wires (Figure 1).

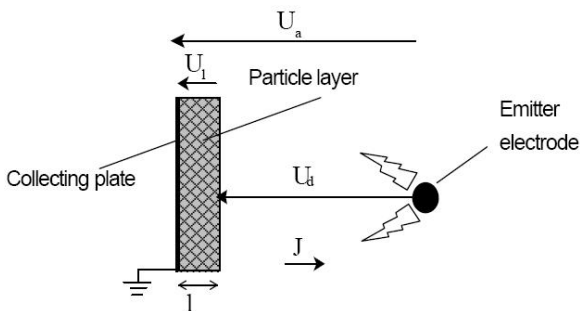


Figure 1. Principle of negative Corona discharge

The collecting high resistance dusts with ESP it is a not well resolved problem. The back-Corona phenomenon is specific for high resistance dust and consists in a series of micro-discharges between the particles from dust layer on the collecting plates. The current-voltage characteristics changes and decrease the efficiency of the ESP.

The back-corona is a non-linear phenomenon [2,3].

A method to determine the occurrence of back-Corona, in a section of ESP, is the measured the current-voltage (i-u) curve. It is important the slope of

i-u curve: if the slope is infinite or negative, a back-Corona occurs in a section. The practical experience shows that the mean current depending on minimum value of the precipitator voltage is the better indication of back-Corona [4].

The new voltage control unit include back-Corona detector device. The old back-Corona detector device has the principle of slope of i-u curve. The main disadvantage of this method is that the power must be reduced to detect the back-Corona.

Another method is based on the minimum value of the precipitator voltage, before and after a spark. If the minimum voltage after spark has higher value than the value before the spark, the back-Corona is detected. It is a better method than the first one. If it is not a spark, a blocking period is induced, when the thyristors are not fired. The current is measured before and after this blocking period of time.

METHODOLOGY

The back Corona effect occur when the particle of the dust has a very high resistivity, especially when is burning low quality coal in power plants, sinter plants, and cement plants. When the particulates have high resistivity, a voltage drop can develop on the layer on the collecting plates. If this voltage drop is high can occurs breakdown between discharge wires and the surface of the layer. A hole of dust results in the layer, on the collecting plates. The electric field increased near this hole (Figure 2).

A strong positive field (instead negative field) occurs in the hole, which generates positive ions which neutralize the charged of the particles in the gas. The dust particles may have positive charged and they migrate towards discharge wires. The operation of the electrodes is upside down. This phenomenon (back Corona) is self perpetuating. Many holes occur on the dust layer on the collecting plates, dust particles will

be attaching on the discharge wires. A voltage drop will be on the dust layer. Electrically, a high current occurs on the low voltage operation, and specify to back Corona, the rise current-voltage characteristic is different then fall current-voltage characteristic (Figure 3) [5,6].

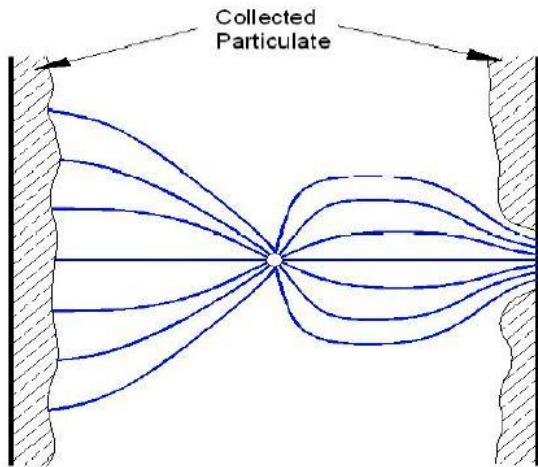


Figure 2. The back Corona between the electrodes

A positive back-Corona discharge occurs when the Corona discharge and layer resistivity are high (10^{10} - 10^{11} Ω -cm). The positive ions from the dust layer drift towards the discharge wires and charged the dust particles with positive charges. The discharge wires become the collecting wires, but the total surface it is not large enough and the particles remain uncollected. The collecting efficiency of ESP drastically decreases.

Usually, the value of electric field in a dust layer is 10-20 kV/cm, and the value of electric field of air is 26 kV/cm.

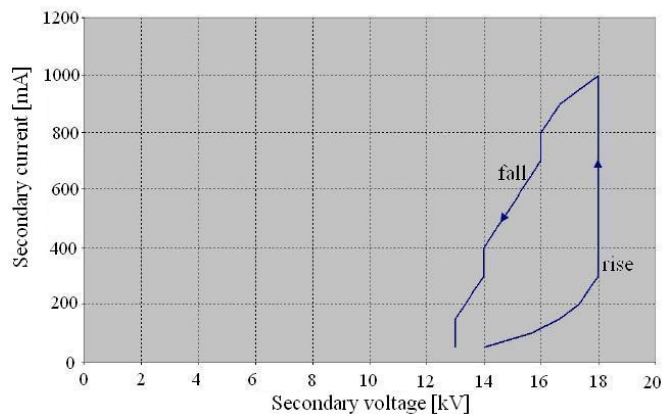


Figure 3. Secondary current as function of secondary voltage in case of back Corona discharges

The back Corona density J_b may be computed with:

$$J_b = k_b \cdot I^{0.4} \cdot (E_l - E_t)^2 \quad (1)$$

where k_b is the power of the particle layer thickness, E_l is the average electric field in the layer, and E_t is the average electric threshold.

The average electric field in the layer depends on resistivity of the dust ρ , and current density J :

$$E_l = \rho \cdot J \quad (2)$$

In time, various methods have been proposed to detect the back Corona. The ratio between the peak and the mean value of the secondary voltage depends on the back Corona. Other electrical parameters that depend on back Corona are: power supply impedance, supply frequency, precipitator load characteristics.

A method is to inhibit the thyristors pulses for a period of time, and than applied pulses for a period of time t_r . The controller monitors the effect of the decay voltage. In this period of time is analyzing the decay characteristics of the voltage. Back Corona is detected when is available the equation:

$$U_{ref} - U_{offset} > U_{decay} \quad (3)$$

where U_{ref} is a reference voltage in the non back Corona condition, U_{offset} is the offset voltage to determine the sensitivity of the detection and it is a controller parameter, and U_{decay} is a decay voltage that is measure Corona onset voltage. The secondary voltage is recorded after the time t_r .

DISCUSSION

At operation of the ESP it is necessary to avoid the negative effects of the back Corona discharges.

In Figure 4 are present the computed current-voltage characteristics for different dust resistivities. The dust thickness is 0.1 cm. The characteristics were made in a model ESP into laboratory [3].

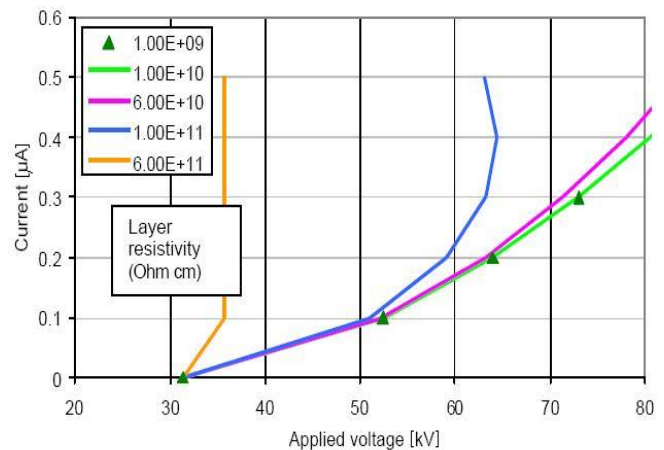


Figure 4. The current-voltage characteristics as function of dust resistivity

For high resistance dust (over $1 \cdot 10^{11}$ Ω -cm) the slope of i - u curve is infinite that indicates the back Corona discharges.

The dust resistivity strongly influences the current-voltage characteristics. The thicknesses of the dust modify the current-voltage characteristics. In Figure 5 the dust resistivity is $6 \cdot 10^{10}$ Ω -cm.

The thicknesses of dust layer increase the current from source. For high value of the voltage, the i - u curve is spreads. The computed and experimental characteristics are likewise.

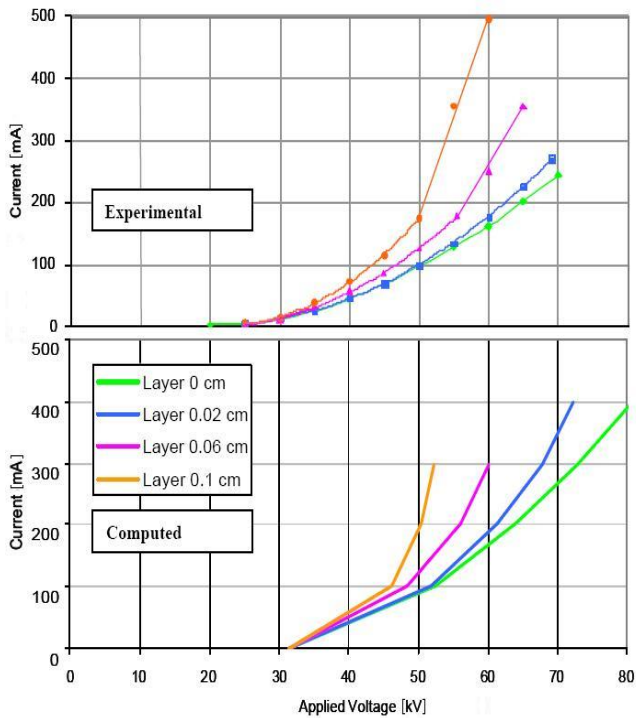


Figure 5. Computed and experimental current-voltage characteristics depending on dust particles thickness

In Figure 6 is present a comparison of collecting efficiency, experimentally by different authors, depending on dust resistivity. Starting at a resistivity about $5 \cdot 10^{10} \Omega\text{-cm}$ the efficiency drastically decreasing [4,7].

In the following figures are present current-voltage characteristics from the industrial ESP connected at a 600 MW coal burning boiler. The ESP has 5 fields, the first one and the last one are equipped with traditional d.c. power supply, while the other 3 fields have d.c. switching power supplies (with low voltage ripple $\pm 1\%$) [8].

The static current voltage characteristics (Figure 7 and 8) have been measure with slowly speed increasing voltage.

The characteristics from Figure 7 was made for a fly ash resistivity $7 \cdot 10^{10} \Omega\text{-cm}$. Under approx. 28 kV, the characteristics are the same, and above this value, the current is higher for the characteristics with dust layer.

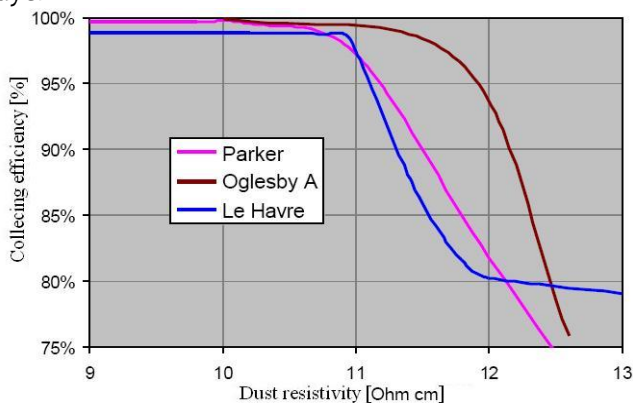


Figure 6. Collecting efficiency depending on dust resistivity

In Figure 8 are present three current-voltage characteristics made from different fly ash resistivity: a. high value ($2 \cdot 10^{11} \Omega\text{-cm}$), b. medium value ($7 \cdot 10^{10} \Omega\text{-cm}$) and c. low value ($3 \cdot 10^9 \Omega\text{-cm}$).

The presence of the back Corona can be made with dynamic (the voltage rise and fall rapidly) current voltage characteristics. The rise and the fall characteristics (the shape of „8”) identify the back Corona discharges.

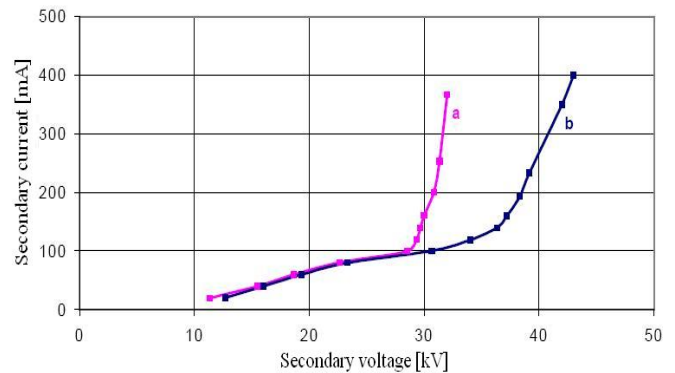


Figure 7. Current voltage characteristics:
a. with dust layers;
b. without dust layers on the collecting plates

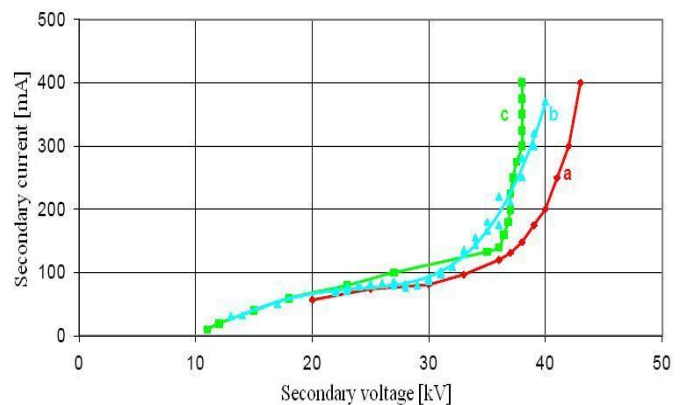


Figure 8. Current voltage characteristics:
a. high, b. medium, c. low resistivity fly ash

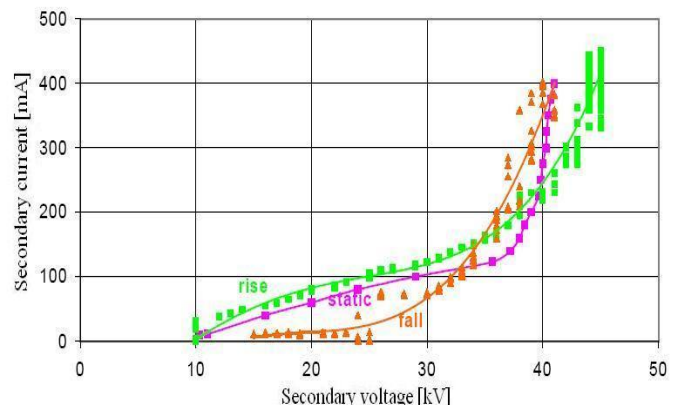


Figure 9. Dynamic current voltage characteristics: at fast rise voltage and at fast fall voltage

In Figure 9, is present the dynamic current voltage characteristic for a high resistivity of the dust. For comparison, on the same graph is the static current voltage characteristic.

CONCLUSIONS

For an ESP that collects high resistivity dust the presence of back Corona discharges is inevitable problem. The negative resistance area from a current voltage characteristics (if the characteristics depending on minimum voltage) is a result of back Corona discharges. With modern control techniques and with adapted algorithm the back Corona may be detected.

The back-Corona phenomenon is diminish if is burn coal with better characteristics. Another solution to diminish back Corona discharges is to modify the dust resistivity by condition the flue gas (with sulphur and ammonia). Using another control technique, intermittent energisation or pulse energisation will be decreasing the back Corona discharges.

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EXTRACTION AND CHARACTERIZATION OF LIPOPOLYSACCHARIDE FROM SERRATIA RUBIDAEA AND ITS CYTOTOXICITY ON LUNG CANCER CELL LINE-NCI-H69

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ABSTRACT: The present study was carried out on Lipopolysaccharide from *Serratia rubidaea* followed by its partial purification, characterization, evaluation of its Cytotoxicity on Lung Cancer Cell Line. LPS was extracted from *Serratia rubidaea* and detected by the addition of Schiff's reagent. The various subgroups such as 2-KDO, uronic acid and 4-amino arabinose were detected by paper chromatography and the subgroups such as Lipid A and free amino groups were detected by Thin layer chromatography. Partial purification of the extracted LPS was done by SDS-PAGE in which bands were obtained in ladder like patterns. The presence of fatty acids, esters, phosphates in LPS of *S.rubidaea* were revealed by GC-MS analysis. LPS was found to exhibit cytotoxicity on the lung cancer cell line NCI-H69.

KEYWORDS: LPS, *Serratia rubidaea*, NCI-H69, Cytotoxicity

INTRODUCTION

Lipopolysaccharide (LPS) is a major component of the outer membrane contributing greatly to the structural integrity of the bacteria, and protecting the membrane from certain kinds of chemical attack. LPS is an endotoxin, and induces a strong response to animal immune systems. Lipopolysaccharides are of crucial importance to gram negative bacteria, and are therefore candidate targets for new antimicrobial agents. Gram-negative bacteria produce a variety of polysaccharides that are important in determining plant and animal-microbe interactions.

These polysaccharides include extracellular, capsular and the cell wall lipopolysaccharides (EPSs, CPSs, and LPSs, respectively). Bacterial lipopolysaccharides are commercially important in different industrial area as such as petroleum, textile, pharmaceutical, and fine chemical industry Sanford¹. Bishop² large number of lipopolysaccharides is medically important, since they are immunogenic. LPSs are the major structural component of cells walls of gram-negative bacteria. They are unique biopolymers whose molecule contains a hydrophobic moiety (lipid A), which consists of fatty acids linked to a phosphorylated disaccharide (comprising two glucosamine residues), and hydrophilic carbohydrate domains. The latter include the core oligosaccharide (the central part of the LPS molecule), consisting of a certain number of monosaccharide residues (approximately 10), and O-specific polysaccharide chains, consisting of repeated oligosaccharide units, whose structure may significantly vary in different strains of the same species. *Serratia* a genus of bacteria (tribe Serratiae) gram-negative, rod which produces a red pigment.

Lipopolysaccharide exhibit a numerous biological activity as antibiotics, helps in immune response, and anticancer property. Lipopolysaccharide exhibits a cytotoxic action on various types of cells via apoptosis^{3,4}. In the present study LPS were extracted and partial purification were performed from selected species of *S. rubidaea*. The components present in LPS were analyzed by GC-MS. The anti cancer property of LPS were determined against lung cancer cell line.

MATERIALS AND METHODS

□ GROWTH OF BACTERIA AND EXTRACTION OF LPS

The selected Gram-negative isolate was grown in Brain heart infusion broth Fukushi et al.⁵ for 24 hours at 37°C and the cells were harvested by centrifugation at 5000 rpm for 10 minutes. Extraction of LPS was carried by Westphal and Jann⁶. The bacterial suspension (5 g dry biomass in 100 ml), was mixed with of 90% phenol previously heated at 67°C, and incubated at 37°C in an orbital shaker at 160 rpm for 15 minutes. The mixture was then placed on ice to facilitate the separation of phases and centrifuged for 20 minutes at 5000 rpm.

The aqueous phase was collected. A second extraction was made on the mixture of phenol and the cellular pellet by addition of distilled water at 67°C. Both aqueous phases were combined and dialyzed against distilled water until the phenol was completely eliminated. The sample was then clarified by centrifugation at 10,000 rpm for 20 minutes at room temperature to eliminate the insoluble material.

LPS was concentrated by alcohol precipitation as follows; Sodium acetate was added at a final concentration of 0.15 M followed by addition of ice cold 96% ethanol drop by drop for a final sample to

ethanol proportion of 1:4. The mixture was incubated for 24 hours at -20°C . The pellet was then collected by centrifugation at 4000 rpm, and suspended at a concentration of 25 mg/mL in distilled water and lyophilized.

□ ANALYTICAL METHODS

The subgroup present in LPS includes 2-Keto-3-deoxyoctonate (2-KDO), Uronic acids, 4-Amino-arabinose, free amino group and Lipid A. The methods used for identification of sub groups present in LPS are as follows

▪ PAPER CHROMATOGRAPHY

The sample was treated with 1% acetic acid at 100°C for 3 hours. The treated sample was gently spotted in Whatman No.1 filter paper and the mobile phase (pyridine, acetic acid, and water in the ratio, 10:4:86, vol/vol/vol; pH 5.3) was allowed to run till it reaches three-fourth of the paper. The spots were detected by spraying 5% thiobarbituric acid for the presence of 2-Keto-3-deoxyoctonate as given by Weissbach and Hurwitz⁷.

The sample was treated with 1N H_2SO_4 at 100°C for 4 h. The treated sample was gently spotted in Whatman No.1 filter paper and the mobile phase (pyridine, acetic acid, and water in the ratio, 10:4:86, vol/vol/vol; pH 5.3), chromatograms were developed by spraying 2% alkaline silver nitrate solution to confirm the presence of Uronic acids Dische⁸

The sample was treated with 10 N HC1 at 100°C for 15 seconds. The treated sample was gently spotted in Whatman No.1 filter paper and the mobile phase (pyridine, formic acid, acetic acid, and water in the ratio, 1:1.5:10:90 v/v/v/v; pH 2.8, the spots were detected by spraying ninhydrin solution to confirm the presence of 4-Amino-arabinose Rondle and Morgan⁹.

▪ TLC ANALYSIS

Silica gel plate was spotted with 10 μl of sample containing extracted LPS and kept in a chamber containing phosphate buffer solution of pH 9-11, which act as a mobile phase. When the solvent run up to 10 cm the plate was removed and air dried for 10 minutes. The spots were then detected by spraying bromocresol green over the chromatogram to confirm the presence of Lipopolysaccharides Caroff et al.¹⁰

The Mobile phase for the amino group Kapustina et al.¹¹ (chloroform, methanol, water and ammonium hydroxide, 100: 50: 8: 4 v/v). Bands were visualized by spraying 20% H_2SO_4 in methanol on the chromatogram followed by heating at 130°C for 10 minutes.

For Lipid A the solvent mixture containing chloroform, pyridine, 88% formic acid, methanol and water (60:35:10:5:2 v/v/v/v). When the solvent reaches 10 cm the plate was removed and air dried. The plate was then observed for the formation of waves Nanette et al.¹²

□ SDS-PAGE FOR LPS (Modified procedure of Formsgaard et al.¹³)

SDS-polyacrylamide gel (10 cm by 10 cm by 0.75 mm) containing 4% and 12.5% acrylamide in the stacking and separating gel was prepared and electrophoresis was done at 50mA for stacking gel and 100mA for separating gel until the tracking dye Bromophenol blue run about 10 cm. SDS-PAGE-fractionated LPS preparations were stained by the silver staining Gromova and Celis.¹⁴

□ GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS) ANALYSIS

The LPS was analyzed by GC-MS (JEOL GCMATE II GC-MS and Finnigan Mat 8230 Mass Spectrometer). The GC column dimension used was 30X0.25mmX0.5mm AB-35MS fused silica capillary column. For GC the injector temperature was about 250°C , column temperature isothermal at 100°C then programmed to rise up to 250°C at $6^{\circ}\text{C}/\text{min}$ and be held at this temperature for 10 minutes. The ion source temperature was 200°C and the interface temperature was 250°C . Helium gas was engaged as a carrier gas at the rate of 1ml/minutes. The spectra were obtained in the EI mode with 70eV ionization energy. The compounds were identified by comparing with the mass spectrum and matched with the inbuilt library.

□ CYTOTOXICITY OF LPS ON LUNG CANCER CELL LINE

The Cytotoxic effect of LPS against NCI-H69 (small lung carcinoma) was assayed by MTT {3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazoliumbromide}. Cells were plated at 37°C for 24 hours on 24 well plate at a density of 10^3 - 10^4 -cells per well, with Minimal Essential Medium (MEM) supplemented with 10% Fetal Calf Serum (FCS). Penicillin (100 units/ml), Streptomycin (100 $\mu\text{g}/\text{ml}$) and Amphotericin B (5 $\mu\text{g}/\text{ml}$) were added to the medium and maintained in a humidified atmosphere (5% CO_2) at 36°C . After 24 hours the cells were exposed to different concentration of LPS, 100 $\mu\text{g}/\text{ml}$, 150 $\mu\text{g}/\text{ml}$ and 250 $\mu\text{g}/\text{ml}$ which were prepared by diluting from stock solution of 5mg/ml. The cells were incubated at 36°C in humidified incubator with 5% CO_2 for a period of 72 hours. Morphological changes of the cell culture were examined using an inverted microscope. After 72 hours cell viability was determined. Cytotoxicity of LPS was determined by plotting percentage cell viability against concentration of LPS.

RESULTS AND DISCUSSIONS

The bacterium used in this study was isolated from soil sample by serial dilution. Pink colored colonies were obtained on nutrient agar. The morphological and biochemical characterization of the bacterium revealed the isolated organism to be *Serratia rubidaea*. The selected organism was inoculated in brain heart infusion broth for the LPS extraction by

hot phenol water extraction method. LPS was concentrated by alcohol precipitation. The extracted LPS were preliminarily detected by using Schiff's reagent. On adding Schiff's reagent to the extracted sample, the color changed from pink to red indicating the presence of LPS. The presence of impurities such as protein, DNA and RNA were also analyzed in the sample. Protein was found to be present in negligible amount whereas DNA and RNA were found to be absent in the sample.

The subgroups such as 2-KDO, uronic acid, 4-amino arabinose, were identified using paper chromatographic techniques. The LPS, free amino group, Lipid A were identified by using TLC. The presence of 2-KDO was confirmed by color change to light yellow on spraying with 5% thiobarbituric acid. Uronic acid was detected by spraying alkaline silver nitrate solution during which orangish red colored spots were developed. On spraying ninhydrin solution, amino sugar formed brown wave's pattern.

LPS was detected by spraying bromocresol green over TLC chromatogram. The extracted LPS formed clear round zones which confirmed its presence in the sample. Charring was observed when TLC plate loaded with sample was sprayed with 20% H₂SO₄ in methanol followed by heating at 130°C. Charring resulted due to the presence of free amino groups. The presence of Lipid A was confirmed by the formation of reddish brown wave like patterns due to reaction of the loaded sample with the solvent system containing chloroform, pyridine, 88% formic acid, methanol and water.

The presence of the LPS was confirmed by SDS-PAGE. The SDS-PAGE procedure was standardized for LPS and a modified silver staining method specific for LPS was employed. After running the gel staining was done. Ladder like patterns of bands were obtained which is characteristic of LPS Formsgaard et al.¹⁵ The whole gel became light brown because of cold staining solution Plate 1.

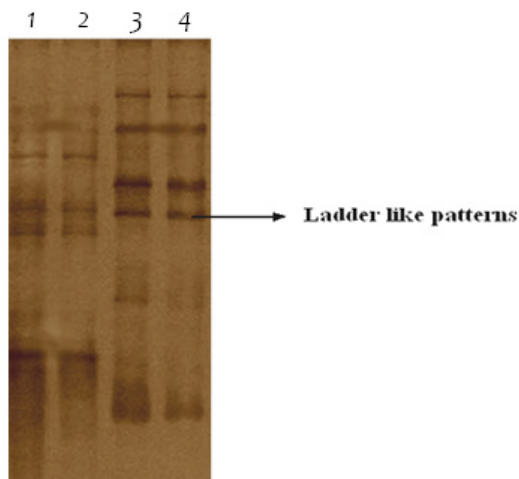


Plate 1. Lipopolysacchrude separation by SDS-PAGE Lane 1-20µl, Lane 2-25µl, Lane 3-30µl, Lane 4-30µl

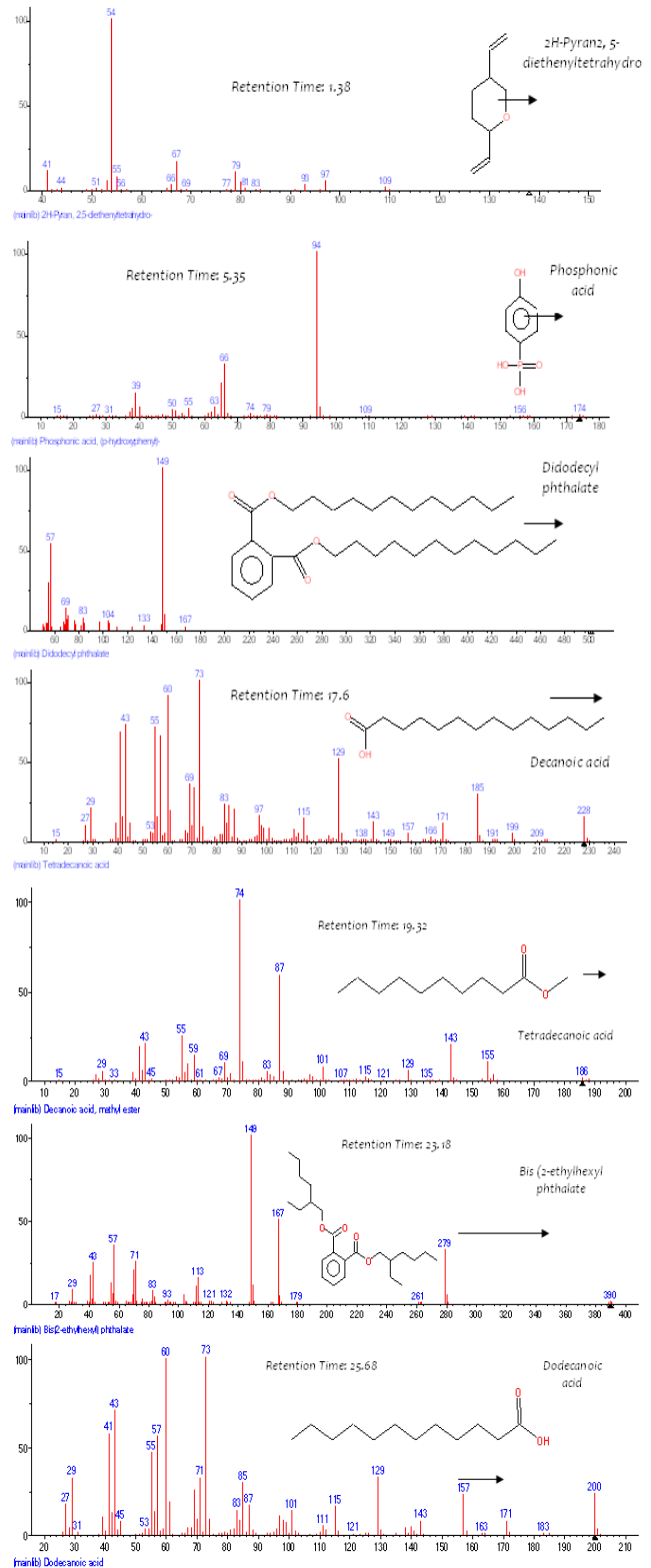


Figure 1: Mass spectra of lipopolysaccharide

The components of LPS were characterized by using GC-MS. The amount of LPS obtained from 5 g of *S.rubidaea* was found to be 0.25 mg. The GC-MS analysis resulted in chromatogram and m/z spectrum. The chromatogram was analyzed for the Hit compounds by comparison with the Hit library with the help of NIST'o8 software. The component present in LPS of *S. rubidaea* was determined by comparison of m/z (mass/energy) spectrum as well as with the hit Library given in Figure 1. The components were found

to be 2H-Pyran,2, 5-diethenyltetrahydro(rt-1.38), Phosphonic acid (rt-5.32), Didodecyl phthalate(rt - 12.62), Decanoic acid (methyl ester) (rt-17.6), Tetradecanoic- acid (rt-19.32), Bis(2-ethylhexyl) phthalate (rt-23.18), Dodecanoic acid (rt-25.68).

The area- percentage, chemical formula and the molecular weight of the compounds are shown in Table 1. The mass spectra of each peak are given in Figure 2. As seen earlier with case of *E. coli* Re-mutant LPS, the initially eluting molecular species contained 3-hydroxytetradecanoic and dodecanoic acid. In later fractions tetradecanoic and hexadecanoic acids appeared Werner¹⁶.

Table 1: Compounds Present In LPS

Retention Time	Compound Name	Formula	Molecular Weight	Area (%)
1.38	2H-Pyran,2,5-diethenyltetrahydro	C ₉ H ₁₄ O	138	6.8
5.35	Phosphonic acid	C ₆ H ₇ O ₄ P	174	1.7
12.62	Didodecyl phthalate	C ₃₂ H ₅₄ O ₄	502	6.84
17.6	Decanoic acid, (methyl ester)	C ₁₁ H ₂₂ O ₂	186	7.83
19.32	Tetradecanoic acid	C ₁₄ H ₂₈ O ₂	228	2.31
23.18	Bis(2-ethylhexyl) phthalate	C ₂₄ H ₃₈ O ₄	390	6.50
25.68	Dodecanoic acid	C ₁₂ H ₂₄ O ₂	200	4.58

The Cytotoxicity of LPS was analyzed by treating the lung cancer cell line-NCI-H69 with different concentrations of LPS such as 100 µg, 150 µg, and 250 µg. MTT assay was followed to determine the Cytotoxicity. Before carrying out the Cytotoxicity assay, all the samples were filtered through 0.45 µm syringe filter.

The cell viability was gradually decreased from 100µg/ml concentration to 250 µg/ml concentrations. The lowest cell viability of 48.88 was observed at 250 µg/ml concentration.. The picture of LPS untreated cell line (control) and LPS treated cell line are shown in Plate 2A, B, C, D. Prakash et al.,¹⁷ investigated the effect of β-carotene on the morphology of NCI-H69 small lung cancer cell line.

Muto et al.¹⁸ studied the effect of β-carotene at a concentration of 10 µmol/L on human cervical cancer cell line, CICC-2. They reported that β-carotene caused chromatin condensation a characteristic property of apoptosis. Stryokova¹⁹ studied the effect of LPS prepared from a strain *Salmonella typhi* isolated from a carrier on sheep erythrocytes. Erythrocytes were treated with alkali-hydrolyzed, peroxidase labeled LPS.

The membrane morphology of LPS treated erythrocytes was studied by electron microscopy. The study revealed a change of typical shape of erythrocyte to oval shape.



Plate 2A-Control

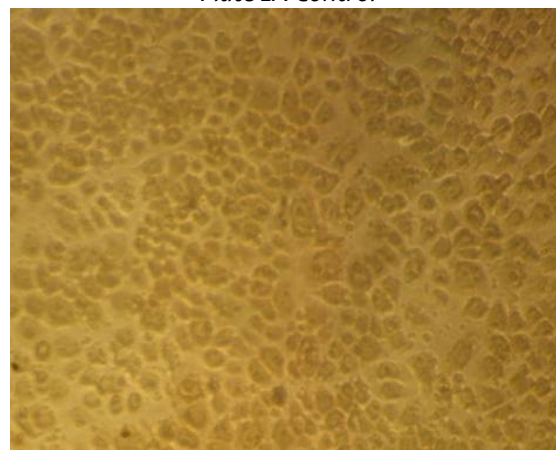


Plate 2B (Conc-100µgLPS/ml)

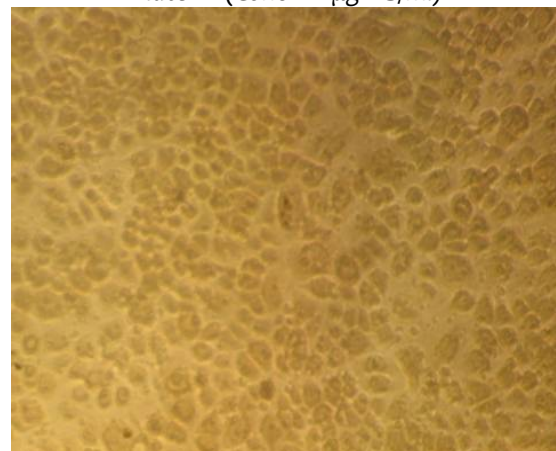


Plate 2C (Conc-150 µgLPS/ml)

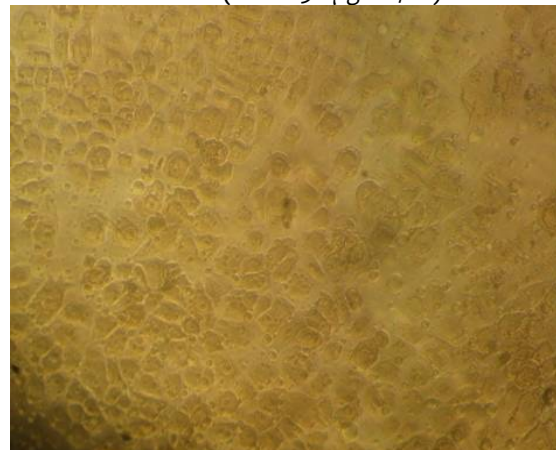


Plate 2D (Conc-250 µgLPS/ml)

Plate 2: MTT Assay of Lps On Human Lung Cancer Cell Line-NCI-H69

The stability of membrane system was also found to be decreased resulting in hemolytic of erythrocytes. The cytokine-inducing capacity of LPS and its Lipid A from *Coxilla burnetti* strain Priscilla on human Mono Nuclear Cells (MNC) was analyzed.

The human MNCs were stimulated with Lipid A and TNF α production of the cells was determined in the supernatant by sandwich-ELISA using monoclonal anti-human TNF α antibody Toman et al.²⁰

CONCLUSIONS

LPS was found to exhibit cytotoxicity on the lung cancer cell line NCI-H69. Of the various concentrations used, percentage cell viability was found to be less at 250 μ g. Cytotoxicity was determined by MTT assay. Thus on increasing the concentration of the LPS extract, the percentage cell viability was found to be reduced. Thus from the present study it is revealed that the LPS of *Serratia rubidaea* has cytotoxic properties. These properties of LPS can be used in the development of drugs for cancers. The study may be further extended to identify the pathways of LPS that have given rise to anti tumor activity.

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AUTOMATIC OF COMPONENT PRODUCTION AND MINIMALIZATION OF PRODUCTION COSTS

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ABSTRACT: The notion of „machinability of materials“ is a complex of characteristics of the machined material which is monitored in the view of its fitness for the production in a certain way of machining. The machinability of materials is considered to be a parameter which characterizes the machined material in the process of cutting and expresses the degree of machining effectivity in terms of material of a product. When optimizing cutting conditions, under certain conditions it is possible to determine optimal serviceability of a machine according to a certain optimizing criterion independently on cutting condition optimization. When cutting conditions and tool durability optimizing, it is necessary to apply certain optimizing criterion within certain restraining conditions. The restrictions are given by technical parameters of a machine, tool, machined material, required quality of machined surface etc. The essential economic criterion is the amount of production cost.

KEYWORDS: machine serviceability, production cost, economic reasons, optimizing

INTRODUCTION

The machinability of materials is considered to be a parameter which characterizes the machined material in the process of cutting and expresses the degree of machining effectivity in terms of material of a product. Cutting speed when considering certain cutting edge durability, surface roughness, degree of splinter deformation and resultant splinter shape and its proportions are utilized as evaluation of machinability indexes. Confrontation with the reference material enables to determine the rated machinability as one of the basic characteristics of machined material used when cutting conditions are optimized.[7]

ECONOMIC REASONS FOR AUTOMATION OF COMPONENT PRODUCTION

When considering machining process from the point of efficiency (productivity) production costs are oblivious. Yet, it is applicable exceptionally.

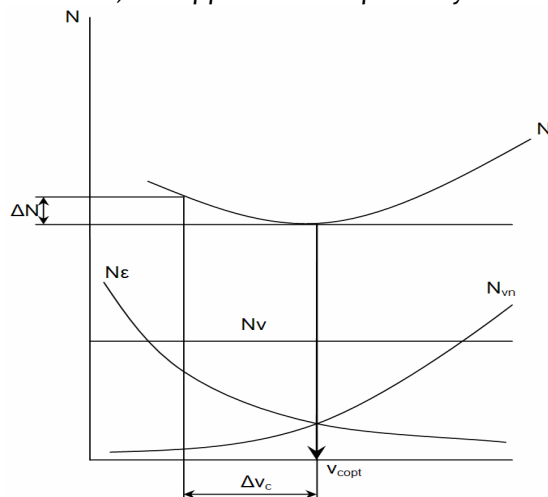


Fig. 1.a. Dependence of N production costs and their components on cutting speed. Conventional machining

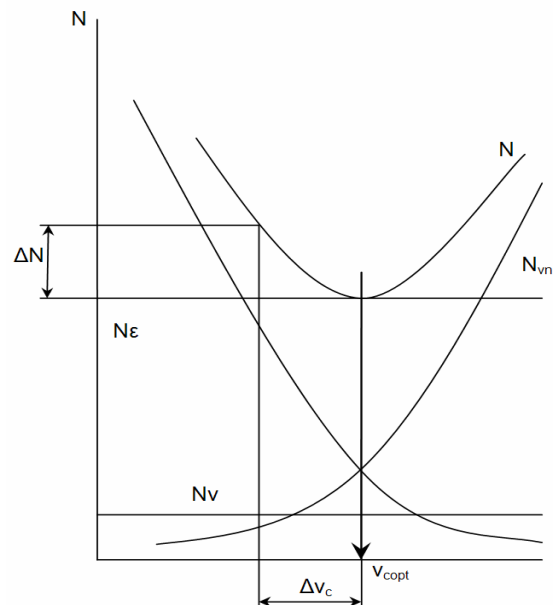


Fig. 1.b. Dependence of N production costs and their components on cutting speed. CNC machining

$v_c \cdot N_c$ – costs on machine work,

N_v – secondary work costs,

N_{vn} – costs to device exchange.

In market mechanism it is required to produce a product in such economic conditions so that its sale price is acceptable and attractive. To start thinking about a production process it is necessary to get an idea about its cost structure.

Using more expensive production installation the costs raise more rapidly. They reach minimum at higher cutting speed than when utilizing usual machines. Disobedience to this relation leads to sharp rise of production costs when machining using the CNC machines. The basic cost development scheme is in the fig. 1.

MATHEMATICAL MODEL MINIMALIZATION OF COSTS

In present, the cutting conditions are mainly chosen from norms that are not optimal.

The nature of cutting conditions optimization is to determine optimal values of given conditions (cutting depth – a_p , underthrust depth – f , cutting speed – v_c) and the optimization of a machine durability.

For a machine with replaceable cutting plates that are re-sharpened is valid:

$$N_{nT} = \frac{C_p \cdot z_p \cdot z_o}{z_h \cdot s_p (z_o + 1)} + (1 + k_{ut}) \cdot \frac{C_{tn}}{z_u} + \tau_{as} \cdot k_c \cdot \frac{M_{as}}{60} \left(1 + \frac{RNO_{pl}}{100}\right) \cdot \frac{z_o}{z_o + 1} \quad (1)$$

where:

z_o is the number of possible re-sharpening of a plate.

Costs to exchange of a device can be given by:

$$N_{vn} = \tau_{vn} \cdot k_c \cdot \frac{M_n}{60} \cdot \left(1 + \frac{RNS_{pl}}{100}\right) + \frac{O_s}{60} = \tau_{vn} N_{vnm} z_v \quad (2)$$

where:

N_{vnm} are costs to exchange of a device per, [min],

M_n – wages of a setup man including social and health insurance, [€ '],

τ_{vn} – time to exchange a device, [min],

The criterion for minimal production costs can be given (production costs to operational department shall be minimum) by the relation:

$$N_c = N_s + N_n + N_m \quad (3)$$

where:

N – production costs to calculate an operational section, [€],

N_s - costs to machine labor per an operational section, [€],

N_n – costs to machines related to the operational section, [€],

N_{vn} – costs to exchange or offset of a worn-out device related to the operational section, [€].

Having substituted the above-mentioned relations into this criterion the optimization criterion to be reached from the point of view of production costs as follows:

$$N = \tau_{As} N_{sm} + \frac{\tau_{As}}{T} k_r N_{nT} + \tau_{vn} N_{vnm} \frac{\tau_{As}}{T} k_r \rightarrow \min \quad (4)$$

or :

$$N = \tau_{As} N_{sm} + \frac{\tau_{As}}{T} k_r (N_{nT} + \tau_{vn} N_{vnm}) \rightarrow \min \quad (5)$$

The machine time can be given by:

$$\tau_{As} = \frac{L_{ch}}{n \cdot f} \quad (6)$$

where:

L_{ch} is the length of machine automatic operation run, [mm],

n - rotational frequency,

f – displacement, [mm]

Substitution (4) in (5) results in the criterion equation:

$$N = \frac{L_{ch}}{n \cdot f} N_{ns} + \frac{L_{ch} k_r}{n \cdot f \cdot T} (N_{nT} + \tau_{vn} N_{vnm}) \rightarrow \min \quad (7)$$

Having modified:

$$\frac{K_1}{n \cdot f} + \frac{K_2}{n \cdot f \cdot T} \rightarrow \min \quad (8)$$

where:

$$K_1 = L_{ch} \cdot N_{sm} \quad (9)$$

$$K_2 = L_{ch} k_r (N_{nT} + \tau_{vn} N_{vnm}) \quad (10)$$

When milling operation, proportional parameter of displacement per rotation f and displacement per tooth fz are considered. Total production costs per a work-piece can be given by the relation:

$$N_c = \sum_1^{nu} N_i + N_v + \frac{N_d}{n} + \frac{N_{sz}}{n} \quad (11)$$

where:

N_c are total production costs per a work-piece, [€],

N_i – production costs to i - operational section, [€],

N_{sz} - costs to a special device necessary for production of a given work-piece, [€],

n – number of produced pieces,

n_u – number of operational sections within one work-piece,

Costs to secondary work:

$$N_v = \tau_{Av} \cdot k_c \cdot \frac{M_o}{60} \cdot \left(1 + \frac{RNS_{pl}}{100}\right) + \frac{O_s}{60} = \tau_{As} N_{vm} \quad (12)$$

Where:

N_{vm} – costs to secondary work, [€],

τ_{Av} – unit secondary time, [min.],

Rate costs:

$$N_B = k_c \cdot \frac{M_s}{60} \cdot \left(1 + \frac{RNS_{pl}}{100}\right) + \frac{O_s}{60} = \tau_{BC} N_{Bm} \quad (13)$$

where:

N_{Bm} are rate costs, [€ '],

τ_{BC} – rate time with shift time over plus, [min]

Criterion of minimum production costs can be also given by the method of hourly operational costs.

Fixed costs whose share in total costs continually raises are just those unwelcome costs that burden production. This is one reason why it is success to produce with optimal capacity employment.

For practical utilization it is appropriate to express the capacity utilization in time units (hours, norm hours).

When formulating the cost model of a production workplace (of a machine) other advantageous properties of this method can be used.

1. Possibility of division (decomposition) hourly overhead lump sum into two individual units as follows:

- Into hourly overhead lump sum of joint expenses (HRP_{sp})
- Into hourly overhead lump sum of a production workplace (a machine) (HRP_{pra})

2. Possibility to decompose each hourly overhead lump sum as the sole number into more partial generic cost items that enables to separately observe individual impacts on hourly overhead lump sum.

The first property enables to present overhead costs to particular activities within the production process with the help of hourly overhead lump sum as the total of two separable components.

Total value of hourly overhead lump sum is consequently given by the total of both components.

While HRP_{sp} will be the same for all workplaces within a single organizational unit (center, operational department, etc.) to which joint expenses are related, the HRP_{pra} value will be unique for each workplace (machine, set of machines). [3,7,8]

The second property allows the distinction of general expenses from the point of generic e.g. for example to components of write-offs, rent (leasing), wages, energy costs, overhead material etc. It is crucial to choose such a classification in concrete application that would respond to the situation given. It is necessary to focus on main items sensible that the less important ones can possibly be joint together. It means for example that while the significant part of a production device will not be true but rented (leased) than that item has to appear in the HRP decomposition. While the production device is true it is useless to mention the item.

The simple solution is not to divide general expenses into two parts i.e. joint expenses of a department and costs of a workplace but leave it as the average value of hourly overhead lump sum designed on the basis of share of total of all overhead costs within a department and total department capacity. It is a simple solution that can be appropriate as the first stage of transition from a calculation through an extra charge to a calculation with the usage of the hourly overhead lump sum method.

By this simplification the influence of individual factors is covered and their impact is not clear in the total calculation.

Essential matters for the working process optimization are a solid analysis of on what the value

of expense units depends. It is determining just because the information enables to manage the working process effectively.

From the point of preceding ideas, there is an alternative coming out to determine minute costs to machine work:

$$N_{sm} = k_c \frac{M_o}{60} + \frac{HRP_{sp}}{60} + \frac{HRP_{pra}}{60} \quad (14)$$

where:

HRP_{sp} hourly absorbed lump sum of joint expenses, [ϵh^{-1}],

HRP_{pra} – hourly overhead lump sum of a production department (a machine), [ϵh^{-1}].

By analogy for minute expenses to exchange of a machine (relation 2):

$$N_{vmm} = k_c \frac{M_s}{60} + \frac{HRP_{sp}}{60} + \frac{HRP_{pra}}{60} \quad (15)$$

The mentioned way of how to express cost items presents the model that comes out of the dynamic calculation principle and uses the method of hourly annual lump sums. It requires a solid analysis mainly of overhead expenses in the relation to a calculation unit. It is a model applicably open e.i. it accepts the costs units that are defined and able to find out in the application given. It relates the lowest organizational levels; it means workplaces (a machine) and a department.

It concerns the open model also from the point of the possibility to enhance it by more-detailed specification of dependence of costs on cutting conditions. [6,7,8]

CONCLUSIONS

When optimizing cutting conditions, under certain conditions it is possible to determine optimal serviceability of a machine according to a certain optimizing criterion independently on cutting condition optimization.

When coming out from optimal serviceability intended from the point of minimum production costs at cutting conditions optimizing, the criterion of maximum reduction is identical with the criterion of minimum production costs.

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CONTROL TOOLS FOR OPTIMIZING ABAP CODES

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ABSTRACT: Given current trends to computerized economic, integrated design development provides premises for a computer-based business processes in order to accommodate to current climate and increase competitiveness. This paper is a study on how to use control tools in ABAP SAP NetWeaver Application Server to perform the best code optimizing. In appropriate case studies, we will refer to the ABAP Runtime Analysis, Memory Analysis, and STAD transaction.

KEYWORDS: software integrated system, runtime analysis, memory analysis, business transaction analysis

INTRODUCTION

SAP Netweaver Application Server ABAP is the SAP Netweaver Application Server from which applications can be programmed in ABAP [1], [2]. It provides the execution environment is a virtual machine ABAP to ABAP programs independent of hardware, operating system and database system. ABAP Workbench is used as the runtime environment for the development of applications. SAP Netweaver Application Server ABAP, client-server system 3-tier, can be used by people or other software. Users can access people using user interfaces which are available via a web browser (using ICM interface) or SAP GUI installed on desktop client computers. Software components can access the connection Remote Function Call protocol RCF (RCF) properly using RFC interface.

Native language of an ABAP system is a generation-4 programming language (4GL) that supports both procedural model and object oriented programming. Persistent data stored in relational databases and ABAP programs accessed through Open SQL instructions. Open SQL consists of the DML (Data Manipulation Language) standard SQL language.

CODE TESTING TOOL: ABAP OBJECTS RUNTIME ANALYSIS (SE30 TRANSACTION)

Running time is important information relative to the performance of code sequences [3]. The ABAP Runtime Analysis tool can analyze the execution time affecting the performance of ABAP software. The ABAP Runtime Analysis can test, for example, programs, methods and functional modules (global subroutines). Test results can be saved in graphic file server applications. These files are available to achieve the necessary optimizations. ABAP Runtime Analysis tool can be executed using transaction SE30 launch – Figure 1.

For example, we should test the YALLS_ARRAY_FETCH_DATA_REF software that uses array fetch reading technology in an internal table of data from a database table, access to data in internal

table is made by reference variable time. We run the software from this window – Fig. 1. After returning from the execution window, the Runtime Analysis window turns as described in Figure 2 and it allows performance evaluation. Test program results are presented in Figure 3.

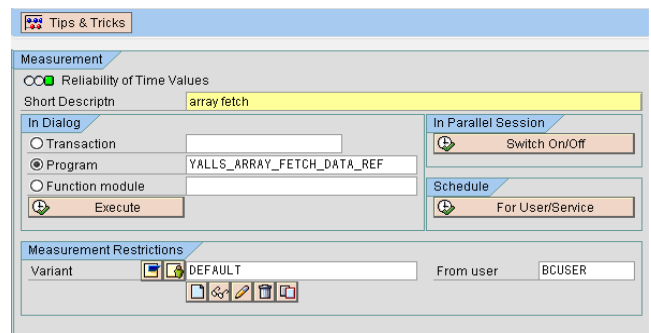


Figure 1. Main interface ABAP runtime analysis tool

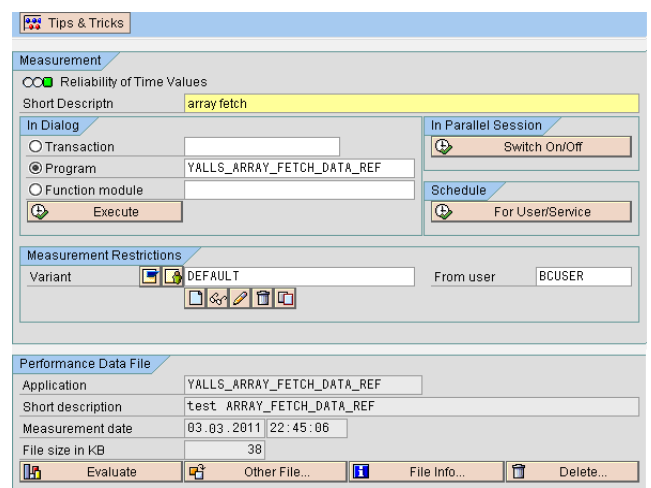


Figure 2. ABAP Runtime analysis interface for data analysis

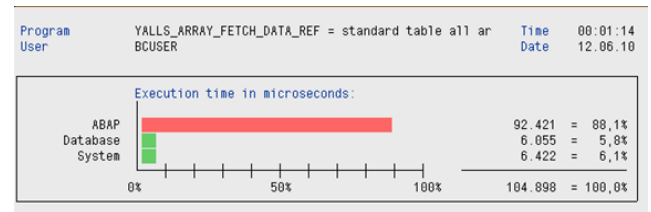


Figure 3. YALLS_ARRAY_FETCH_DATA_REF software test results

We can now read the ABAP instructions runtime time in microseconds, as well as the time to work with the database and runtime time operating system.

CODE TESTING TOOL: MEMORY ANALYSIS

An analysis of the software memory can be used by the Debugging process. We should use the Replace Tool from the Toolbar and choose to receive the Special Tool - Figure 4, and then we choose Memory Analysis option to analyze it in terms of memory used in the software code.

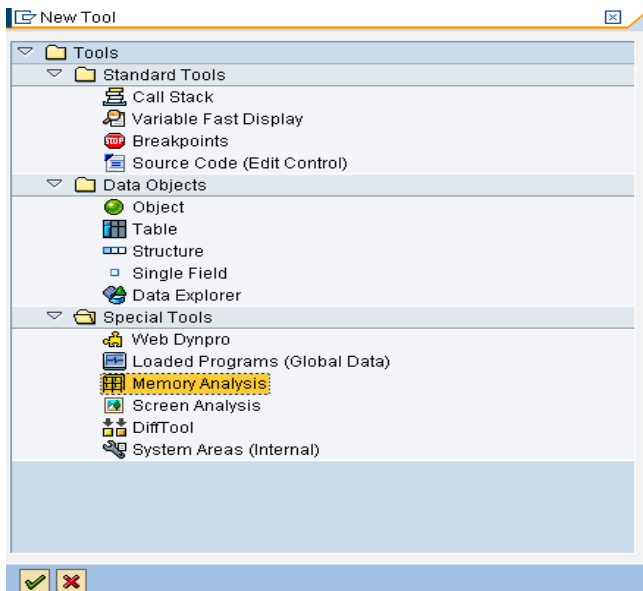


Figure 4. Memory analysis by debugger

Figure 5 describes the memory test results of codes in YALLS_ARRAY_FETCH_DATA_REF software.

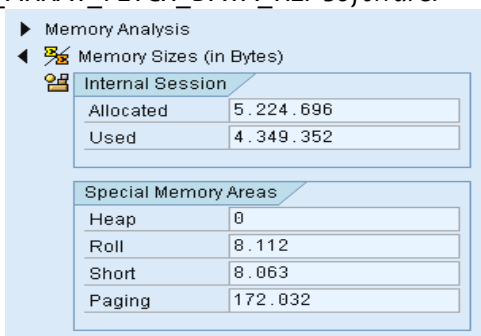


Figure 5. Memory analysis results

In Figure 5, memory size is specified in bytes. Special areas of memory are: Heap Memory -private memory reserved for runtime processes of the Application Server; Roll Memory is reserved for copying data sources such as roll file, if the runtime processes of application server change; Short memory - memory for storing intermediate results resulting from the use of such a screen is automatically cleaned after each dialog step.

STAD TRANSACTION (BUSINESS TRANSACTION ANALYSIS)

Business Transactions Analysis calculates the system resource usage of individual transactions for ABAP systems and provides a detailed analysis of a transaction and the dialog steps. The selection criteria include user, transaction, program, task type, start date, and start time. [1]

SAP Workload: Business Transaction Analysis

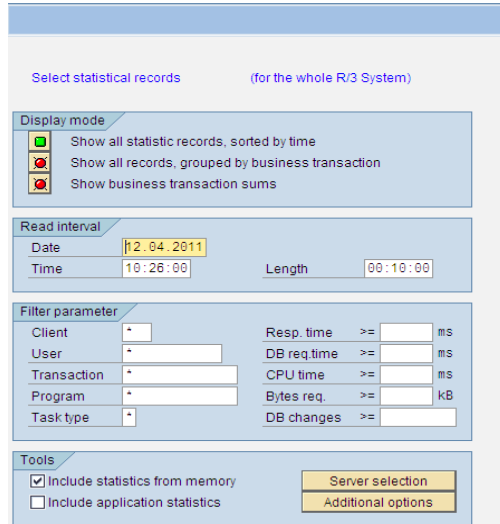


Figure 6. STAD transaction

This transaction enables us to set up the system through several variants - Figure 6: displaying single records as they are displayed in Transaction STAD, displaying the single records grouped by business transaction, or displaying business transaction or job totals.

The system always analyzes a time frame that is larger than the reading time, because the start date and time define the beginning of the period to be analyzed and the read time defines the duration of that period. By choosing Include statistics from memory, the system analyzes statistical records that were not yet written to the statistic file, but which are contained in the statistics buffer. To analyze very recent time periods, is necessary to include the buffered records. With Server selection we can analyze only the statistics of specific servers. With Additional options we can influence the time frame mentioned above or the wait time for RFC's to be analyzed if we do not receive data from a server that was called as a result of RFC problems, or busy application servers that increase waiting time.

Testing it by STAD transactions for a transactional operation, the job name is SDOE_LOAD - Figure 7; the response time results, time in WP's, Waiting time, CPU time, DB req time, Memory used, and transferred kBytes.

SAP Workload: Business Transaction Analysis

System: BPC Client: 000 Number of RFCs which responded (without errors): 1 (1)
 Analysed time: 15.04.2008 / 12:40:00 - 15.04.2008 / 13:00:00
 Display mode: Business transaction sums

Started	Server	Step	Type	Transaction or jobname	User	Response time (ms)	Time in WP (ms)	Wait time (ms)	CPU time (ms)	DB req. time (ms)	UNC elapsed time (ms)	Memory used (kB)	Transferred (kB)
				**	HOLLAPK	0			0	0			0
12:40:40	localhost_BMC_10	2	TR	+AB_RESET_JOBIDS	HOLLAPK	1	1	0	0	0	0	0	0,0
12:40:40	localhost_BMC_10	1	TR	SAPSYSST	HOLLAPK	75	75	0	10	53	0	4.267	2,0
12:40:51	localhost_BMC_10	5	TR	SESSION_MANAGER	HOLLAPK	4.110	3.131	1	840	311	0	4.267	78,0
12:41:42	localhost_BMC_10	4	TR	STAD	HOLLAPK	1.341	1.241	0	70	12	0	4.267	8,0
12:41:50	localhost_BMC_10	1	TR	SESSION_MANAGER	HOLLAPK	1.150	800	1	130	43	0	4.267	47,0
12:41:58	localhost_BMC_10	432	TR	SDOE_LOAD	HOLLAPK	589.324	338.243	41.653	45.440	61.463	0	9.555	14.423,0
12:41:58	localhost_BMC_10	1	TR	SESSION_MANAGER	HOLLAPK	1.165	798	1	130	41	0	4.267	47,0

Figure 7. Job name SDOE_LOAD from STAD

RESULTS AND INTERPRETATION OF DATA PROCESSING EFFICIENCY INCREASE IN ABAP IN DATABASE TABLES

We will study various techniques [4], [5], [6] for processing data in a table. We suggest reading the records in a table according to selection criteria introduced by a screen with a single parameter selection and display records after processing a classic GU SAP list.

To read the data using two techniques: SELECT ... END SELECT cycle and ARRAY FETCH technique. SELECT ... END SELECT cycle requires sequential reading of information and attaching the internal table line by line. ARRAY FETCH technique involves reading the entire contents in an internal table. Data from internal table can be accessed in several ways: work area, field-symbol (label field) and variable time reference. The tests we perform at 10, 40, 70 and 100 table entries, watching the way ABAP instructions runtime, as well as runtime time of the database performance and total number of records in the table varies.

For the group of codes, we test two data reading techniques in database table, “select ... end select” and “array fetch”; and in case of the array fetch technique we look for effectiveness of three means of access to data from internal table: work area (a line-table type time object), every reference variable or field-symbols, and the results are described in Figure 8-10.

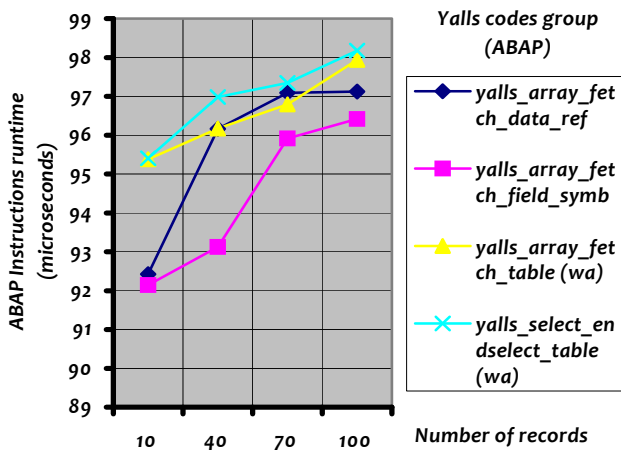


Figure 8. ABAP Runtime instructions depending on the number of records in the database table

In Figure 6, we describe the instructions execution of a lower ABAP when runtime with symbols for accessing field data from internal table. In this case, we use only one data object where we rewrite and process sequential values from the internal table. ABAP instructions runtime increases along with the number of records, because in all cases internal table reading and processing is done sequentially in a “loop ... end loop” cycle. The increase is more pronounced when using “select ... end select” technique that reads one line of the table and attaches it to the internal table. If case of array fetch technology data is read “globally”.

In terms of database runtime, we can see - in Figure 7 - that it increases along with the number of records, which are almost similar in all three cases in which we used the array fetch technique, therefore the increase was more obvious when using “select ... end select” technique, with a slightly larger number of records.

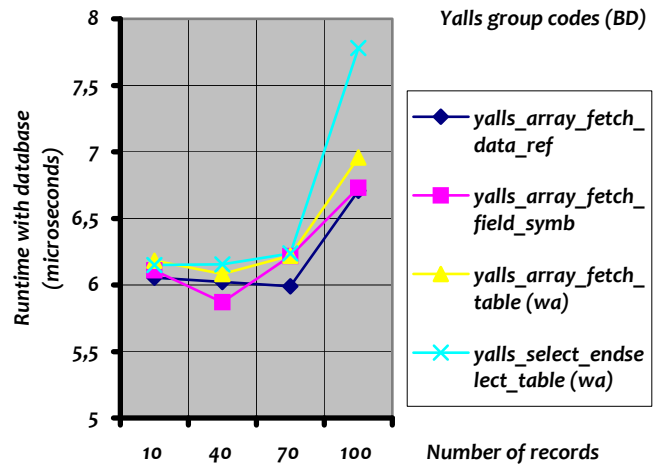


Figure 9. Runtime database records the number of database table

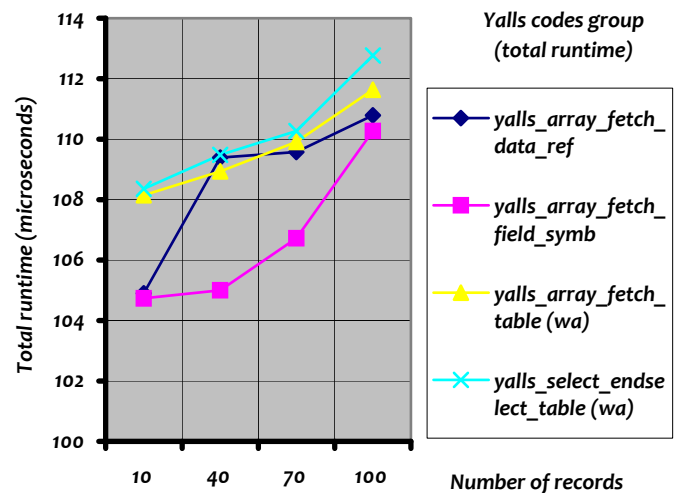


Figure 10. Total runtime of the software according to the number of records in the database table

Figure 8 reinforces the idea that using array fetch technology and accessing data from the internal table by the symbol field is a better solution over time. In terms of memory consumption, an analysis of codes from the yalls group revealed the results presented in Figures 11-13.

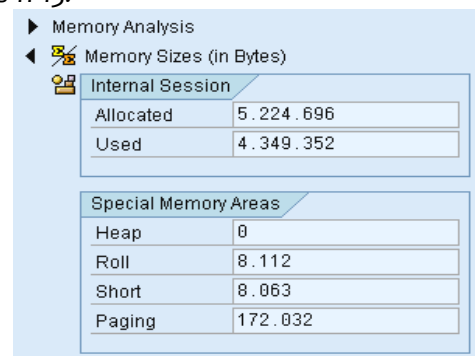


Figure 11. Yalls_array_fetch_data_ref Memory analysis

Memory Analysis	
Memory Sizes (in Bytes)	
Internal Session	
Allocated	5.224.696
Used	4.349.040
Special Memory Areas	
Heap	0
Roll	8.112
Short	8.063
Paging	172.032

Figure 12. Yalls_array_fetch_field_symbols
Memory analysis

Memory Analysis	
Memory Sizes (in Bytes)	
Internal Session	
Allocated	5.224.696
Used	4.426.512
Special Memory Areas	
Heap	0
Roll	8.112
Short	8.063
Paging	172.032

Figure 13. Yalls_array_fetch_table (wa)
Memory analysis

And speaking of memory used, array fetch technique with accessing data from internal table with the symbol field is the most effective.

CONCLUSIONS

This paper collects several studies referring to the involvement of the control tools, such as ABAP Runtime Analysis and Memory Analysis in order to analyze all methods to optimize data processing codes of the level of persistence on SAP Netweaver 2004's, ABAP Application Server. The analysis performed showed that the most effective reading data technique from one data table is array fetch. As far as access to data in internal table is concerned, it is efficient to use the symbol field both in terms of processing time and memory used. These studies can be of great use for an efficient coding of this integrated system which is also an ERP system (Enterprise Resource Planning).

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CONTROLLER DESIGN FOR BEHAVIOR PREDICTION OF SECOND ORDER CLOSED LOOP SYSTEM IN AUTOMATED INDUSTRIAL PROCESSES

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ABSTRACT: The process requirements, in a manufacturing environment, are subject to fluctuations dependent on both internal and external factors. Thus, most modern industries utilize automated control systems, which can make the necessary dynamic adjustments for achieving optimum productivity and product quality. The PID, PI, and PD controllers are widely relied upon for such automated control of processes. However, the adjustment and optimization of some of the functional aspects of these controllers, according to the process demands, are time consuming. Such fine tunings are usually done based upon expert knowledge and tech manuals. This study addresses this problem and presents a solution. The authors illustrate the simulation and development of a controller, using a GUI in MATLAB 2008, which is able to accept the process requirements as input and simulate necessary control actions based on the predictions made. The simulator, discussed, only handles Second Order Systems, which are prevalent in automated industrial control systems. The inputs required are the transfer function of the process and some relevant data from the corresponding frequency response domain. From these, the simulator can predict the closed loop behavior of the system. After the predictions, the GUI provides three viable controller choices to the user. The controller options are PI, PD, or PID types which offer greater flexibility to the user in optimizing the present condition of the process based on the fine tuned parameters for the chosen controller as determined by the simulator. Hence, the efficient operation and optimum output of the automated process is ensured.

KEYWORDS: Dynamic Control Simulator, Closed Loop System, Second Order System, PID Controller, Automated Industrial Processes

INTRODUCTION

Manufacturing processes, in today's competitive market, have to balance many almost mutually exclusive goals such as: higher productivity, stringent quality control, flexibility, short product lifetime, lower lead time, and reduced product price. Invariably, such adjustment and optimization of the process are too complex for manual oversight and control. Thus, a majority of modern industries have switched over to dynamic and automated process control systems. Such controllers perform online monitoring and fine tuning of the processes in order to meet all the manufacturing goals. Albaker et al. [1] utilized PID controllers to design the dynamic non-linear flight control of a propeller driven fixed wing Unmanned Ariel Vehicle (UAV). Their simulator could correctly predict the actions necessary for maintaining the commanded flight path of the UAV. Their predicted results were verified using actual experiments performed on the flight guidance of the UAV.

Upadhyay et al. [2] developed an adaptive non-linear feedback controller using PID controllers in order to maintain the temperature of a Continuously Stirred Tank Reactor (CSTR) in a chemical plant. They observed that the results of their simulation were in accord with experimental data. It was also mentioned that their particular controller design was very robust

to modeling errors and random disturbances occurring in the tank; CSTRs by nature have strong non-linear behaviors.

Li et al. [3] discussed the application and importance of PID controllers in their review article. They also presented many cases of computer simulation of PID controllers' actions and their experimental validations. They concluded that there was a significant difference between academic research findings on PIDs and the problems encountered in using such controllers in the industry.

However, the development of a simple and user friendly GUI based software, for the prediction of common controller actions and their fine tuning to meet process requirements, has rarely been researched. The authors of this research, therefore, have developed a simulator using MATLAB 2008 [4, 5] in order to predict the closed loop response of second order systems from the process requirements and corresponding frequency domain data as inputs. For guidelines the authors referred to the seminal work of Patwari et al. [6]. Patwari et al. had previously utilized MATLAB 2008 and Visual Basic 6 Enterprise Edition to develop a simulator for the prediction of chip serration frequency during end milling operation. The authors' simulator has a built-in Graphical User Interface (GUI) that illustrates the results of the prediction and provides the user, in vivid details, with

three types of basic controllers to select from. The three types of controllers are: (1) PI (Proportional and Integral), (2) PD (Proportional and Derivative), and (3) PID (Proportional, Integral, and Derivative). These three types of controllers are routinely used in automated control systems and the software provides the flexibility of choosing any one of them. Any controller, chosen, has already been adjusted by the software to meet the optimum output criteria of the particular process under consideration.

The predictions of the software were validated in the case of a PID controller against experimental data and analysis. The PID controller was selected as it is the most common feedback controller used in dynamic closed loop control systems in automated industrial processes. The results of the validation along with the discrepancies observed are discussed in this paper along with suggestion to improve the prediction process.

CONTROLLER ARCHITECTURES

A. PID CONTROLLERS

PID controllers calculate an error ‘e’ value, for the process, as the difference between a measured process variable ‘Y’ and a desired setpoint ‘R’. The controller attempts to minimize the error by adjusting the process control inputs ‘u’. the PID controller algorithm involves three separate parameters: (1) The Proportional ‘P,’ denoted by the proportional gain ‘K_p,’ (2) The Integral ‘I,’ represented by the Integral gain ‘K_i,’ and (3) The Derivative ‘D,’ usually represented by the derivative gain ‘K_d.’ The P depends on the present error, the I on the past error, and the D on the future error. The weighted sum of these three actions is utilized by the PID controller in order to generate the necessary process control signal u for the control of such parameters as the position of a control valve or in the case of the present research the power supply of a heating element. Due to its inherent flexibility, the PID controller is usually used, especially, where the underlying process is too complicated. Figure 1 is the block diagram of a PID controller and equation 1 is the typical transfer function.

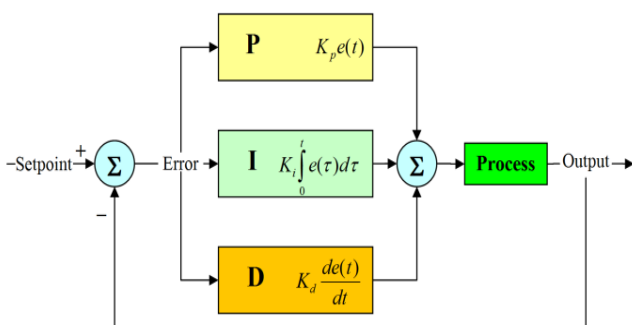


Figure 1 Block diagram of a PID controller

By tuning the three gain parameters, the PID algorithm can provide control instructions for

necessary actions designed for a specific process requirement. The responsiveness of the controller is determined by the degree of overshoot and system oscillations. The simulator developed by the authors is capable of fine tuning the gain parameters as well as determining the specific controller response parameters. Consequently, the user is able to select the correct PID controller for the optimal results as well as know the limitations of the controller selected.

B. PI CONTROLLERS

Some applications do not require the use of all three actions and thus, the controller architecture may be simplified by setting the derivative gain to zero. This is done as derivative actions are sensitive to measurement noise. Such a controller is known as PI and has only two gain terms.

C. PD CONTROLLERS

The least common of the three controllers, the PD controller lacks the integral gain term. However, this can sometimes lead to major errors as the absence of an integral term can prevent the system from attaining the target value, due to the control action.

EQUIPMENTS

MATLAB 2008 was the only software used in the development of the simulator and the GUI. For the experimental validation of the simulator predicted results, a standard setup was used which included the following hardware:

1. Model M3 PID Controller
2. Rupert & Co. Ltd. (England) electric heater with electric thermometer.
3. A standard analog stopwatch

METHOD

The GUI (figure 2 and 3) enables the user to perform the whole analysis with ease and precision. In the first stage, of the analysis, the user is asked to enter the coefficients of the PID controllers transfer functions. The frequency response is then selected to generate Bode plots for impulse magnitude and phase, as shown in figure 2. The plots are used to determine the necessary frequency responses such as: Phase Margin, Band Width Frequency, and Constant value. Once these values are inserted into the software prompt by observing from the bode plot, the software displays its predictions for closed loop behavior as in figure 2. The predicted parameters are: Damping Ratio, Setting Time (in seconds), Rise Time (in seconds), and Steady State Error. These are then used to in the next stage of analysis as in figure 3.

The four controller response parameters are then taken into account to select the type of controller (in this case PID) to be employed with specified values for gain coefficients by the software. The result is numerical and graphical representation of the controller action, as shown in figure 3.

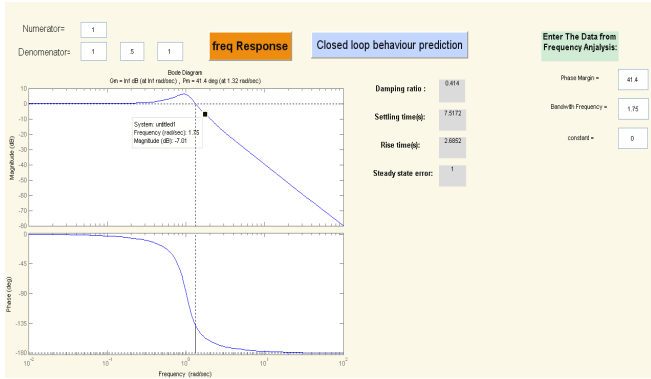


Figure 2 GUI displaying Bode plots of frequency domain analysis for PID controller

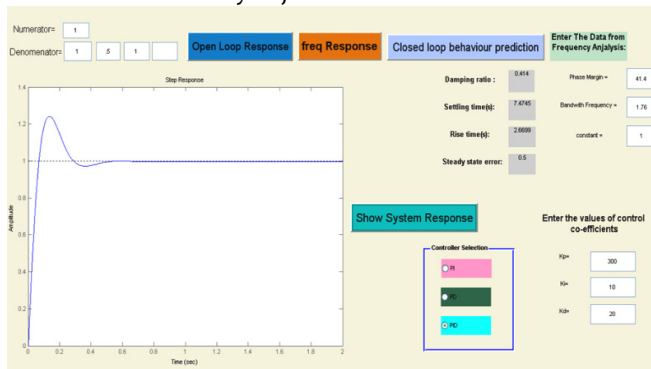


Figure 3. GUI showing PID closed loop controller behavior

The experimental validation of the PID controller's predicted response by the software was performed in the laboratory. The PID controller was used to control the temperature and power input to an electric heater. Measured variable was the temperature reached by the heater whose set point was set at $T_0 = 32^\circ\text{C}$. The time taken to reach the set point was recorded along with the power input to the heater in increments of 30 seconds.

In the same way PD Controller was also employed to see if the GUI can successfully predict its response also.

RESULTS AND DISCUSSIONS

The results of the simulator's prediction for a specific PID controller and its validation from experimental data are shown in figures 4 to 7.

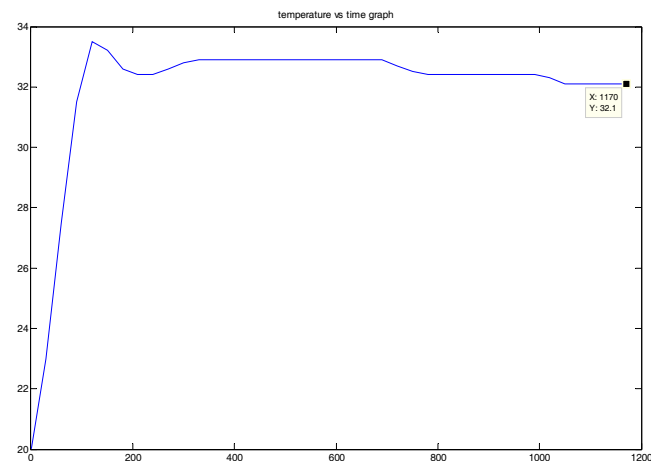


Figure 4. Temperature vs. time plot of predicted response of PID controller as determined by the software

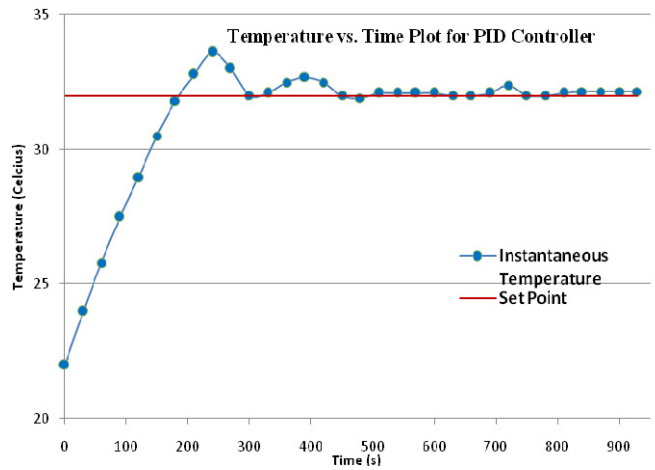


Figure 5. Temperature vs. time plot of PID controller performance as determined by experiment

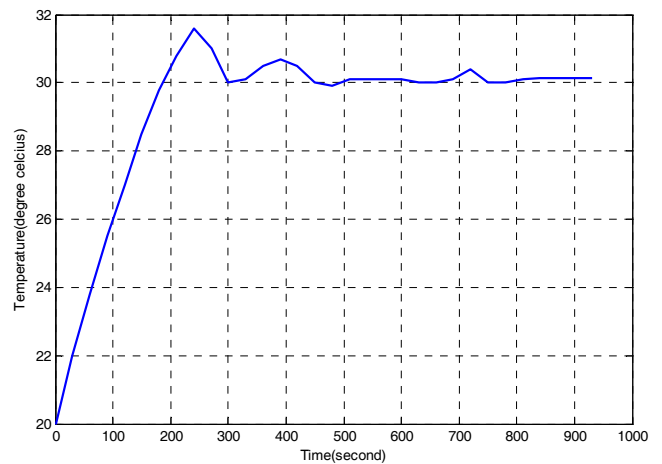


Figure 6. Temperature vs. time plot of predicted response of PD controller as determined by the software with set point 30

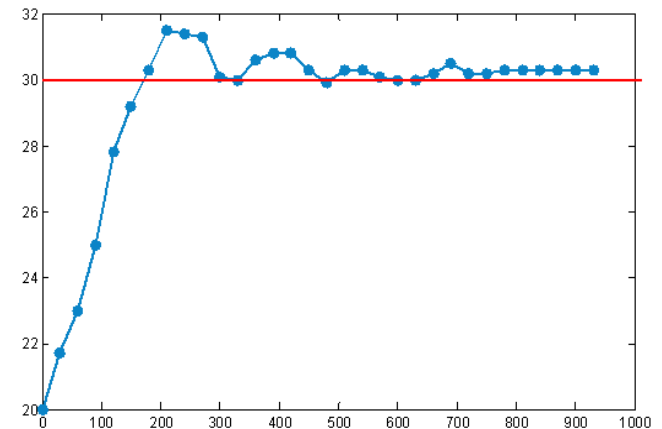


Figure 7. Temperature vs. time plot of PD controller performance as determined by experiment with set point 30

It was observed that the temperature vs. time graphs for both the predicted and experimental results of the PID and PD controller were almost similar. Both curves show the same general shape and fluctuations about the respective set points. Yet, there are certain discrepancies.

PID CONTROLLER

1. For PID controller the time taken to reach a reasonably close neighborhood of the set point of 32°C was shorter at 930 seconds in the

experimental case compared to 1170 seconds as predicted by the software. This is due to the effect of the surrounding environment during the experiment. Such random external disturbances such as air current, ambient temperature fluctuations, leakage of heat from the setup, and inherent sensor and human error are responsible for this difference.

2. Also, the time taken to attain the maximum temperature of about 33.5 °C was much shorter in the simulation result. This can again be attributed to external environmental effects.
3. Due to the application of PID Controller the system overshoot and steady state error are considerably low and for attaining more reduced rising time and settling time the proportional control action (kp value) should be increased more.

PD CONTROLLER

4. For PD Controller the predicted result shows that the rising time is 240 sec whereas the actual experimental result shows that the rising time is about 210 sec, which is very near to the predicted result.
5. Both the predicted and experimental results show almost the same response. But the experimental curve shows a bit more steady state error. And the system overshoot is almost negligible in both the cases as here we applied the derivative control here.

The time taken for the controller to reach a constant temperature which is near to the set point (30 degree) is about 800 second from the experiment. But from the simulated result the time was 830 second. The difference can be considered within the experimental limitations and the random effects of the environment.

CONCLUSIONS

The comparison of the results in the two cases, simulation and experimental setup, only highlight the importance of fine tuning when closed loop controllers are utilized in the real cases. The authors are currently investigating the use of more adaptive and robust controller setups to address these issues. Nonetheless, PID controllers are very common and the simulator is very simple, user friendly, and cheap to implement and use. The authors are confident that their simulator will greatly benefit the work of engineers employed in the industry or involved in state-of-the-art research involving PID, PI, and PD controllers.

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THE QUALITY OF TEMPERATURE MEASUREMENT WITH VISUAL PYROMETER

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ABSTRACT: A temperature is a fundamental parameter in metallurgical operations. Reliable and continuous measurement of temperature is essential for effective control of the operation. Thermocouples were the traditional devices used for this purpose, but they are unsuitable for continuous measurement because they rapidly dissolve. Pyrometers are suited especially to the measurement of moving objects or any surfaces that can not be reached or can not be touched. The quality of temperature measurement with pyrometer with a vanishing filament was evaluated using the analysis of uncertainty and the measurement systems analysis (MSA).

KEYWORDS: temperature, pyrometer, uncertainty, MSA

INTRODUCTION

The demands on the measurement of the qualitative characters of products, services, trades and processes increase in connection with the pressure towards to the quality. The measurement is important in all phases of production. It starts in the research, goes on in development, monitoring of raw materials as the inputs, semi-finished products, process of production, environment and the final check-out. May be said “What you can not measure, you do not know to product”. The growth of measurement quality yields new knowledge as a rule and its application forces the improvement of the measurement.

The aim of measurement management system according to standard STN EN ISO 10012:2004 [1] is to regulate the hazard of incorrect result of measurement equipment or measurement process. Incorrect results negatively affect the final quality of products with economic or moral damages. They can affect the health, safeness, property, environment, governmental interests. We can suppose that confirmed (calibrated and verified) equipment is accurate also at the end of calibration interval. But there is obvious danger of equipment misdirection (incompetent appraiser, environment or inappropriate method). The probable result of misdirection is incorrect values measured with accurate and true equipment.

A temperature is a fundamental parameter in metallurgical operations. Reliable and continuous measurement of temperature is essential for effective control of the operation. Thermocouples were the traditional devices used for this purpose, but they are unsuitable for continuous measurement because they rapidly dissolve. Pyrometers are suited especially to the measurement of moving objects or any surfaces that can not be reached or can not be touched.

EQUIPMENT AND METHOD

A pyrometer is a non-contacting device that intercepts and measures thermal radiation. This device can be used to determine the temperature of an object's surface. The disappearing filament pyrometer principle of measurement is a thin, heated filament over the object to be measured and relied on the appraiser's eye to detect when the filament vanished. The object temperature was then read from a scale on the pyrometer. The appraiser's eye as a sensor brings subjective influence (quality of appraiser, for example his or her competence, perception, skill discipline and vigilance) into measurement process. The range of measured temperatures is between 800 and 2200°C as a rule.

The thermoelectric equipment TESTOterm 9010 was used as check (working) standard. Its exploring element with cased chromel – alumel (K) thermoelectric couple touched the body surface. The standard uncertainty of calibration (the equipment with exploiting element) $u_{kal} = 1,516^{\circ}\text{C}$ for temperatures up to 900°C and $u_{kal} = 2,086^{\circ}\text{C}$ for upper ones. The uncertainty includes recommended sources for calculation of B type uncertainty [2].

Two identical pyrometers – Pyromet 1 (PVS and PJP) were used as measurement equipments. The discrimination (effective resolution) - the value of the smallest scale graduation (range 700 – 1500°C) $d^* = 10^{\circ}\text{C}$, the maximal permissible error guaranteed by producer is $\pm 22^{\circ}\text{C}$ (maximum permissible bias error as $\pm 1.5\%$ of the upper limit of measuring range 1400°C is recommended by OIML for ordinary accuracy class of pyrometers [3]).

EXPERIMENTAL

The measurement was carried out on ten levels of temperature between 800 and 1000°C. The measured body - grey-black cube of SLI (natural iron magnesite)

was heated in a resistance furnace. Its surface temperature was measured with standard. Once the standard indicated stabilized temperature, two appraisers (A, B) measured the surface temperature of body with two pyrometers in random order. Each of appraisers carried out three trials with one pyrometer (12 measurements at one temperature level in common). The temperature of body, measured with standard was read six times at one level. The result of imperfect furnace regulation and heat removal throughout the measuring aperture was some variation of the body surface temperature. This fact became one of the sources of uncertainty of temperature.

The distance between objective of pyrometer and measured body was 1.3 m, the ambient temperature was 22.9 – 24.1°C, the relative humidity 40.3 – 52.4 % with absence of any dust, vapor, smoke and external magnetic field apart from that of the earth. Their presence could to absorb thermal radiation with decreasing of measured temperature.

Total standard uncertainty of temperature, measured with standard:

$$u_{et} = \sqrt{u_A^2 + u_{kal}^2} \quad (1)$$

$$u_A = \frac{s}{\sqrt{n}} \quad (2)$$

s = standard deviation, n = 6 is number of trials (3 trials each of appraisers).

The uncertainty of average temperature \bar{T} , measured with standard at one level was expressed as a relative expanded uncertainty U_{rel} (coverage factor k = 2). The values of \bar{T} and U_{rel} for particular levels illustrate Figure 1 and 2 (“standard”).

The temperature measured with the vanishing filament pyrometer is dependent on the emissivity of the object. With greater use of brightness pyrometers, it became obvious that problems existed with relying on knowledge of the value of emissivity ϵ . Emissivity was found to change, often drastically, with surface roughness, bulk and surface composition, and even the temperature itself.

A true black body would have an $\epsilon = 1$ while any real object would have $\epsilon < 1$. The scales of pyrometer match with temperature of true black body. Because of real bodies radiate less energy, their measured temperature is constantly less. For calculation of correction the value of $\epsilon = 0.6$ (for fire-clay or chamotte and wave-length $\lambda = 0.65 \mu\text{m}$). The correction, add to measured temperature was calculated by equation (3), regarding the recommendations of producer

$$T_k = 0.0575 T - 19.45 \quad (3)$$

T = measured temperature

Corrected value of temperature

$$T_{kor} = T + T_k \quad (4)$$

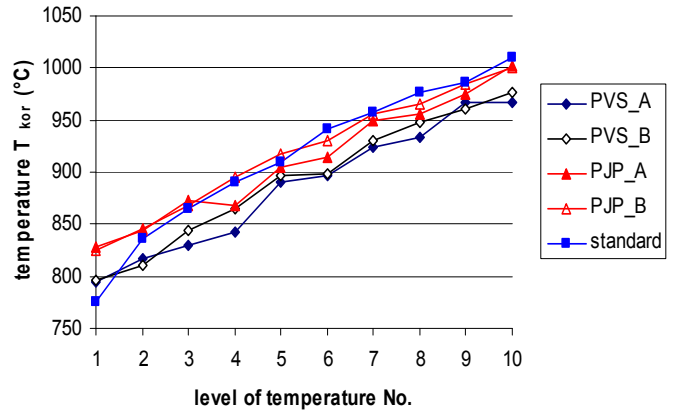


Figure 1. The average values of temperature measured with pyrometers and standard

The average corrected values of temperature T_{kor} measured by particular appraisers with both pyrometers illustrates Figure 1. According to unpaired t-test to compare two means ($\alpha = 0.05$) the differences between the values of temperature, measured by appraisers A and B ($p = 0.7137$) and with pyrometers PVS and PJP ($p = 0.1852$) by conventional criteria are considered to be not statistically significant.

The standard uncertainty of temperature measured by pyrometer was calculated using equation (5):

$$u_{pyr} = \sqrt{u_A^2 + u_{res}^2 + u_{et}^2 + u_{sys}^2} \quad (5)$$

Uncertainty u_A was calculated by equation (2): s = standard deviation, n = 3 is number of trials (one appraiser with one pyrometer), $u_{res} = 0,29 \times d^* = 2,9$ uncertainty resulting from discrimination d^* , u_{et} is standard uncertainty of temperature measured by standard at given level, calculated by equation (1) and u_{sys} is standard uncertainty of bias error, calculated from difference between temperature measured with pyrometer and with standard to [4] using equation (6).

$$u_{sys} = 0,6 \cdot |(T_{kor} - \bar{T})| \quad (6)$$

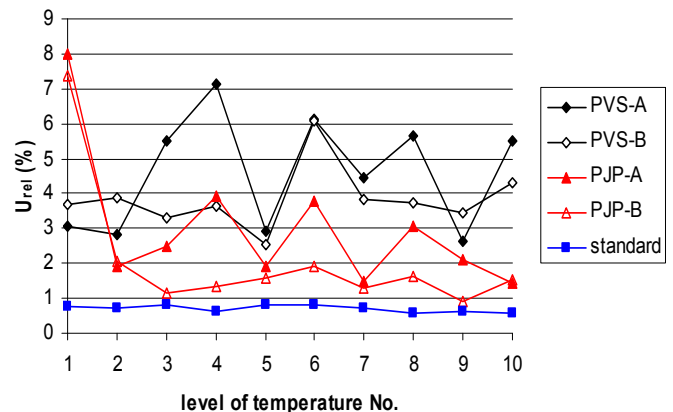


Figure 2. The relative expanded uncertainty U_{rel} of temperatures

The values of uncertainty of average corrected temperature T_{kor} , measured with pyrometer at one level, expressed as relative expanded uncertainty U_{rel} ($k = 2$) illustrates Figure 2. The uncertainty of pyrometer is 3 to 6 times more than uncertainty of standard.

MEASUREMENT SYSTEMS ANALYSIS

In addition to analysis of uncertainty the quality of measurement process was evaluated by "Measurement systems analysis" (MSA). This method is not standardized yet, but is recommended in the reference manuals, used the first of all in the automotive industry. MSA helps conform to ISO/TS 16 949:2002 requirements as well as AIAG standards. It is an experimental and mathematical method of determining how much the variation within the measurement process contributes to overall process variability. The measurement process, running in capable measurement system (consists of measurement equipment, samples, environment, method, appraisers...) is capable as well.

The computation of capability by GRR method MSA (analysis of repeatability and reproducibility) was carried out in accordance with [5] using the software Palstat CAQ with significance level $\alpha = 0.01$ and confidence level $\alpha = 0.01$ (5.15σ). The values of capability indices are in tab. 1.

The first step of analysis is to estimate whether the discrimination is sufficient. A general rule of thumb is the discrimination ought to be at least one - tenth the process variation [5, p. 44]. If we compare the variability is expressed by standard deviation (s) which does not run over $18.3^{\circ}C$ (level No. 4, measured by appraiser A with pyrometer PJP) and the discrimination of equipment ($10^{\circ}C$), the resolution is not sufficient. Because average value of standard deviation is $3.88^{\circ}C$, the discrimination ($0.1^{\circ}C$) of standard is sufficient.

The measurement system ought to be in statistical control, the range control chart was used. Analyzed process is in the control, all ranges (for pyrometers and standard) are between control limits. If one couple (appraiser and equipment) is out of control, the method used or (and) metrological characteristics differ from the others. The area within the control limits of the X-bar control chart represents measurement sensitivity („noise“). One half or more of the averages should fall outside the control limits. If the data show this pattern, then the measurement system should be adequate to detect variation between the levels of temperature and the measurement system can be provide useful information for analyzing and controlling the process, or else system lacks adequate effective resolution. The analyzed system has high resolution: 80 - 90 % of

measurements with pyrometer and 90 % with standard are out of control limits (tab. 1).

The number of distinct categories ("ndc", based on Wheeler's discrimination ratio) is connected with the resolution of measurement equipment. It indicates the number of various categories, which can be distinguished by the measurement systems. It is the number of non-overlap 97 % confidence intervals, which cover the range of expected variability of product. The "ndc" is over 5 for capable processes, the values over 2 may be conditionally used for rough estimations.

Table 1. The indices of MSA

equipment	PVS	PJP	Standard
appraisers	A/B	A/B	A-B
%R	0	0	0
%X	90	90	90
%EV	11.5	14.7	6.0
%AV	7.7	9.4	0.7
%PV	99.0	98.5	99.8
%GRR	13.8	17.4	6.1
ndc	10.13	7.99	23.3

The %EV index represents the cumulative influence of measurement equipment, measuring method and environmental conditions on the variability. It is a function of average range of trials of all appraisers. Because standardized measurement method was used and the measurement equipments were in valid calibration interval only the condition of environment could affect the %EV index.

The %AV index represents the influence of appraisers on the variability, for example their liability (responsibility) and competence. It is a function of the maximum average appraiser difference. Low value of index confirms good competence of appraisers. The value of index is significantly affected by equipment.

The %GRR index represents the process capability in practice. %GRR < 10 % (the rate of the manufacturing production process variability that is „consumed“ by measurement system variation) is generally considered to be an acceptable – capable measurement system, %GRR > 30 % is not acceptable. Analyzed measurement process by standard is capable. The processes using pyrometers are conditionally capable.

The %PV is a function of the range of temperatures. It is sensitive to variability of particular levels of temperature. The values of %PV indirectly define suitability of used measurement equipment for specific measurement. The value of %PV for accurate equipment is between 90 and 99 %. Because %PV of standard is 99.8 % the equipment is too sensitive for analyzed system and therefore uselessly expensive.

Normalized histogram – histogram plot is a graph that displays the frequency distribution of the gage error of subjects who participated in the study (a couple appraisers – equipment). The graph provides a quick

overview how the error, i.e. difference between observed value and reference value (samples average) is distributed.

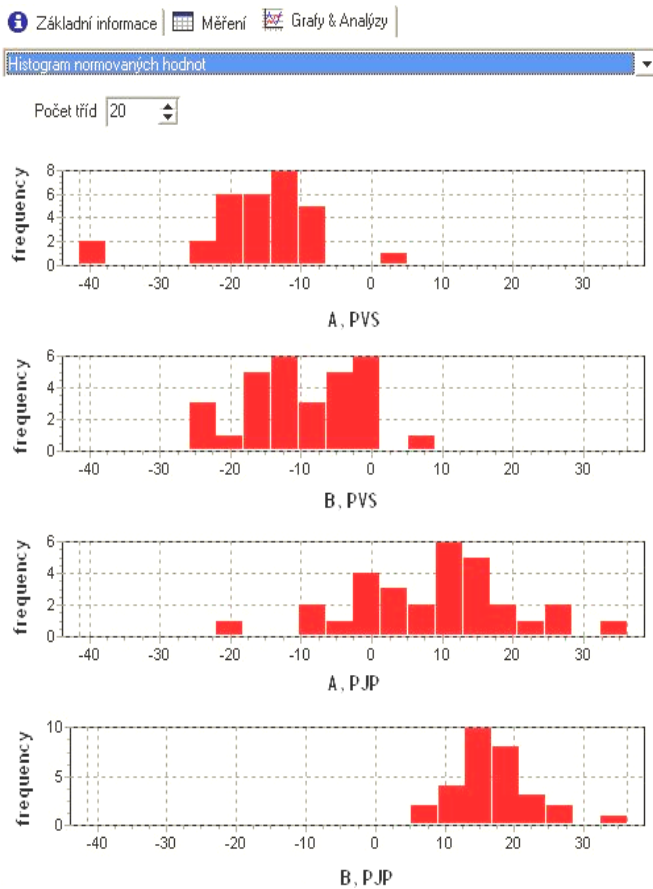


Figure 3. The normalized histogram for temperatures

As illustrates Figure 3, the differences of bias (systematic error – the difference between histogram’s peak and 0) and variability (random error – the width of histogram) between subjects are significant.

CONCLUSIONS

The results obtained are summarized as follows:

- The measurement of temperature with pyrometer has more significant uncertainty than measurement with thermocouple.
- The capability of temperature measurement process, with pyrometer by MSA method is conditionally acceptable.
- The equipments affected the quality of measurement process more significantly than appraisers.
- As for uncertainty the best conjunction is appraiser B and pyrometer PJP (average uncertainty $U_{rel} = 2.07\%$).

ACKNOWLEDGEMENTS

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MANUFACTURING AND TESTING OF DOUBLE-BASE SWIRL INJECTOR IN ORDER TO IMPROVE SPRAY CHARACTERISTICS

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ABSTRACT: A new design procedure for double-base liquid injectors is proposed in this paper. The procedure is based on theoretical and experimental results. Then a computer code is developed and the performances of these injectors are studied for various conditions. Finally, four injectors are manufactured with high precision and then mounted on a test stand in order to investigate various important spray characteristics. A specialized laboratory was setup for the measurement of macroscopic spray characteristics under different pressure such as droplet distribution, spray angle, swirl effect. Through PDA cold test, the microscopic characteristics of injectors spray are also measured.

KEYWORDS: Swirl Injector, Double-Base Injector, Macroscopic and Microscopic Characteristics, PDA Laboratory

INTRODUCTION

As shown in figures 1 and 2, the double based liquid-liquid injectors have many advantages making them applicable in aerospace industries. Fuel and oxidizer can be mixed more efficiently in such injectors, creating an ideal combustion condition and reducing the probability of combustion instability [1].

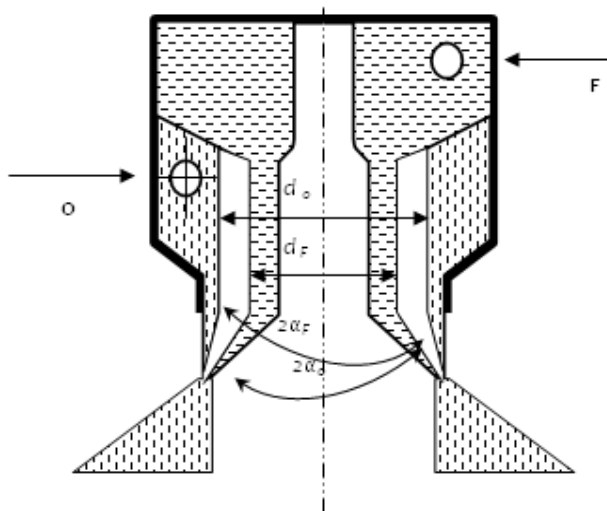


Figure 1: Double base- swirl injector



Figure 2: A Manufactured Injector

The swirl effect's advantages include producing micro-diameter droplets and desirable spray angle which provide the perfect combustion condition. The rules used in the swirl injector theory are based on the principles of mass, angular momentum, energy conservation, maximum flow rate and minimum energy laws.

Based on the design procedure, a computer code is developed, which performs the design and necessary calculations of different dimensions of injector. This program designs injector based on design data and calculates its dimensions. The necessary parameters for internal and external nozzles are fed into the program separately for obtaining their geometries. However, as mentioned, the radius of external nozzle should be more than the external radius of nozzle in the inner injector [2]. At the same time, the spray cone angle of inner injector should be more than outer injector, therefore both spray cones would contact to each other after discharging from injector. According to the design condition the internal nozzle must inject flow of 20 cc/sec in defined pressure of 10 bars. The external nozzle must also inject 120 cc/sec in 4 bars. The spray angles for the internal and external nozzles obtained 85° and 75° respectively.

MANUFACTURING THE INJECTORS

Four injectors are manufactured based on design calculations. The double-based swirl injector has three parts including internal nozzle, external nozzle and lid [3]. Brass metal was chosen due to its special characteristics for accurate machining and minute drilling [4]. Detailed drawings of internal and external nozzle are shown in figures 3 and 4. These three parts are brazed and assembled precisely as shown in figure 5.

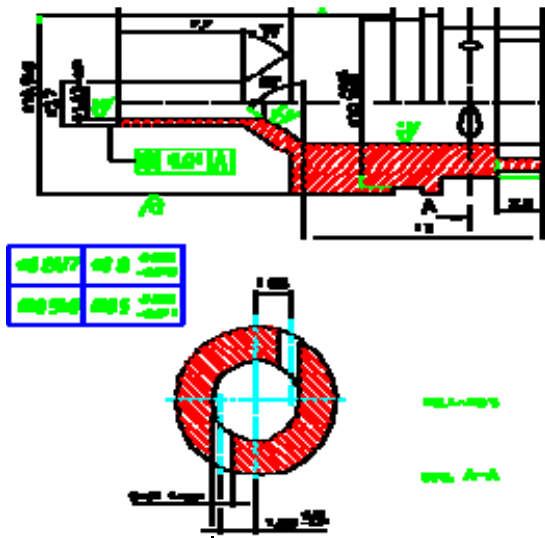


Figure 3: Manufacturing Diagram of the Internal Nozzle

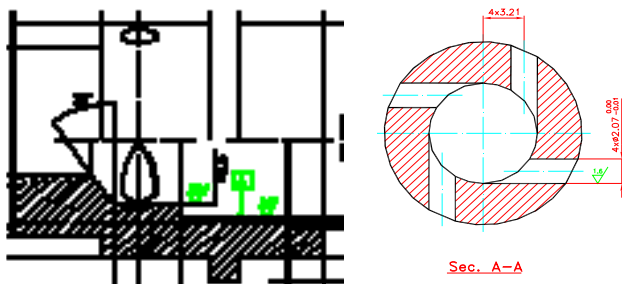


Figure 4: Manufacturing Diagram External Nozzle



Figure 5: Assembled and disassembled of a Manufactured Injector

HYDRODYNAMIC TEST LABORATORY

To check the quality of the manufactured injectors, a preliminary laboratory set-up is needed. This set-up will measure the macroscopic characteristics of injectors spray such as homogeneous spray distribution, spray angle and swirl effect on the spray formation under different pressure.

This test rig was set up with the following parts as, Injector Stand, Pressurized Liquid Tanks, High Pressure Nitrogen Capsule, Manometer and Regulator, Radial and Sectional Collector, Stroboscope and High Speed Camera. The liquid emitted by the injectors are collected in two different collectors made of Plexy glass material as shown in figure 6 (a) and (b). The level of fluid in the radial and sectional collectors display spray distribution quality in r and θ direction respectively [5]. Sectional collector divided into six 60° section and the radial one divided into three co-centric cylinders. Furthermore, a high speed camera is used to

capture the spray cone angle and atomized spray distribution of both internal and external nozzle [6].

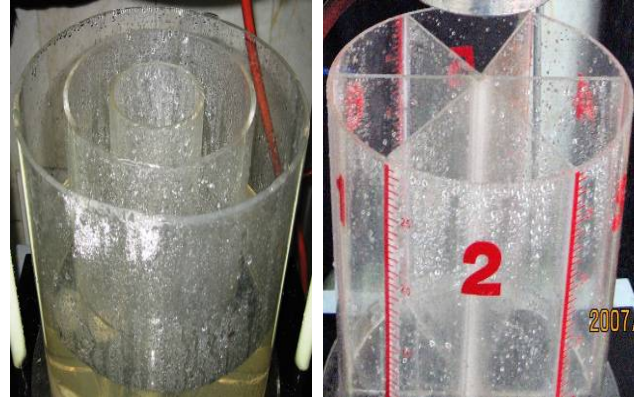


Figure 6: (a) Radial and (b) Angular Collector

EXPERIMENTAL TEST RESULTS OF INJECTORS – FLOW-PRESSURE TEST

This test is conducted to measure the flow changes under different working pressures for both internal and external nozzles. Figures 7 and 8 present the results of the experimental flow for a specific set of design conditions.

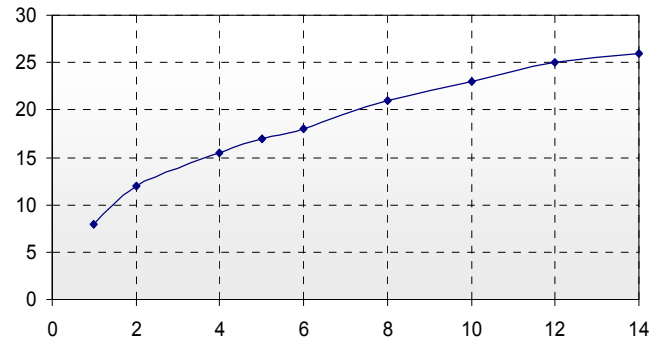


Figure 7: Flow rate of internal nozzle (cc/s) versus pressure (bar)

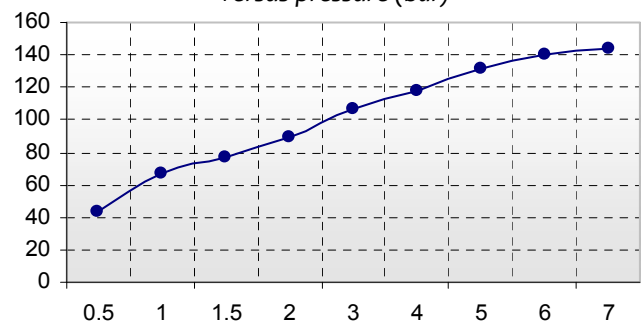


Figure 8: Flow rate of external nozzle (cc/sec) versus pressure (bar)

SPRAY ANGLE TEST

To show the spray formation of internal and external nozzle clearly a stroboscope and a high speed camera are used. Picture 9 displays the spray circulation of injector. As fluid pressure increases from 0 to 10 bar, the spray cone gradually opens to become fully developed as seen in figure 10.

In figures 11 (a) and (b) the spray cone angle of both internal and external nozzle are approximately 70° and 80° respectively under design condition ($P_0=4$, $P_f=10$ bar) which are satisfactory in the light of theoretical calculations.

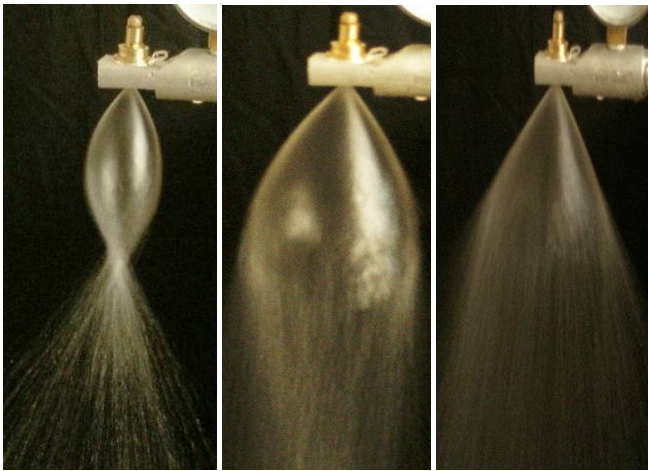


Figure 9: Spray Formation Stages with Regarding to Fluid Swirl



Figure 10: Fully Opened Spray Cone Under design conditions ($P_f=10$, $P_o=4$ bar)

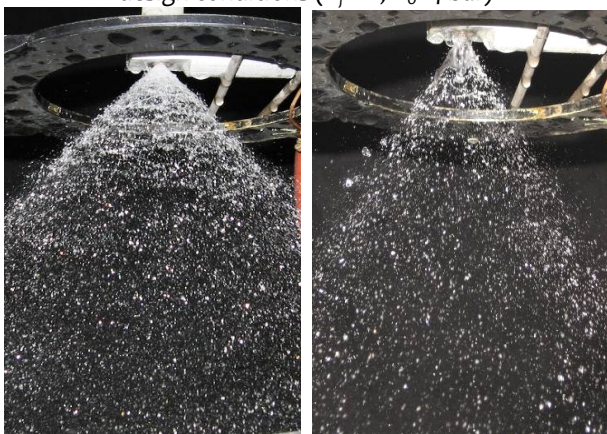


Figure 11: Spray cone angle of (a) internal and (b) External nozzle

SPRAY DISTRIBUTION AND HOMOGENEITY TEST

Sectional and radial collectors are used to check the symmetry of the fluid spray [7].

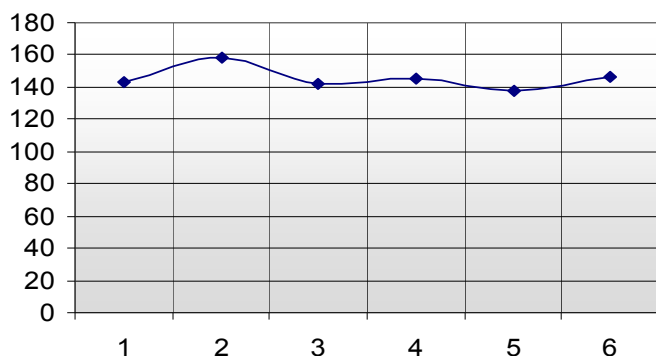


Figure 12: Spray distribution of the injector in each 60° section

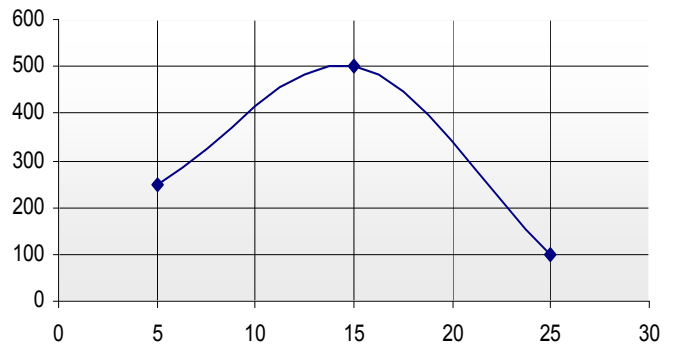


Figure 13: Spray distribution of the injector in each cylinder

To obtain a symmetrical distribution of injection, the machining and drilling processes must be precise and accurate. Figures 12 and 13 show the spray distribution in each compartment of the collector [8].

MICROSCOPIC SPRAY DROPLET TEST

Using PDPA (Phase Doppler particle analyzer) laser laboratory, the microscopic characteristics of the injector spray have been identified [9]. As shown in figure 14 phase Doppler particle analyzing system consists of a laser light source, optical arrangements, a transmitter, and a data acquisition system. The visualization system used in this experiment consists of a laser source, lenses and mirrors, a high-pressure spray chamber, and CCD camera [10].

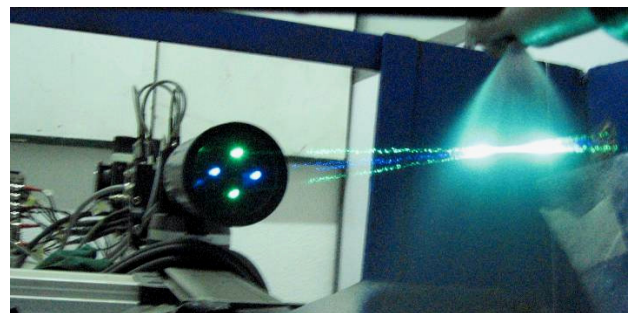


Figure 14: View of laser beams emitted to the spray

Mounting the injector on the apparatus and setting the fluid tanks pressure on the design condition droplet normal velocity (m/s) and SMD (Sautre Mean Diameter) distribution at 100mm downstream, for $P_o=4$ and $P_f=10$ bar and $T= 25^\circ\text{C}$, is shown in Figure 14.

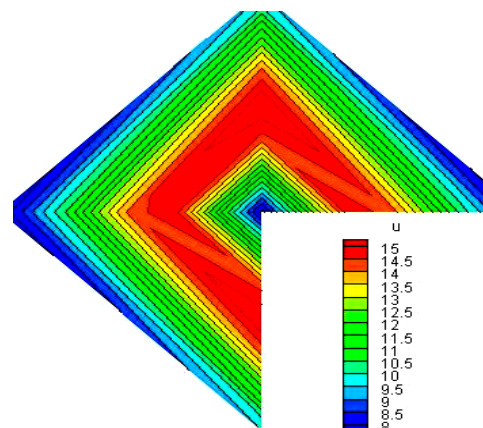


Figure 15: Velocity (m/s) distribution of Spray in a normal plan

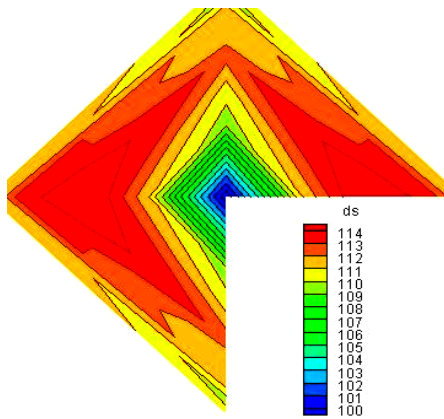


Figure 16: SMD (Micron) distribution of injector spray in a normal plan

There is a high velocity zone around the injector axis that represents existence of the spray liquid sheet as it is seen in Figure 15. Droplets normal velocities are obtained in the range of 11 m/s. According the figure 16, droplets with less mean diameter are placed in center of the spray cone and the diameter increases along radius [11].

CONCLUSIONS

The swirl double-base injector was designed with a new method. Then a computer code was developed to calculate the specific parameters of the injector. Based on these results, four injectors were manufactured precisely including internal nozzle, external nozzle and lead. To check the performance of these injectors, experimental tests were conducted. According to the figures 7–16 the injectors have excellent microscopic and microscopic spray characteristics such as spray angle, droplet distribution, Sautre Mean Diameter and droplet velocity.

The results clearly show that the manufactured injectors produce flawless spray jets.

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FOCUS ON QUALITY ASSURANCE IN THE ROLLS MANUFACTURING – APPROACHES FOR INCREASING THE ROLLING-MILL ROLLS QUALITIES

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ABSTRACT: Quality assurance is the activity of providing evidence needed to establish quality in work, and the activities that require good quality are being performed effectively. All those planned and systematic actions are necessary to provide enough confidence that a product or service will satisfy the requirements for quality. Our approaches the issue of quality assurance of the rolling mill rolls, from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation. The experimented research, as well as the optimization of the manufacturing technology, allows the conclusion of direct results for the rolls. The beneficiaries of these results are the unit in which the rolls are manufactured, as well as the unit that exploits them. The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have a different influence upon the quality and the safety in the exploitation.

KEYWORDS: Quality assurance, cast-iron rolls, manufacturing, laboratory research, mathematical modeling

INTRODUCTION

In our foundries, specialized in the cast iron rolls, in spite of trying the most accurate guidance of the iron melting processes, of the outside treatments melting aggregate, of the molding and drying of moulds (the so-called casting process), of the cooling and the directional solidification of the castings in the moulds, as well as of the rapping, cleaning and the subsequent processing of the rolls, the performance factor remains relatively low.

Quality assurance covers all activities from design, development, production, installation, servicing and documentation. It includes the regulation of the quality of raw materials, assemblies, products and components, services related to production and inspection processes. Production logistics is the term used for describing logistic processes within an industry. Also, the purpose of production logistics is to ensure that each equipment and technologies is being fed with the right product in the right quantity and quality at the right point in time.

What materials, products, or information come into the activity? What materials, products, or information flow out of the activity? Quality engineers use the D-M-A-I-C model (define, measure, analyze, improve, and control) to document processes before beginning process improvement. If processes are documented, another series of logical questions apply: Are the processes being followed? Are they within acceptable control and performance parameters? Are they outdated? Can they be improved? Those are the questions which determine the correlations between the logistics process and the quality assurance.

Roll makers always ask about rolling conditions and the necessity to choose the right grade of roll material and roll users always ask about the mechanical and physical properties of roll material. Sometimes they feed these figures into their rolling model, but sometimes they also need them for unknown reasons. This information is very rarely useful for selecting the right supplier. Roll makers and roll users frequently have to discuss experiences, performance results, and special requirements of the mill. Roll failure problems can be solved by good cooperation. In engineering and manufacturing, quality control and quality engineering are involved in developing systems to ensure products or services are designed or produced to meet or exceed customer requirements. These systems are often developed in conjunction with other business and engineering disciplines using a cross-functional approach. By collecting data from samples at various points within the process, variations in the process that may affect the quality of the end product can be detected and corrected, thus reducing waste as well as the likelihood that problems will be passed on to the customer.

THE RESEARCH ACTIVITIES AND THE OBJECTIVES

In a typical scientific research process there is a stage that consists of the following activities: a review of literature, an exploration of existing theories, a review of theoretical background and a definition of the terminology used.

The research activities devoted to materials relate to their production, characterization and use. These, mainly focused on ferrous alloys (particularly on irons), relate to:

- Optimization of the processes for developing new technologies in collaboration with industry;
- Production technologies;
- Research into solutions for management of products;
- Improvement of the quality of cast and rolling products;
- Development of statistical tools for quality control;
- Theoretical modeling and experimental study.

The main objectives, in accordance with the above mentioned activities, are the followings:

- Study of the influence of chemical elements on iron mechanical properties;
- Modeling in order to optimize the production flows;
- Characterization of mechanical properties;
- Development of new technologies;
- Multivariate statistical analysis of industrial data;
- Analysis on various methods to improve the hardness and mechanical properties;
- Simulation of melting, forming, casting and cooling processes;
- Optimization of production processes.

The final scope is the optimization of the specific processes, that's equivalent to respond to new economic and environmental imperatives, designers must optimize the real behavior of the casting materials.

The multidisciplinary point of view relates to the use of various research methodologies. Modeling refers to the representation of knowledge through algorithms and tools. The resulting models are used both in applications that aim at scientific understanding and also in applications that aim at practical understanding. Scientific and technological methodologies refer to empirically-based and modeling-based approaches that draw upon advanced tools for measuring and processing information.

QUALITY ASSURANCE IN THE ROLLS CASTING INDUSTRY

Specialty literature, from Romania or from foreign countries, offers for study a rich technical material, concerning the manufacturing process of rolling mills rolls and the lamination process, as special treaties, didactic handbooks, studies of production and special papers. The area of mathematically modeling and the metallurgical processes optimization is approached in the specialty manuals and scientific papers, since there are no treaties in area. The researches of durability in the exploitation is near un-existent, with the exception of some specialty works, treated summary and to general mode, as well as of some works elaborated by the didactic staff from Faculty of Engineering from Hunedoara, along researchers and

specialists from the rolls manufacturing industry and from rolling sectors.

In the rolling industry, the quality of rolls is in directly accordance with the quality of technologies (defined by the casting equipments, materials, applied procedures, etc) and also, by the quality of the manufacturing process (charging, melting, inoculation, ladle treatment, casting, cleaning, etc), which are presented in Figure 1.

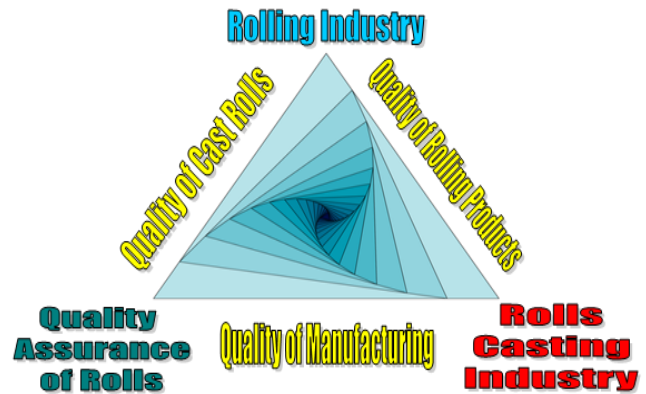


Figure 1. Quality assurance in the rolling industry and the rolls casting Industry

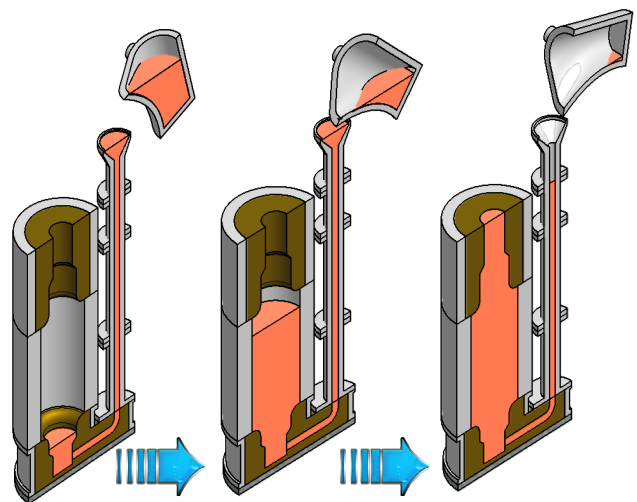


Figure 2. Casting technology of the iron rolls (simplex procedure)

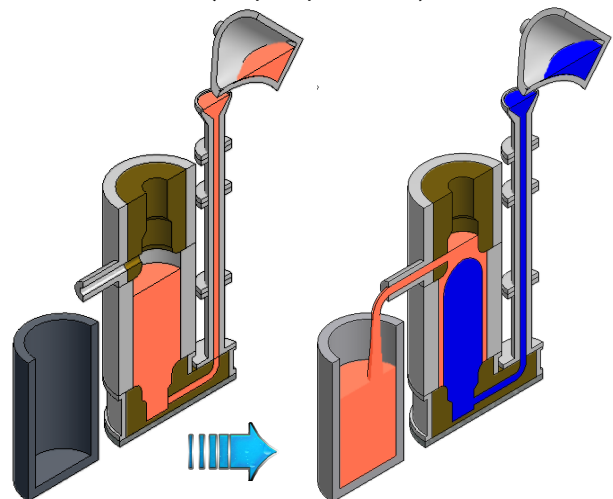


Figure 3. Casting technology of the bimetallic iron rolls

The manufacture of rolls (see Figure 2 and Figure 3) is in continuously perfecting, the requirements for superior quality rolls are not yet completely satisfied, in many cases, the absence of quality rolls preventing the realization of quality laminates or the realization of productivities of which rolling mills are capable. Basic properties of rolls and properties of the material are two totally different sides of a problem and very often this difference is ignored. However, when we start to discuss about the rolls mechanical properties, we have to analyze the rolls material or the roll-properties.

The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have a different influence upon the quality and the safety in the exploitation. Our approaches on quality assurance of the rolling mills roll are defined from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation.

The quality assurance research fields can be defined through the general research area, through the different experiments effectuated in the laboratories, and, also, through the modern calculation programs, optimization technologies and better capitalization of the manufacturing data.

The entire operations from selection of raw materials to dispatch of finished products go through a series of quality control checks conducted by a team of metallurgists. The products are tested for surface hardness by the conventional hardness testing equipment along with sample checks. In the laboratory to confirm to specification defined by the customers. The metallographic and mechanical tests are carried out to ensure the over all internal soundness, in particular, the quality of bound between the shell and core.

Depicted, developed, specified process and methods have been institutionalized for achieving the quality requirements of products of various grades. Synchronization between all activities and sub process are maintained to build desired properties in products.

All the incoming materials are checked according to laid down procedures for acquiring right material to manufacture specified products. At each stage of manufacturing, Quality Control Inspectors are engaged to ensure only defect free materials are produced. By identifying non-conforming products, actions are taken to prevent recurrence of defects as a continuous process of improvement.

Finally, each product goes through final inspection before being shipped. The foundry has modern inspection and testing facilities to keep update with the present requirements of fast and accurate

inspection and testing need. The cast rolls are inspected during the course of manufacturing, after completion and are held to our strict quality control criteria. In conclusion, every stage of the production process from design and development through to implementation must be conducted correctly.

QUALITY OF ROLLS ASSURED BY THE MODELING OF ROLLS MANUFACTURING TECHNOLOGIES

Industrial engineering is also operations management, systems engineering, production engineering, manufacturing engineering, or manufacturing systems engineering. Where most engineering disciplines apply skills to very specific areas, industrial engineering is applied in every industry. Industrial engineers typically use computer simulation, especially discreet event simulation, for system analysis and evaluation. The computer is used to generate a numerical model of reality for the purposes of describing complex interaction among components of a system.

Quality assurance can be defined as all activities that contribute to defining, designing, assessing, monitoring, and improving the quality of products. In quality assurance, data are used to analyze processes, identify problems, test solutions, and measure performance. Data are important because they ensure objectivity. The collection and analysis of data allow us to develop and test hypotheses. Comparing data from before and after a change can allow us to verify that the changes have actually led to improvements.

Starting from the principle of modeling process, used as necessary basic instrument, both in phase of conception, as well as in the industrial technologies analysis, is determined the optimum regimes of the cast rolls, from the view from chemical composition, as one as the most important parameters of disturbance of the manufacturing process.

The enunciation of some mathematically modeling results, described through a number of multi-component equations determined for the spaces with 3 the and 4 dimensions, as well as the generation of some regression surfaces, of some curves of levels, of the volumes of variation, of the lines of outlines of the volumes of variation of surfaces and the areas of variation of these, can be represented and interpreted by technologists and can be considerate diagrams of correlation between the analyzed variables.

From this point of view the multidisciplinary research is inscribes in context of scientific capitalization of the process and the industrial technologies optimizations, on the way of the analysis and the mathematical experiment. The quality assurance through the modeling phenomenon is presented in Figure 4(a-g) as a logistic chart.



Figure 4(a). The Iron Melting Process

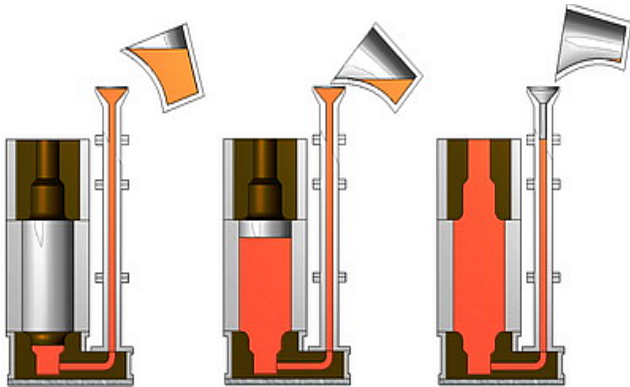


Figure 4(b). The Casting Process



Figure 4(c). The Products (Cast Rolls)

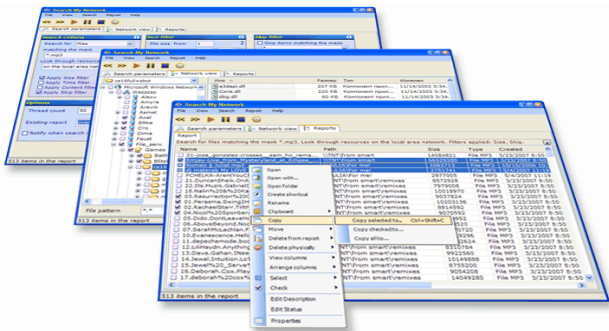


Figure 4(d). Databases Upgrade

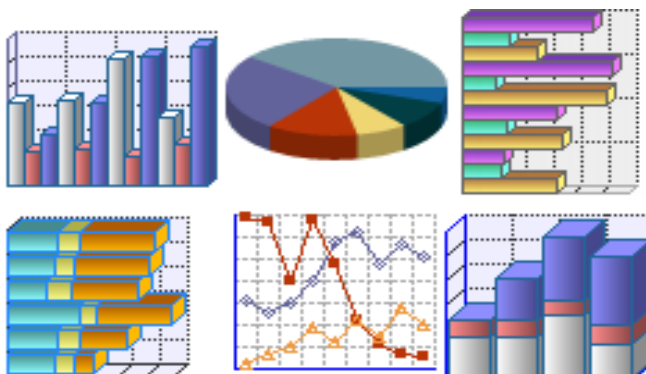


Figure 4(e). The Mathematical Approaches & the Graphical Addenda

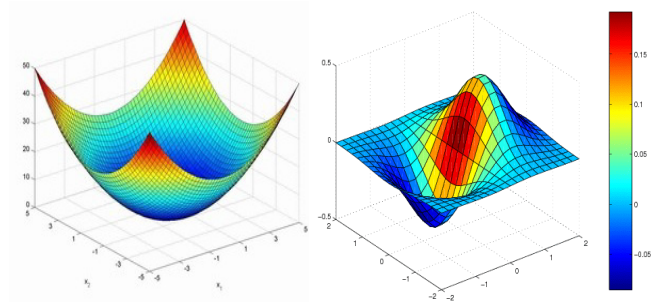


Figure 4(f). The Optimizing, Modeling & Tailoring

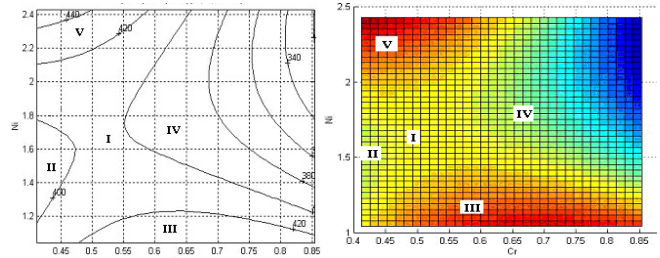


Figure 4(g). The Plotting & Technological Domains

The character of the metallurgical processes optimization is influenced by the complex peculiarities of these, which take place into a great number of variables (parameters) that operates independently or cumulate.

For these reason, to analyze the metallurgical processes is used, mainly, the statistical fundamental methods that permit to draw conclusions, from the observed values, about the repartition of the frequencies of various parameters, about their interaction, about verification validity of certain premises, and about the research of the dependencies among different parameters. However, the statistical methods of the metallurgical process analyses do not solve a series of aspects regarding the mode of establish the decisions for the management of the process. Thereof, parallel with the statistical methods it was developed optimization methods.

The optimization of any technological process has, as a base, a mathematical model. The search for the best solution, for the truth, requests either to find, on the way of a study, definitive truths, or of relative valid truths, valid only in certain conditions, and which, in relation with the definitive truths, include implications and errors. Because we disposed of real data, the optimization model is based on industrial data, obtained from cast-iron rolling mills rolls. Their analysis shall lead to the optimization pattern, through the prism of the multi-component correlations, enounced by mathematical formulae.

Through its nature, the quality assurance in the rolls manufacturing is a research with interdisciplinary character. It approaches, on aside, the technical area of manufacturing and exploitation of rolls, both in theory and practice, and on the other hand, the areas of the statistical mathematic analysis, of the

algorithms and the numerical calculus methods, as well as the mathematical modeling and optimization area, applied to a product so simple from point of view of the geometry, but so complex, as structure, property and characteristics ensued, as the rolling mills rolls are.

These results are immediate practical utility both the cast-iron rolling mills roll manufacturing industry, and the rolling sectors. In this sense, these researches results can be used in the collective framework of the foundries and the rolling mills sectors, for assurance quality of rolls as far back as phase of production, as well as in exploitation these, what lead to, inevitably, to the assurance quality of produced laminates.

CONCLUSIONS

The aim of the purpose research is to answer to as many questions possible regarding the quality of the rolls. In this sense the realization of optimum chemical compositions of the cast-iron can constitute a technical efficient way to assure the exploitation properties, the material from which the rolling mills rolls are manufactured having an important role in this sense.

In these sense, our researches propose to analyze the optimization of the manufacturing technology of the cast rolls, especially those from cast-iron - using electronic calculus technique as the modeling phenomenon and mathematical interpretation of the technological processes.

The proposed research theme solicits the uses of knowledge from science and the material engineering areas (the elaboration of the cast-iron, the treatment in liquid state of the cast-iron, the preparation of the molding sands, the preparation of the combined casting equipments, the drying of the forms, the cast in metallic and combined forms, the preparation of surfaces, the quality of the cast pieces, the reject forms of castings, the metals lamination, the rolls calibration, etc.), from the mechanic engineering (the hardness measurement, the foundry equipments, the plastic deformation equipments, the study of wear, the thermal fatigue study), from the mathematical sciences (statistics, mathematical regressions, mathematical modeling and optimization, etc.), and from the informatics, programming and calculus techniques. For the obtaining outcomes in this research area, is required the transfer of the concepts and the methodology between the mentioned areas.

Through the original aimed elements mentioned above, the suggested researches allow the enunciation of new approaches in the area afferent to the theme. The best way to roll makers to achieve better rolls is to ensure that better materials and improved manufacturing processes are used and that roll users take account of rolling conditions and

improved rolling processes. When we start to discuss about the rolls mechanical properties, we have to analyze the rolls material or the roll properties.

The choice of material for rolls is the operation which takes into consideration the own solicitations of the lamination process afferent to the type of laminates (half-products or the finite laminates), and the features of different materials considerate optimum in the fabrication of different typo-dimensions of rolls. In conclusion, the rolls quality problems can be solved by good cooperation between the rolls manufacturers and roll users. Engineering is concerned with the design of a solution to a practical problem. A scientist may ask “why” a problem arises, and proceed to research the answer to the question or actually solve the problem in his first try, perhaps creating a mathematical model of his observations. By contrast, engineers want to know “how” to solve a problem, and “how” to implement that solution. In other words, scientists attempt to “explain” phenomena, whereas engineers use any available knowledge, including that produced by science, to “construct” solutions to problems.

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BENCHMARKING OF FRICTION MODELS USED IN THE SIMULATION SOFTWARE PAMSTAMP 2G BY STRIP DRAWN TEST

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ABSTRACT: Due to nature of the actual deformation process that taking place in each individual region of deep drawing it is important to define different values of friction coefficients in different regions at FEM modelling of sheet metal stamping processes. In this contribution analytical models for determination of friction coefficients under blankholder and also on die drawing edge by strip drawing test are presented. These models were verified by experimental strip test and FEM simulation under the same contact conditions. Zn coated IF steel sheet DX45D was applied for experimental and simulation research.

KEYWORDS: deep drawing, strip drawn test, friction coefficient, simulation

INTRODUCTION

Formability of steel sheets depends on material properties (mechanical properties, microgeometry of contact surfaces), geometry and also microgeometry of contact surfaces of die, blankholder pressure, applied lubricant, etc. [1,2,3,4,5].

Accurate determination of the influence of individual parameters on technological characteristics is ambiguous because single parameters are changed from one case to another and their impact on formability is changed as well. It is possible to predict the influence of material properties, geometry of die, stamping conditions on sheet formability using simulation methods which enable us to optimize the utilization of material properties under specific conditions.

With the increasing importance of the FEM analysis in preproduction, the need for exact values, which serve as input data for FEM simulation, is becoming more and more important. These input data are important for accurate description of material behaviour and contact conditions [10]. In order to predict sheet metal formability it is important to define the friction coefficient on the die contact surfaces. Friction conditions were the subject of the study [6,7,8].

To determine the friction coefficients for different combinations of surfaces and lubricants the different model (radial strip drawing friction test, pin-on-disc, etc.) and technological tests (cup test) that model the stressing of material in real stamping process have been used [5,8].

ANALYSIS OF FORCE RATIOS ON CONTACT SURFACES

Stamping processes (deep drawing, stretching and bending) can be characterized by the types of contacts between the steel sheet and the die shown in Figure 1. The most frequently occurring types of contacts during stamping are shown in Figure 1a, b. In

Figure 1a the strip is sliding between two die flat contact surfaces separated by lubricant. In Figure 1b there is shown the model of bending and also sliding of strip on die drawing edge.

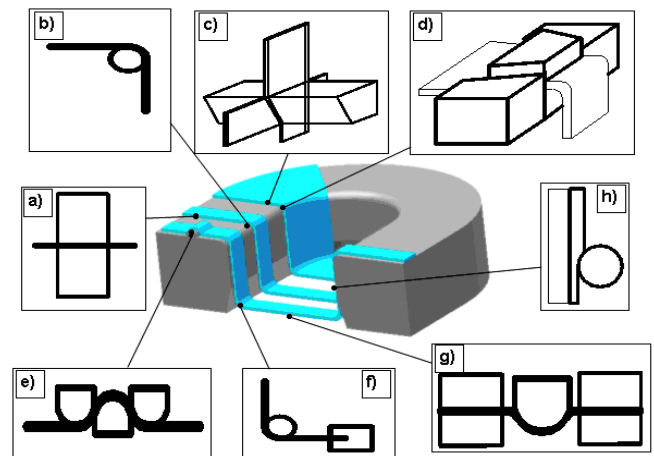


Figure 1. Types of contacts for deep drawing

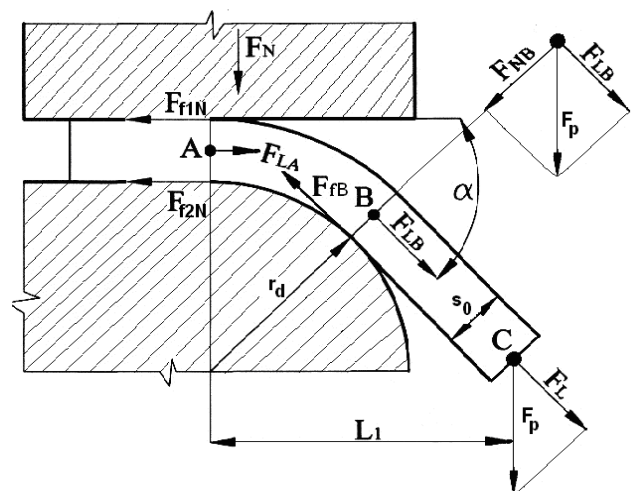


Figure 2. Scheme of forces at strip drawing.
 α - wrapping angle of the die drawing edge (the bending angle of the blank around the die drawing edge)

According to these basic types of models we are able to analyze the majority of contacts for sheet metal stamping operations. To create the analytical model we proceed from the following assumptions:

- Distribution of pressure on contact surfaces is non-homogeneous.
- The contact zone between the blank and the die at drawing radius (between point A and point B, as illustrated in Figure 2) is expressed as follows: $b_0 \cdot r_d \cdot \alpha$, where b_0 is original width of blank).
- Under the same forming conditions (materials, amount of lubricant, roughness of contact surfaces, normal pressure) the friction coefficient on a flat surface is equal to that on rounded surface [4,8,9].

The most FEM codes use the Coulomb's friction law. According to modified Coulomb's law (state under blankholder) the friction force between the blank (sheet metal strip) and blankholder F_{f1N} is determined as follows:

$$F_{f1N} = 2 \cdot f_1 \cdot F_N \quad (1)$$

where f_1 is the coefficient of friction between the blankholder and blank, F_N is blankholding force.

During simultaneous strip drawing under blankholder and over die drawing edge, the strip in the point A on the die drawing edge is retroactively bended – Figure 2. The back bending force F_{bA} in the point A is as follows:

$$F_{bA} = \frac{M_B}{L_1} \quad (2)$$

and bending moment of internal forces M_B is [8,9]:

$$M_B = \frac{b_0 \cdot k_f \cdot s_0^2}{4} \quad (3)$$

where b_0 - original width of blank, s_0 - original thickness of blank, k_f - flow stress of blank (drawn strip).

Since both F_N and F_{bA} result in a reacting force at point A with the same value respectively, the friction force between the blank and the die F_{f2N} is as follows [4,9]:

$$F_{f2N} = (F_N + F_{bA}) \cdot f_2 \quad (4)$$

and summary friction force F_{fA} at point A is:

$$F_{fA} = F_N \cdot f_1 + (F_N + F_{bA}) \cdot f_2 \quad (5)$$

where F_{f1N} and F_{f2N} are friction forces between flat dies, f_1 and f_2 - friction coefficients between flat dies.

If we assume that friction coefficients in zone under blankholder (between blank and blankholder f_1 and between blank and die f_2) are equal ($f_1 = f_2$), then the friction coefficient may be expressed as follows [4,9]:

$$f_{1,2} = \frac{f_1 + f_2}{2} \quad (6)$$

and total friction force F_{fA} in the point A will be:

$$F_{fA} = 2 \cdot f_{1,2} \cdot F_N + F_{bA} \cdot f_{1,2} \quad (7)$$

According to calculation of rope friction the longitudinal drawing force F_L at point A is [8,9]:

$$F_{LA} = F_{fA} \cdot \exp(\alpha \cdot f_3) \quad (8)$$

where f_3 – friction coefficient on the die drawing edge. Contact length L_{cr} between blank and die drawing radius r_d can be expressed as follows:

$$L_{cr} = r_d \cdot \alpha \quad (9)$$

where α is the bending angle of the blank around the die drawing edge, r_d - radius of die drawing edge, b_b - contact width of grip and blank (strip), L_b - contact length of grip and blank (strip).

If we assume $\alpha = \pi/2$ then longitudinal drawing force F_L will be:

$$F_L = [(2 \cdot F_N + F_{bA}) \cdot f_{1,2}] \cdot e^{\frac{\pi \cdot f_3}{2}} \quad (10)$$

then $F_p = F_L$ (11)

If we suppose that in the case of simulator with rotating roller the friction coefficient on the drawing edge is $f_3 = 0$, then the drawing force F_p after establishing into Eq. (11) and after arrangement will be:

$$F_{p(f3=0)} = (2f_{1,2} \cdot F_N + F_{bA} \cdot f_{1,2}) \quad (12)$$

If we express from Eq. (12) the friction coefficient in conformity with the Coulomb's law as portion of difference of drawing $\Delta F_{p1,2}$ ($f_3=0$) to difference of blankholding forces $\Delta F_{N1,2}$ due to the reference blankholding force $F_{N1,ref} = 2$ kN we obtain the following equation:

$$f_{1,2} = \frac{F_{p2(f3=0)} - F_{p1,ref(f3=0)}}{2(F_{N2} - F_{N1,ref})} = \frac{\Delta F_{p1,2(f3=0)}}{2 \cdot \Delta F_{N1,2}} \quad (13)$$

where F_{bA} is bending force, $F_{N1,ref} = 2$ kN, F_{N2} blankholding force whereas it is valid $F_{N1,ref} < F_{N2}$, $F_{p2(f3=0)}$ drawing force generated by blankholding force F_{N2} , $F_{p1,ref(f3=0)}$ drawing force generated by blankholding force $F_{N1,ref}$.

Stress acting on the contact areas under the blankholder and on drawing edge of die (see Figure 1b) was modelled by simulator in horizontal position and with fixed roller - Figure 3. Assuming that the roller is fixed, the friction coefficient on the drawing edge is $f_3 > 0$, then we can calculate the drawing force by the Oehler's formula:

$$F_{p(f3>0)} = F_{bA} + (2f_{1,2} \cdot F_N + F_{bA} \cdot f_{1,2}) \cdot \exp(\alpha \cdot \pi / 2) \quad (14)$$

and

$$F_{p(f3=0)} = F_{bA} + (2f_{1,2} \cdot F_N + F_{bA} \cdot f_{1,2}) \quad (15)$$

Then after arrangement we obtain:

$$F_{p(f3>0)} = F_{p(f3=0)} \cdot [\exp(\pi \cdot f_3 / 2)] \quad (16)$$

If the wrapping angle is $\alpha = 90^\circ$ (in radian $\pi/2$), then the friction coefficient f_3 on die drawing edge is:

$$f_3 = \ln \left(\frac{F_{p(f3>0)}}{F_{p(f3=0)}} \right) \frac{2}{\pi} \quad (17)$$

where $F_{t(f_3=0)}$ is drawing force generated by a rotating roller, $F_{t(f_3>0)}$ is drawing force generated by a fixed roller, f_3 is friction coefficient on the die drawing edge.

FEM SIMULATION OF STRIP DRAWN TEST

Strip drawing simulation was realized using software Pam-Stamp2G. Model of experimental device was created in 3D CAD/CAM software Pro/Engineer and its components were exported in neutral format igs. The die geometry was created according to real testing device: drawing die radius 10 mm, flat die part dimensions 30 in length and 50 mm in width (area of blankholder). Meshing of die components and strip were realized in meshing module of Pam-Stamp 2G during models import. Meshed die components are shown in Figure 3. Drawing die was split as it is shown in Figure 1 on two parts in order to simulate different friction conditions under blankholder and drawing radius.

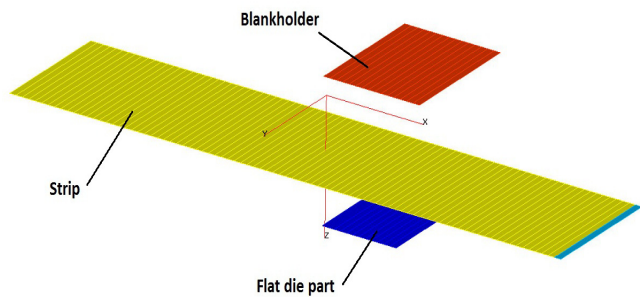


Figure 3. Set-up of strip drawing simulation – strip pulling

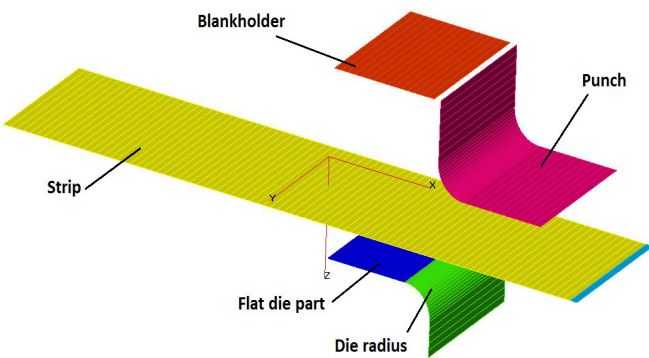


Figure 4. Set-up of strip drawing simulation - strip bending and pulling

There were researched two states of strip drawing as it is shown in Figure 3 and Figure 4: strip drawing with blankholding (where strip was moved in direction x – see Figure 3) at first, and strip drawing with bending and pulling (where strip is bent and then pulled in direction z – see Figure 4) at second. During simulation states strip was pulled with velocity 1 m/s applied in corresponding axis. Section force was defined between strip end nodes during simulation and section force element and strip drawing force was then calculated. Blankholding force in z-direction and “Accurate” contact type were applied during both simulation stages.

Experimental material DX54D was verified in simulation and Holomon’s hardening curve was defined according to measured data shown in Tab. 1. As a yield law Orthotropic Hill48 material law was used with Isotropic hardening definition. Orthotropic type of material anisotropy was defined by Lankford’s coefficients according to measured data shown in Tab. 1. Thickness of material was 0.78 mm.

Table 1. Material properties of DX57 D – zinc coated IF steel sheet

Rolling direction	0°	45°	90°	Average values
Yield strength 0,2% YS [MPa]	170	180	184	182
Ultimate tensile strength UTS [MPa]	292	304	297	300
Material constant K [MPa]	492	503	487	497
Strain hardening exponent n	0,208	0,203	0,215	0,207
Lankford’s coefficients $r_{0^\circ}, r_{45^\circ}, r_{90^\circ}$	1,98	1,04	1,59	1,59

In order to compare experimental results of strip drawing and simulation were set up blankholding force 4 kN with friction coefficients 0,125 (blankholder) and 0,08 (die radius) and blankholding force 9 kN with friction coefficients 0,110 (blankholder) and 0,07 (die radius). These values were chosen based on experimental results of strip drawn test using testing device in Figure 5.

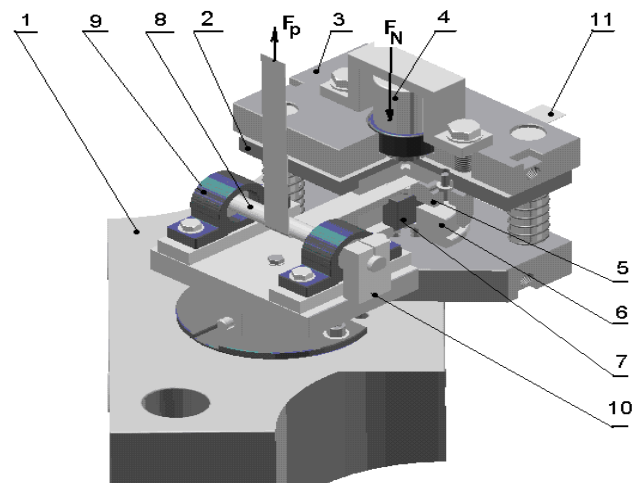


Figure 5. Model of friction simulator – strip drawing test. 1-base plate, 2-middle plate, 3-upper plate, 4-hydraulic clamping cylinder, 5-upper grip, 6-lower grip, 7- dynamometer for measurement of blankholding force, 8-roller, 9-ball bearings, 10- brake mechanism of the roller, 11-strip

EXPERIMENTAL SIMULATION OF STRIP DRAWN TEST

For modelling of stress state on flat and curved regions was used the friction simulator, shown in Figure 6. This simulator enables the modelling load of contact surfaces under blankholder modelled by using a simulator with a rotating roller is shown in Figure 1a.

Load of contact areas on the die drawing edge with a fixed roller is shown in Figure 1a,b.

Drawing conditions were as follows: blankholding forces $F_N = 4.0, 9.0$ kN, strip drawing speed $v = 10$ mm/s, roughness of the upper and lower grips $R_a = 0.4$ μm , roughness of roller $R_a = 0.4$ μm . The surface of steel strip was lubricated with lubricant Anticorit Prelube 3802-39 S with a kinematic viscosity of 60 mm²/s at 40 °C in the amount of 2 g/m².

Table 2 and Table 3 shows adjusted values of blankholding forces F_N and friction coefficients for simulation, measured drawing forces F_{f1N} , $F_{p(f3=0)}$ and $F_{p(f3>0)}$. For evaluation of friction coefficient in the area under blankholder were applied analytical Eq.(1) and Eq. (13). The Eq.(17) for calculation of friction coefficient f_3 on drawing edge of stamping die was used.

Table 2. Calculated friction coefficients – strip drawing without bending (Figure 3)

Material DX 54 D	Blankholding force F_N [N]	Drawing forces [N]		Friction coefficients	
		State 1 F_{f1N} [N]		$f_{1,2}$ according to relation (1)	$f_{1,2}$ according to relation (13)
FEM simulation, $f_{initial} = 0,125$	4000	999		0,125	-
	9000	2254		0,125	0,125
FEM simulation, $f_{initial} = 0,11$	4000	878		0,11	-
	9000	1981		0,11	0,11
Experiment	4000	998		0,125	
	9000	1986		0,11	0,099
FEM simulation and Experiment conformity [%]	4000	100,1		100	-
	9000	99,7		100	90-100

Note: State 1 – strip pulling within flat surfaces of blankholder and die

Table 3. Calculated friction coefficients – strip drawing with bending (Figure 4)

Material DX 54 D	Blankholding Force F_N [N]	Drawing forces [N]		Friction coefficients		
		State 2 $F_{p(f3=0)}$ [N]	State 3 $F_{p(f3>0)}$ [N]	$f_{1,2}$ acc. to rel. (13)	$f_{1,2}$ acc. to rel. (1)	f_3 acc. to rel. (17)
FEM simulation, $f_{initial} = 0,125$	4000	1362	1546		0,17	0,08
	9000	2631	-	0,127	0,146	
FEM simulation, $f_{initial} = 0,11$	4000	1246	-		0,156	
	9000	2365	2619	0,117	0,131	0,065
Experiment	4000	1108	1258		0,125	0,08
	9000	2361	2646	0,099	0,11	0,07
FEM simulation and xperiment conformity [%]	4000	120	123		136	100
	9000	100	99	100 - 106	119	93

Note: State 2 – strip pulling and bending along rotating cylinder; State 3 – strip pulling and bending along fixed cylinder

REACHED RESULTS AND DISCUSSION

Results of strip drawing simulation are shown in Figure 6. There is shown strip bending force is independent on both blankholding force and friction conditions and its maximal value is 0,439 kN. Average value of strip pulling force is 1,546 kN; 2,619 kN respectively. A moving average filter (MVA) in PamStamp 2G with a window width of 25 is applied on these curves and the average value of strip pulling force is calculated as average value from time 60 s till the end of simulation.

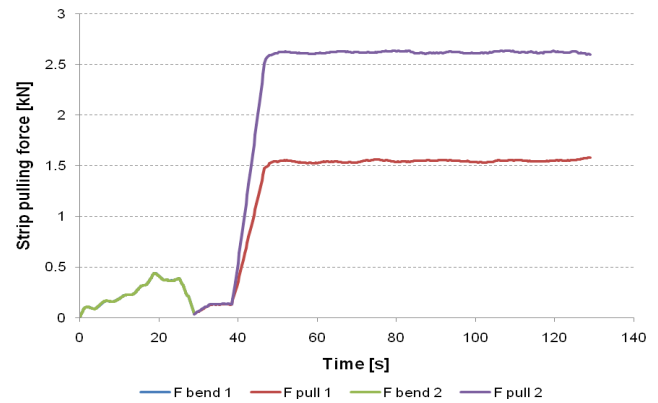
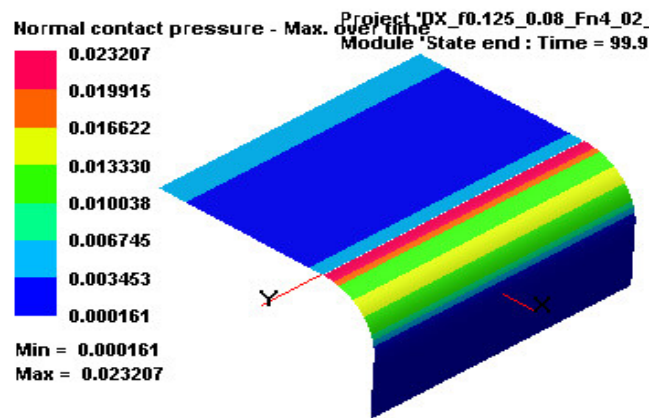
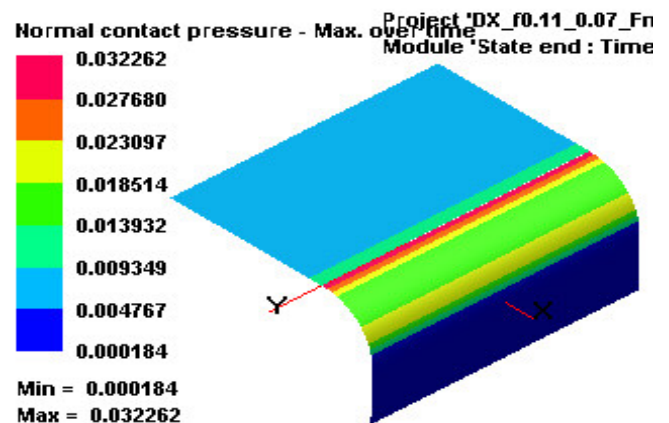


Figure 6. Graphs showing strip bending and pulling force at different friction and holding conditions.

- a) $F_N = 4$ kN; $f_{1,2} = 0,125$; $f_3 = 0,08$
- b) $F_N = 9$ kN; $f_{1,2} = 0,11$; $f_3 = 0,07$



- a) $F_N = 4$ kN; $f_{1,2} = 0,125$; $f_3 = 0,08$;



- b) $F_N = 9$ kN; $f_{1,2} = 0,11$; $f_3 = 0,07$

Figure 7. Maximal normal contact pressure during strip drawing simulation

Figure 7 shows normal contact pressure during strip drawing simulation. Maximal values of normal contact pressure are 23,207 MPa; 32,262 MPa respectively and they are on the first part of die radius in both cases. Course of normal contact pressure along flat die part and die radius is shown on Figure 8. As it is shown in figure, there are two maximum values of normal contact pressure. The first one is located at the radius start with maximum values of normal contact pressure 23,207 MPa and 32,262 MPa. The second one maximum is at blankholding force 4 kN in $50,625^\circ$ with value of 14,275 MPa and at blankholding force 9 kN in $61,875^\circ$ with value of 20,394 MPa.

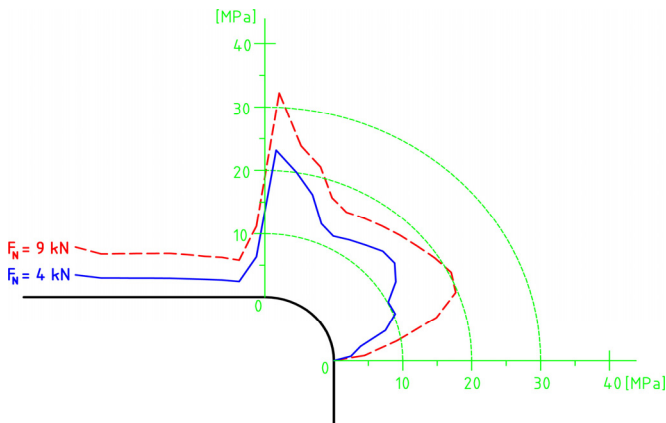


Figure 8. Course of normal contact pressure along flat die part and die radius

CONCLUSIONS / SUMMARY

Based on reached results of strip drawing experiments and FEM simulation it is possibly to state:

1. With pressure increasing on contact surfaces between blank and die, using Anticorit lubricant, friction coefficient values decrease. Concern Fuchs declares the same tendency in its commercial papers. We assume Anticorit lubricant includes high-pressure additives and its efficiency increases with pressure rising.
2. Evaluation of friction coefficients from strip drawing test between flat die parts and strip drawing test with strip bending along fixed and rotating cylinder according to eq. (1) gave greater differences (up 39 %) than evaluation of friction coefficients according to eq. (13), with difference approx. 6 %.
3. Better conformity was reached between friction coefficients computed from strip pulling force values according to eq. (13) than according to eq. (1) taking into account friction coefficients computed from experimentally measured pulling and blankholding forces. The advantage of eq. (13) is that friction coefficient is computed from ratio of pulling and blankholding force differences, what eliminates the influence of some factors (bending force influence, friction in bearings etc.) to pulling force.

By comparing friction coefficients on die radius computed according to eq. (17) from experimental measured and FEM simulation results were reached difference approx. 7 %. It means friction model described by eq. (17) for drawing die radius implemented in PAM STAMP 2G simulation software is in very good conformity to experimental measured results.

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CLASSIFICATION OF VARIOUS SECURITY TECHNIQUES IN DATABASES AND THEIR COMPARATIVE ANALYSIS

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ABSTRACT: Data security is one of the most crucial and a major challenge in the digital world. Security, privacy and integrity of data are demanded in every operation performed on internet. Whenever security of data is discussed, it is mostly in the context of secure transfer of data over the unreliable communication networks. But the security of the data in databases is also as important. In this paper we will be presenting some of the common security techniques for the data that can be implemented in fortifying and strengthening the databases.

KEYWORDS: Security techniques, cryptography, hashing, steganography

INTRODUCTION

In this ever growing cyber world where millions and trillions of bytes of data is transferred everyday over the internet, the security of this data is a top priority and a major challenge.

Data security has become a necessity for every individual who is connected to internet and uses the internet for any purpose. It is a requirement that is a must in every aspect of the operation performed on the internet. Operations like online money transactions, transfer of sensitive information, web services, and numerous other operations need security of data. Along with these operations on the internet, data security is also essential and important in databases.

Databases are the storage areas where large amount information is stored. The nature of information stored varies and depends on different organizations and companies. Nevertheless, every type of information needs some security to preserve data. The level of security depends on the nature of information. For example, the military databases require top and high level security so that the information is not accessed by an outsider but the concerned authority because the leakage of critical information in this case could be dangerous and even life threatening. Whereas the level of security needed for the database of a public server may not be as intensive as the military database.

Database security is essential because they suffer from security threats that may prove harmful and disastrous if disclosed or accessed publicly. Below we will present some security threats that are suffered by the databases.

□ **Privilege Abuse:** When database users are provided excessive privileges than their required functionality, then these privileges can be intentionally or unintentionally exploited.

- **Legitimate Privilege Abuse:** In this attack, the attacker with the legitimate privilege access to the database may abuse the information stored in the database for the malicious purposes.
- **Privilege Promotion:** The attacker in this attack takes advantage of the software vulnerabilities and errors and then elevates his clearance level to access the critical information stored in the database.
- **Operating System Vulnerabilities:** In operating system vulnerabilities, the attacker exploits the vulnerabilities in the operating system to gain unauthorized access to the database for malicious reasons.

To alleviate these database security attacks many database security techniques have been proposed. Most of these techniques strengthen the access control mechanisms to restrict illegal access to the database.

In our paper we discuss some of the common security techniques that can be used in addition to the access control mechanisms to store the data securely and in such a way that any outsider will not be able to understand the information, even if he is able to retrieve it.

Below we list some common security schemes that can be applied to database security.

- **Cryptography:** Cryptography is the study and the practice of the techniques wherein the plaintext by encryption is converted to an obfuscated and non-readable text.
- **Hashing:** Hashing is defined as the transformation of a variable length data into a fixed length string by using hash functions without which the retrieval of the data is not possible.
- **Steganography:** Steganography is process of concealing sensitive information in any type of cover media.

- **Access Control:** Access control mechanisms restrict the access to the database and its information to outsiders except for the authorized users.

The rest of the paper is organized as follows: Section 2 illustrates some common security techniques that can be implemented in enhancing the security of the database. A Comparative Analysis is presented in Section 3 followed by the Conclusion in Section 4.

VARIOUS DATABASE SECURITY TECHNIQUES – Securing Database using Cryptography

Sesay et al. proposed a database encryption scheme. In this scheme the users are divided into two levels: Level 1 (L1) and Level 2 (L2) [1], [2]. Level 1 users have access to their own private encrypted data and the unclassified public data, whereas Level 2 users have access to their own private data and also classified data which is stored in an encrypted form.

Liu et al. proposed a novel database encryption mechanism [3], [4]. The proposed mechanism performs column-wise encryption that allows the users to classify the data into sensitive data and public data. This classification helps in selecting to encrypt only that data which is critical and leaves the public data untouched thereby reducing the burden of encrypting and decrypting the whole database, as result of which the performance is not degraded.

Mixed Cryptography Database [5] scheme is presented by Kadhem et al. The technique involves designing a framework to encrypt the databases over the unsecured network in a diversified form that comprise of owning many keys by various parties. In the proposed framework, the data is grouped depending upon the ownership and on other conditions.

Securing Database using Steganography

Das et al. [6] explained various techniques in steganography that can be implemented to hide critical data and prevent them from unauthorized and direct access. The various techniques include still image steganography, audio steganography, video steganography, IP Datagram steganography.

Naseem et al. presented a method that uses steganography to hide data [7]. In the proposed scheme the data is embedded in the LSB's of the pixel values. The pixels values are categorized into different ranges and depending on the range certain number of bits is allocated to hide the sensitive data.

Kuo et al. presented a different approach to conceal data. In this scheme the image is divided into fixed number of blocks [8], [9], [10], [11]. Histogram of each block is calculated along with the maximum and minimum points to mask the data. This mechanism increases the hiding capacity of the data.

Dey et al. employs a diverse approach to efficiently hide the sensitive data and escalate the data hiding capacity in still images [12], [13], [14]. The technique

involves using prime numbers and natural numbers to enhance the number of bit planes to cloak the data in the images.

Securing Database using Access Control

Bertino et al. [15] explains an authorization technique for video databases. In the proposed scheme, the access to the database and to a particular stream of the video is granted only after verifying the credentials of that user. The credentials may not just be the user-id but it may be the characteristics that define the user and only after successful verification of the credentials the user is granted the permission to access the database.

Kodali et al. presented a generalized authorization model for multimedia digital libraries [16], [17], [18]. The scheme involves integrating the three most common and widely used access control mechanisms namely: mandatory, discretionary and role-based models into a single framework to allow a unified access to the protected data. The technique also addresses the need of continuous media data while supporting the QoS constraints alongside preserving the operational semantics.

An authorization model is proposed by Rizvi et al [19], [20], [21], [22], [23]. In the explained technique is based on authorization views which enable authorization transparent querying in which the user queries are formed and represented in terms of database relations and are acceptable only when the queries can be verified using the information contained in the authorization rules. The work presents the new techniques of validity and conditional validity which is an extension of the earlier work done in the same area.

COMPARATIVE ANALYSIS OF VARIOUS DATABASE SECURITY TECHNIQUES

In [1], [3], [5] cryptography is implemented to keep the data in the database secure by encrypting the data. In [1], the authors have categorized the users in two levels: Level 1 and Level 2. Based on the Level of the user the accessibility of data provided. Level 1 users are allowed to access their own private encrypted data and the public data, whereas Level 2 user is permitted to access both, the encrypted private data and the encrypted classified data. The advantage of this scheme is that the grouping of users and grouping of data into two levels avoids the burden of unnecessary encryption of the whole data. Only the classified data and the private data are encrypted and the public data is left unchanged. A rather different approach is followed by [3]. In [3], the authors perform column-wise encryption of the data that is defined as the sensitive data by the users. The column-wise encryption approach prevents the whole database to be encrypted but only the critical

information, thus averting the performance degradation problem of the database during the retrieval of the data. A varied style is undertaken by the authors in [5]. In this scheme mixed mode cryptography is employed to secure the database over the untrusted and unreliable network in a mixed form. Many keys are held by different parties who have the access to the database so that even when the database is attacked at multiple points by an insider or an outsider the database is not comprised. The authors in [7], [8], [12] have proposed steganography as a method that can be implemented to secure the data in the database. In [7] still images are used to hide the data. In the explained scheme the pixels in the image grouped based on their intensity to hide the data. The advantage possessed by this method is that based on the intensity of the pixels a varied number of bits can be utilized to conceal the data instead of fixed number of bits. Instead of grouping the pixels of the complete image based on the intensity, the authors in [8] divide the image in equal sized blocks and the histogram of these blocks is calculated. The maximum and minimum points of the histogram are recorded and the critical data is embedded in between these points. The benefit in this approach is that the embedding capacity of the image is enhanced. To achieve the same result of increase the hiding capacity of the image and to conceal the data the authors in [12] have followed a different approach. In this technique prime numbers are used to utilize not just the lower bit planes of the image but even the higher bit planes of the image, thereby extending the hiding capacity.

Table 1a: A summary of the various Data Security Techniques - Brief Description of the Technique

Security Technique	Brief Description of the Technique
1. Cryptography	Cryptography is a technique to protect the data in which the plaintext or data is converted into a cipher text by applying encryption so that the resultant cipher text is in an unreadable form.
2. Steganography	Steganography is technique of hiding or concealing the sensitive data in any type of cover media.
3. Access Control/ Authorization	Access Control/ authorizations mechanisms restrict the illegal access to databases and those with valid credential and the authorized users are granted access to the database.

Authorization techniques are presented in [15], [16], [19]. In [15], authorization techniques for video database are proposed. The scheme involves authorizing the users based on their credentials to provide access to the video database.

Table 1b: A summary of the various Data Security Techniques - Security Techniques Proposed

Security Technique	Security Techniques Proposed
1. Cryptography	<ol style="list-style-type: none"> In [1] the authors presented that only encrypts the classified data and the unclassified data is left unchanged. Access is granted to the data by grouping the users into two levels: Level 1 and Level 2. The authors in this technique [3] allow the users to classify the data based on the nature of the data as critical or public. Only critical data is encrypted column-wise which helps in avoiding the degradation of the performance. In [5] a novel approach of mixed cryptography is presented. The proposed is applied to databases that reside over the unsecured networks.
2. Steganography	<ol style="list-style-type: none"> The authors in [7] explained a method that focuses on utilizing the intensity of the pixels to hide data instead of the conventional approach where just 1 LSB bit is used to hide the critical data. In the next approach a single image is divided into blocks of equal sizes [8] whose histogram is calculated and the data is hidden in the histograms of these blocks.
3. Access Control/ Authorization	<ol style="list-style-type: none"> Authorization technique for video database is proposed in [15]. In the proposed scheme a user is granted access to the video stored in the database only after verifying its credentials. In [16] a generalized framework is presented. In this method, mandatory, discretionary, and role-based models are integrated into a unified framework to allow access to the database. A method based on authorization views is explained in [19]. The scheme enables transparent querying in which the user's queries are represented into database relations. The users are granted access only when the information is present in authorization view.

The credentials may contain the characteristics defined for the users and not just their user identifications.

A stricter approach is followed by [16]. In the method involves integrating the mandatory, discretionary and role-based models into a unified framework that grants access to the data in the database.

Another technique based on access control mechanism is proposed by [19]. The authors in [19] use authorization views that enable transparent querying which are validated only when the information is present in the authorization views otherwise they are not. The benefit provided by this approach is that only the information and rules present in the authorization views are accepted and only then the access is granted otherwise the access is denied to the database.

TABLE 1 below lists a brief overview of the security techniques along with their description.

CONCLUSIONS

In this paper we talked about various security vulnerabilities that the database suffers from and the need for security to alleviate these vulnerabilities. We also presented some common security techniques that can be employed to augment and enhance the security of the database against some known attacks and security threats.

In Section 1 we provided an introduction about the database and the security threats and need for security in the database. In the next section we discussed various security techniques that may be implemented in the database. A Comparative Analysis of the techniques discussed in Section 2 is presented in Section 3.

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Announcement

According to the **PEOPLE'S REPUBLIC OF CHINA/ROMANIA JOINT RESEARCH PROJECT - no. 40-5/18.10/2010**
between
MILITARY ECONOMICS ACADEMY OF WUHAN, P.R. CHINA,
and
UNIVERSITY "POLITEHNICA" OF TIMIȘOARA, ROMANIA,
the **FACULTY OF ENGINEERING HUNEDOARA**
organize

CHINESE – ROMANIAN CONFERENCE on APPLIED SCIENCES in DEFENCE



Organizers:

MILITARY ECONOMICS ACADEMY of Wuhan, CHINA



and

UNIVERSITY POLITEHNICA of Timisoara, ROMANIA



in cooperation with:

**SCIENTIFIC INTERDISCIPLINARY VALUES FOR EDUCATION
AND RESEARCH SOCIETY, Timisoara, ROMANIA**

and

Micro-Mega, Hunedoara, ROMANIA



Hunedoara, 15 – 16 June, 2012

Faculty of Engineering Hunedoara, ROMANIA

Co-Chairs: Yiwen JIANG, Ludovic Dan LEMLE

Honorary Committee: Zhou LAIXIN, Viorel Aurel ȘERBAN, Guo ZHONGHOU,
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Virginia SOCALICI, Lucia VÎLCEANU, Erika ARDELEAN, Ionel MUSCALAGIU, Marius BENEĂ

According to the **PEOPLE'S REPUBLIC OF CHINA/ROMANIA JOINT RESEARCH PROJECT - no. 40-5/18.10/2010**
 between
MILITARY ECONOMICS ACADEMY OF WUHAN, P.R. CHINA,
 and
UNIVERSITY "POLITEHNICA" OF TIMIȘOARA, ROMANIA,
 the **FACULTY OF ENGINEERING HUNEDOARA**
 with cooperation of **A.G.I.R. and S.C.I.V.E.R.S.,**
 organize

THE SECOND CHINESE – ROMANIAN SYMPOSIUM ON INTER-GOVERNMENT JOINT RESEARCH PROJECT



Hunedoara, 18 – 19 June, 2012
Faculty of Engineering Hunedoara, ROMANIA

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 Yiwen JIANG, Military Economics Academy of Wuhan, P.R. CHINA
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Scientific Events in 2012

1. THE 7th INTERNATIONAL SYMPOSIUM – MACHINE AND INDUSTRIAL DESIGN IN MECHANICAL ENGINEERING – KOD 2012 24–26 May 2012, Balatonfüred, HUNGARY

The aim of the symposium is to review the current state of knowledge and present the scope of scientific research and innovation in the field of engineering design, product developing and management.

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 and graphical engineering, industrial design and shaping, product development and management,
- to propose technically 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

Detailed informations here: <http://www.kod.ftn.uns.ac.rs/>

2. THE 4th INTERNATIONAL SCIENTIFIC CONFERENCE MANAGEMENT OF TECHNOLOGY STEP TO SUSTAINABLE PRODUCTION – MOTSP 2012 14–16 June 2012, Zadar, CROATIA

International Conference Management of Technology – Step to Sustainable Production (MOTSP 2012), will take place from 14-16 June 2012 in Zadar, Croatia as a joint project organized by the Faculty of Mechanical Engineering and Naval Architecture and Faculty of Graphical Arts both from the University of Zagreb, Croatia, Faculty of Management, University of Primorska, Koper and Faculty of Mechanical Engineering, University of Maribor, Slovenia, Faculty of Mechanical Engineering, Ss. Cyril and Methodius University, Skopje, Macedonia, and Politecnico di Torino, Italy.

The main objective of this Conference is to gather international experts from academic entities, research laboratories and industries related to the field of Management of Technology and Sustainable Production. The Conference will also provide a platform for sharing knowledge, ideas and results between science and industry.

The management of technology, stimulation of innovation and invention and transfer of technology are important challenges of the developed countries and countries in transition. Detailed informations here: <http://motsp2012.org/>

3. INTERNATIONAL CONFERENCE ON INDUSTRIAL LOGISTICS – ICIL 2012 14–16 June 2012, Zadar, CROATIA

The International Conference on Industrial Logistics (ICIL) 2012 will take place in Croatia, from June 14th to June 16th 2012, hosted by the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb and International Centre for Innovation and Industrial Logistics (ICIL).

International Centre for Innovation and Industrial Logistics (ICIL) is a non-profit professional association which has been developing an integrated view of Industrial Logistics, sharing and exchanging ideas and research results among students, researchers, academics and industrialists. The biannual International Conference on Industrial Logistics (ICIL) is the main mean to attain these objectives worldwide, moving from France 1993 to Brazil 1995, USA 1997, Russia 1999, Okinawa 2001, Finland 2003, Uruguay 2005, Lithuania 2006, Israel 2008, again Brazil 2010 and Croatia 2012.

The conference will feature a multidisciplinary program that will include original research results and contributions to the fields of logistics and supply chain management. Organizing and Scientific Committee gladly invite professionals, academics, students and industrialists to send contributing papers to the Conference.

Detailed informations here: <http://icil2012.info/>

4. THE 2nd CONFERENCE – MAINTENANCE 2012 13–16 June 2012, Zenica, BOSNIA & HERZEGOVINA

Faculty of Mechanical Engineering in Zenica and Society of Maintainers in B&H organize the 2nd Conference "Maintenance 2012". Conference objectives are:

- Gathering of people engaged in maintenance funds for the operation of various aspects and their structural organization,
- Communication of the results of research in the field of maintenance, as theoretical and practical,
- Exchange of experiences from practical maintenance activities,
- Transfer of knowledge in the field of maintenance.

The Conference will be performed as follows: plenary session (Key papers concerned global topics), symposium (papers according to the conference topics) and workshops, when needed.

Detailed informations here: <http://www.odrzavanje.unze.ba/>

5. THE 12th INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC GEO-CONFERENCE AND EXPO – SGEM 2012 (SURVEYING GEOLOGY & MINING ECOLOGY MANAGEMENT) – MODERN MANAGEMENT OF MINE PRODUCING, GEOLOGY AND ENVIRONMENTAL PROTECTION 17–23 June 2012, Albena, BULGARIA

The SGEM GeoConference focuses on the latest findings and technologies in surveying geology and mining, ecology, and management, in order to contribute to the sustainable use of natural resources. In this regards all theoretical, methodological and conceptual reports presenting contemporary geoscience development and problems solving ideas are expecting with a great interest. Special attention will be given to reports, proposing science based ideas for decision-making and adaptation to the new reality of global changes.

The GeoConference will bring together researchers, educators, and practitioners representing research and educational institutions, companies, government agencies and consulting organizations from all over the world to exchange of ideas, to define the research priorities in the above fields and to propose potential solutions of problems related to the global changes. Detailed informations here: <http://www.sgem.org>

6. THE 20th ANNUAL INTERNATIONAL CONFERENCE ON COMPOSITES, NANO OR METALS ENGINEERING – ICCE-20
22–28 July 2012, Beijing, CHINA

The ICCE conference is unique in that while it is an engineering conference, it has attracted numerous chemists, physicists and scientists from diverse fields in our efforts to promote interdisciplinary research on composites. Of particular concern is the challenge for materials engineers to understand the wide diversity of length scales ranging from nano to micro to macro and full scale and to question the validity of the theories or models which are known to be valid only in certain length scales. The ICCE is among the first composite materials conferences which take a leading vital role to bridge the gap between nano-chemistry and nano-engineering and attracted hundreds of papers in this existing relatively new field of nano-composites engineering.

The ICCE conference will provide a forum for the exchange of information and ideas in virtually all areas composite materials research. The goals of the ICCE conference are:

- To BRIDGE THE GAP between Materials Science, Mechanics and manufacturing of Composite Materials;
- To ENCOURAGE INTERDISCIPLINARY research bridging the gap between aerospace technology, bio-materials, chemistry, electronics, fluid mechanics, infrastructures, magnetic materials, nanotechnology, physics, powder metallurgy, sensors/actuators, among others and
- To ENCOURAGE LEVERAGING of composite materials research resources through joint research between participants and writing joint research proposals.

Detailed informations here: www.icce-nano.org

7. THE 9th INTERNATIONAL CONGRESS “MACHINES, TECHNOLOGIES, MATERIALS - INNOVATIONS FOR THE INDUSTRY” – MTM'12
19–21 September, 2012, Varna, BULGARIA

We invite you to take part in the 9th International Congress “Machines, Technologies, Materials - Innovations for the Industry”, which will be held from 19th till 21st September 2012 again in hotel “Aqua Azur” in the sea resort “St. Konstantin and Elena”, region Varna, as a comprehensive scientific-technical manifestation, which includes three main topics. The Congress program includes also five special congress sub-sections which previously were held separately.

We believe that and this time the Congress will be a successful international forum in the field of engineering science. We hope that in this way the Congress MTM'12 will become a bigger innovation mediator between scientific research and industry and we offer you to take advantage of this opportunity. We believe that you will take this opportunity and contribute to the success of the Congress with your researches and experience.

We would be very grateful to you if you recommend MTM'12 to colleagues of yours, from your country and abroad, who might have scientific and practical interests in the thematic area of the Congress.

Short information about the Congress you may find in the attached file and detailed information is available on <http://mech-ing.com/mtm/>

8. THE 9th INTERNATIONAL CONFERENCE – ELEKTRO 2012
21–22 May 2012, Rajecské Teplice, SLOVAKIA

The conference is the ninth of the international series of conferences which began in 1995 initially as a national conference with international participation. The conference is organized by the Faculty of Electrical Engineering, University of Žilina, every two years. The purpose of the conference is to provide an international forum for researchers and professionals interested in electrical and electronic engineering as well as boundary areas with the main attention to the conference topics.

Detailed informations here: <http://www.elektro.uniza.sk>

9. THE 6th INTERNATIONAL CONFERENCE ON INDUSTRIAL ENGINEERING AND MANAGEMENT – IEM2012
10–12 August, 2012, Zhengzhou, CHINA

You are invited to submit papers in all areas of Industrial Engineering and Management. All papers accepted will be indexed by Ei Compendex and ISTP.

Manufacturers and developers of equipment, components, software and services complementing the topics of the conference are invited to display their state-of-the-art products. The exhibition will be placed in the conference area. For further information, potential exhibitors can contact with email: iciem2012@163.com.

Detailed informations here: <http://www.ieee-iciem.org>

10. THE 11th INTERNATIONAL CONFERENCE NEW WAYS IN MANUFACTURING TECHNOLOGIES 2012
21–23 June, 2012, Prešov, SLOVAKIA

On behalf of whole organization committee we would like to invite you to the XI. International Conference “NEW WAYS IN MANUFACTURING TECHNOLOGIES”, which will be organized on the occasion of 20th anniversary of the Faculty of Manufacturing Technologies with a seat in Prešov, Technical University of Košice.

Detailed informations here: <http://web.tuke.sk/fvtpo/nwmt2012/>

11. THE 9th INTERNATIONAL SYMPOSIUM ON TOOLS AND METHODS OF COMPETITIVE ENGINEERING – TMCE 2012
7–11 May, 2012, Karlsruhe, GERMANY

It is our pleasure to invite you to the Ninth International Symposium on Tools and Methods of Competitive Engineering, TMCE 2012 at Karlsruhe, Germany, May 7 - 11, 2012. The focus of the TMCE 2012 Symposium will be on Mobile and ubiquitous technologies for global product development and production processes. This Symposium will be jointly organized by the Karlsruhe Institute of Technology (KIT), Germany, and the Delft University of Technology, the Netherlands.

TMCE 2012 will offer a traditionally high standard professional program, as well as several attractive and entertaining social and cultural events. You are cordially invited to participate in this exciting event with your industrial tutorials, scientific podium and poster papers, or simply as part of the audience.

The Symposium is offered to product designers, product managers, product, process and environmental engineers, information and knowledge technology managers, engineering technology managers, quality and process engineers, engineering IT suppliers and vendors, academic researchers, technology transfer centers, engineering educators and industrial advisors.

TMCE 2012 will offer a high standard professional program as well as a set of entertaining social functions. The focus of the professional program will be on Mobile and ubiquitous technologies for global product development and production processes. Experience the TMCE traditions together with many more participants from government, academia, and industry. You are cordially invited to propose industrial tutorials and to submit technical papers. You will also have the opportunity for product demonstrations. Participation of students is encouraged and supported with reasonable discounts. As earlier, the Proceedings will be published as hard-cover book and the best papers will be republished in special issues of international journals. The Organizing Committee is going to establish a Symposium-related journal for publication of review, research and application papers.

Detailed informations here: <http://www.tmce.org/>

12. THE 4th INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND TECHNOLOGIES – ROMAT 2012
17–19 October, 2012, Bucuresti, ROMANIA

On behalf of the Organizing Committee, we are honored to invite you to participate and submit a paper at the 4th INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE AND TECHNOLOGIES – ROMAT 2012 organized by POLITEHNICA University of Bucharest - Materials Science and Engineering Faculty in association with Bucharest Chamber of Commerce and Industry.

We are convinced that your presence will particularly contribute to a high level of the conference and it is an occasion to achieve an efficient idea and information exchanges for further development of this field.

Detailed informations here: <http://www.romat2012.eu/>

13. THE 5th INTERNATIONAL SYMPOSIUM ON INDUSTRIAL ENGINEERING – SIE2012
14–15 June, 2012, Belgrade, SERBIA

The 5th International Symposium of Industrial Engineering – SIE 2012 is organized by Industrial Engineering Department, Faculty Of Mechanical Engineering, University Of Belgrade, Serbia and Steinbeis Advanced Risk Technologies, Stuttgart, Germany.

The aim of the 5th International Symposium of Industrial Engineering – SIE 2012 is to contribute to a better comprehension of the role and importance of Industrial Engineering and to mark the twentieth anniversary of the Industrial Engineering program in Serbia, established at FME, Belgrade. The Symposium is expected to foster networking, collaboration and joint effort among the conference participants to advance the theory and practice as well as to identify major trends in Industrial Engineering today. According to these goals the Symposium addresses itself to all experts in all fields of Industrial Engineering to make their contribution to success and show capabilities achieved in the work that has been done are very welcomed.

We invite high quality submissions of papers describing original and unpublished results of conceptual, constructive, empirical, experimental, or theoretical work in all topics of industrial engineering.

Detailed informations here: <http://www.mas.bg.ac.rs/mfb-en/conferences.html>

14. THE 18th EUNICE CONFERENCE ON INFORMATION AND COMMUNICATIONS TECHNOLOGIES
29–31 August, 2012, Budapest, HUNGARY

The aim of the annual EUNICE conference is to provide a forum that brings together young researchers and scientist from Europe and neighboring regions to meet and exchange ideas and recent works on all aspect of information and communication technologies.

For any additional information please consult the conference website: <http://tmit.bme.hu/eunice2012>

15. FEDERATED CONFERENCE ON COMPUTER SCIENCE AND INFORMATION SYSTEMS – FedCSIS 2012
9–12 September, 2012, Wrocław, POLAND

The 2012 Federated Conference on Computer Science and Information Systems cordially invites you to consider contributing an Event (conference, symposium, workshop, consortium meeting, and special session).

Each Event may run over any span of time within the conference dates (from half-day to three days). The FedCSIS Events provide a platform for bringing together researchers, practitioners, and academia to present and discuss ideas, challenges and potential solutions on established or emerging topics related to research and practice in computer science and information systems.

The FedCSIS Events provide a platform for bringing together researchers, practitioners, and academia to present and discuss ideas, challenges, and potential solutions on established or emerging topics related to research and practice in computer science and information systems.

The Events will be selected based on the scientific/technical interest and/or their relevance to practitioners in their topics, the clarity of the proposal in addressing the requested information, the innovativeness of the Event topics, and the capacity in the FedCSIS multi-conference program.

Detailed informations here: <http://www.fedcsis.org/>

16. THE 5th INTERNATIONAL CONFERENCE ON MASS CUSTOMIZATION AND PERSONALIZATION IN CENTRAL EUROPE (MCP – CE 2012)
– CUSTOMER CO-CREATION IN CENTRAL EUROPE
19 – 21 September, 2012, Novi Sad, SERBIA

On behalf of the Organizational Board and Scientific Committee of the 5th International Conference on Mass Customization and Personalization in Central Europe (MCP – CE 2012), we cordially invite you to participate and to share your research ideas, efforts and results with other scientists, entrepreneurs and corporate managers, dedicated to the idea of Mass Customization and Personalization.

Organized for the fifth time, the biannual MCP-CE conference would like to emphasize the role and importance of Customer Co-Creation that offers customers a chance to express their differences, and also an opportunity for innovations and new business models such as MC and Open Innovation platforms, for sharing designs and developments and benefits from the experiences of others.

Detailed informations here: <http://www.mcp-ce.org/>

17. INTERNATIONAL CONFERENCE ON SCIENCE AND TECHNIQUE IN THE AGRI-FOOD BUSINESS – ICoSTAF2012
– THE 50th ANNIVERSARY OF ENGINEERING EDUCATION IN SZEGED
7th June, 2012, Szeged, HUNGARY

University of Szeged, Faculty of Engineering in cooperation with Hungarian Academy of Sciences, Regional Committee in Szeged and Hungarian Scientific Society of Food Industry organize International Conference on SCIENCE and TECHNIQUE in the AGRI-FOOD Business – ICoSTAF2012.

For any additional information please visit: www.icostaf2012.mustra.hu

18. THE 13th INTERNATIONAL CONFERENCE ON OPTIMIZATION OF ELECTRICAL AND ELECTRONIC EQUIPMENT – OPTIM 2012
24 – 26 May, 2012, Brasov, ROMANIA

It is our pleasure and honour to welcome you to the 13th INTERNATIONAL CONFERENCE ON OPTIMIZATION OF ELECTRICAL AND ELECTRONIC EQUIPMENT, sponsored and organised by Transilvania University of Brasov, Romania, between 24th – 26th of May 2012. As in previous editions, OPTIM'2012 is co-organized by University Politehnica of Timisoara and Technical University of Cluj-Napoca and it is technically co-sponsored by the Institute of Electrical and Electronics Engineers (IEEE) through three of its societies: Industrial Electronics (IES), Industrial Applications (IAS) and Power Electronics (PELS), along with the Institution of Engineering and Technology (IET).

Detailed informations here: <http://www.info-optim.ro>

19. THE 7th IEEE INTERNATIONAL SYMPOSIUM ON APPLIED COMPUTATIONAL INTELLIGENCE AND INFORMATICS – SACI 2012

24 – 26 May, 2012, Timisoara, ROMANIA

Authors are welcome to submit original and unpublished papers and attend the IEEE 7th International Symposium on Applied Computational Intelligence and Informatics (SACI 2012) to be held on May 24-26, 2012 in Timisoara, Romania. Detailed informations here: <http://conf.uni-obuda.hu/saci2012/general.htm>

20. MACHINE-BUILDING AND TECHNOSPHERE OF THE XXI CENTURY

17 – 22 September, 2012, Sevastopol, UKRAINE

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 XIX international science and engineering conference MACHINE-BUILDING AND TECHNOSPHERE OF THE XXI CENTURY taking place in the city of Sevastopol on September 17-22nd 2012.

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.

Detailed informations here: <http://donntu.edu.ua/ukr/7/konf/sevastopol/about.htm>

21. INTERNATIONAL CONFERENCE ON MATHEMATICAL MODELING IN PHYSICAL SCIENCES – IC-MSQUARE 2012

3 – 7 September, 2012, Budapest, HUNGARY

The conference aims to promote the knowledge and the development of high-quality research in mathematical fields that have to do with the applications of other scientific fields and the modern technological trends that appear in them, these fields being those of Physics, Chemistry, Biology, Medicine, Economics, Sociology, Environmental sciences etc.

You may find details of the Conference visiting the Conference website at <http://www.icmsquare.net>.

22. INTERNATIONAL CONFERENCE ON COMPUTATIONAL & EXPERIMENTAL ENGINEERING AND SCIENCES – ICCES'12

April 30 – May 4, 2012, Crete, GREECE

ICCES is an organization of highly reputed international researchers, from academia, industry, and governments across the world, in the general disciplines of computational and experimental engineering and sciences. Each year, ICCES conferences bring together more than 500 of the world's most respected researchers in the disciplines such as Nanoscience and Technology; Nanostructured Materials; Engineering, Biology and Medicine; Bio-MEMS/Bio-NEMS/Labs-on-Chips/Life-Chips, Complex Engineering Systems; Molecular and Cellular Biomechanics; Computers, Materials, & Continuum; Computer Modeling in Engineering & Sciences; Sustainability, Environment, & Climate; Disaster Prevention & Control; Computational Biology, Biomechanics and Bioengineering; Meshless and Novel Computational Methods; Soft Computing and Fuzzy Logic, etc. The main focus of ICCES is to bring out interactions between engineering, life sciences, and the physical sciences, and to promote research at their interfaces, so that the fast-paced developments in these disciplines can be quickly translated in to engines for global economic growth. ICCES conferences have attracted the attention of various national academies, national governments, and multinational corporations. In continuing the great tradition of the previous ICCES conferences, ICCES2012 is being held in Crete, Greece. ICCES extends the warmest welcome the world's leading researchers in computational and experimental engineering and the sciences, to confer in Crete to exchange their ideas, and participate in the social gatherings for scientific networking.

Detailed informations here: <http://www.icces.org/index.html>



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MANUSCRIPT PREPARATION – General Guidelines

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 25 mm.
- The bottom and right margins shall be 25 mm.
- The text shall have both the left and right margins justified.

The original of the technical paper will be sent through e-mail as attached document (*.doc, Windows 95 or higher). Manuscripts should be submitted to e-mail: redactie@fih.upt.ro, with mention “for ACTA TECHNICA CORVINIENSIS – Bull. of Eng.”.

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.

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.

KEY WORDS

The author should provide a list of three to five key words that clearly describe the subject matter of the paper.

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 Georgia or 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.

ACKNOWLEDGEMENTS

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.

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