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CONTENT

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FASCICULE 3 [JULY – SEPTEMBER]. TOME III. 2010

Abstract:
This work aims to determine the durability of highly deformable viscous solids under tensile loads. It is based on the damage accumulation in relation with two specific areas. The first one is initially intact and the second one contains in the beginning initial imperfections due to the structure or to the penetration of an environmental fluid. The durability assessment is based on damage accumulation. The durability of two kinds of rubbers is established by introducing the criterion of critical concentration of damage - determined by tests at two speeds. Power and exponential law are used to describe the rate of damage. Wöhlers curves thus obtained are compared with experimental data.

Abstract:
Most of the time, the strength structures who have not been statically determined, cut to the right sized, and checked out by the classic methods of the material strength cause the over sizing, because specialists use approximate measurements in order to decrease the number of mathematical calculation. This paper work describes the optimization of the main beam of a strength structure of a traveling crane used in metallurgy – by using economical criteria. In order to accomplish the best suited size, we have to perform both an analytic and experimental study about the performance of the traveling crane. Both the analytic and experimental studies have pointed out that we are able to come up with the best sizes in order to reduce the material consumption we used during the production process of the main beam within the strength structure of the traveling crane we have analyzed.

Abstract:
The present paper shows how to achieve structural analysis, kinematics, respectively kinetostatic and computer-aided vertical positioning mechanism of the seat to road vehicles. The kinematic analysis of the mechanism is to verify kinematic parameters of the mechanism correspond to the values imposed by the design theme, and by kinetostatic analysis are determined the forces of mechanism elements, respectively the calculation of their strength.

Abstract:
Theoretical solution of unsteady flow past an uniformly accelerated infinite vertical plate variable temperature and mass flux analyzed . The temperature from the plate to the fluid is raised to Tω and the species concentration is raised to constant rate. The dimensionless governing equations are solved using Laplace-transform technique. The velocity, temperature and concentration fields are studied for different physical parameters like thermal Grashof number, mass Grashof number,

Schmidt number and time. It was observed that the velocity increases with increasing values of thermal Grashof number or mass Grashof number. It was also observed that the velocity increases with decraesing values of the Schmidt number.

Abstract:
To have the invoices paid in time is a dream of every businessman. The nineties characterized by low payment morale were replaced by an era of economic growth with better situation in the payments area. This positive trend has recently been disturbed by economic crisis and warnings of low payment morale in economics are starting to appear. Experts are of opinion that many companies can be affected by this problem, even such ones that didn't know this problem in the past.

Abstract:
To program complex graphic applications required to create and play virtual scenes in virtual environments, graphics libraries and interfaces are being used, program development systems (Toolkits) which offer the programmer the opportunity to reuse a large number of already developed and implemented graphic functions and thus to focus on design and complexity of application. The modern technology used in this work adds real value to teaching through animation elements that describe certain phenomena which can hardly be studied and understood by conventional means, interactivity and dynamic properties of knowledge assessment by pupils / students.

Abstract:
In most industrial applications implying some rotating machines, the surveillance of vibrations occupies a major role in the setting of machine surveillance. Indeed, the surveillance of vibrations normally makes while combining measures of absolute vibrations of landings or we present an application of a supervisory control and data acquisition system (SCADA) to a system of vibratory surveillance of pumps in a thermal power plant. Thus, the functionality of a supervisory system for real time processes is presented. Then we present the concepts of a SCADA system. The paper briefly discusses the different steps of this application and some advantages of SCADA systems used in thermal power plants.

Abstract:
Energy crisis and climate change are rocking the entire world at this moment. Refrigeration forms a major power consumer, ranging from domestic applications to industrial applications. Apart from a leading energy absorbing system, it also takes part in global warming by letting out harmful ozone depleting substances and hence turns against the environment. It is the right time to switch over from the conventional compressor based refrigeration systems. Magnetic refrigeration proves itself to be highly efficient and environmental friendly refrigeration system, making it to be the most promising source of cooling systems in the near future. Simulation of the magneto caloric refrigeration system using computational fluid dynamics approach forms the major part of this paper.

Abstract:
A prominent problem in manufacturing automation is the accurate and reliable presentation of small parts, in a single specified configuration called preferred orientation, to a work cell. This is often referred to as the "part feeding" problem. Low cost automation is employed to develop the part feeding system for brake liner, a typical asymmetric part. Currently handling of such asymmetric parts is done either manually or by using expensive robot and vision

Abstract:
Most of the servomotors used in practice are controlled by common PI controllers having clear and distinct effects on the controlled plant yet suffering from rather poor robustness in terms of changing parameters of a plant or load variations. The variations in both the plant parameters and the load necessitate adjusting controller gains to meet the performance indices. In this paper, a fuzzy controller with reference model is used for forcing a plant to behave as a first-order reference showing good results even for drastic changes of the plant parameters. The results are compared to a common PI controller with P and I gains tuned according to symmetric optimum criterion. The whole control scheme is implemented in Fuzzy Logic Toolbox under Matlab/Simulink.

Abstract:
Entrepreneurship, as a key development activity and as a source of major competitive advantage of individual countries compared to others, with its manifestations, such as entrepreneurial activity and climate, has become an indispensable element represented in the development strategies of all world countries regardless of their current development. It has been generally accepted that entrepreneurship, with minimum theory and basic knowledge of the profession, is learned by the examples of good and bad world practices. This paper reveals a fundamental change in the importance of entrepreneurship and small business functions in generating employment, competition, innovation and overall economic progress, and answers to the questions: How will entrepreneurship expand in the future in terms of fields of activities and types of businesses and which branches and activities will be particularly attractive? What will consumers expect from products and services and how entrepreneurs and their businesses will respond to their needs? How will demographic trends affect the structure of future entrepreneurs?

Abstract:
Quantity surveyors are construction economists who fulfill varied and comprehensive duties to support cost-effective construction and property development projects. The core competencies of quantity surveyors include determining project budgets, measuring project quantities, preparing contract documentation (such as Bills of Quantities and cost control documents), administering contracts, and preparing final accounts. Despite being recognized as a professional discipline distinct from architecture and civil engineering since 1836, quantity surveyors are not immune to the threats and changes in their operating environment. Some parties in the construction industry have been critical about the quality of works and services provided by quantity surveyors. Some even question the importance of appointing quantity surveyors as project consultants. Because of these challenges, the profession needs to regroup and take stock of the whole situation so that they will not become extinct in the future. All parties who have vested interest in the development of the profession, be it the students, educators, registered as well as unregistered quantity surveyors must find an answer to arguably, the declining roles of quantity surveyors and the lack of recognition they receive in construction projects. However, recognizing the importance of professional competence, this paper has looked into issues relating to quantity surveyors' competency. As results, this paper was revealed that, quantity surveying educators and practices alike, are still deeply entrenched in the 'traditional' core competencies rather than the newer and more novel services and skills.

Abstract:
Power electronics based power systems are being increasingly considered for transportation systems such as land, sea/undersea, air, and space vehicles due to their advantages in efficiency, performance, flexibility, and power density. In order to have superior performance, the rectifier-converter systems need to be rigorously regulated. The DC power supply is ingredient part in the

automotive industries because it has been used as a DC power supplies for a wide range of loads. Meanwhile, it is mandatory for battery charging. These types however, cause many problems such as poor power factor, high input current harmonics distortion and uncontrolled DC voltage.
In this paper, an improved input power factor correction with low input current total harmonics distortion that uses a combined control system consists of two nested loops with a feedback of the DC voltage and input current as long as a feed forward from the output power. The system has been analyzed, modeled, simulated and experimentally verified. The novel feature of the proposed control scheme resides in fact that it is not only achieve nearly unity power factor with minimum input current total harmonics distortion only but it also introduce superior performance in DC voltage transient conditions.

Abstract:
In our research we examined an apple orchard trained to intensive canopy forms from work organizational and economic aspects. We determined the organizational tasks and also the worktime demand of orchard planting by using norms. In our model calculations we tried to evaluate how far the profitability of production can be increased by enhancing its intensively. We calculated the operational norms of the production using the appropriate methods: handwork norm by workday survey and machine norm by Working-process-cyclic time method. It can be stated, that intensive apple production is characterized by low profitability. The high historical cost, the payback period is extremely long, the rate of returns is very unfavourable, the low annual income determines weak profitability. In our calculations we tried to evaluate how far the profitability of production can be increased by enhancing its intensively. It can be concluded, that beyond a certain level, enhancing intensively spoils the profitability of the orchard, thus – according to our calculations - selecting the greater distance production method is the favourable option.

Abstract:
The subject of this paper is robotisation of cell-injection process and in particular development of an accuracy analysis, virtual model of micro-nano robot and calibration of the structure. To cover all requirements as high-speed, fine positioning and orientation preloaded stack piezo-actuators with closed loop are selected. Main issues of methodology for accuracy analysis and microrobot calibration are presented. Virtual model of micromanipulator is realized according to the synthesized kinematical structure with 3 DoF. The future work is related with development and calibration of real prototype of microrobot with 3 DoF according to the realized virtual model and obtained results. Microrobot, subject of this paper could cover the working space presented by the cell size between 10μm and 30μm. It has to position and orientate the needle close to the cell membrane and finally to realize cell-injection penetrating the cell membrane with high speed thus preventing the cell from damage.

Abstract:
In engineering and manufacturing, quality control and quality engineering are involved in developing systems to ensure products or services are designed and 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. Quality assurance is the activity of providing evidence needed to establish quality in work, and that activities that require good quality are being performed effectively. All those planned actions necessary to provide enough confidence that a product or service will satisfy the given requirements for quality. 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 management, production, and inspection processes.

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DAMAGE OF RUBBERS IN AGGRESSIVE MEDIA

Abstract:
This work aims to determine the durability of highly deformable viscous solids under tensile loads. It is based on the damage accumulation in relation with two specific areas. The first one is initially intact and the second one contains in the beginning initial imperfections due to the structure or to the penetration of an environmental fluid. The durability assessment is based on damage accumulation. The durability of two kinds of rubbers is established by introducing the criterion of critical concentration of damage - determined by tests at two speeds. Power and exponential law are used to describe the rate of damage. Wöhlers curves thus obtained are compared with experimental data.

Keywords:
rubbers, damage, diffusion, critical concentration

DETERMINATION OF THE INITIAL IMPERFECTIONS

On the basis of our previous works [1, 2] a two-phase damage model is assumed, regarding different phase structures. The first phase (zone) is without initial imperfections, while the second one contains defects that have different nature - one can always find them in real structures. The first zone can be considered as a zone with reduced damage development in the beginning, while in the second one the damage occurs at higher rate in the beginning destroying the initial imperfections. The two phases are bonded to each other and perform in parallel - figure 1. The volume content of the first phase is f while that of the second one - (1-f). The material of the first phase undergoes continuously increasing effective stresses -$\sigma_{eff,1}$. In the uniaxial stress state we may express them on the basis of the Kachanov's model [3], i.e.

$$\sigma_{eff,1} = \frac{\sigma}{1-D} f \,, \qquad (1)$$

where D is the damage parameter and σ is the nominal stress. Here the damage rate grows continuously until material damage saturation takes place.

The material of the second phase is initially subjected to large effective stresses $\sigma_{eff,2}$ due to the presence of initial imperfections.

The effective stresses continuously decrease, owing to the stress redistribution and destruction of the initial imperfections. We may write for $\sigma_{eff,2}$ that

$$\sigma_{eff,2} = \frac{\sigma}{D}(1-f) \qquad (2)$$

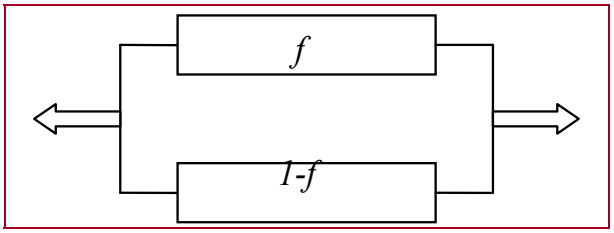

Figure 1. Scheme of the two phase damage model

Here, the damage rate continuously decreases until defect saturation of the material takes place. Summarizing the two effective stresses – equations (1) and (2), for the resulting effective stresses we get the following expression

$$\sigma_{eff} = \frac{\sigma}{1-D} f + \frac{\sigma}{D}(1-f) = \varphi(D)\sigma \quad . \qquad (3)$$

Moreover, it stands clear that the function

$$\varphi(D) = \frac{f}{1-D} + \frac{1-f}{D} \qquad (4)$$

represents a concentration function. The volume fraction of the "ideal" part f is a structure parameter.

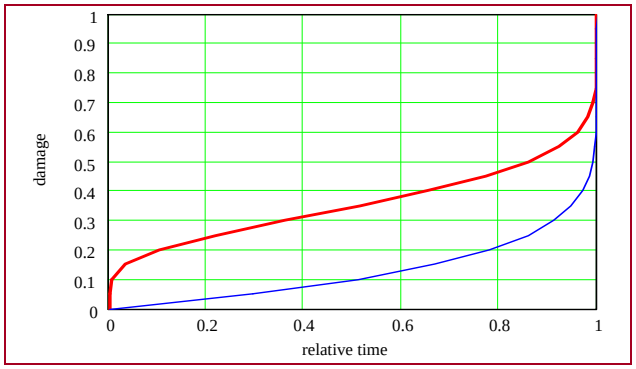

Figure 2. Damage accumulation using our model (upper line) and those of Kachanov (lower line)

The model here discussed, can have different interpretation. In the case of environmental diffusive fluid the first zone can be considered as a zone with low concentration (first critical concentration) and reduced damage development in the beginning according to the Kachanov's model, while in the second one the concentration is higher and damage occurs at higher rate in the beginning – equation (2). The damage curves here proposed possess an inflection point whose position depends from the structure parameter f - figure 2. On this figure the time is normalized (dividing the real time by the failure one). The material critical state is attaint when the damage parameter D reaches some critical value $D^* < 1$. This critical stage can be obtained experimenttally according to the elastic module degradation or in the case of rubbers using a two strain rate tests-see & 3.

LAW OF DAMAGE RATE

We complete the model by introducing a non-linear damage law that may be a power function of the effective stresses or an exponential one (Arrhenius) [4, 5]

$$\frac{dD}{dt} = H(\sigma_{eff})^m = H\varphi(D)^m \sigma^m \,, \qquad (5)$$

$$dD/dt = \frac{1}{A_o}\exp\frac{E-\gamma\sigma_{eff}}{kT} =$$

$$dD/dt = \frac{1}{A_o}\exp\frac{E-\gamma\varphi(D)\sigma}{kT} \,. \qquad (6)$$

Here t – is the time; H, m respectively A_o, E, γ - experimentally deduced parameters; k – the Boltzmann constant and T – the absolute temperature. The second low (6) possesses certain advantage considering perfect structures (strongly oriented polymers). In this case A_o, E, γ are respectively the period of atom vibration, the activation energy of the chemical bounds destruction and the atomic volume. Considering real solids these parameters should be adjusted. After integration of equation (5), respectively (6) one obtain the damage – time curves - figure 2.

$$t = \frac{\int_0^D \varphi^{-m} dD}{H\sigma^m} \,, \qquad (7)$$

$$t = A_o \int_0^D \exp\frac{E-\gamma\varphi(D)\sigma}{kT} dD. \qquad (8)$$

The analysis of these relations shows that the curves of damage accumulation are S - shaped (see figure 2). A number of experimental data prove that the damage curves are S-curves - [6, 7, 8]. Plumtree, Shen and Talrejas propose in [6, 7] a second-degree model for describing those curves. They introduce the term "critical damage state" and describe separately the two damage processes – without and with a crack. The studies introduce also a number of experimental parameters, and significant efforts are required to prepare the experimental set up.

CRITICAL DAMAGE CONCENTRATION AND WÖHLER'S CURVE

It is well known [4, 6], that the Katchanov's damage parameter D varying from 0 (intact solid) to 1 (fully damaged solid) do not reach the value of 1 due to the crack interactions. We employ here a simple method to determine the critical damage concentration (CDC) – an important parameter related with the durability [2, 4, 6].

In [9] was proposed and in [10] was developed an approach to find the time damage dependence experimentally, which consists in

the following elements. One accepts a critical damage criterion (failure). Considering brittle materials, that can be the fracture. For ductile or viscous ones that can be the maximal stress on the stress-strain diagram. Considering rubbers the failure criterion can be choose as the beginning of the color change of the material. At the place of the classical damage equation $\dot{D} = \dot{D}(\sigma, D)$ *- see eq. (5), we introduce the strain rate, which can be easily imposed and controlled during the experimentation.*

$$\dot{D} = \dot{D}(\dot{\varepsilon}, D) . \qquad (9)$$

We present here briefly the experimental scheme to obtain the damage curve. Probes are predeformed with high strain rate $\dot{\varepsilon}_e$ *(damage) during some time* t_1*, then the strain rate decrease considerably -* $\dot{\varepsilon}_o$ *(without damage comparing with the case with the strain rate* $\dot{\varepsilon}_e$*) until failure (defined previously) occurs. The second test with the highest strain rate* $\dot{\varepsilon}_e$ *continue longer -* $t_2 > t_1$ *and then the lowest strain rate is imposed until failure. This manipulation imposing different increasing times* $t_i > t_{i-1}$ *continue until failure with the maximal strain rate* $\dot{\varepsilon}_e$*. The limit strains (until failure occurs according to the adopted criterion) are shorter than the foregoing ones obtained by shorter pre-exposition times with* $\dot{\varepsilon}_e$*. One suppose that the difference between the limit strain with strain rate* $\dot{\varepsilon}_o$ *without pre-exposition with* $\dot{\varepsilon}_e$ *and the respective limit strains with increasing pre-exposition times represent an integral value characterizing the damage accumulation. Dividing this difference on the limit strain without pre-exposition one obtain the damage accumulation parameter of Kachanov - D. Imposing different damage degrees (from* t_1 *to* t_n*) one can obtain n points from the damage curve. The relative limit strain with the maximal possible pre-exposition time corresponds to the limit (critical) damage accumulation. This approach can be used to obtain the Wöhler's curves - eqs (7, 8). If in equations (7 and 8) one pose* $D \to D^*$ *one obtain the relation critical stress – failure time. The respective curve (*σ_f *-*t_f*) concerning the first law of damage rate is derived from equations (7) for* $D \to D^*$ *and* $t \to t_f$

$$t_f = \frac{\int_0^{D^*} \varphi^{-m}(D) dD}{H^m (\sigma_f)^m} . \qquad (10)$$

Concerning the other law of damage rate, from eq. (8) we have respectively

$$t_f = A_o \int_0^{D^*} \exp \frac{E - \gamma \varphi(D) \sigma_f}{kT} dD . \qquad (11)$$

The curves using eq.(10) for our rubbers are illustrated on figure 4 and the next ones.

WÖHLER'S CURVES CONCERNING THE INVESTIGATED RUBBERS

On the figure 3 we have put the experimental points and the Wöhler's curves according to eq. (10) and (11) for the BN rubber and the first critical concentration of oxygen.

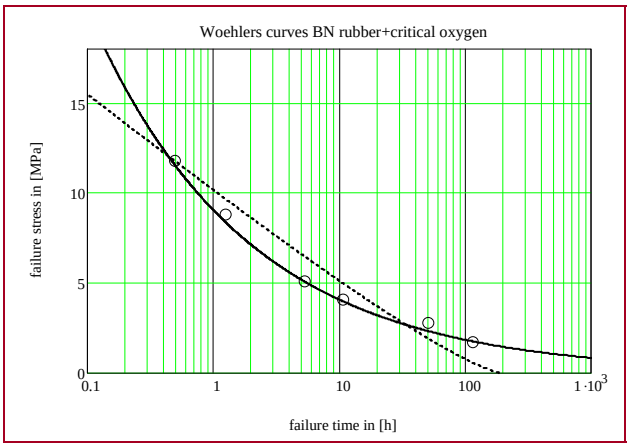

Figure 3. Wöhler's curves for BN rubber – first critical concentration of oxygen. Solid line – eq.(10), dashed line – eq.(11).

Obviously we can't apply eq. (11) for our rubbers, because in logarithmic scale that is a right line. The experimental data here are: in eq.(10) $m = 2.879$, $H = 2.606 \times 10^{-6}$*, in eq.(11)*

$$D^* = 0.321 , \; A_o = 1.917 \times 10^{-8} [1/\sec] ,$$

$$k = 1.3806 \times 10^{-23} [J/K] , \; U = 0.99 \times 10^{-19} [J] ,$$

$$\gamma = 0.7 \times 10^{-27} [m^3] , \; T = 297 [K] , \; f = 0.531 .$$

On the figure 4 one can see the Wöhler's curve for BN and the first critical water concentration. The parameters are $m = 3.548$, $H = 2.885 \times 10^{-6}$*. On the figure 5 we have illustrated the Wöhler's curve for BN and the first critical concentration of engine oil. The parameters are* $m = 3.548$, $H = 2.885 \times 10^{-6}$*.*

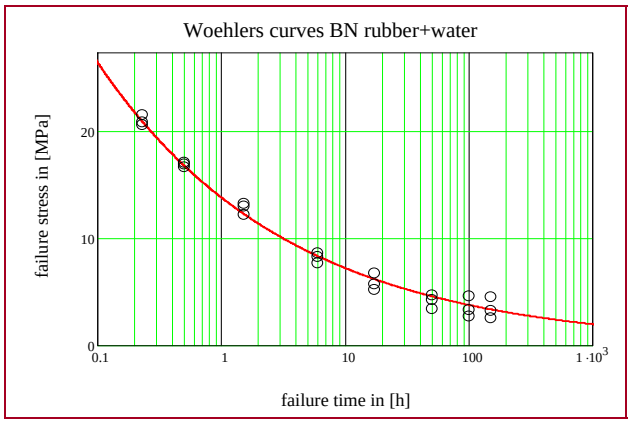

Figure 4. Wöhler's curve for BN – first critical water concentration. Solid line - eq.(10), points – experimental data (3 tests for every stress level).

Note. All the points are illustrated only in figure 4. To the other ones we have put only the averaged values.

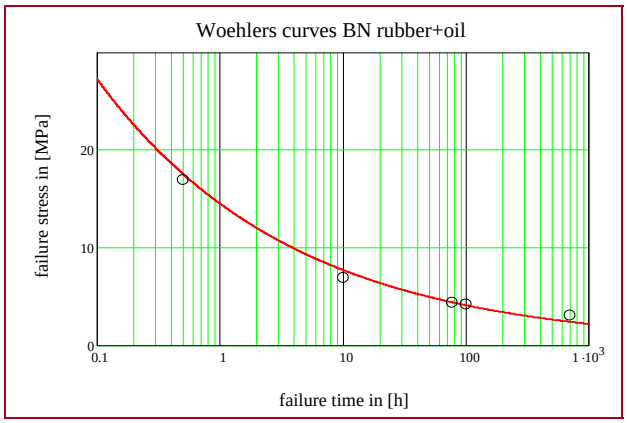

Figure 5. Wöhler's curve for BN – first critical concentration of engine oil

On the figure 6 we have illustrated the Wöhler's curve for BN and the first critical concentration for 20% sulphuric acid. The parameters are $m = 3.548$, $H = 2.885 \times 10^{-6}$. *On the figure 7 we have illustrated the Wöhler's curve for PI and the first critical concentration for oxygen. Here we have* $m = 3.548$, $H = 2.885 \times 10^{-6}$. *On the figure 8 we have illustrated the Wöhler's curve for PI and the first critical concentration for water, here* $m = 3.548$, $H = 2.885 \times 10^{-6}$. *On the figure 9 we have illustrated the Wöhler's curve for PI and the first critical concentration for engine oil. Here* $m = 3.548$, $H = 2.885 \times 10^{-6}$. *On the last figure 10 on can see the Wöhler's curve for BN and the first critical concentration of 20% solution of sulphuric acid. The parameters are* $m = 3.548$, $H = 2.885 \times 10^{-6}$.

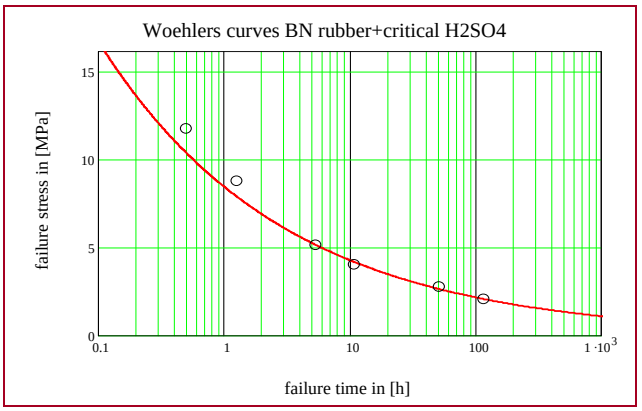

Figure 6. Wöhler's curve for BN – first critical concentration of 20% of sulphuric acid

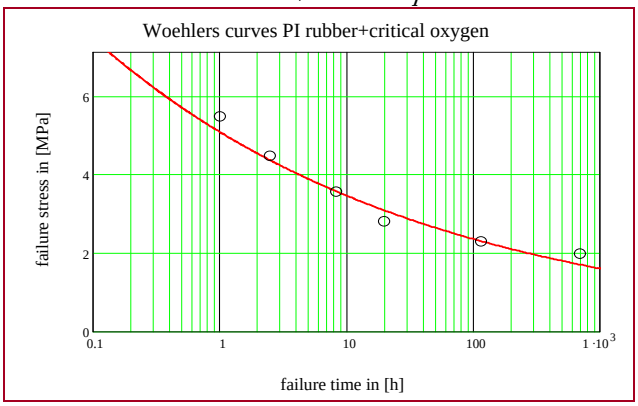

Figure 7. Wöhler's curve for PI – first critical concentration of oxygen

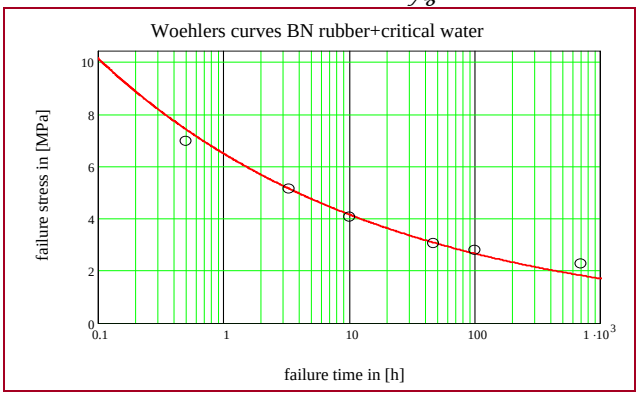

Figure 8. Wöhler's curve for PI – first concentration of water

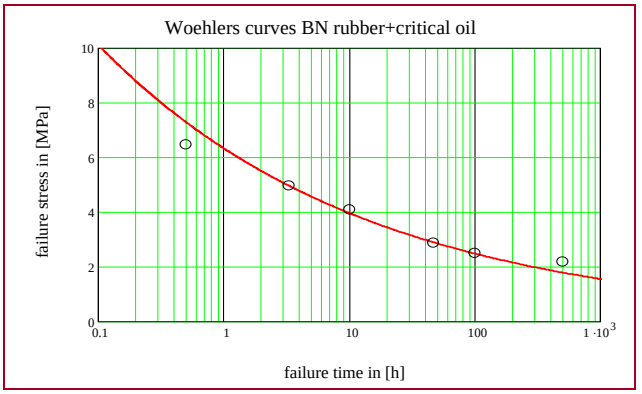

Figure 9. Wöhler's curve for PI – first critical concentration of engine oil

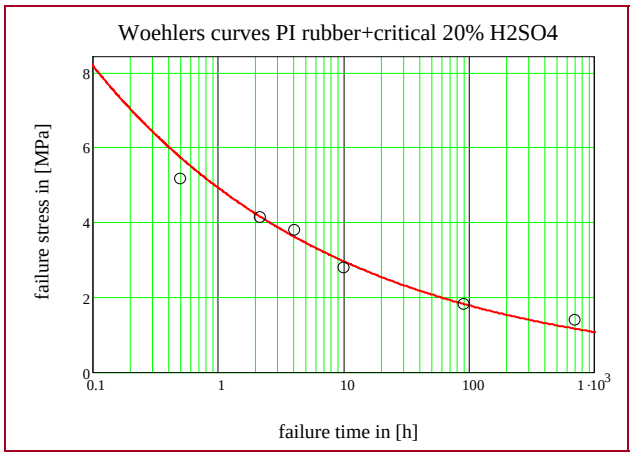

Figure 10. Wöhler's curve for PI - first critical concentration of 20% solution of sulphuric acid

CONCLUSION

One can make the following conclusions. Many investigations show that the critical damage D^* is limited between 0.2 (brittle state) and 0.8 (ductile state). Here we have obtained helpful relations to determine the critical damage. The proposed model describes successfully the mechanical comportment of different couple rubber-environment for static charges. The S curve of the damage accumulation is also adequately described using one equation, against the existing two-stage approaches. The introduction of initial imperfections is very important concerning materials containing technological defects or (and that is important concerning this investigation) in the case of materials surrounded by aggressive media (penetrating fluids). The relative penetration surface represents an initial imperfection zone because of the accelerated damage in this zone.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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OPTIMISATION OF AN OVER-SIZED BEAM, PART OF A CRANE BRIDGE, BY APPLYING THE ECONOMICAL CRITERIA

Abstract:
Most of the time, the strength structures who have not been statically determined, cut to the right sized, and checked out by the classic methods of the material strength cause the over sizing, because specialists use approximate measurements in order to decrease the number of mathematical calculation. This paper work describes the optimization of the main beam of a strength structure of a traveling crane used in metallurgy – by using economical criteria. In order to accomplish the best suited size, we have to perform both an analytic and experimental study about the performance of the traveling crane. Both the analytic and experimental studies have pointed out that we are able to come up with the best sizes in order to reduce the material consumption we used during the production process of the main beam within the strength structure of the traveling crane we have analyzed.

Keywords:
optimization, economical, criteria, beam, crane-bridge

INTRODUCTION

In general, the optimisation is defined, [4], as being the search of a problem, finalised with a result that, compared with other possible results, it is the best one. Based on this result, technical or economical decisions can be made.
A solution for an optimisation problem can be obtained only if we equally take into account all the factors that determine it. In this respect, the resistance structures can't be approached apart from the construction they are part of, because it is an evident interdependence between them and the rest of the construction. This interdependence shall be expressed in the optimisation process. In the same time, it was found that, at least in the current stage, it is not possible to realise an overall optimisation that leads to a general solution capable to satisfy all the imposed aspects and requirements. That's why the current researches aim only the optimisation of certain technical, technological and economical aspects.
The present-day simplification of the optimisation problem consists of the schematisation of the real solutions, by introducing simplifying hypotheses with covering character.
Having in view this aspect, a part of the solutions found so far has been applied in practice, because they were finalised as algorithms and computational programmes, [4].

OPTIMISATION CRITERIA OF THE RESISTANCE STRUCTURES

The resolution of an optimisation problem presumes the definition, for the analysed case, of the following elements: designing variables, designing restrictions and objective function. The correlation between the variables,

restrictions and the objective function can be realised through an optimisation criterion that offers the possibility to choose the most adequate solution for the analysed problem. Currently, the main optimisation criteria applied to the resistance structures, are: technical and economical.

Regarding the technical criteria used to optimise the resistance structures, they are considered a problem of "extreme" (maximum or minimum), being applied to different parameters to determine the best solutions for realising the resistance structure. This criterion refers to an optimisation scheme, namely: determination of the structure form and sizes, which corresponds to a certain type of loading able to lead to optimum parameters as regards to the resistance and rigidity criterion.

Regarding the technical criteria used to optimise the resistance structures, we can say they are multiple, each of them being able to lead to a different optimum as to the same parameter. The researches performed until now, in order to apply the economical criteria to the sizing of the resistance structure, start, in principal, from two ideas: mitigation of the specific weight of the structure and reduction, as much as possible, of the fabrication costs, [4]. If this criterion underlies of the optimisation process, then the objective function is the cost price of the structure.

The optimisation based on the technical criteria leads to the determination of constructive solutions for the resistance structure, solutions that ensure its resistance and stability in operation, and the optimisation based on the economical criteria leads to the structure specific weight mitigation or to lowest fabrication expenses, which represents a measure of the economical efficiency.

Currently, it is considered that a rational solution for a resistance structure can be obtained only if there are equally taken into account all the factors that determine it, this think imposing the harmoniously combination of the technical and economical criteria. The interdependence between these ones is explained by the fact that the cost price of a resistance structure is made, on the one hand, of the costs of the materials used to make its elements and the costs of fabrication, transportation and montage and, on the other hand, from the maintenance costs during the entire existence period of the construction whose part the structure is. In their entirety, the material costs are practically proportional to the material weights, e.g. any material price reduction determines the metallic structure weight mitigation.

According to the literature, for the activity of designing and re-designing of the resistance structures that belong to metallurgical equipments, the optimisation criteria refer especially to the reduction of: consumption of steel they are made of, cost price of the materials used to make to structure, manpower and execution time.

At the resistance structures made of one solus material (the case of the metallurgical equipments), the mitigation of their weight implicitly ensure the cost reduction in the optimisation process.

If the material quantity represents the determining element in establishing the structure cost, then the criterion gets the form of the minimum weight condition. This situation is frequently met in case of the resistance structures of the metallurgical equipment made of standardised elements, whereat their processing and building-up costs are usually evaluated based on weight.

In this paper, it is presented the optimisation of a central beam, part of the resistance structure of a bridge-crane that operates in the Continuous Casting hall of an integrated steel plant.

THE OBJECTIF OF OPTIMIZATION

The travelling crane we are analysing is able to lift up to 100 KN, and the items are lift up to 17,3 m. Therefore, the strength structure is made of two longitudinal beams, as well as two end beams: left and right. The cross section of the resistance elements – caissons – is symmetrical and made of universal iron – they are weld together. Fig.1 presents the constructive scheme of one of the longitudinal beam of a crane bridge. We have found the best sizing of this beam with the help of the OPTSTAR module, and it belongs to the finite-elements COSMOS calculation software.

In order to make the calculation, we have come up with the design of the longitudinal beam we have complied with the geometrical design and the operation process, [1], [2], [3]. The calculation pattern is described in fig.2.

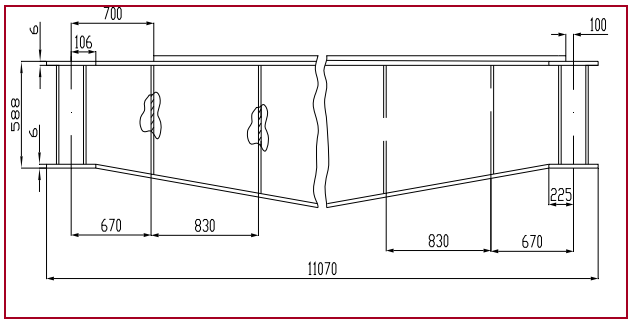

FIGURE 1. Design scheme of the longitudinal beam from the resistance structure of the crane bridge

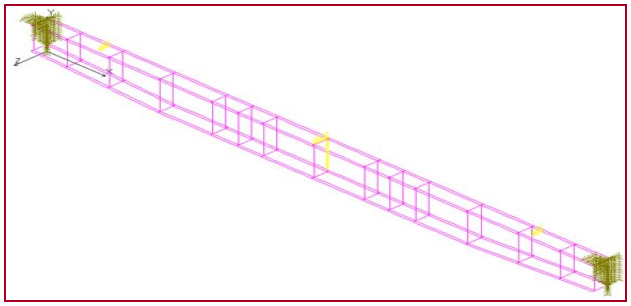

FIGURE 2. The pattern of the calculation pattern used for the best sizing of the longitudinal beam

MATHEMATICAL MODEL

The definite mathematical pattern for the problem of finding the best sizing for the longitudinal beam we have considered the following elements, [3]:

- *designing variable features: the width of the plate of the stringer: $\delta_{min} < \delta < \delta_{max}$;*
- *designing restrictions – we consider the equivalent tension specific for the shaping up: $\sigma_{von\ Misses} < \sigma_{adm.}$;*
- *the objective function – the weight of the resistance structure's stringer: $G = G_{min.}$.*

We have produced several different variants for the calculation software – the side cores. All the variants are the following:
variant 2: $\delta_{t\ sup} = \delta_{t\ inf} = 7{,}5$ mm and $\delta_{i\ lat} = 6$ mm; variant 3: $\delta_{t\ sup} = \delta_{t\ inf} = 7{,}5$ mm and $\delta_{i\ lat} = 5$ mm; variant 4: $\delta_{t\ sup} = \delta_{t\ inf} = 6$ mm and $\delta_{i\ lat} = 6$ mm; variant 5: $\delta_{t\ sup} = \delta_{t\ inf} = 6$ mm and $\delta_{i\ lat} = 5$ mm; variant 6: $\delta_{t\ sup} = \delta_{t\ inf} = 5{,}5$ mm and $\delta_{i\ lat} = 6$ mm; variant 7: $\delta_{t\ sup} = \delta_{t\ inf} = 5{,}5$ mm and $\delta_{i\ lat} = 5$ mm
The loadings have been considered in the elastic field, and therefore the elastic constants have been introduced, corresponding to the material OL 37.
Variant 1 is considered the original variant, where: $\delta_{t\ sup} = \delta_{t\ inf} = 8$ mm and $\delta_{i\ lat} = 6$ mm. Fig. 3 describes a cross section of the main beam, subject to our fitting. We have: $\delta_{t\ sup,\ inf}$ - the width of the upper bed plate, and the lower bed plate of the bin; $\delta_{i\ lat}$ – the width of the side cores of the beam.

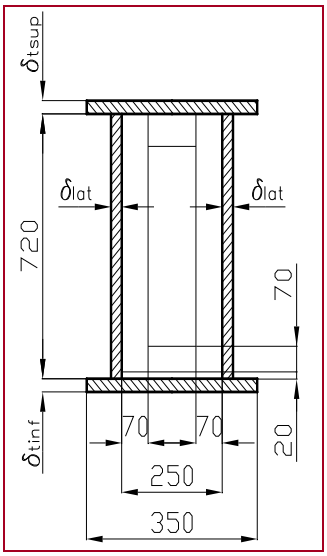

FIGURE 3. The cross section of the resistance elements

RESULTS

As a result of the calculation software based on finite elements for the variants we have already mentioned, we should enumerate the significant results of the fitting process.
After we have studied and interpreted the results we had obtained, we have observed that the smallest size to reduce the width of the bed plates is 5.5 mm, and 5 mm (variant 7) for this fitting variant, the equivalent tensions which is specific to any reshaping for the longitudinal beam I goes between 20.135 N/mm^2 and 161.08 N/mm^2 fig. 4, 5 and 6, [3].

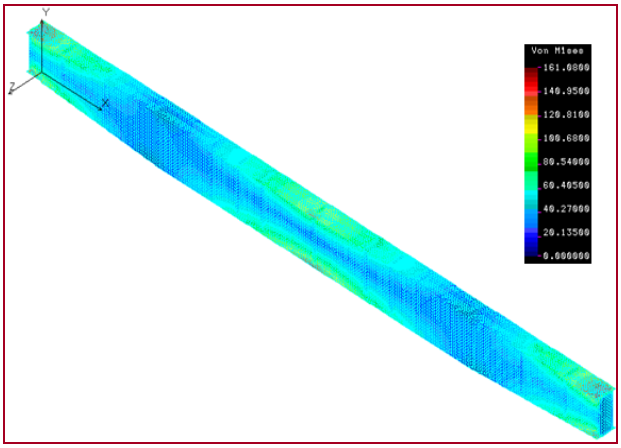

FIGURE 4. The distribution of the tension $\sigma_{Von\ Misses}$ for the fitted longitudinal beam

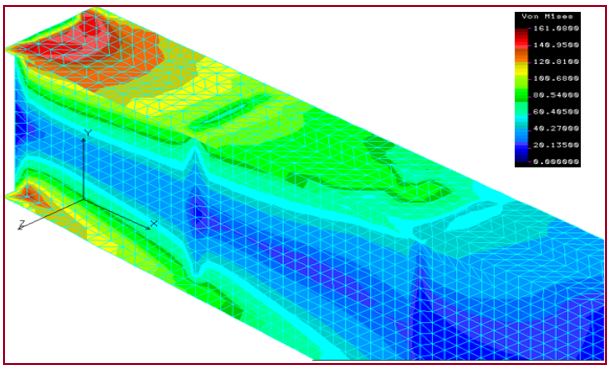

FIGURE 5. Details about the distribution of the $\sigma_{Von\ Misses}$ tension for the fitted longitudinal beam

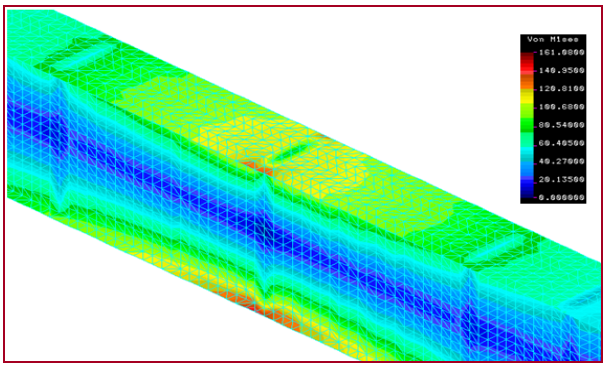

FIGURE 6.The distribution of the $\sigma_{Von\ Misses}$ tension for the fitted longitudinal beam I at the middle of the opening

As far as we see, von Misses equivalent tension reaches the highest values at the ends of the longitudinal beam, at the connection points with the end beams, at the upper bed plate and the lower bed plate – 161.08 N/mm^2. As far as the middle of their opening, we see that we have reached highest values at the level of the beam wings 143.78 N/mm^2 (sides of the lower bed plate), and at the connection point between the lower bed plate and the side core, we have 151.74 N/mm^2.

After we have analyzed the distribution of the results for the $\sigma_{von\ Misses}$ equivalent tension we have obtained after finding the best fitting with the results we have obtained by experimenting (we have described them in detail in [3] and [4]), we see that the difference amongst them reaches 10%. As far as the experiments are concerned, we have been able to perform them with the help of the resisting electrical tensiometry; for that reason the crane bridge has been loaded with steel lingots with specific precise weight. In the case of the strength structure we have analyzed, we knew the sizes of the cross-sections, and the fact that all the elements had been subject to static stress (their loads had been increased until they had exceeded the limit loads). The worst loading version was 120 KN - [5]. This confirms that the calculation pattern we have used is the best, fig.7, [5].

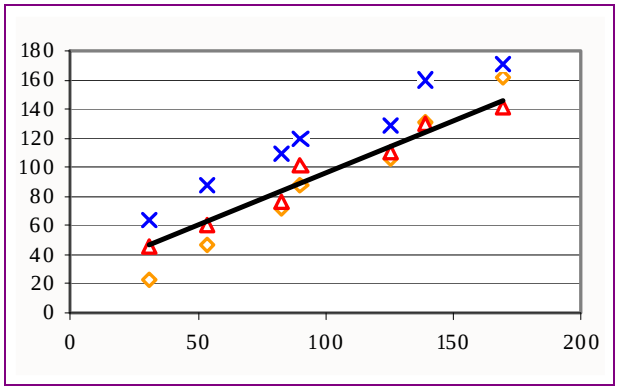

FIGURE 7. The variation diagram of equivalent tension- analytical value, experimental value and optimizing value

For that version, we should calculate how much raw material we would use, and establish the percentage we are able to saved. We have to calculate the weight of the main beam according to the relation (1):

$$G = g \cdot \rho \cdot \sum_{i=1}^{4} A \cdot l_i \qquad (1)$$

This relation (1), contains the following elements: G – total weight of the stringer, [kg]; g – gravitational speed, [m/s^2]; A – cross-section area of an element of the stringer, [m^2]; l – the length of the stringer, [m]; ρ - the density of the raw material, [kg/m^3].

After we have calculated it, we have been able to reduce the weight of the I-type longitudinal beam with almost 8,46 % - for version no. 1 – and with 20,6 % - for version no. 7.

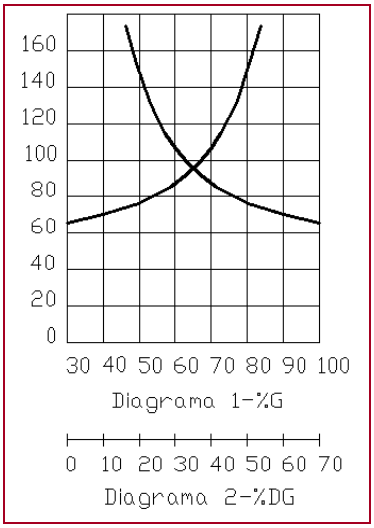

FIGURE 8. The variation diagram of the highest equivalent tension of an element situated in the middle of the opening of an longitudinal beam

In fig.8 we describe the highest equivalent tension variation of an element situated in the middle of the opening of the I-type longitudinal beam, which is situated on the lower plate, close to the connection point with the side core, and according to the weight „G" of the whole strength structure; we must also reduce the weight - ΔG.

CONCLUSION

In this paper work we have analyzed the best sizing of the main beam within the strength structure of a traveling crane that we use for the continuous casting in a metallurgy plant.
Thus, we have considered that the walls of the cross-section (caisson-type) of the longitudinal beam I have changed their features, meanwhile the height of the sections remained the same; we have theoretically reduced its weight with almost 20,6% (considering the production technology of the plates that the caisson is made of), but practically we have reduced it to 8,46%, without exceeding the required resistance of the raw material.
The prevailing economic criterion is to cut off investments, considering the opportunity cost. Beam weight reduction eliminates the costs calculated during the initial estimation, while maintaining the same results. From this point of view it is necessary to consider the revision, the site organization, element replacement, their assembly and testing, involving at least 20% less raw material required to produce the beam.
The optimisation based on the technical and economical criteria leads to the structure specific weight mitigation or to lowest fabrication expenses, which represents a measure of the economical efficiency.

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ANALYSIS OF SEAT POSITIONING MECHANISM IN ROAD VEHICLES

Abstract:
The present paper shows how to achieve structural analysis, kinematics, respectively kinetostatic and computer-aided vertical positioning mechanism of the seat to road vehicles. The kinematic analysis of the mechanism is to verify kinematic parameters of the mechanism correspond to the values imposed by the design theme, and by kinetostatic analysis are determined the forces of mechanism elements, respectively the calculation of their strength.

Keywords:
Mechanism, kinematic chain, position, speed, acceleration

INTRODUCTION

Analysis of plane mechanisms known to one evolution over time. Thus in practices are known several methods of analysis of plane mechanisms (positional, kinematic, kinetostatic or dynamic), respectively the graphical methods, graphoanalitics and analytical each of them having advantages and disadvantages.
Graphics and graphoanalitics methods (vector equations method, projected instantaneous center of rotation, similarity, respectively polygon method forces, etc.), have the advantage that are very easily to use, requires a relative low workload, but the accuracy of results is not always the one, because the measurement error in the graphic plane.
Analytical methods (polygonal contour method) involve writing equations contour projections and their successively derivation, respectively the equations of equilibrium, resulting linear equations systems who need to be solved for as many positions of leadership element. The workload is very high, requiring solving equation systems using programs written in different programming languages, but the accuracy of results is high. This method has the disadvantage that requires knowledge of a programming language.
With the development of CAD software (Computer Aided Design) software companies have developed software packages specific field of engineering. Thus, for modeling and simulating mechanical systems are known several applications such as Mecaplan, Algor, Adams, WorkingModel, SAM, Catia, Watts & Roberts, etc. some of them doing calculations by finite element method.
Further in the following paragraphs will be present the modeling, analysis and simulation of mechanism with SAM51 program.

POSITIONING MECHANISM STRUCTURAL ANALYSIS

Overall scheme of the mechanism, 3D modeled in Autodesk Inventor Professional is shown in Figure 1.

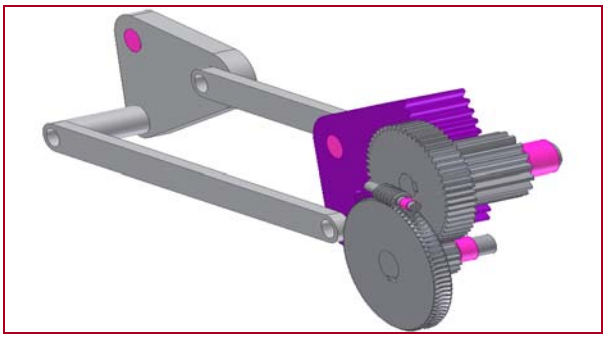

Figure 1. Overall scheme of the mechanism

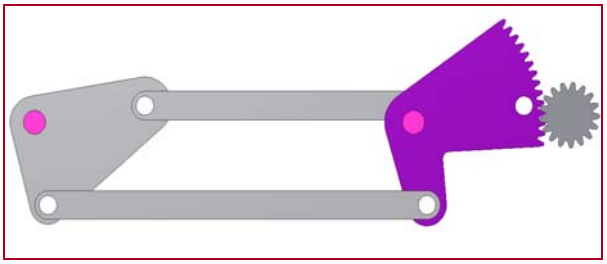

Figure 2. Articulated parallelogram mechanism

Analysis will consider only the basic mechanism, articulated parallelogram (Figure 2). Kinematic scheme of the mechanism is shown in Figure 3, and has the following technical characteristics:

Figure 3. Mechanism kinematic scheme

- Lifting height – 38 mm
- While lifting chair – 3,1 s
- kneeling chair time – 3,1 s
- angle of rotation of the element manager (1+5) – 45 degrees
- loading mechanism – 1200 N + weight

Geometric dimensions of component kinematic elements:

l_1 = 35 mm; l_2 = 170 mm; l_3 = 35 mm; l_4 = 50 mm; l_5 = 50 mm; distance between bearings 1 and 4 – 170 mm

Analyzing kinematic scheme of the mechanism (Figure 3) may specify the following:

- The mechanism consists of three moving kinematic elements, 1+5, 2, 3+4 (items 3 and 4 respectively 1 and 5 are hardened one each other, relative angle between them keeping constant).
- The mechanism consists of four kinematic Class V joints (C5), 1,2,3,4, joint 5 and 6 don't have kinematic role (assurance the link with rod port - chair).
- The mechanism can be considered plane, so the family will be equal three.

So: $f = 3$; $n = 3$; $C_5 = 4$ (1)

Mechanism mobility degrees number:

$$M = 3n - 2C_5 = 3 \cdot 3 - 2 \cdot 4 = 1 \quad (2)$$

Mobility degrees number is equal to 1, the positioning mechanism is well defined, so for each leadership element position (1) correspond well-defined positions of other cinematic elements.

POSITIONING MECHANISM KINEMATIC ANALYSIS

Positioning mechanism kinematic analysis was performed using program SAM51 for seat lifting kinematic cycle, considered more damaging than the descent cycle and involves the following steps:

- ***Mechanism modeling***: mechanism will be modeled in the lower extreme position (Figure 4), based on kinematic joints coordinates resulting from geometric synthesis:

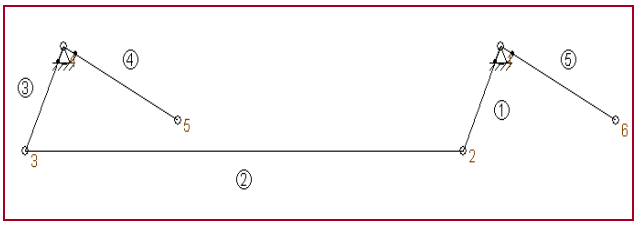

Figure 4. Lower Extreme Position
Joint 1 - (125.37,22.55); Joint 2 - (110.58,-9,17); Joint 3 - (-59,42,-9,17); Joint 4 - (-44,63,22.55); Joint 5 - (0,0); Joint 6 - (170,0)

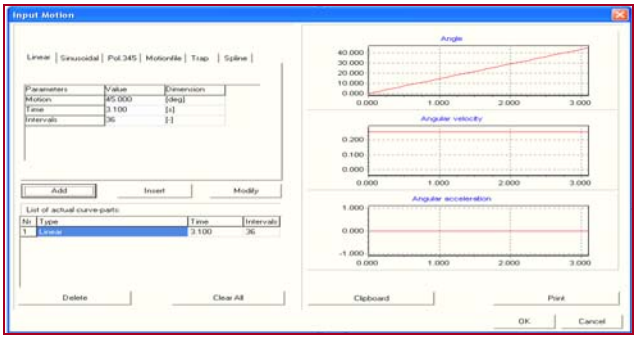

Figure 5. Input motion of the mecanism

- ***Specify the input motion of mechanism***. The input motion of the mechanism would be a uniform rotational in kinematic joint 1 (angular acceleration $\varepsilon_1 = 0$) as shown in Figure 5 (for lifting - rotation angle 45 degrees, kinematic cycle time 3,1 s).

- ***Kinematic analysis***. *It seeks changes in graphic form the kinematic quantities variations of kinematic components items within the time in which the complete lifting of the seat race. For example is presenting kinematic joints D - E, which are part of the port rod - chair (not represented in the kinematic scheme, being parallel to the main rod 2).*

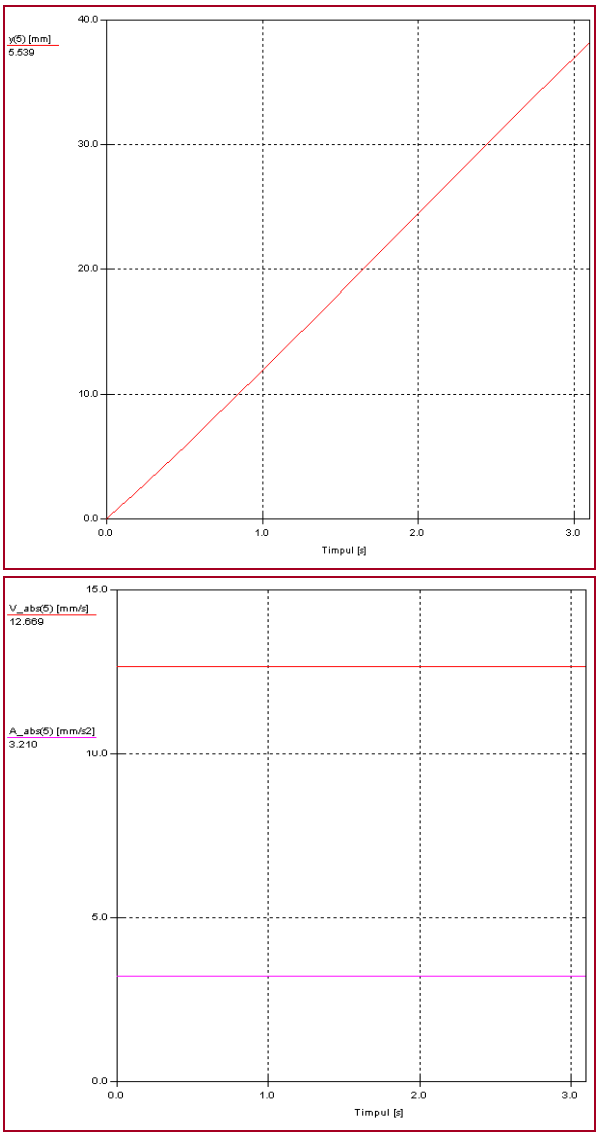

Figure 6. Kinematic of joints D – E

Their movement is identical with the movement of any point on the rod port - seat. According to the graphs in Figure 6, follows the following sizes:

- *Vertical movement: y(5) 0 ÷ 38 mm, complies with the design theme – vertical movement of the seat being – 38 mm*
- *Absolute speed: v_abs(5) = 12,669 mm/s = const*
- *Absolute acceleration: a_abs(5) = 3,210 mm/s²*

THE POSITIONING MECHANISM KINETOSTATIC ANALYSIS

Kinetostatic analysis of the positioning mechanism involves the following steps:

- ***External loading mechanism establish*** *(Figure 7) - is considered the loading mechanism force, F = 1200 N, distributed on port rod seat - with their two marginal joints: in joint D: F = 600 N; in joint E: F = 600 N*

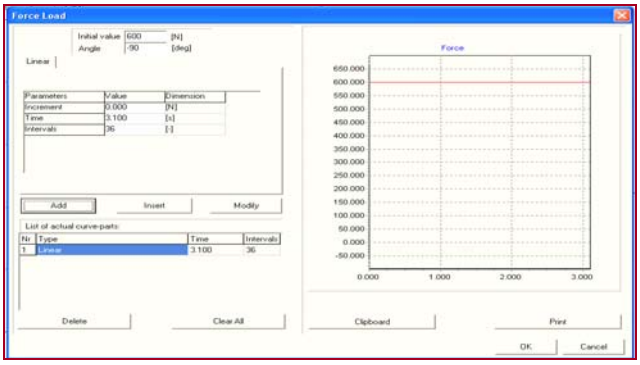

Figure 7. Force load

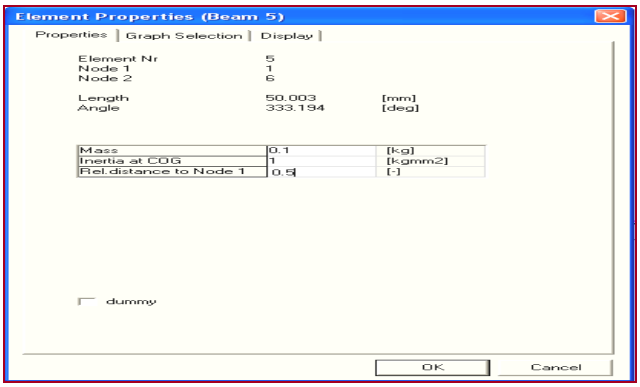

Figure 8. Element properties

- ***Defining the masses, moments of inertia and center of gravity position*** *for each kinematic element – will be done individually for each individual item as shown in Figure 8. Although the kinematic elements don't have considerable masses, in calculations will also consider the weight forces. To simplify the centers of gravity should be at mid-length features, and moment of inertia around an axis through the center of gravity will be considered equal to 1.*

Scheme loading mechanism for positioning the seat at minimum position obtained by the above is shown in Figure 9.

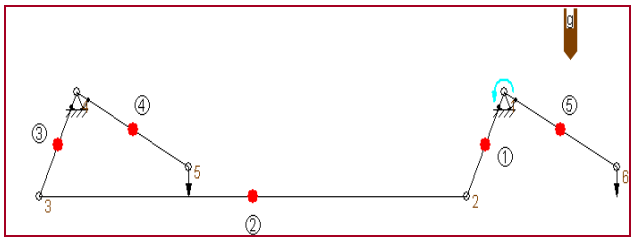

Figure 9. Mechanism charging scheme

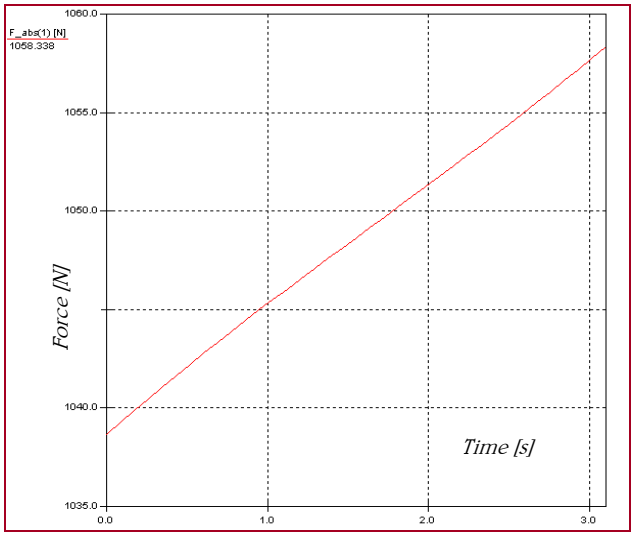

Figure 10. Joint 1 reaction force variation

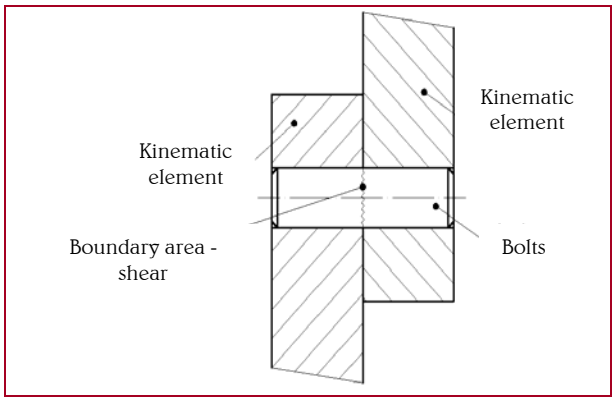

Figura 11. Bolts stress scheme

- ***Obtaining variations in graphic form, the reactions*** *of the kinematic joints on the kinematic cycle corresponding with lifting mechanism from down to up position (3,1sec). For example Figure 10 presents graphical variation of joint reaction 1.*

Maximum values of the reactions in joints are:

Joint reaction in1: RAo = 1058,338 N; Joint reaction in2): RA = 1962 N

Joint reaction in3: RB = 1962 N; Joint reaction in4: RBo = 1057,778 N

Joint reaction in5): RD = 600,763 N; Joint reaction in6: RE = 601,226 N

With the maximum values of the reaction forces war made the sizing calculations of the bolts that materialize kinematic joints. Stress scheme of the bolts is shown in Figure 11, the basic stress being shear stress in the contact area between the two kinematic elements forming that joint. Necessary diameter of the bolts results from the shear resistance condition.

$$\tau_f = \frac{R}{A} \Rightarrow A_{nec} = \frac{\pi d_{nec}^2}{4} = \frac{R}{\tau_{af}} \Rightarrow d_{nec} = \sqrt{\frac{4R}{\pi \cdot \tau_{af}}} \qquad (3)$$

where: R – maximum value of the kinematic joint reaction

τ_{af} – shear permissible strain for bolts material

Bolts material: OL50, τ_{af} = 112 MPA (N/mm²)

After each kinematic joint calculation, the following values for bolts diameters will results: d_1 = 10 mm; d_2 = 8 mm; d_3 = 8 mm; d_4 = 10 mm; d_5 = 8 mm; d_6 = 8 mm

CONCLUSION

Road vehicles seat positioning mechanism analysis, made by the SAM 51 program, is a fast and efficient way to determining kinematic parameters in each stage of operation mechanism, respectively forces from elements and kinematic joints necessary for there dimensioning on stress that are submitted.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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HEAT TRANSFER EFFECTS ON ACCELERATED VERTICAL PLATE WITH VARIABLE TEMPERATURE AND MASS FLUX

Abstract:
Theoretical solution of unsteady flow past an uniformly accelerated infinite vertical plate variable temperature and mass flux analyzed . The temperature from the plate to the fluid is raised to Tω and the species concentration is raised to constant rate. The dimensionless governing equations are solved using Laplace-transform technique. The velocity, temperature and concentration fields are studied for different physical parameters like thermal Grashof number, mass Grashof number, Schmidt number and time. It was observed that the velocity increases with increasing values of thermal Grashof number or mass Grashof number. It was also observed that the velocity increases with decraesing values of the Schmidt number.

Keywords:
linearly, accelerated, vertical plate, variable temperature, mass flux

INTRODUCTION

Processes involving coupled heat and mass transfer occur frequently in nature. It occurs not only due to temperature difference, but also due to concentration difference or the combination of these two. Quite often, there exist certain industrial processes involving continuous surfaces that move steadily through an otherwise quiescent ambient environment for which a correct assessment of the axial temperature and concentration variation of the material are given relevant importance.

Gupta et al(1979) have studied free convection on flow past an linearly accelerated vertical plate in the presence of viscous dissipative heat using perturbation method. Free convection effects on flow past an accelerated vertical plate with variable suction and uniform heat flux in the presence of magnetic field was studied by Raptis et al(1981). Raptis and Singh (1983) MHD free convection flow past an accelerated vertical plate. Mass transfer effects on flow past an uniformly accelerated vertical plate was studied by Soundalgekar (1982). Again, mass transfer effects on flow past an accelerated vertical plate with uniform heat flux was analyzed by Singh and Singh (1983). Basant Kumar Jha and Ravindra Prasad (1990) analyzed mass transfer effects on the flow past an accelerated infinite vertical plate with heat sources . The skin friction for accelerated vertical plate has been studied analytically by Hossain and Shayo (1986).

It is proposed to study unsteady flow past an uniformly accelerated infinite vertical plate in the presence of variable temperature and mass flux. The dimensionless governing equations are solved using the Laplace-transform technique. Such a study found useful in hot extrusion of steel, the lamination and meltspinning processes in the extrusion of polymers.The solutions are in terms of exponential and complementary error function.

GOVERNING EQUATIONS

Here the unsteady flow of a viscous incompressible fluid past an uniformly accelerated vertical infinite plate with variable temperature and mass flux has been considered. The x-axis is taken along the plate in the vertically upward direction and the y -axis is taken normal to the plate. At time $t' \le 0$, the plate and fluid are at the same temperature T_∞ and concentration C'_∞. At time $t' > 0$, the plate is accelerated with a velocity $u = u_0 t'$ in its own plane against gravitational field. The temperature from the plate to the fluid is maintained uniformly and the concentration level is raised at an uniform rate. Then under the usual Boussinesq's approximation the unsteady flow is governed by the following equations:

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

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

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

With the following initial and boundary conditions:

$$\begin{array}{llllll} & u=0, & T=T_\infty, & C'=C'_\infty & forall & y,t'\le 0 \\ t'>0: & u=u_0 t', & T=T'_\omega, & \dfrac{\partial C}{\partial y}=-\dfrac{j''}{D} & at & y=0 \\ & u\to 0 & T\to T_\infty, & C'\to C'_\infty & as & y\to\infty \end{array} \qquad (4)$$

On introducing the following non-dimensional quantities:

$$U=\frac{u}{u_0}, t=\frac{t' u_0^2}{\nu}, Y=\frac{y u_0}{\nu},$$

$$\theta=\frac{T-T_\infty}{T_\omega - T_\infty}, Gr=\frac{g\beta\nu(T_\omega - T_\infty)}{u_0^3}, C=\frac{C'-C_\infty}{\left(\frac{j''\nu}{D u_0}\right)}, \qquad (5)$$

$$Gc = g\beta^*\left(\frac{j''\nu^2}{D u_0^4}\right), Pr=\frac{\mu C_p}{k}, Sc=\frac{\nu}{D}$$

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

$$\frac{\partial U}{\partial t} = Gr\theta + Gc\, C + \frac{\partial^2 U}{\partial Y^2} \qquad (6)$$

$$\frac{\partial \theta}{\partial t} = \frac{1}{Pr}\frac{\partial^2 \theta}{\partial Y^2} \qquad (7)$$

$$\frac{\partial C}{\partial t} = \frac{1}{Sc}\frac{\partial^2 C}{\partial Y^2} \qquad (8)$$

The initial and boundary conditions in non-dimensional quantities are

$$\begin{array}{llllll} & U=0, & \theta=0, & C=0 & forall & Y,t\le 0 \\ t>0: & U=t, & \theta=t, & \dfrac{\partial C}{\partial y}=-1 & at & Y=0 \\ & U\to 0, & \theta\to 0, & C\to 0 & as & Y\to\infty \end{array} \qquad (9)$$

SOLUTION PROCEDURE

All the physical variables are defind in the nomenclature. The dimensionless governing equations (6) to (8), subject to the boundary conditions (9), are solved by the usual Laplace-transform technique and the solutions are derived as follows:

$$\theta = t\begin{bmatrix} (1+2\eta^2 \mathrm{Pr})\ erfc\ (\eta\sqrt{Pr}) \\ -\dfrac{2\eta}{\sqrt{\pi}}\sqrt{Pr}\ \exp(-\eta^2 \mathrm{Pr}) \end{bmatrix} \qquad (10)$$

$$C = 2\sqrt{t}\left[\frac{\exp(-\eta^2 Sc)}{\sqrt{\pi}\sqrt{Sc}} - \eta erfc(\eta\sqrt{Sc})\right]$$

$$U = t\left[(1+2\eta^2)erfc(\eta) - \frac{2\eta}{\sqrt{\pi}}\exp(-\eta^2)\right] \qquad (11)$$

$$+\frac{Grt^2}{6(\mathrm{Pr}-1)}\begin{bmatrix} (3+12\eta^2+4\eta^4)erfc(\eta) \\ -\dfrac{\eta}{\sqrt{\pi}}(10+4\eta^2)\exp(-\eta^2) \\ -(3+12\eta^2\,\mathrm{Pr}+4\eta^4(\mathrm{Pr})^2) \\ erfc(\eta\sqrt{\mathrm{Pr}})+\dfrac{\eta\sqrt{\mathrm{Pr}}}{\sqrt{\pi}}(10 \\ +4\eta^2\,\mathrm{Pr})\exp(-\eta^2\,\mathrm{Pr}) \end{bmatrix} \qquad (12)$$

$$+\frac{Gct\sqrt{t}}{3(Sc-1)\sqrt{Sc}}\begin{bmatrix} \dfrac{4}{\sqrt{\pi}}(1+\eta^2)\exp(-\eta^2) \\ -\dfrac{4}{\sqrt{\pi}}(1+\eta^2 Sc)\exp(-\eta^2 Sc) \\ -\eta(6+4\eta^2)erfc(\eta) \\ +\eta\sqrt{Sc}(6+4\eta^2 Sc)erfc(\eta\sqrt{Sc}) \end{bmatrix}$$

where, $\eta = \dfrac{Y}{2\sqrt{t}}$.

RESULTS AND DISCUSSION

For physical understanding of the problem, numerical computations are carried out for different physical parameters Gr, Gc, Sc, Pr and t upon the nature of the flow and transport. The value of the Schmidt number Sc is taken to be 0.6 *which corresponds to water-vapor. Also, the*

values of Prandtl number Pr are chosen such that they represent air (Pr = 0.71) and water (Pr=7.0). The numerical values of the velocity,tamperature and concentration are computed for different physical parameters like Prandtl number, thermal Grashof number, mass Grashof number, Schmidt number and time.

The velocity for different values of the Schmidt number (Sc = 0.16,0.3,0,6,2.01), Gr = Gc = 5 and Pr=0.71 time t = 0.4 are shown in figure 1 in the presence of air. The trend shows that the velocity increases with decreasing Schmidt number. It was observed that the relative variation of the velocity with the magnitude of the Schmidt number.

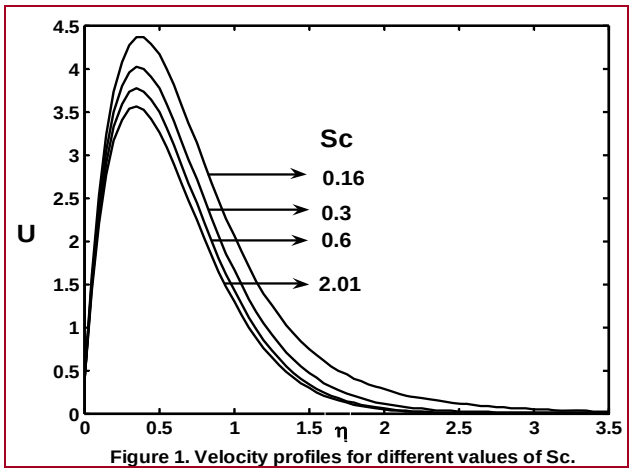

Figure 1. Velocity profiles for different values of Sc.

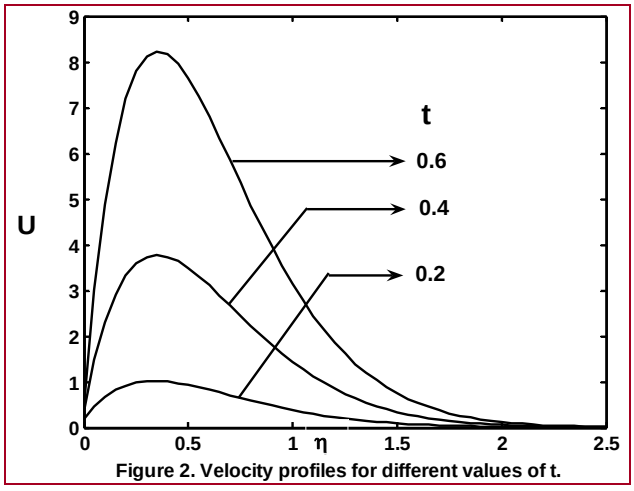

Figure 2. Velocity profiles for different values of t.

The effect of velocity for different (t = 0.2,0.4,0.6), Gr = 5 , Gc = 5 and Pr=0.71 are studied and presented in figure 2. It was observed that the velocity increases with increasing values of t . Figure 3. demonstrates the effects of different thermal Grashof number (Gr = 2,5) and mass Grashof number (Gc = 2,5) and Pr=0.71 on the velocity at time t = 0.4 . It was observed that the velocity increases with increasing values of the thermal Grashof number or mass Grashof number.

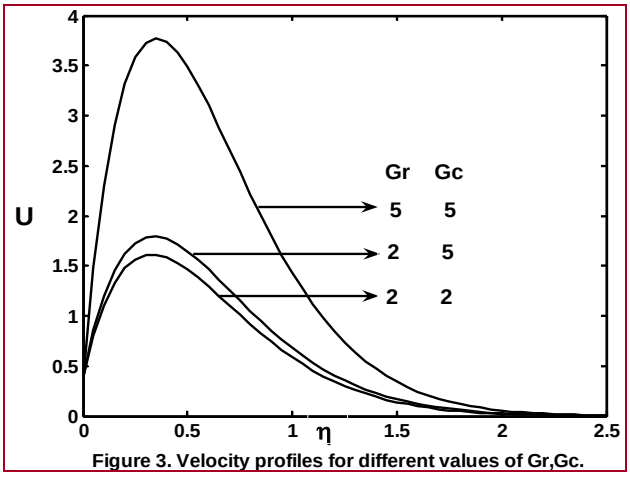

Figure 3. Velocity profiles for different values of Gr,Gc.

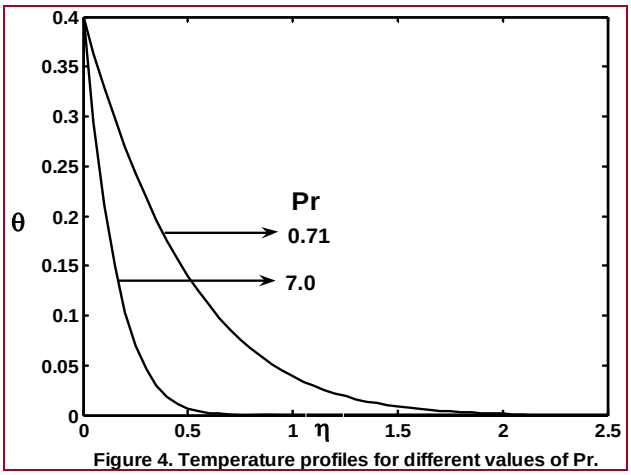

Figure 4. Temperature profiles for different values of Pr.

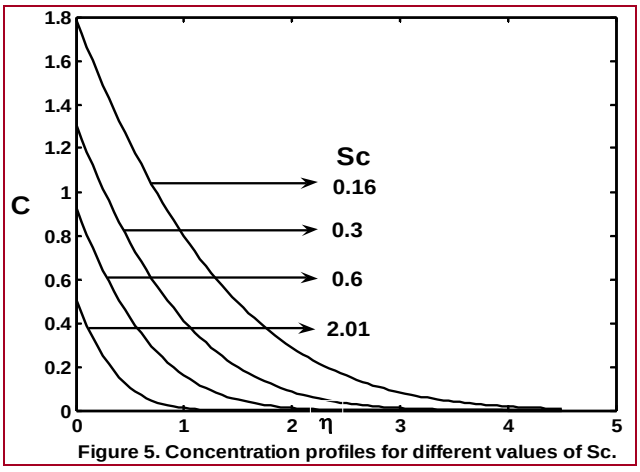

Figure 5. Concentration profiles for different values of Sc.

The temperature profiles are calculated for water and air from equation (10) and these are shown in Figure 4. at time t=0.4. The effect of the Prandtl number plays an important role in temperature field. It was observed thet the temperature increases with decreasing Prandtl number. This shows that the heat transfer is more in air than in water.

Figure 5 represents the effect of concentration profiles at time $t = 0.4$ for different Schmidt number ($Sc = 0.16, 0.3, 0.6, 2.01$). The effect of concentration is important in concentration field. The profiles have the common feature that the concentration decreases in a monotone fashion from the surface to a zero value far away in the free stream. It was observed that the wall concentration increases with decreasing values of the Schmidt number.

CONCLUSION

Theoretical syudy of unsteady flow past an uniformly accelerated infinite vertical plate in the presence of variable temperature and mass flux have been analyzed. The dimensionless governing equations are solved by the usual Laplace-transform technique. The effect of different parameters like thermal Grashof number, mass Grashof number, Schmidt number and t are studied . The conclusion of the study are as follows:

- *The velocity increases with increasing values of Gr, Gc and t .*
- *The transient velocity increases with decreasing Schmidt number Sc.*
- *The wall concentration increases with decreasing Schmidt number.*

NOMENCLATURE, GREEK SYMBOLS, SUBSCRIPTS

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

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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INTELLIGENT MANAGEMENT OF ASSETS BY ANALYTIC METHODS

Abstract:
To have the invoices paid in time is a dream of every businessman. The nineties characterized by low payment morale were replaced by an era of economic growth with better situation in the payments area. This positive trend has recently been disturbed by economic crisis and warnings of low payment morale in economics are starting to appear. Experts are of opinion that many companies can be affected by this problem, even such ones that didn't know this problem in the past.

Keywords:
economic growth, assets management, methods

CATEGORIZATION OF ASSETS IN SR

In early nineties, it was clear that the state help will be necessary by solution of risky loans resulting mainly from centrally controlled economics. The amount of unpaid loans in the bank sector was increasing due to economical, legal and political conditions bound with transformation of economics and deficiency in experience of banks in market environments. This had negative effect not only on the banks but on the whole business environment and therefore it was necessary to stop the process of increase of irrecoverable assets and to quicken the process of recovery of loan portfolio of banks. The situation could not be solved in the year 1993, where in conditions of the new state other problems had arisen. Later NBS accepted resolution num 3. from 3rd March 1995 about "Rules of evaluation of assets and under-balance sheet obligations of banks according to their risks for creation of resources to cover these risks". According to severity of risk of loss that they contain, assets can be divided into these five categories regarding the mentioned resolution:

1. Standard assets

These are such assets, where there is no reason to be doubtful that the asset will be paid in time and in full sum of its nominal value by keeping other conditions according to the contract. This category includes all assets that fulfill all of the following conditions:

- *the client is solvent, economic situation and paying ability are such that there is no expecting of danger in payment of fund, interests and fees,*
- *latency in payments is not longer than 30 days,*
- *the bank supplied the client correct type of loan,*
- *the client used the loan on purpose defined by loan contract.*

2. Standard assets with conditions

Standard assets with conditions are such assets where worsening of their quality has appeared, but according to accessible data it is expected that they will be paid in full sum of their nominal value.

This category includes such assets that fulfill at least one of the following conditions:

- *the client has economic and financial difficulties, which aren't however of such measure that it wouldn't be expected that he would be able to overcome them and pay the loan in full sum,*
- *delays in payments are longer than 30 days but not longer than 90 days,*
- *the client didn't supply the bank needed financial reports at least 30, at most 90 days from the moment these should be supplied to the bank,*
- *the bank supplied the client incorrect type of loan regarding his demands (e.g. a short-term loan to cover long term activities),*
- *the client used the loan on other purpose than set in the loan contract.*

3. Nonstandard assets

Nonstandard assets are such assets where it is probable that they won't be paid in full sum of their nominal value, while payment for the bigger part of their nominal value is highly probable. Nonstandard assets have at least one of the following features:

- *the debtor is in considerably bad economic situation and financial end economic difficulties, based on which it can be expected that he will become insolvent in near future (during the time of contract with the bank),*
- *delays in payments are longer than 90 days, but not longer than 180 days,*
- *the client has not supplied the bank with needed financial reports and other data at least 90 days, at most 180 days from the moment these should be supplied to the bank.*

4. Doubtful and disputable assets

Doubtful and disputable assets are such, where payment in their full nominal sum is very improbable or doubtful. Partial payment is however highly probable. Doubtful assets have at least one of the following signs:

- *the debtor is insolvent,*
- *delays in payments are longer than 180 days, but not longer than 360 days,*
- *the client has not supplied the bank with needed financial reports and other data at least 180 days, at most 360 days from the moment these should be supplied to the bank.*

5. Loss assets

Loss assets are such assets that appear according to accessible data as unrecoverable, or recoverable only partially in a very low sum or after fulfillment of some conditions.

Loss assets are assets that have at least one of the following signs:

- *the client doesn't pay his obligations at least 360 days,*
- *the client has not supplied the bank with needed financial reports and other data more than 360 days, from the moment these should be supplied to the bank.*
- *the client is in a concourse or in liquidation (irrespective of the amount of losses).*

Nonstandard, doubtful and loss assets are designated as classified assets.

MANAGEMENT OF ASSETS

Fears from future touch not only the building companies where nonpayment was well known in the past, but also companies in productive or network industry are affected, lately also financial institutions belong in this category. Banks record loans that people and companies cannot pay. Due to the global economic crisis, people are loosing their employment. Some companies replace worse access to bank financing by delaying payment of invoices and in this way they fund themselves by supply loans. Under such payment conditions, more and more companies are getting into economic problems, because their revenues for supplement of goods and services are really endangered. The importance of active control of assets is thus increasing.

However, there appears the question what can be recommended to such companies, clients of which cannot pay for their obligations. Will the present solutions of assets recovery be efficient? It can be assumed that the influx of new cases will flood advocate offices and courts, thus slowing down court or other recovery. In the case of sale or forwarding of the asset to collecting companies, we can face disinterest to buy or decrease in price of packages of assets. An appropriate solution lies in prevention of occurrence of non-recoverable assets and mainly better use of information about customers, their behavior and recovery of assets by use of analytic applications.

ANALYTIC MODULES

In recent past, modern solutions for intelligent management of assets began to appear on the market, aimed at improvement of cashing and the process of assets recovery. The essence lies in expansion of the traditional tools of assets management by analytic modules, by help of which more accurate information for active prevention of unrecoverable assets. By use of analytic methods, we can understand better the behavior of customers (potential debtors) and in case of delays; the system can choose the optimal communication channel. For every debtor, the system automatically sets itself and will execute individual recovery campaign, while it selects the order of actions and their escalation.

Different scenarios of recovery are at disposal, while the system alone modifies the scenarios according to obtained data (internal and external) in accordance to reactions of the debtor. The important part of the system is calculation of real expenses for recovery including fines and fees bound with a particular case. If we choose to solve the asset by an external cashing company, the system can set the most appropriate moment for advancing of the asset to the company. If we choose to sell the package of assets the analytic software will help us to precisely set the price of such portfolio of assets. The price is set except expenses also based on the probability of payment of the asset, this means the amount of its recovery price. Such evaluated package of assets brings better arguments for price negotiations by sale.

The use of analytic methods in the area of assets management is not entirely new. We can observe the incursion of analytic methods into all enterprise processes. The implementation of analytics usually means increase in efficiency or accuracy and obtaining of new information and overview of processes. Intelligent management of assets is exceptional not only by strong use of analytics but also optimization procedures. These are tasked with selection of optimal parameters of assets management as is use of resources, capacities and channels (personal, technical, e.g. a call center) by the highest efficiency of the process by the lowest costs. Optimization is used by selection of addressing of the debtor by an appropriate communication channel and also selects strategy of actions towards him with optimal escalation. It also selects the most appropriate intervention strategy for every debtor (in-house, outsourcing, sale). Automation of different tasks bound with recovery (e-mails, SMS, letters) is evident, while it also selects manual tasks bound with recovery (phone calls, letters, visits…). The result of such interconnection of modern technologies bring a unique solution that can be described with:

- *high success rate of the process of recovery,*
- *low costs for securing the process of assets,*
- *the possibility of automated processing of tasks bound with the process of recovery,*
- *systematic and individual approach to debtors,*
- *delicate approach to debtors, that increases chances of continuation of cooperation.*

USE OF ANALYTIC MODELS

The use of analytics is traditionally most successful where there is a lot of information that cannot by processed by traditional manual and expert methods. Therefore the gains in the area of assets management will be reflected in companies that have a numerous clients:

- *banks,*
- *insurance companies,*
- *network industry companies,*
- *telecommunications,*
- *leasing companies,*
- *tally companies, etc.*

or in cashing companies that solve management of assets for their clients.

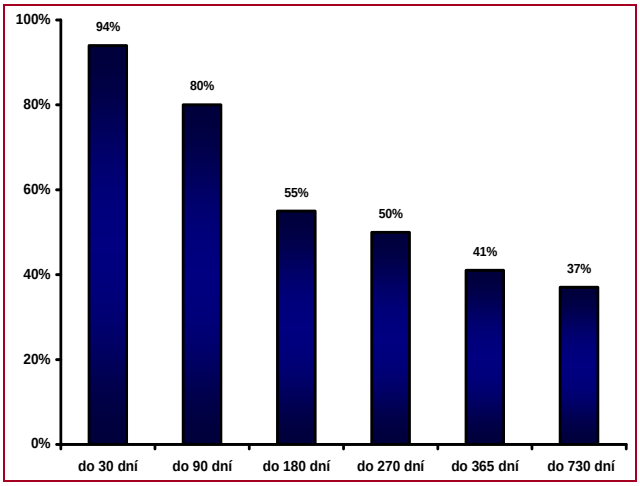

Fig. 1: The process of intelligent management of assets

THE TASKS OF INTELLIGENT RECOVERY

Intelligent recovery has the following tasks:

- *to minimize costs bound with recovery,*
- *to maximize the income from fees of delays,*
- *to classify the type of the debtor and to select the efficient approach to the asset recovery,*
- *intelligent (self-learning) models of debtors' behavior or strategies of recovery,*
- *to automate the whole process of recovery.*

The world's trend in the area of assets management is to shorten the time of recovery of financial means from assets by setting the process of contacting and claiming of payments for every individual debtor..

The success of recovery is conditioned by:

- *speed (the age of assets),*
- *existence of sufficient legal grounds,*
- *the insurance of the assets,*
- *the existence of debtor's properties,*
- *used methods of recovery.*

CONCLUSION

The intelligent management of assets represents a revolutionary breakthrough in the area of assets recovery on the Slovak market. It is mainly designated for active businessmen. It represents a combination of the most efficient and most penetrative methods of assets recovery that is presently accessible. Within the frame of this method, unique approaches are used, result of which is the maximal payment recovery in the shortest possible time and all of this for only a fraction of price of standard recovery. The result of these approaches is a service that brings the clients presently unknown comfort that presents with speed and efficiency a solution that doesn't presently have any real competition.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] SORINA SERBAN

USE OF ANIMATION IN TEACHING CHEMISTRY

Abstract:
To program complex graphic applications required to create and play virtual scenes in virtual environments, graphics libraries and interfaces are being used, program development systems (Toolkits) which offer the programmer the opportunity to reuse a large number of already developed and implemented graphic functions and thus to focus on design and complexity of application.
The modern technology used in this work adds real value to teaching through animation elements that describe certain phenomena which can hardly be studied and understood by conventional means, interactivity and dynamic properties of knowledge assessment by pupils / students.

Keywords:
virtual environments, graphics libraries and interfaces, animation elements, chemistry

THEORETICAL CONSIDERATIONS

Multimedia is addressed to people, and people can feel the information system through at least 7 perceptive senses namely: sight, hearing, touch, smell, taste, balance and position. The different types of environments are associated with different human senses, such differs: vision - text, image, 2D and 3D graphics, animations, video; hearing - sound (speech, music, etc...); touch - Braille language; balance - video games ; position - virtual reality, smell and taste don't have technologies yet.

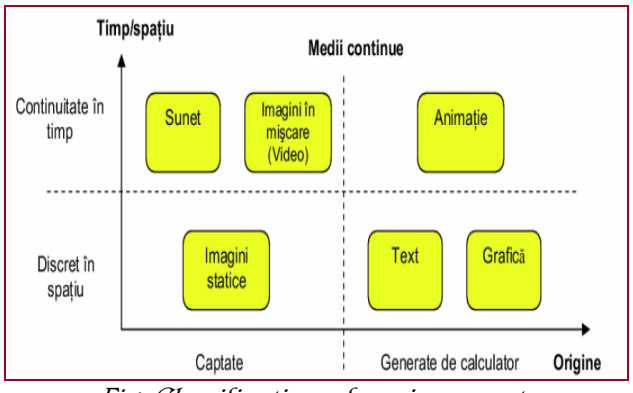

Fig. Classification of environment

A multimedia application requires storage space. The application has several multimedia elements like color images, text, audio or video sequences, all these require more memory. Multimedia technology, especially animation, creates psychological moments which contribute to the collection and saving material. A web 3D technology is an important factor in spatial skills training. 3D image and 3D animation in particular, allow stimulating the trainees to understand the concepts.
One of the first standards for the exchange of information in 3D format on the Internet is VRML (Virtual Reality Modeling Language). A new standard to apply concepts of VRML, but much more complex in terms of technology is Extensible 3D or X3D. X3D files contain lines of code describing a 3D virtual environment. Three-dimensional models designed to introduce new benefits for 3D user interaction with graphical interface. The potential to create 3D user interfaces, and organize information in the third dimension is enormous.
A different method to improve the interactivity of the user interface is to involve external tools that communicate effectively with graphic scene

designed in 3D. Examples of such utilities are HTML and JavaScript. In graphical interfaces based on HTML and JavaScript, most user interaction is done with JavaScript functions while HTML serves as operating environment for these scripts.

Animations and digital videos are graphic scenes in bitmap (frame) rolled rapidly. Animations can be achieved within the creative system, changing the position of objects rapidly, or by sequencing frames that correspond to movement of a character to create the illusion of movement. To create movies you can use QuickTime or Microsoft Video for Windows, programs which allow creating, editing and presenting a digitized moving video within multimedia applications. QuickTime and AVI are two formats for storage and playback digitized video sequences in and from files of the disk.

APPLICATION PRESENTATION

When running an animation it is important to distinguish between knowledge that involves animation (when the movement is essential to understand the acquired information) and knowledge with emphasis on animation (when the movement is not part of the context to be learned, but it is used in order to draw attention to some aspects of content).

On a computer monitor the organic compound molecules "become alive", lessons take place as if by themselves. Students come into a fascinating, virtual world where microcosm is brought to real dimensions.

This paper presents an application where we tried to represent some forms with similar structures that have spatial geometry of chemical compound using avi and mpg video animation. We used GIF Animator and Ulead Video Studio programs to achieve them. Each rotation of a compound was realized with GIF animator as a sequence of images and to transform it into video files (OLE object type in our database) and constant rotation these images were placed end to end to simulate a continuous motion and transformation into video files with Ulead Video Studio.

Animation can be run by double-clicking the image or by activating it with the event click on button "run animation". It takes between 6 to10 seconds. The event was scheduled in the "object properties" window and the corresponding button code:

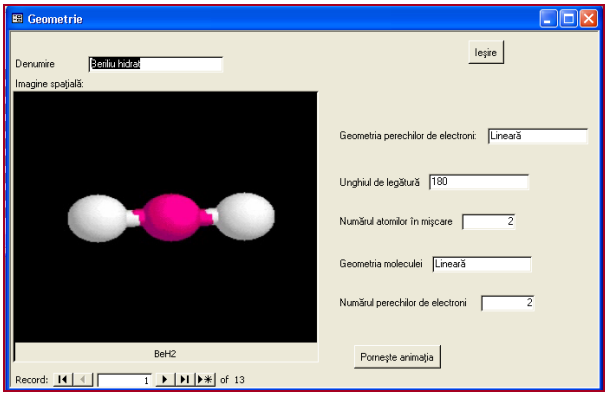

Fig.1.Hydrated beryllium

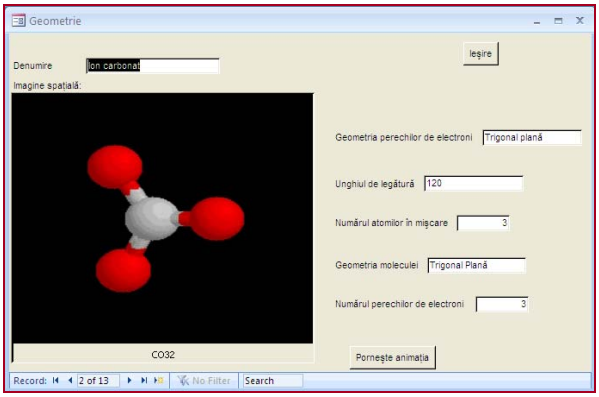

Fig.2.Carbonate ion

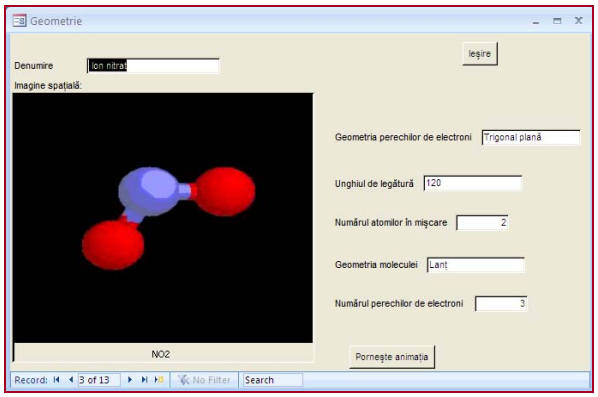

Fig.3.Nitrate ion

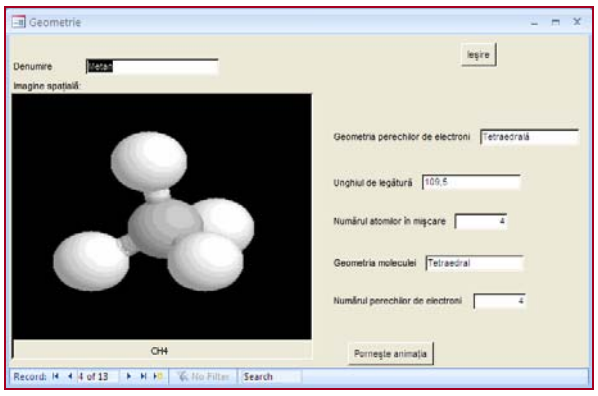

Fig.4.Methane

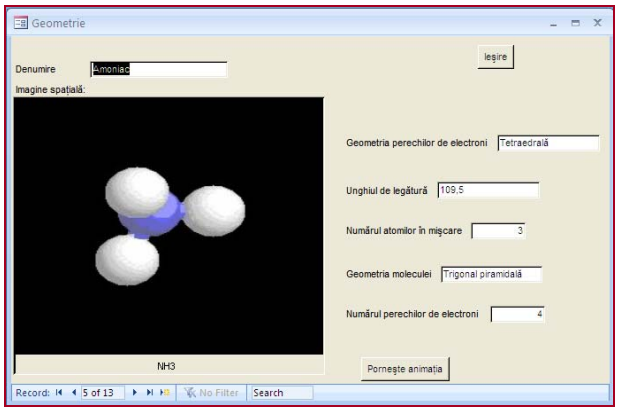

Fig.5.Ammonia

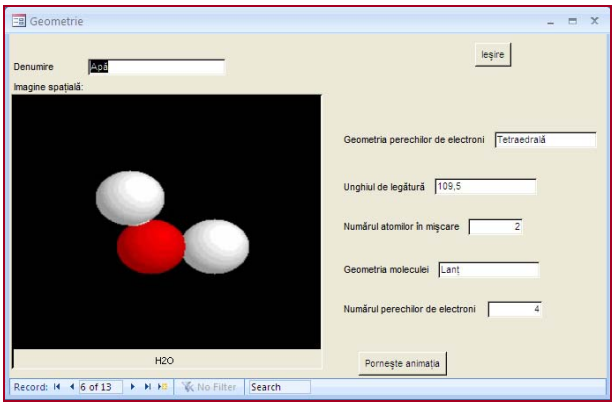

Fig.6.Water

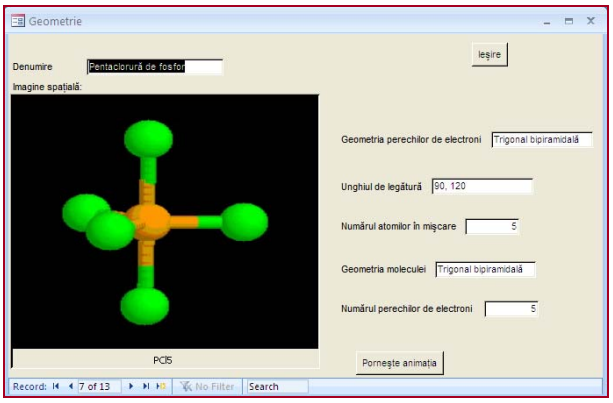

Fig.7.Phosphorus pentachloride

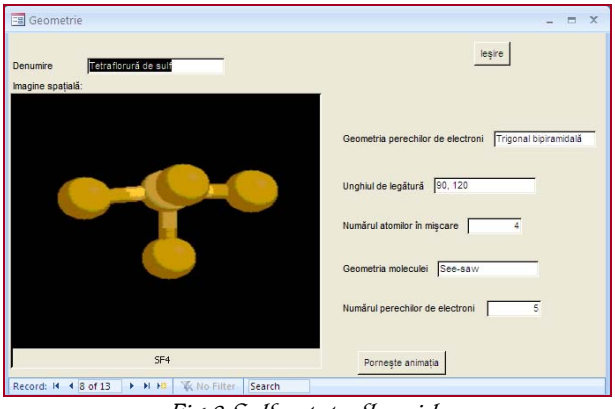

Fig.8.Sulfur tetraflouride

CONCLUSION

Development of representation by real interactive graphics, 3D animation, is the solution for cognitive psycho-pedagogical training schemes as interdependence of concepts and prototypes.
Such a conceptualization allows argumentation, once again, in favor for the role of information technologies, communications and media in shaping the personality suited to upward information environment affected by globalization.
If we apply media information technologies in teaching-learning Chemistry courses with the help of educational multimedia, we will ensure:

- *increased volume of assimilated information;*
- *increased efficiency of teaching-learning computer;*
- *reduce the time required for training;*
- *developing the skills to use multimedia technologies*

If this concept is correct, then the practical results of research should be better than those obtained from traditional methods of teaching-learning.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] M.N. LAKHOUA

SUPERVISION OF AN INDUSTRIAL SYSTEM USING SCADA

Abstract:
In most industrial applications implying some rotating machines, the surveillance of vibrations occupies a major role in the setting of machine surveillance. Indeed, the surveillance of vibrations normally makes while combining measures of absolute vibrations of landings or we present an application of a supervisory control and data acquisition system (SCADA) to a system of vibratory surveillance of pumps in a thermal power plant. Thus, the functionality of a supervisory system for real time processes is presented. Then we present the concepts of a SCADA system. The paper briefly discusses the different steps of this application and some advantages of SCADA systems used in thermal power plants.

Keywords:
Vibration pumps, surveillance, thermal power plant, SCADA

INTRODUCTION

Supervision consists of commanding a process and supervising its working. To achieve this goal, the supervisory system of a process must collect, supervise and record important sources of data linked to the process, to detect the possible loss of functions and alert the human operator.
The main objective of a supervisory system is to give the means to the human operator to control and to command a highly automated process. So, the supervision of industrial processes includes a set of tasks aimed at controlling a process and supervising its operation [1-2-3].
Supervisory control and data acquisition systems (SCADA) are widely used in industry for supervisory control and data acquisition of industrial processes. The process can be industrial, infrastructure or facility [4-5-6].
The objective of this paper is to show interests of the use of a SCADA system for the surveillance of pumps vibrations in a thermal power plant (TPP). An example of a SCADA system of the center of production of electricity of Rades is presented. The next section briefly describes the characteristics of systems of vibration surveillance in a TPP. Next, the interests of the application of the SCADA system are developed. The last section presents a discussion about some advantages of the application presented.

SURVEILLANCE OF PUMPS VIBRATION

Systems of vibration surveillance are often equipped of measure chains for other complementary parameters, as the axial position, the crankiness, the differential dilation, the dynamic pressure, the speed of rotation and the temperature.
Among the new systems of measures [7-8-9], we mention notably IDS (system of icing detection) and AGMS (system of measure of the entrefer between the rotor and the stator) that complete a system of vibration surveillance efficiently, but that are also usable as of the autonomous specific systems.
The MMS system (System of Machine Surveillance) is the synthesis of the long

experience of Vibro-Meter in the domain of the surveillance of machines and its expertise to master technologies of vanguard as for the manufacture of the electronic of surveillance [10].

The instrument of vibration control measures the vibration all the time when machines (turbine of power plant, big dimension compressor, pump, blower…) are in service. When the supervised vibration reached the amplitude of vibration, that is adjusted in advance, the instrument gives out an exit of point of alarm contact to give a warning to the working of the machine or gives out an instruction to stop the working of the machine, avoiding so the danger and accidents before they occur.

The mechanical vibration that is developed in a machine is controlled by a sensor of vibration and is converted in electric signal and this signal is introduced in an amplifier of vibration. In this amplifier, a signal that is proportional to the speed of vibration and supervised by an instrument of vibration control, and convert in a signal that is proportional to the displacement of the vibration, and this last is to its tower convert in a tension to continuous current, that is given back like signal to an indicator and a signal to the circuit of alarm.

The instrument of vibration measure used in our application is constituted by a sensor of vibration (Model U1-FH) and an instrument of vibration control (Model AVR-148) [11]. In fact, the sensor of vibration, model U1-F, is similar to the construction of a loudspeaker to permanent magnet. The sensor is attached to the machine on the one hand with screws and on the other hand to connect to the system of registration with the special cables.

With sensors of Vibro-Meter, we can measure in general most the critical parameters in the surveillance of machines, but particularly what concerns vibrations. In this domain, Vibro-Meter proposes a vast range of sensors, of conditioners of the signal as well as an effective signal transmission.

Sensors of proximity and other translators of displacement are based on currents of Foucault and present a high linearity with an active compensation of the temperature. Some sensors, as piezoelectric accelerometers, have favors to be deprived of the mobile pieces, what permits to guarantee their reliability and a long life span.

The piezoelectric sensor is used as detector of shock, vibration or percussion. It captures the mechanical vibrations that transmit itself in a material.

Figure 1 presents the diagram block of the system vibratory surveillance of a pump used in a TPP.

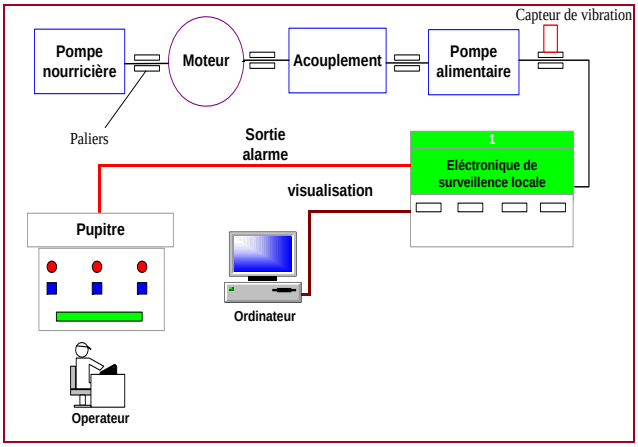

Fig. 1. Diagram block of the system vibratory surveillance

To achieve a complete monitor of surveillance, we always associate a module of treatment UVC 691 with a module of surveillance with a high performance PLD 772.

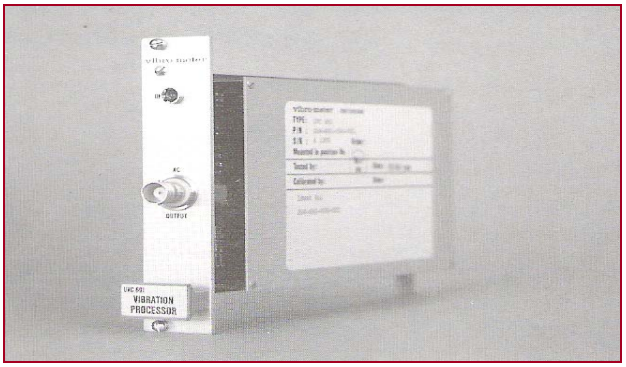

Fig. 2. Module of treatment UVC 691

UVC 691 is a module of signal treatment assorted to different sensors and conditioners via a galvanic separation.

Most modules of Vibro-Meter provide unipolar signals in the range of 0 to 10 V DC. However, the PLD 772 can accept some bipolar signals in the range of 0 to ±10 V DC.

In fashion of programming of the PLD 772, the user has the possibility to define the calibration of the display and all parameters of alarm.

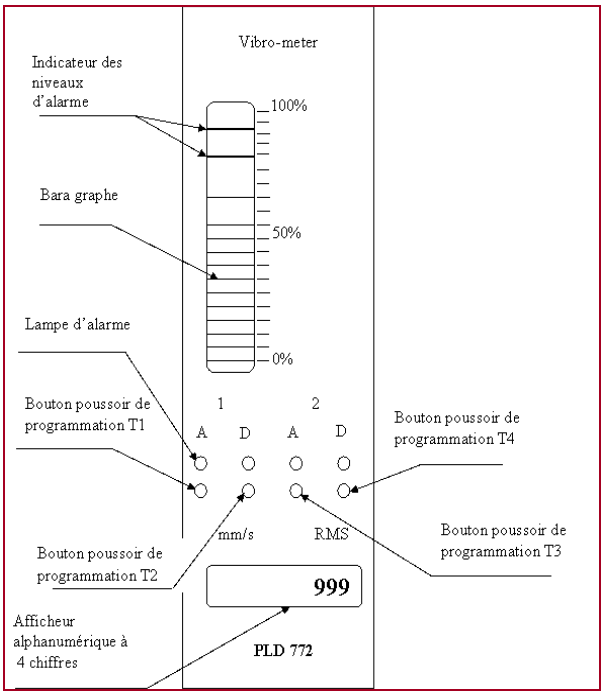

Fig. 3. Module of surveillance PLD 772

While equipping the PLD 772 of an interfacing RS-485, the module is capable to the digital communication. Thus, a system of surveillance can make part of a cabled network. A computer detains the main computer role. All other modules PLDS 772 in racks are some secondary stations. Such a link between a system of surveillance and a main computer is in measure to do functions of programming from afar and of data transfer.

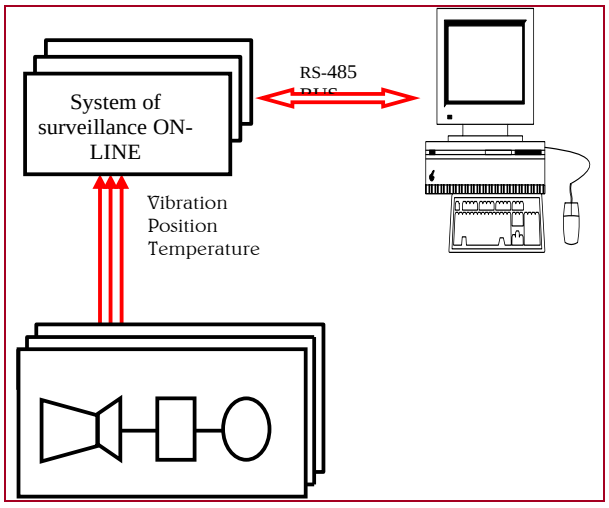

Fig. 4. Transfer of data between units

The central computer can read the calibration of every module at all times PLD 772. Instructions of set up and a special authorization permit to modify parameters of calibration or doorsteps of alarm of every surveillance module. Commands become thus easy and the result is from afar a fully programmable surveillance system.
The computer calls each module periodically to ask it the measured values (DC signals) and the state of alarm of every channel. Such a process of acquirement suits the registration of data and the creation of a data basis very well with the acquisition in DC in order to do an analysis of tendency subsequently using software of conditional maintenance.

USING A SCADA SYSTEM IN A TPP

SCADA system is used to observe and supervise the shop floor equipments in various industrial automation applications. SCADA software, working on DOS and UNIX operating systems used in the 1980s, was an alarm-based program, which has a fairly simple visual interface.
The SCADA system usually consists of the following subsystems:

- *A Man-Machine Interface (MMI) is the apparatus which presents process data to a human operator, and through this, the human operator, monitors and controls the process.*
- *A supervisory system, acquiring data on the process and sending commands to the process.*
- *Remote Terminal Units (RTUs) connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.*
- *Communication infrastructure connecting the supervisory system to the RTUs.*

In fact, most control actions are performed automatically by RTU or by programmable logic controllers (PLC). Host control functions are usually restricted to basic overriding or supervisory level intervention. For example, a PLC may control the flow of cooling water through part of an industrial process, but the SCADA system may allow operators to change the set points for the flow, and enable alarm conditions, such as loss of flow and high temperature, to be displayed and recorded. The feedback control loop passes through the RTU or PLC, while the SCADA system monitors the overall performance of the loop [12-13].
With the advances of electronic and software technologies, the supervisory control and data acquisition systems are widely used in industrial plant automation. It provides an efficient tool to

monitor and control equipment in manufacturing processes on-line. The SCADA automation system always includes several functions, e.g., signal sensing, control, human machine interface, management, and networking.

The Société Tunisienne de l'Electricite et du Gaz (S.T.E.G) is a vertically integrated monopoly for power and gas. It is responsible for power transmission and distribution and gas distribution. The monopoly of the power generation has been abolished, and the first IPP is a reality. The transmissio²n and distribution losses of the Tunisian electricity grid are about 12% of the power generated [14].

During the last few years, the S.T.E.G has evolved in a difficult international conjuncture characterized by the increasing of the hydrocarbon's prices. In spite of this economic situation, the S.T.E.G has deployed many efforts in different domains of its activity that enabled it to record some remarkable results. This is why the growth of 4.8% of the national production of electricity in 2007 enabled to the S.T.E.G to answer to the country evolution demand under the best conditions of continuity and security [14].

Among the units of electricity production of the S.T.E.G, the center of production of electricity of Rades (near to Tunis) that consists of a system producing the electricity while using dry water steam to drag the alternator in rotation. This steam is generated in a furnace that transforms the chemical energy of the fuel (NG, heavy fuel-oil) in calorific energy.

In fact, a TPP is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser. The greatest variation in the design of TPPs is due to the different fuel sources. Some prefer to use the term energy center because such facilities convert forms of heat energy into electrical energy.

In TPPs, mechanical power is produced by a heat engine which transforms thermal energy, often from combustion of a fuel, into rotational energy. Most TPPs produce steam, and these are sometimes called steam power plants. TPPs are classified by the type of fuel and the type of prime mover installed.

The electric efficiency of a conventional TPP, considered as saleable energy produced at the plant busbars compared with the heating value of the fuel consumed, is typically 33 to 48% efficient, limited as all heat engines are by the laws of thermodynamics. The rest of the energy must leave the plant in the form of heat.

Since the efficiency of the plant is fundamentally limited by the ratio of the absolute temperatures of the steam at turbine input and output, efficiency improvements require use of higher temperature, and therefore higher pressure, steam.

This overheated steam drags the HP rotor (high pressure) of the turbine in rotation and relaxes to the exit of the HP body of the turbine, so it comes back again in the furnace to be until 540° after, it will be sent back to the MP body (average pressure) then to the BP body (bass pressure) of the turbine.

During these steps, the calorific energy is transformed in available mechanical energy on the turbine. Thus, this mechanical energy will be transmitted to the alternator, being a generator of alternating current, in the goal to produce the electric energy.

After the condensation, water will be transmitted thanks to pumps of extraction in the station of BP to be warmed progressively before being sent back to the furnace through the intermediary of the food pumps.

This warms progressive of water has for goal to increase the output of the furnace and to avoid all thermal constraints on its partitions. And this station of water is composed of a certain number of intersections that is nourished in steam of the three bodies of the turbine. Finally, the cycle reproduces indefinitely since steam and water circulate in a closed circuit.

Most of the TPPs operational controls are automatic. However, at times, manual intervention may be required. Thus, the plant is provided with monitors and alarm systems that alert the plant operators when certain operating paracounters are seriously deviating from their normal range.

An example of a SCADA system of a TPP is presented (Figure 5). The stations belong to a superior network Ethernet (10 Mb/s). Principally, this network enables to exchange files between the stations. It enables to avoid the overload of the Node bus network. In fact, the SCADA system is composed by modules that exchange

information thanks to the communication network. It exist three levels in the SCADA system: acquisition; treatment and Men/Machine Interface.

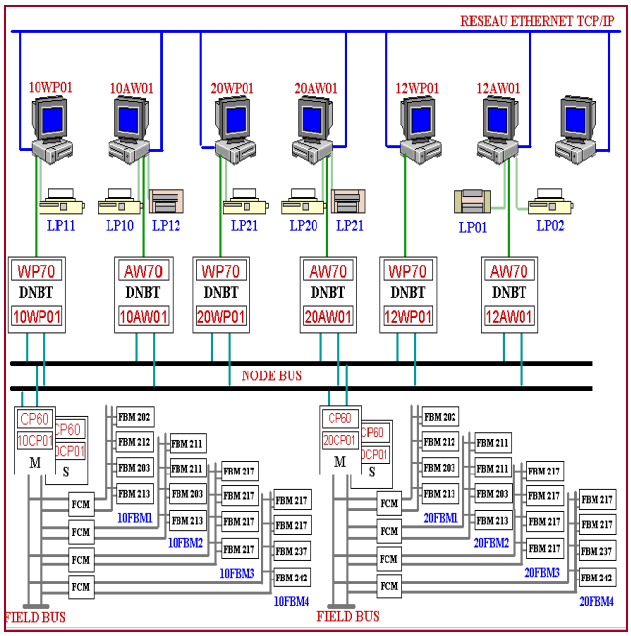

Fig. 5. Architecture of a SCADA system.
Legend: I/A: Intelligent / Automation ; FBM: Field bus modules ; FCM: Field Bus Communication Module ; AW: Application work station ; WP: Work station Processor ; CP60: Control Process60 ; DNBT: Dual Node bus.

CONCEPTION OF DISPLAYS FOR PROCESS PUMPING

Series process graphics to be displayed via FoxView software. It allows creating and maintaining dynamically updating process displays. Displays can represent the plant, a process area, or a detailed portion of the process. FoxDraw provides numerous time and effort saving features to make building, configuring, and maintaining displays easy. Included with FoxDraw is a large library of graphical components ready to be included and configured in displays (Figure 6). These objects range from simple arrows and ISA (International Society of Automation) control symbols to 3D images of process control components such as tanks and turbines.
FoxDraw includes over 1200 prebuilt objects such as pumps, tanks, pipes, motors, valves, and ISA symbols. Standard libraries include vast selections of simple and complex objects with which to build displays.

We have built many displays with FoxDraw that are used by FoxView, and become the I/A Series interface to the pumping process. Figure 7 presents the display of the pump A of the thermal power plant.

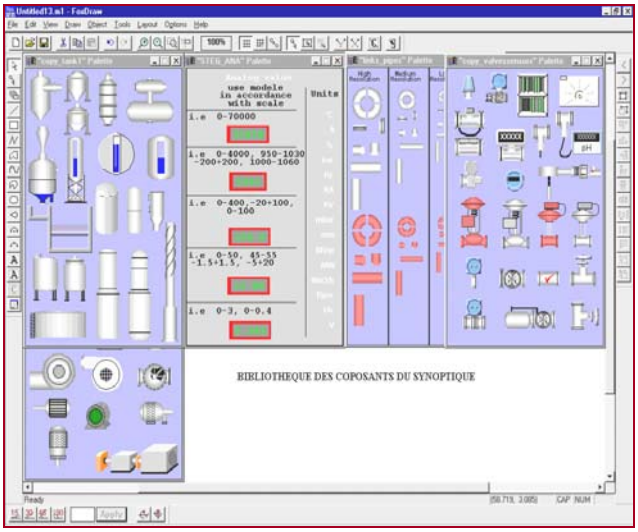

Fig. 6. Library of FoxDraw

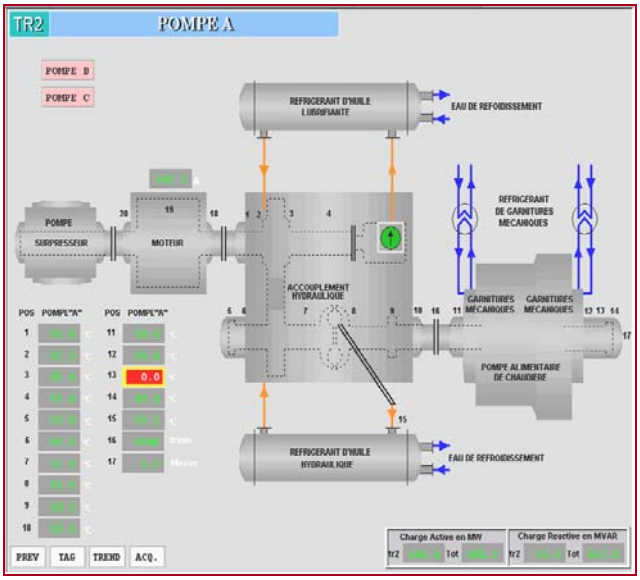

Fig. 7. Display of the pump A of the TPP

CONCLUSION

In this paper, an application of supervision of a system vibratory surveillance in a thermal power plant was presented. This application permits the creating and maintaining dynamically updating the pumping process displays.
A supervisory system must take into account the physiological and cognitive features of the supervisory operator because an inadequacy between the supplied information and the operator's information requirement is

dangerous. So, to be more efficient, the design of a supervisory system should be human centered.

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COMPUTATIONAL THERMAL ANALYSIS OF MULTIPLE DISC TYPE ROTARY MAGNETIC REFRIGERATION SYSTEM

Abstract:
Energy crisis and climate change are rocking the entire world at this moment. Refrigeration forms a major power consumer, ranging from domestic applications to industrial applications. Apart from a leading energy absorbing system, it also takes part in global warming by letting out harmful ozone depleting substances and hence turns against the environment. It is the right time to switch over from the conventional compressor based refrigeration systems. Magnetic refrigeration proves itself to be highly efficient and environmental friendly refrigeration system, making it to be the most promising source of cooling systems in the near future. Simulation of the magneto caloric refrigeration system using computational fluid dynamics approach forms the major part of this paper.

Keywords:
Magnetic refrigeration, magneto-caloric effect, magneto-caloric material, magnetic entropy, Computational Fluid Dynamics, star CCM plus

INTRODUCTION - MAGNETIC REFRIGERATION

With alarming issues like ozone layer depletion, global warming and climate changes, the conventional systems have to make their way through environmental-friendly application areas. Refrigerators play a significant role in environmental pollution by releasing harmful ozone layer penetrating agents. Hence, a new process must be devised for refrigeration technology which must be free from the polluting agents and also it must be able to work under low energy consumption. Since power conserved is power produced, the system should be capable of working with high efficiency. Magnetic refrigeration technology provides a promising future in this regard by being a vibration free, noise free, eco-friendly, non-polluting, highly efficient refrigeration technology. This paper gives a basic idea on magnetic refrigeration explaining the magneto caloric effect, the associated thermodynamic relations and cycles, heat transfer system along with the validation of design using gadolinium discs for refrigeration using computational fluid dynamics simulation.

COMPARISON WITH CONVENTIONAL REFRIGERATION

The efficiency of magnetic refrigeration can be 30–60% of Carnot cycle, whereas the efficiency of vapour compression refrigeration is only 5–10% of Carnot cycle[15]. Therefore, the magnetic refrigeration is expected to have great applicable prospects.

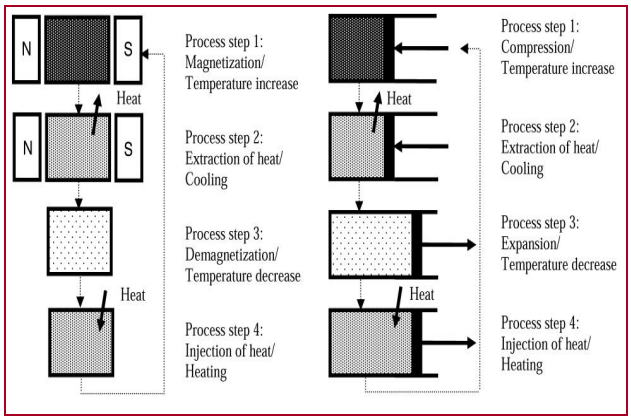

Fig 1.1 Comparisons between Magnetic Refrigeration and Vapour Compression Refrigeration [3]

MAGNETO-CALORIC EFFECT

Magnetic refrigeration utilizes the magneto-caloric effect. This effect causes a temperature change when a certain metal is exposed to a magnetic field. All transition metals and lanthanide series elements obey this effect. This tends the metal to heat up as a magnetic field is applied. As the magnetic field is applied, the magnetic moments of the atom align. When the field is removed, the material cool down since the magnetic moments become randomly oriented. The phenomenon is shown in Fig 1.2.

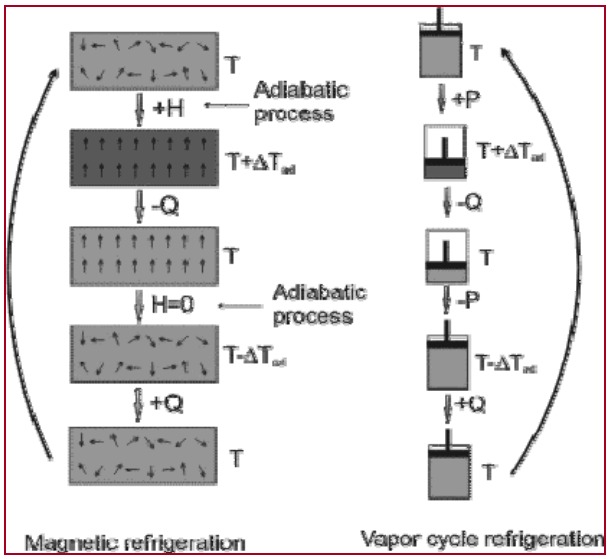

Fig 1.2 Magnetic Refrigeration with Dipole arrangement

NEED OF THE HOUR

Magnetic refrigeration is an environment-safe refrigeration technology. The magnetic refrigeration does not have ozone-depleting and greenhouse effects for employing magnetic materials as refrigeration media. What is more, the magnetic refrigeration unit can be compact, for the magnetic entropy density of magnetic material is larger than that of refrigerant gas. The magnetic field of magnetic refrigeration can be supplied by electromagnet, superconductor or permanent magnets, which have no need for compressors with movable components, large rotational speed, mechanical vibration, noise, bad stability and short longevity.

LITERATURE SURVEY – INPUT POWER CALCULATION

Peng Li et al (2006) suggests that, according to the laws of thermodynamics, a real refrigerator operating between two heat reservoirs with cooler end (Cold heat exchanger) at T_c with refrigeration capacity Q_c and hotter end (Hot heat exchanger) at T_h with heat rejection rate Q_h, requires the input power W per cycle.

$$W = ((T_h/T_c) - 1)Q_c + T_h .\Delta S_{gen} \text{ [6]} \quad (3.1)$$

ΔS_{gen} – Entropy generation rate due to irreversible losses in a refrigeration cycle

COOLING LOAD CALCULATION

C. Zimm et al (2006) formulated the following:

$$\text{Cooling load } Q_c = a.M_{dot}.C_f.\Delta T_b \text{ [14]} \quad (3.2)$$

M_{dot} – fluid flow rate
C_f – Heat capacity of the fluid
ΔT_b – Temperature change in the material
a – Coefficient (the coefficient a is close to 1 for moderate fluid flow rates of the fluid)
L.A. Tagliafico et al (2006) suggested that, for a given fluid, the heat transfer process mainly depends on[7]
(i) Relative velocity between fluid and disk,
(ii) Disk geometry,
(iii) MCM porosity (or void fraction),
(iv) Ratio between heat transfer area and MCM volume,
(v) Average particle dimension (related to the previous).

ASSUMPTIONS

The main assumptions and simplifications, useful to shorten the description without any loose of generality, are as follows:

1. *Steady state regime: all the considered quantities do not depend on time*

2. *Negligible heat and mass transfer losses towards the outside of the refrigerator*
3. *MCM adiabatic processes will be also considered internally reversible, that is isentropic. This is not a severe assumption, since MCE is almost reversible, except in the case of pronounced hysteretic behaviour of the MCM, which usually does not occur at the very low cycle frequency used in these devices. Thus, the MCM Brayton cycle is composed of internally reversible processes while entropy production occurs at fluid-solid interface due to the heat transfer processes across a finite temperature difference, and, inside the fluid, to friction losses and mixing.*
4. *The thermo-physical properties of the intermediary fluid (constant pressure specific heat, viscosity, thermal conductivity, density, and so on) have been assumed constant, and computed at the mean working temperature experimented all over the cycle.*
5. *The MCE has been assumed instantaneous: that is the refrigerating material takes no time to change its temperature when the external magnetic field suddenly changes.*

MAGNETO-CALORIC EFFECT AND ENTROPY

B. F. Yu et al (2003) found that entropy of magnet at constant pressure, S(T,H), which is both magnetic field and temperature dependant, consists of the magnetic entropy (S_M), the lattice entropy (S_L), and the electronic entropy (S_E):

$$S(T,H) = S_M(T,H) + S_L(T) + S_E(T)[13] \quad (3.3)$$

In the above formation, SM is a function of both H and T, but SL and SE are functions of T only. As a result, only the magnetic entropy, SM, can be controlled by changing the strength of magnetic field[10].

MAGNETIC MATERIAL – SELECTION OF ROOM TEMPERATURE MAGNETIC MATERIAL

The gross cooling capacity is less than that of the condition of $(S_L+S_E)\sim 0$. As the core of the magnetic refrigeration, several features of magnetic materials are required for application[2]:

- *Large total angular momentum number J and Lande factor g of ferromagnetic material, which are crucial to MCE;*
- *Modest Debye temperature (A high Debye temperature makes the fraction of lattice entropy small correspondingly in high temperature ranges);*
- *Modest Curie temperature in the vicinity of working temperature to guarantee that the large magnetic entropy change can be obtained in the whole temperature range of the cycle;*
- *Essentially zero magnetic hysteresis;*
- *Small specific heat and large thermal conductivity to ensure remarkable temperature change and rapid heat exchange;*
- *Large electric resistance to avoid the eddy current loss;*
- *Fine moulding and processing behaviour to fabricate the magnetic materials satisfactory to the magnetic refrigeration.*

The prototype magnetic material available for room temperature magnetic refrigeration is the lanthanide metal gadolinium (Gd). At the Curie temperature of 294 K, Gd undergoes a second-order paramagnetic - ferromagnetic phase transition. The Table 3.1 shows the values observed during research on Gd.

Table 3.1. Observations on Gd

ΔT_{ad}	ΔH
6	2
12	5
16	7.5
20	10

MAGNETIC REFRIGERATION CYCLE

Magnetic refrigerator completes cooling/ refrigeration by magnetic material through magnetic refrigeration cycle. In general a magnetic refrigeration cycle consists of magnetization and demagnetization in which heat is expelled and absorbed respectively, and two other benign middle processes. The basic cycles for magnetic refrigeration are magnetic Carnot cycle, magnetic Stirling cycle, magnetic Ericsson cycle and magnetic Brayton cycle, among which the magnetic Ericsson and Brayton cycles are applicable for room temperature magnetic refrigeration for the Ericsson and Brayton cycles employ a regenerator to achieve a large temperature span and are easy to operate[13]. Fig. 3.1 shows the Brayton cycle, which is employed in our research.

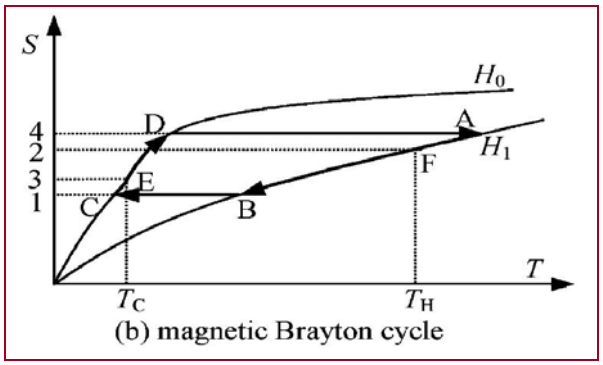

Figure 3.1. Magnetic Brayton Cycle

MAGNETIC BRAYTON CYCLE

Magnetic Brayton cycle consists of two adiabatic processes and two isofield processes as shown in Fig. 3.1. The magnetic refrigerant cycles between the magnetic field of H_0 and H_1, and the temperature of high and low temperature heat source T_H and T_C, respectively. During the isofield cooling process A-B (constant magnetic field of H_1), magnetic refrigerant expels heat of the area of AB14 as Fig. 3.1 indicates. During the isofield heating process C-D (constant magnetic field H_0), magnetic refrigerant absorbs heat of the area of DC14. No heat flows from and out of the magnetic refrigerant during the adiabatic magnetization process D-A and the adiabatic demagnetization B-C process. The Brayton cycle can exhibit optimal performance as well with magnetic refrigerants having parallel T–S curves.

FORM AND DESIGN OF MAGNETIC FIELD

There are two modes to apply magnetic field on magnetic refrigerant:
(a) both magnetic refrigerant and magnet are static. Pulsed magnetic field or alternate on-off magnetic field is applied. There is no driving device and the power consumption may be great;
(b) there is relative movement between magnet and magnetic refrigerant. The movement fashion may be reciprocating or rotary. In this way, the strength of magnetic field is stable whereas the extra mechanical power is needed due to the great magnetic attractive force. This method is made use in our research by making the magneto-caloric material to sweep into the magnetic field through the rotation of the material, which is later explained in the design sub-section.

Because the MCE is induced by magnetic field, the magnetic field strength plays a key role in the magnetic refrigeration. The specific MCE rate change at $T \sim T_C$ is ~ 3 K/T at lower fields and ~ 2.2 K/T at a higher 5 T field. It is still a difficulty to apply a high field.
The magnetic field has a serious influence on the magneto-caloric effect of the magnetic material. The adiabatic temperature change ΔTad is approximately proportional to the magnetic field $H^{2/3}$. Moreover, the field experienced by magnetic refrigerant is influenced by its temperature to some extent.

DESIGN OF MULTIPLE DISC TYPE ROTARY MAGNETIC REFRIGERATION SYSTEM - PROPOSED DESIGN

Principle: rotary magnetic refrigeration
Magnet: permanent magnet (sintered NdFeB)
Magnetic field intensity: 1.5 T
Magneto caloric Materials: Gadolinium (99 percent pure)
Number of stages: 1
Design cooling power: 50 W

CONSTRUCTION

The setup consists of a single stage containing a cylindrical chamber made of insulated material which houses the MCM discs. The chamber is split into two halves along the diameter by an insulated wall. Cooling takes place in one chamber and heating occurs simultaneously in the other chamber due to MCE. The working fluid flows over the surface of the MCM discs ensuring effective heat transfer. The constructional features of the discs are shown clearly in the figures 4.2.1, 4.2.2 and 4.2.3 for better understanding.

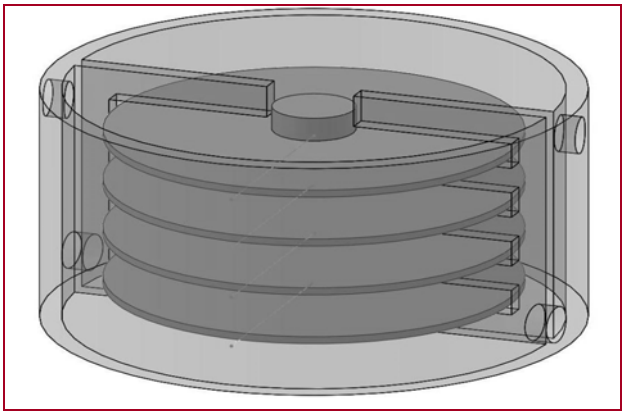

Figure 4.2.1. Complete assembly of the chamber

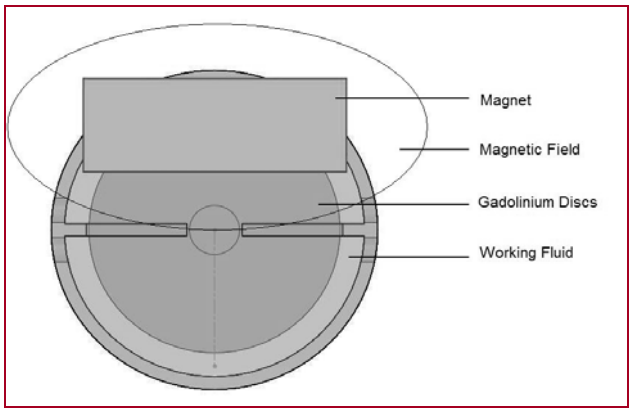

Figure 4.2.2. Chamber under magnetic field

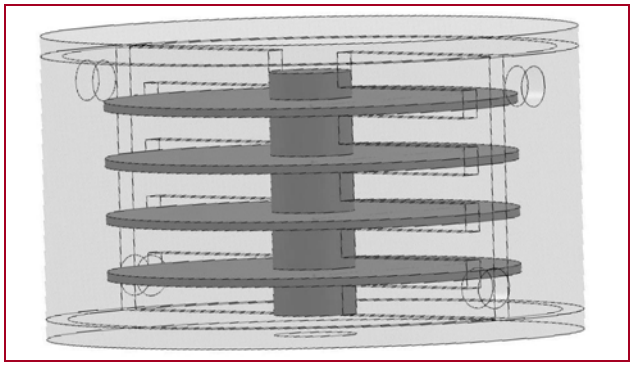

Figure 4.2.3. Entire assembly

SIMULATION USING COMPUTATIONAL FLUID DYNAMICS

The main aim of the research is to study the influence of rotating speed of the magneto-caloric material embedded discs on the magneto-caloric effect produced in the system. This objective is verified with the previously discussed design using the computational fluid dynamics software called STAR CCM plus. The system was modeled using STAR DESIGN software and the analysis was done using STAR CCM plus. At CD-adapco, the developer of STAR CCM plus, it is believed that CFD should be used where it is most effective: right at the start of the design process. In the past, CFD has struggled to keep pace with the rapidly evolving CAD data that is a feature of the earliest stages of design.
STAR-CCM+ and STAR-CD simulations can be setup, run and post-processed from within popular CAD and PLM environments such as SolidWorks, CATIA V5, Pro/ENGINEER and NX. No other approach will get you from CAD model to an accurate CFD solution more quickly or more reliably. CFD results are linked directly to the CAD geometry (a process called associativity). After any modification in the CAD model the simulation results can be updated almost instantly by clicking the "update solution" button, allowing the rapid and thorough investigation of the design space. Hence this software is used as a tool of Computational Fluid Dynamics, in order to get accurate and reliable results, when compared to the other available software in this platform. The following section will brief upon the design methodology and simulation techniques used in order to obtain the results. The figure 5.1 shows the model after getting imported into the Star CCM plus window.

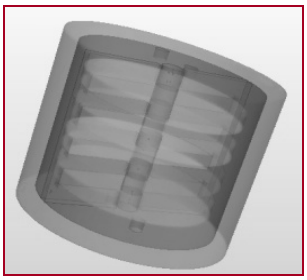

Figure 5.1. system after importing in STAR CCM plus

Design specifications:

- *Disc diameter: 70 mm*
- *Disc thickness: 7 mm*
- *Number of discs: 4*
- *Gap between discs: 7 mm*
- *Disc material: Gadolinium*
- *Working fluid: water*

Boundary conditions used for flow simulation:

- *Inlet velocity: 0.014 m/s*
- *Outlet flow split ratio: 1*
- *Internal energy generation rate of hot disc: 481125 W/cu. m*
- *Internal energy absorption rate of cold disc: 481125 W/cu. m*
- *Inlet temperature of working fluid: 298 K*
- *All other elements namely shaft, chamber and separator walls are assumed to obey adiabatic conditions.*
- *Each region was assigned to a separate physical model.*
- *The discs and shaft were assigned as moving reference frame model with a particular value of rotational speed and other elements were assigned as stationary.*
- *The simulation was iterated till the residuals reached their minimum values.*

Material properties:

- *Gadolinium:*
- *Density: 7900 kg/cu. m*
- *Specific heat capacity at constant pressure: 260 kJ/kg K*
- *Thermal conductivity: 10.6 W/m/K*

RESULTS AND DISCUSSIONS

The simulation results reveal that the maximum possible temperature span that can be obtained with this set up has an evident impact caused by the change in the rotational speed of the system, under the ideal conditions. Here, the system is considered to be homogeneous and steady state values are preferred for iterations. But, in real system there will be losses in enthalpy which will lead to a lower temperature span. The losses can be generally associated with the following aspects:

- *Assumptions used in computational modelling and simulation*
- *Modelling*
- *Adiabatic processes*
- *Perfectly insulated systems*
- *Material homogeneity*
- *Ideal flow conditions*
- *Nature of Magneto-Caloric Material*
- *Fabrication Methodology*
- *Environmental stress*
- *Unaccountable losses.*

The obtained results can be well represented with the help of the following table 6.1 clearly below:

Table 6.1. Observations recorded from Simulation results

Trial number	*Rotational Speed (in rpm)*	*Maximum Temperature (in Kelvin)*	*Minimum Temperature (in Kelvin)*	*Temperature span (in Kelvin)*
1	*0*	*307.60*	*292.93*	*14.67*
2	*5*	*308.31*	*293.26*	*15.05*
3	*10*	*304.33*	*293.19*	*11.14*
4	*20*	*301.70*	*294.59*	*7.11*

It is interesting to note from the above table that the temperature span decreases with increase in the rotational speed of the system, which can be more correctly told as the rotational frequency i.e. number of cycles made by the magneto-caloric material per unit time. This can be due to the fact that, the main factor concerned about the effective and efficient working of the magneto-caloric effect is attributed to the change in entropy of the magneto-caloric material, which forms the back bone of the induction of the temperature gradient within the system. Thus entropy transition is not a suddenly occurring phenomenon, as though illustrated by the theoretical thermodynamics. It is well known that each and every process, whether it comes under chemical, physical, electro-chemical or thermal field, it is associated with irreversibility. This irreversibility plays a major role in influencing the entropy change of any physical material. These irreversibility, in addition also lead to various losses which are unaccountable as well unavoidable in most of the cases, leading to overall efficiency drop of the system. Thus, it is necessary to make the system run effectively under the various working conditions.

The simulation result obtained by considering the system at static condition is given below in the figure 6.1. It shows that the maximum temperature attainable is 307.6 K and the minimum temperature at the cold side is 293.26K, with the temperature span of around 15.05 K.

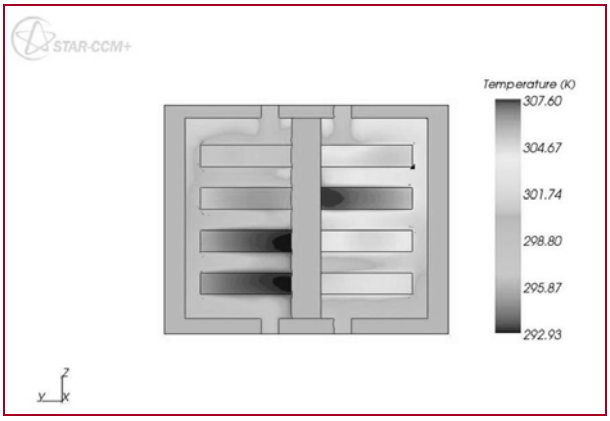

Figure 6.1. Temperature distribution inside the system at stationary condition – planar view

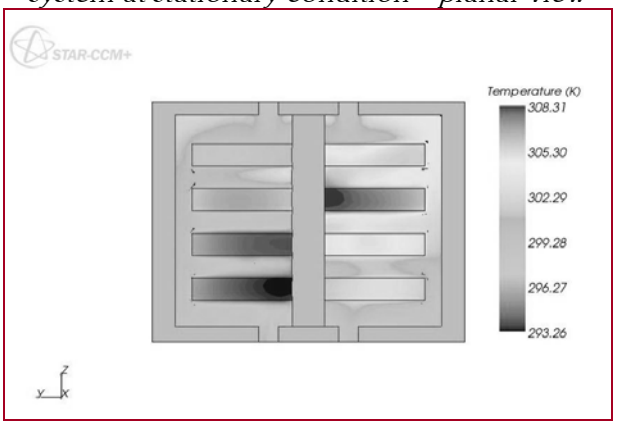

Figure 6.2. Temperature distribution inside the system at 5 rpm – planar view

The simulation result obtained by considering the system running at 5 rpm is given below in the figure 6.2. It shows that the maximum temperature attainable is 308.31 K and the

minimum temperature at the cold side is 293.26 K, with the temperature span of around 14.67 K. The simulation result obtained by considering the system running at 10 rpm is given below in the figure 6.3. It shows that the maximum temperature attainable is 304.33 K and the minimum temperature at the cold side is 293.19 K, with the temperature span of around 7.11 K.

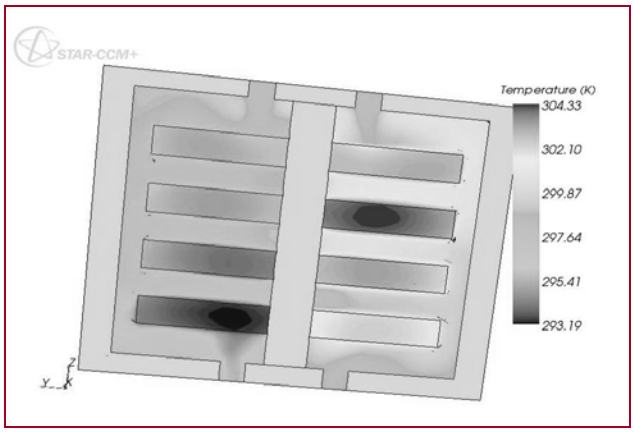

Figure 6.3. Temperature distribution inside the system at 10 rpm – planar view

The simulation result obtained by considering the system running at 20 rpm is given below in the figure 6.4. It shows that the maximum temperature attainable is 301.70 K and the minimum temperature at the cold side is 294.59 K, with the temperature span of around 11.14 K.

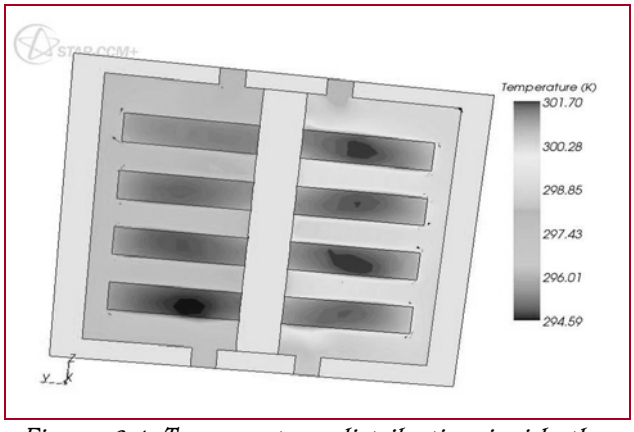

Figure 6.4. Temperature distribution inside the system at 20 rpm – planar view

CONCLUSIONS AND SCOPE FOR FUTURE WORK

The study reveals that for smaller magnetic fields high thermal spans are only possible, if the rotation frequency is low. That is a result of the connection of the rotation frequency and the fluid velocity, given by a criterion to keep the carry-over leakages small. And only small fluid velocities lead to small pressure losses in the porous structures of the rotary wheels. But, if these velocities must be small, also the angular velocity and the frequency must be low. The same conclusion is also suggested by the 2007 year Annual Report issued on 'application of magnetic refrigeration and its assessment' by the University Of Applied Sciences Of Western Switzerland [5]. This is very encouraging phenomenon, which also opens the door for similar researches to be carried out in the near future. Some of their suggestions similar to us are discussed in the following paragraphs.

Thus, we can say that applications with smaller temperature differences are much more favourable. This results from the limited adiabatic temperature difference of the magneto-caloric materials. The result then is that numerous cascading or regeneration stages have to be taken into consideration. These lead to additional heat transfer losses, so that the coefficient of performance is lower.

Furthermore, the restriction of an operation to a domain around the Curie temperature of the magneto-caloric material makes systems with steady operation conditions more favourable.

At higher magnetic fields the dependence on the rotational frequency is smaller. This is because a second loss, the irreversibility between stages, is also important. If the magnetic field strength is high, a lower number of stages must be foreseen, and these irreversibility are lower. And even more, because of fewer stages, fewer rotors in series occur, and also the pressure drop loss is smaller. That explains why high fields are very interesting for the magnetic/magneto-caloric machine design. Even though, the system is having a lot of advantages, the main drawback lies behind the fact that the cost of available magneto caloric materials are at peak and the permanent magnets suffer from yielding sufficient change in magnetic entropy of the material. Hence, in future lot of works should be carried out in finding out different magneto caloric materials and successful permanent magnets. We also propose to study machines with superconducting magnets with large cooling powers. The economy of such systems will be determined by the installation costs of superconducting magnets. A further study of all these aspects will lead to more information.

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MANUFACTURING AUTOMATION FOR HANDLING ASYMMETRIC COMPONENTS

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

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

INTRODUCTION

Automation is generally employed in the field of material handling and orienting in a manufacturing environment. An accepted definition of materials handling is the art and science of moving, positioning, packing and storing substances in any form. The material handling devices are normally designed around standard production machinery and integrated with specially made feeders. Such feeders replace human effort by supplying the material-to-be-worked at the work station. Machinery designers undertake the design of special elements based on the material-to-be-handled, range available in the market, affordability etc. Asymmetric components in the form of circular/cylindrical sectors are few areas unchartered. In the present work, brake liner, a typical asymmetric component has been considered and a feeding system is developed to feed and orient them. With our manufacturing sectors requiring large volume of such a product, automation based processes become essential. In the field of research, automation is not new and there has been substantial amount of literature published in this area. However, the published work is mostly limited to cylindrical and regular prismatic components. The sector shaped parts like brake liners, half bearings have more number of stable poses, which makes the processes of feeding and orienting, complex. Hence, a specialized feeding system has to be designed. Boothroyd [1] has done seminal work on characterizing industrial part feeders. An excellent introduction to mechanical parts feeders can be found in Boothroyd's book .With Poli and Murch[2], he developed taxonomy of

industrial parts and feeders for orienting such small industrial parts.Goldberg and Gordon smith [3] discussed a class of mechanical filters that can be described by removing polygonal sections from the track of the feeder; they refer to this class of filters as traps, which eliminate or reorient the parts until they reach the final preffered orientation. These traps do not employ any sensor based devices. Robert-Paul Berretty et al [4]has discussed about design of traps for vibratory bowl feeders . B.K.A.Ngoi et al [5] has analyzed the natural resting aspects of parts in vibratory bowl feeders using 'Drop Test'. The works of Dina R. Berkowitz et al [6] concentrated on a tool based on dynamic simulation for Markov model building of part feeders. This Markov model was used to evaluate the performance of the feeder. Edmondson et al [7] has developed a flexible parts feeding system using flex feeders, pattern matching sensors and PLC. Wee et al [8] developed a flexible belt parts feeder to separate cylindrical parts. Patrick S.K. Chua et al [9] developed an active feeder for handling cylindrical parts having grooves at one end. Omno C Goemans et al [10] discussed about blades for feeding 3D parts on vibratory tracks. He had considered L-type and T-type components for his experiments. In the present paper, an attempt is made to design a simple inexpensive trap to make the asymmetric component (brake liner) fall in the preffered orientation on a moving conveyor without the aid of robots and sensors. The conventional manufacturing of brakeliners segment parts involve the following processes as shown in Table.1 The granules are mixed with chemicals and are preformed into a brakeliner sheet. The brakeliner sheet is cut into samll brakeliner pieces in a slitting machine. The brakeliners are then sent for internal grinding, external grinding, chamfering and final inspection.

Table.1 Manufacturing of brake liners

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

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

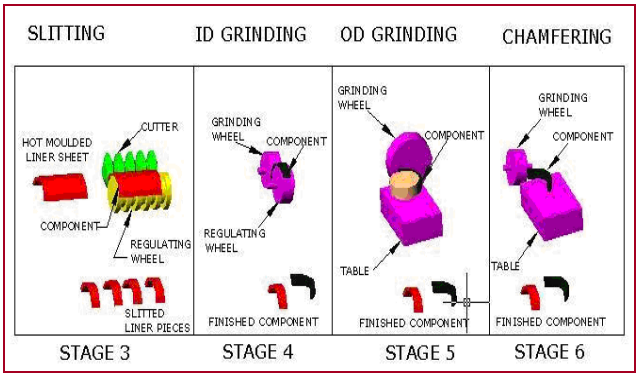


Figure.1 Machining stages of brake liners

OBJECTIVES & METHODOLOGY

The following objectives are addressed to fulfill the above requirements:

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

The methodology of the work is listed below:

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

NATURAL RESTING ORIENTATION OF THE BRAKE LINER

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

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

Out of the eight orientations, the neighbouring orientations are clubbed into same family and are named as orientations 'a', 'b' and 'c' as shown in Figure.4. The orientations 1,2 3 and 4

which rest on the sector shaped sides are grouped as orientation 'a'. The orientations 6 and 8 which have their open side facing towards sky are grouped as orientation 'b'. The orientations 5 and 7 which have their open side facing towards ground are grouped as orientation 'c'. The orientations a, b and c were considered only for drop tests and for design of traps, orientations 1 to 8 were considered.

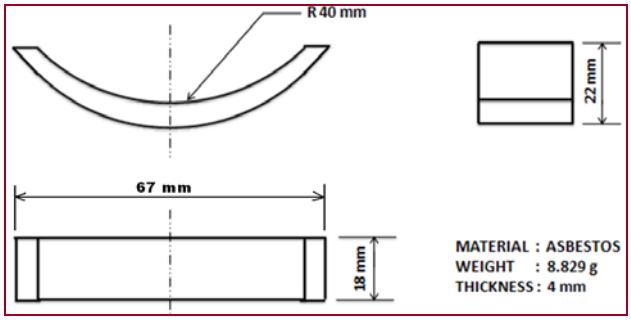


Figure.2 Brake Liner

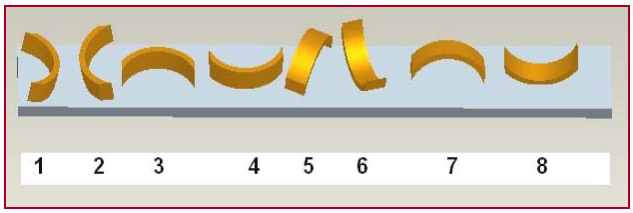


Figure.3 Resting orientations of brakeliner

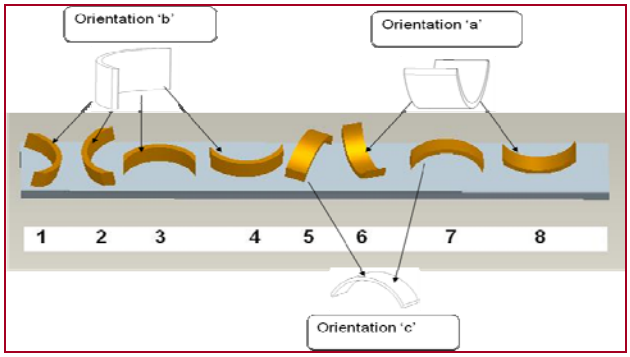


Figure. 4 Clubbing of orientations of brakeliner

DROP TEST

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

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

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

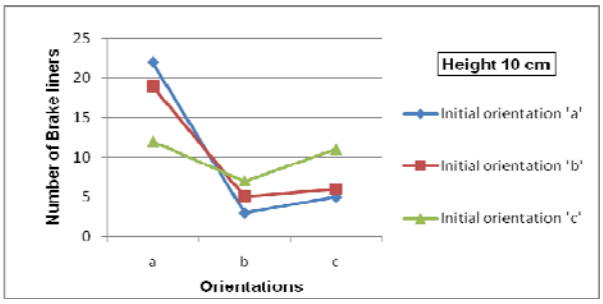


Figure.5(a) Effect of initial orientation when dropped from 10 cm height

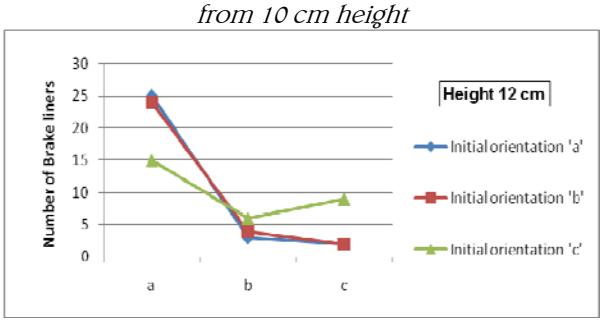


Figure.5(b) Effect of initial orientation when dropped from 12 cm height

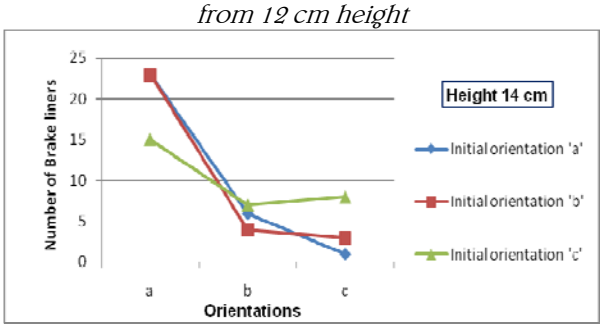


Figure.5(c) Effect of initial orientation when dropped from 14 cm height

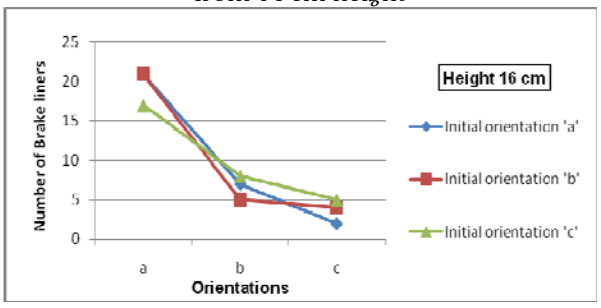


Figure.5(d) Effect of initial orientation when dropped from 16 cm height

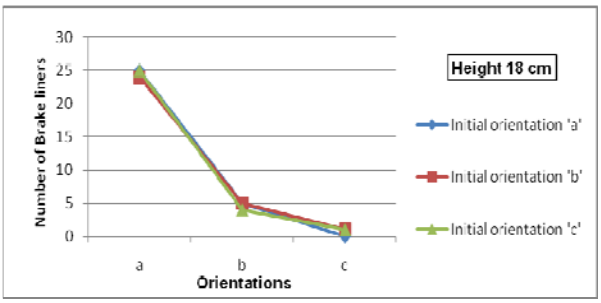


Figure.5(e) Effect of initial orientation when dropped from 18 cm height

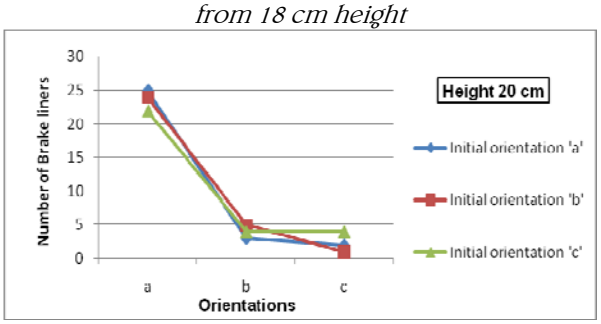


Figure.5(f) Effect of initial orientation when dropped from 20 cm height

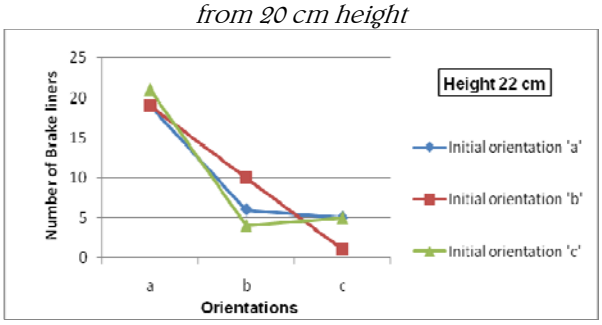


Figure.5(g) Effect of initial orientation when dropped from 22 cm height

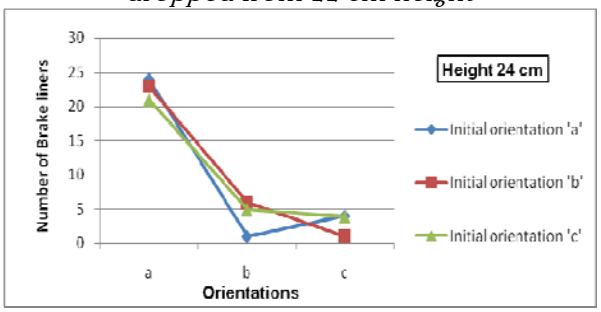


Figure.5(h) Effect of initial orientation when dropped from 24 cm height

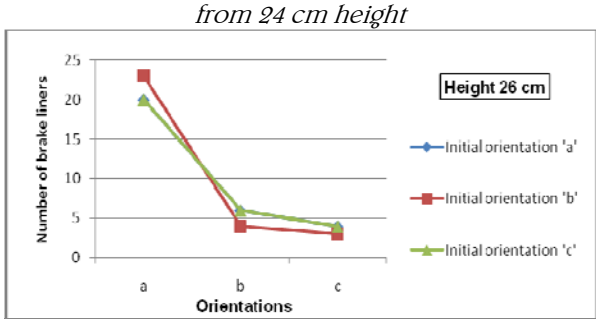


Figure.5(i) Effect of initial orientation when dropped from 26 cm height

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

DESIGN CONSIDERATION FOR TRAPS

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

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

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

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

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

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

Gap. *A gap is an interruption of the supporting area that spans the entire width of the track. Both of its boundaries are perpendicular to the vertical surface of trap. The shape of a gap can*

thus be characterized solely by the distance between these two parallel boundaries. This distance is referred as the gap length.

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

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

DESIGN OF TRAP I

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

Markov model for Trap I

Markov model was used to compute the probability that a part in a particular initial orientation will end up in the preferred final orientation. The probability for each pre- and post-orientation, that the gate will convert, was computed. Once Markov model for each gate was obtained, the gate models were chained together to get a model for the entire feeder.

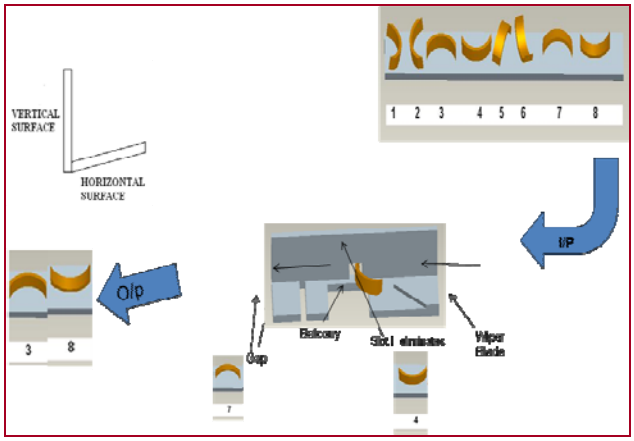
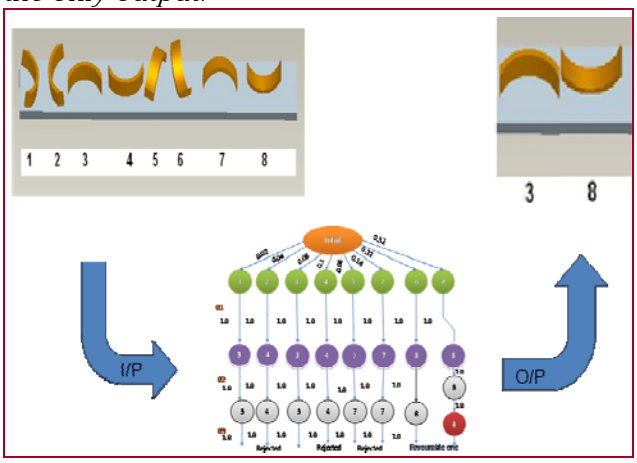


Figure.6 Model of Trap I

Orientations 3 and 8 were the output of the trap I as shown in Figure.6. From Markov model as shown in Figure.7, the efficiency of the trap I was estimated as 54%. Also, it can be seen that the preferred orientation 8 came out with the undesired orientation 3. It has to be eliminated or reoriented to get preferred orientation 8 as the only output.



Probability for Preffered orientation = 0.54

Figure.7 Markov model for Trap I

DESIGN OF TRAP II

The need for trap II was to reject or reorient the orientation 3, without disturbing the preferred orientation 8. An edge riser, an active tool with a guiding block was used to exactly reorient the part in orientation 3 into orientation 8 and allow only orientation 8 without any disturbance, as shown in Figure.8. The guiding block guide the part in orientation 3 to send it to the next gate, edge riser . The part in orientation 8 was unaffected by the edge riser. As the part moves over the edge riser, change of momentum takes place. Because of this change of momentum the part is decelerated. At a particular height, the centre of mass of the part falls out of the projected area of the part, and hence the parts topple and get converted to orientation 8.

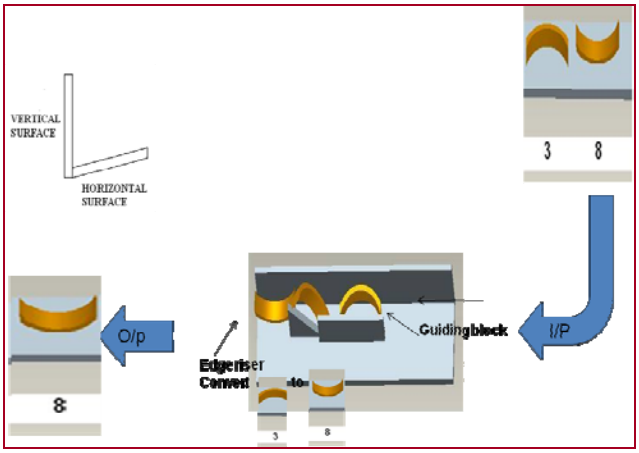
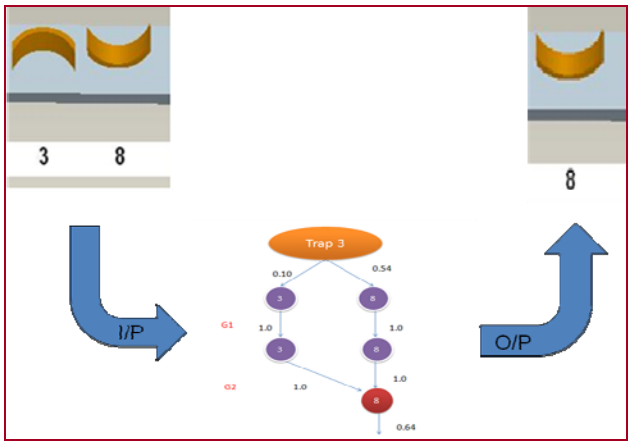


Figure.8 Model of Trap II

Markov model for Trap II

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



Probability for Preffered orientation = 0.64
Figure.9 Markov model for Trap II

DESIGN OF TRAP III

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

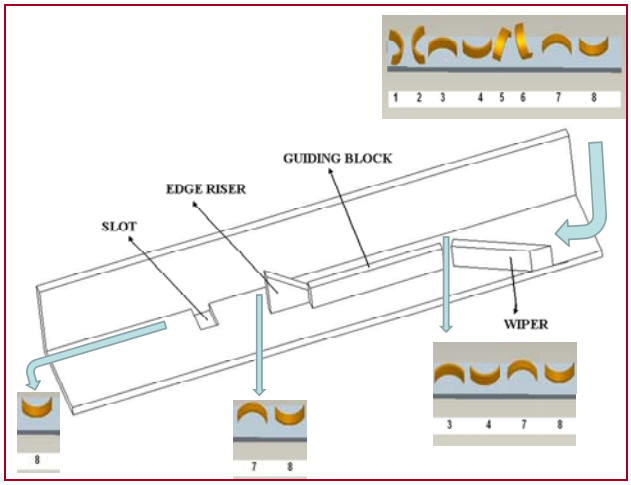


Figure.10 Model of Trap III

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

DETERMINING THE CRITICAL DIMENSIONS OF THE TRAP AND FABRICATION OF TRAP

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

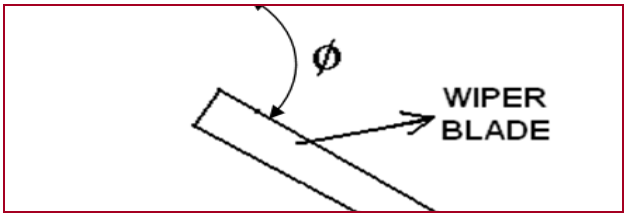


Figure.11 Wiper blade angle

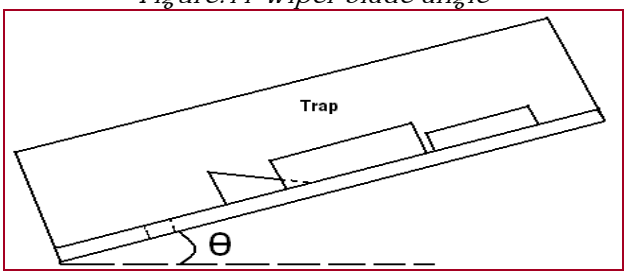


Figure.12 Trap inclination angle

Determining the orientation of wiper blade

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

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

- *A sample size of 30 parts was taken.*
- *The wiper blade angle was fixed to particular angle (Ø).*
- *Parts were dropped at random orientations at the entry of the wiper blade.*
- *The number of parts that have successfully exited the wiper blade with or without*

reorientation was noted.

- Steps 1 to 5 were repeated 5 times (5 trials) so that the results are reliable.
- Steps 1 to 6 were repeated by varying the wiper blade angle (Ø) from 20° to 40°.

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

Determining the trap inclination angle

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

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

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

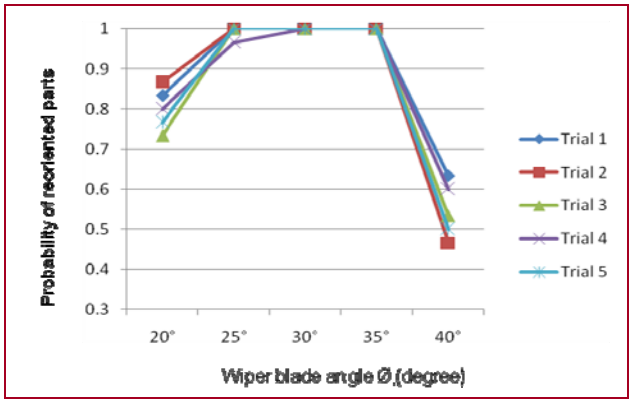


Figure.13 Effect of wiper blade angle on successful orientation of parts

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

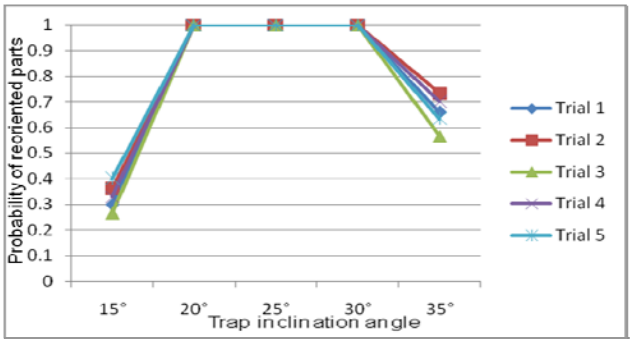


Figure.14 Effect of Trap inclination angle on successful orientation of parts

Fabrication of trap

The trap was fabricated (Figure.15) using acrylic plastic. Acrylic plastic was chosen as it has a fairly low coefficient of friction when compared to other materials, ease of fabrication, low cost and bulk availability. The above discussed experiments were repeated using the acrylic plastic trap and the appropriate wiper blade angle range was found to be between 25° to 35°. Similarly, the appropriate trap inclination angle was found to be between 9^0 and 11^0.

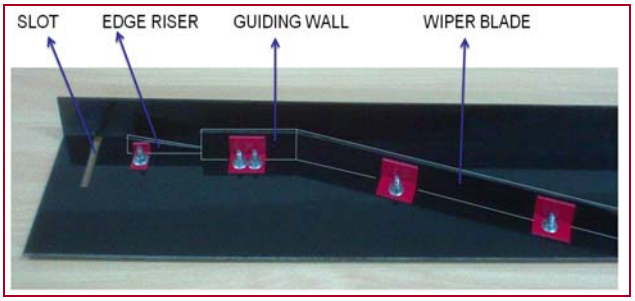


Figure.15 Fabricated trap

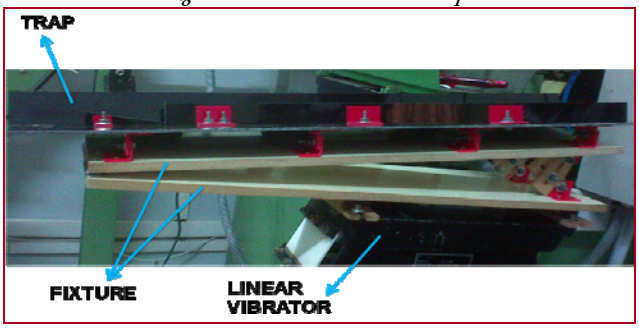


Figure.16 Experimental set-up

OPTIMISATION OF PARAMETERS FOR MAXIMUM CONVEYING VELOCITY

The frequency, amplitude of vibration and the trap inclination angle play a critical role in determining the conveying velocity of the trap assembly. ANOVA (Analysis of Variance) technique was adapted to find the effect of these three factors on conveying velocity of the trap. Figure.16 shows the experimental set-up, i.e. trap

mounted on a linear vibratory feeder. Levels are the limits within which the factors can vary during the experiment. The level was chosen as three. The outcome of these (Factors and Levels) combinations gave 27 experiments (Levels ^{Factors} = 3^3 = 27). Table.2 shows the factors and levels chosen.

Table.2 Chosen factors and levels

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

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

Table.3 Full Factorial array

Factors / No.	Vibration amplitude, a (% of input voltage)	Excitation frequency, f (Hz)	Trap angle, Θ (theta)	Response (average velocity, x 10^{-2} m/s)
1	A_1	F_1	T_1	2.30
2	A_1	F_1	T_2	3.28
3	A_1	F_1	T_3	4.95
4	A_1	F_2	T_1	3.14
5	A_1	F_2	T_2	3.97
6	A_1	F_2	T_3	5.98
7	A_1	F_3	T_1	4.19
8	A_1	F_3	T_2	4.82
9	A_1	F_3	T_3	6.87
10	A_2	F_1	T_1	2.68
11	A_2	F_1	T_2	3.47
12	A_2	F_1	T_3	5.41
13	A_2	F_2	T_1	3.39
14	A_2	F_2	T_2	4.43
15	A_2	F_2	T_3	6.34
16	A_2	F_3	T_1	4.33
17	A_2	F_3	T_2	5.05
18	A_2	F_3	T_3	7.18
19	A_3	F_1	T_1	3.20
20	A_3	F_1	T_2	3.74
21	A_3	F_1	T_3	6.17
22	A_3	F_2	T_1	3.79
23	A_3	F_2	T_2	4.78
24	A_3	F_2	T_3	7.10
25	A_3	F_3	T_1	4.33
26	A_3	F_3	T_2	5.73
27	A_3	F_3	T_3	7.86

Legend: $_{1,2}$ and $_3$ → Levels.

Full factorial array

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

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

Regression Analysis

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

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

$$\text{with } R^2 = 95.2\ \%$$

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

Table.4 Comparison of regression results with experimental results

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

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

ANOVA

From the results of ANOVA, it was observed that for variation in the response, amplitude has contributed upto 5.11%, frequency has contributed upto 22.29% and trap inclination angle has contributed upto 71.58%. This shows that they had statistical significance on the conveying velocity obtained, especially the trap inclination angle. It is also seen that the error associated to the ANOVA for conveying velocity is approximately 1.02%.

CONCLUSION

The salient conclusions of the work are listed below:

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

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ACTA TECHNICA CORVINIENSIS
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[1.] PŘEMYSL MATOUŠEK

ELEVATOR WITH THE POSSIBILTY OF CONTROL BY MOBILE PHONE

Abstract:
The electro - pneumatic model with the possibility of being controlled by a mobile phone was designed and constructed on the Department of Applied Cybernetics by the diplomats Přemysl Matoušek and Tomáš Kvapil. This electro - pneumatic model serves for education of the students of this department, it enables the students to practice STL language, programming of microprocessors and it also helps to acquaint the students with pneumatic components and also with sensors in practice. The module for remote control of PLC by means of SMSs was projected for the application of electro - pneumatic elevator, but it can be also used in practice to control or signal the state of technological process or the machine.

Keywords:
mobile phone, electro - pneumatic model, electro - pneumatic elevator

INTRODUCTION

The model of electro - pneumatic elevator is a laboratory model of elevator that combines the pneumatic and electronic components. This model can be controlled manually by the buttons or by a mobile phone by means of SMSs. The central operating unit consists of a PLC that controls the air flow rate into central non - piston unit, which carries the cabin of the elevator, and into eight valves controlling the floor doors. The buttons that are attached to the PLC serve for calling the cabin into appropriate floor. An SMS card, also attached to the PLC, enables the communication not only with the PLC, but also with the mobile phone. This SMS card receives the commands from the PLC and sends them in short SMSs to the receiver. The card also receives the SMSs from the mobile phone, transforms them and then sends the commands that were sent by SMS, to the PLC. Consecutively, the PLC switches proper pneumatic units in such way, so that the required position of the cabin could be reached.

Figure 1: Project of elevator model construction

Figure 2: Final construction of elevator model

CONSTRUCTION

The project of the construction was designed in CAD software VariCAD. The frame of the model was made of aluminous profiles, whereas the basic proportions come from the chosen non - piston unit fasten to the bottom and the top part of the frame. The front side is separated into four floors by the aluminous profiles that carry the door pistons. Highs carrying the elevator door are fastening to the right side of the frame. The door is filled with blue plexiglass, the rest sides are properly modified and made from black boards of polymer.

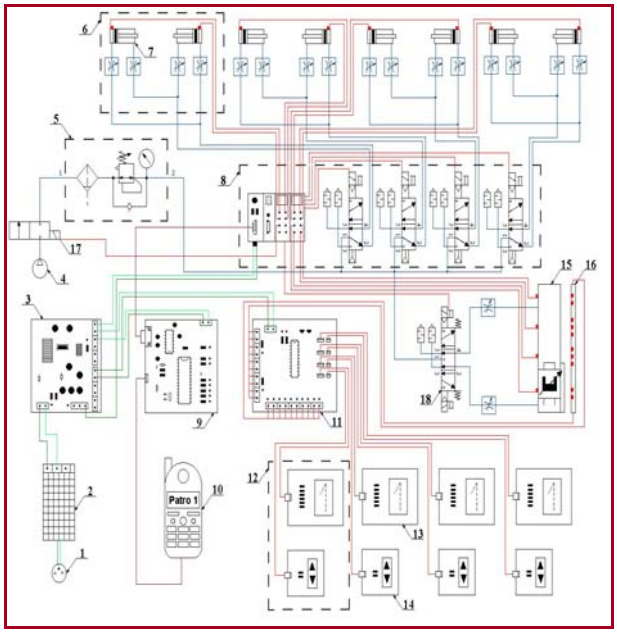

Figure 3: Scheme of controlling the elevator model (Legend: red – electrical signals, blue – pneumatic signals brown – RS - 232, green – power supply)

The elevator cage is welded from stainless metal plates and directly attached to the non - piston unit. An arm with a magnet, also fixed to the cage, is placed. There in order to control the motion of the elevator cage. The printed circuits (SMS card, supply card, operating display card), distributor plinth and the mobile phone are attached to the back side of the frame.

CONTROLLING OF THE PNEUMATIC COMPONENTS

The regulation of the air piped from the compressor 4 (Figure 3) ensures the regulation set. This set is composed of an transforming valve and an electrically controlled throttle - valve that is joined on air filter, 17 (Figure 3). This regulation set is placed in the bottom part of the frame together with the PLC. Another part of the PLC is the valve terminal 8 (Figure 3) .This valve terminals is made of four two - way valves, where each of them controlls the motion of the two pistons carrying the floor door of the elevator mode 6 (Figure3, Figure 4). Motion of these eight door pistons 7 (Figure 3) and the central non - piston unit 15 (Figure 3) is scanned by the reed contacts attached to the PLC. A three - way valve 18 (Figure 3), also fixed to the PLC, serves for the control of the central non - piston unit motion.

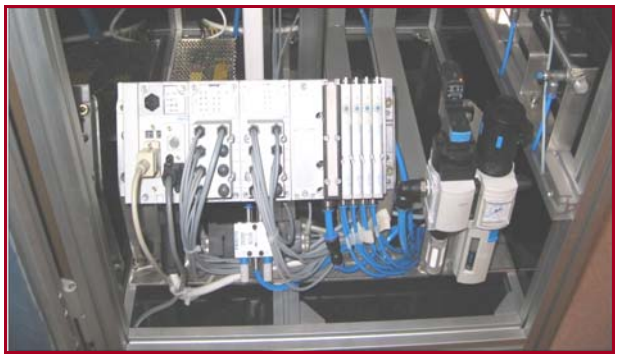

Figure 4: Central controlling complement of the model

Figure 5: Fixation of door pistons

The valve terminal is programmed by the program in STL (language) and communicates with the series line RS - 232 and SMS card. The motion of the elevator can also be controlled manually by means of the buttons placed in each floor of the model. Structure of controlling of the pneumatic components is represented in Figure 5.

THE POWER SUPPLY OF ELEVATOR MODEL

In the model it is necessary to feed the PLC, integrated circuits, displays etc. whereas the supply voltage of PLC is 24V and of the integrated circuits 5V. From this reason, the power supply of the model is ensured by the switch - mode supply 2 (Figure 3) and to its input the line voltage is brought 1 (Figure 3).

Figure 6: Realization of power supply of the elevator

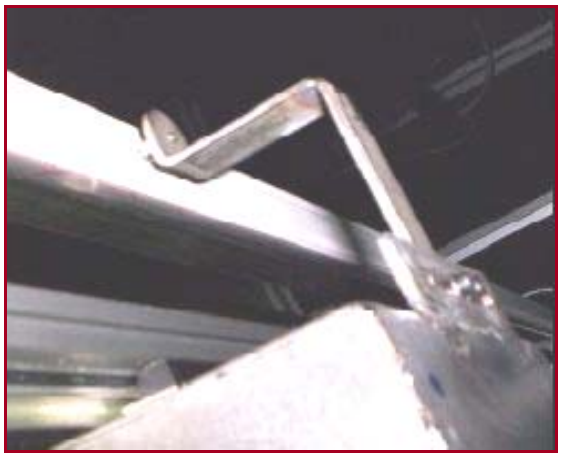

Figure 7: Scanning of the position of elevator cabin with means of a magnet moving along the sensor plinth

An output voltage of this supply is 24V and the supply is fixed to the bottom plastic board of the model. The output voltage is conducted to the input of the supply card 3 (Figure 3) that distributes the 24V voltage, protects PLC against high currents and also stabilizes the led voltage to 5V. The PLC is connected to the supply card. The supply card contains different components, where the most important part is a switched stabilizer LM2576 that implements the fore mentioned voltage stabilization.

CONTROL OF SIGNALIZATION

Position of the elevator cabin is scanned by reed contacts that are a part of sensor - plinth 16 (Figure 3) fixed to the frame behind the central non - piston unit. The plinth is connected to the operating display card 11 (Figure3). This card processes the signals coming from the reed contacts and on the basis of results the operating display card controls the seven - segment displays 13 (Figure 3) and display representing the direction of elevator cabin motion 14 (Figure 3). Each of this display is a part of printed circuits board together with components that ensure their correct operation and this circuit is connected to the operating display card. The couple of displays (seven - segment display and a display representing the direction of cabin motion) are placed in each floor 11 (Figure 3). The reed contacts are switched by a magnet that is attached to the elevator cabin.

A sensor plinth is mainly composed of reed contacts, LEDs and is attached to the operating display card. The reed contacts in the sensor plinth are placed in such a way, so that the position where the cabin stops can be scanned and it is also possible to detect the direction of the motion. If the cabin starts to move in one of the two directions, it is immediately after going on from the stop position, switches the reed contact that is placed above the stop position. This operation causes that the signal to the operating display card is led. The card evaluates the signal and switches an appropriate display arrow. The sensors placed in the stop position are used for displaying the floor numbers, where the cabin stops. Switching of one of the contacts is also signalized by the LED.

Processing of the signals led from the sensor plinth is done by the operating display card. The main unit of this card is made of AVR ATmega8

microprocessor by ATMEL Company. The card is further filled with components that ensure the connection of reed contacts from the plinth, their voltage transformation, and with components for connecting the cards with the floor display and an arrow displays that are placed in each floor of the model. The microprocessor ATmega8 is programmed by the control algorithm written in language C.

Figure 8: Connection of particular floors

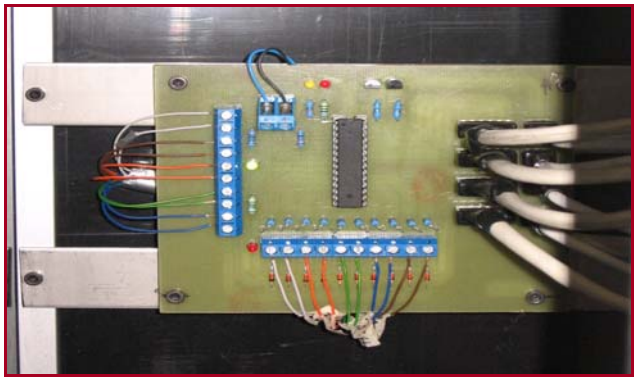

Figure 9: Control display card

CONTROLLING THE ELEVATOR BY MEANS OF MOBILE PHONE

The electro - pneumatic model is controlled by means of SMSs through the SMS card 9 (Figure 3) to which the PLC and the mobile phone Siemens C35i are connected 10 (Figure 3). Both of these two devices are connected to the SMS card by the series link RS – 232. Their communication is done through a non-synchronous way. The basic components of the SMS card are the microprocessor ATmega 162 by the ATMEL Company, the components for voltage values transformation and components that signal the operation of SMS card.

SMS card communicates with the mobile phone by means of AT commands. In the case, that a new SMS with a valid command was received by the mobile phone, a AT command is sent by SMS card to the mobile phone. On the basis of this command the phone sends back a PDU datagram. This PDU datagram consists of many information, for example the telephone number of the receiver, the telephone number of the sender, the date of receiving the SMSs, etc. The most important part of the datagram is a coded text. This text must be decoded in a seven - bit way. If the decoded text contains a valid command, it is sent to the PLC that switches appropriate valves so that the required position of the elevator cabin is achieved. In the opposite case, if the cabin reaches required position, the PLC generates the command and then sends it to the SMS card. The SMS card encodes the received command in a seven - bit way and a new made PDU datagram is sent to the mobile phone. During this actions the receiver gets the SMS in which is informed about the reaching of the required position of the cabin. The SMS card pursues also several other actions, for example erasing the SMSs according to the need of the mobile phone, dialing the phone numbers, ending the phone calls, etc. The controlling algorithm is also written in C language.

***Figure 9:** The placement of the SMS card with the attached mobile phone in the model of the elevator.*

THE PROBLEMS

The main problem of this model is the inaccuracy in positioning the elevator cabin, that always over or under passes the required

floor. This problem is caused by the compressibility of the air and mainly by the passive resistances. In the model there are reed constants that scan reaching the floor.

Figure 10: *The placement of the SMS card with the attached mobile phone in the model of the elevator*

Figure 11: *A view into the interior of the final of solution of the model*

In each floor there is one reed contact that signals reaching the floor. If the magnet, that is a part of the elevator cabin, switches the reed contact on, the air supply is switched off and the cabin is deflected from the floor (both during the motion up and down) owing to the compressibility and the passive resistances. This phenomenon cannot be eliminated for example, by back-pressure braking hence it has to be solved by means of self-adapting control, because this system is non-linear. This is the reason why I am dealing with the project of an adaptive LQ controller. This adaptive LQ controller should solve the problems with the positioning and it also should be transmittable for various pneumatic operating mechanisms. This adaptive controller is developed on the system prototype with the use of real time system (PXI 1042Q) and LabView software by NI.

RESULT

The electro - pneumatic model of the elevator was made for an educational purpose and during its construction many theoretic knowledge from various fields were applied. The pneumatic components that are used in the model are by Festo S.R.O. Company that, by its support, enabled the realization of this project. The other components of the model are made in laboratories of the Department of Applied Cybernetics TUL inclusive of the desks of the printed circuits. More detailed information about the procedure of the construction is available on the websites of the department, www.kky.tul.cz/elevator.

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ACTA TECHNICA CORVINIENSIS
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[1.] AGATA RADVANSKA

THE ENVIRONMENTAL IMPACTS OF INLAND WATER TRANSPORT AND POSSIBILITIES OF OIL SPILLS CLEANING

Abstract:
The inland water transport is of great importance in European economy. It is necessary to implement wide safety rules to achieve also environmental friendly kind of transportation – mainly occupational safety, fire protective and environmental measures, to avoid oil and oil-based products leakage into the water environment. If still, accident occurs, immediate action has to be done, to minimize the negative impacts of the oil spill on the environment.
Even all the safety measures are taken and implemented; the risk of accident is still present. Therefore, prompt action has to be taken to reduce negative environmental impacts, using the oil barriers, oil absorbers, chemical agents, oil collectors and other devices.

Keywords:
inland waterways, accident, oil barriers, oil absorbers

INTRODUCTION

Inland navigation can contribute to making transport more sustainable, particularly where it substitutes for road transport, but inland shipping and especially the development of waterways for navigation can have considerable environmental impacts. [1], [8]
Waterways for inland navigation can have significant impacts on the ecological value and water quality of water bodies. Water pollution or damage caused by the inland vessels, dredging pose a threat to aquatic environment. Another significant threat to the environment is caused by operational discharges of mineral oil and lubricants, as well as organic substances (mainly PAHs) due to shipping operations. [7]
The nature and extent of the impacts depends on the vessel types and on the characteristics of the water body itself. The kinds of mitigation techniques that can be employed can also differ markedly, for example between sections of river with rocky bed and banks, and reaches with sandy or muddy bottoms situated in flood plains. In some cases new works for navigation can be designed to improve water quality or biodiversity and create valuable habitats. [2], [10] Altering the shape of river courses to improve navigation affects bottom and bank characteristics and the dynamics of sediment transportation. Effects can spread up- and downstream over many years. Without careful attention, alterations can interfere with communication between the main channel, side branches and backwaters. Permanent changes to water levels and flows affect the whole river valley bottom and notably the ecology of floodplains. This can affect the habitats and biodiversity. [10], [4], [5] The greatest attention in the paper is paid to the oil spills and oily-based liquid spills into the water environment and possibilities of negative effects mitigation.

CHARACTERISTICS OF OIL-BASED PRODUCTS

Proper classification and characterization of crude oils and oily products in a release situation is one of the most important and earliest response tasks that must be undertaken. Hazards to personnel and biotopes depend highly on the chemical and physical properties of these substances Non-petroleum-based oils also pose a potential threat to human health and the environment. Crude oils contain hundreds of different hydrocarbons, and other organic and inorganic substances including atoms of sulfur, nitrogen and oxygen, and metals such as iron, vanadium, nickel, and chromium. [20]

The distribution of oil spilled on the water surface occurs under the influence of gravitation forces. It is controlled by oil viscosity and the surface tension of water. Only ten minutes after a spill of 1 ton of oil, the oil can disperse over a radius of 50 m, forming a slick 10-mm thick. The slick gets thinner (less than 1 mm) as oil continues to spread, covering an area of up to 12 km^2 [6]. During the first several days after the spill, a considerable part of oil transforms into the gaseous phase. Besides volatile components, the slick rapidly loses water-soluble hydrocarbons. The rest - the more viscous fractions - slow down the slick spreading. [21]

Upon release, the hydrocarbons that are composed of fewer carbon and hydrogen atoms vaporize, leaving behind a heavier, less volatile fraction. Gasolines are comprised of relatively high proportions of toxic and volatile hydrocarbons, such as benzene, which is known to cause cancer in humans, and hexane, which can affect the nervous system. Gasoline and kerosene releases are exceptionally hazardous due to their high flammability. Crude oils and semi-refined products, such as diesel and bunkering oils, may contain cancer-causing polycyclic aromatic hydrocarbons and other toxic substances. [20], [3]

CRISIS MANAGEMENT AND PREPAREDNESS FOR OIL RELEASE

Oil release and spills occur despite efforts to prevent them. It is necessary to prepare a timely and coordinated response to the emergency of undefined magnitude, place, time, and other circumstances. The crisis management for emergency with oil release requires significant planning and personnel training. Well-designed facility, local, area, regional, and national contingency plans assist response personnel in their efforts to contain and clean up any size spill by providing information that the response teams will need before, during, and after an oil spill occurs. Training ensures that emergency responders know how to act with minimum impact to the environment. [14] [3]

TECHNIQUES AND EQUIPMENT FOR CLEANING OIL AND OIL BASED SPILLS

A number of advanced response mechanisms are available for controlling oil spills and minimizing their impacts on human health and the environment. The key to effectively combating spills is careful selection and proper use of the equipment and materials most suited to the type of oil and the conditions at the spill site. Damage to spill-contaminated waters and dangers to other threatened areas can be reduced by timely and proper use of containment and recovery equipment. [3], [15]

Primary line of defense against oil spills is the mechanical containment or recovery. Containment and recovery equipment includes a variety of booms, barriers, and skimmers, as well as natural and synthetic sorbent materials, that are used to capture and store the spilled oil until it can be disposed of properly. [15], [5]

Skimmers are the devices for recovering spilled oil from the water's surface. The efficiency of skimmers depends highly upon waterway conditions. In moderately rough or choppy water, skimmers tend to recover more water than oil. Various types of skimmers (e.g. weir, oleophilic and suction) (Fig. 1, 2) are in use, and each type offers advantages and drawbacks depending on the type of oil being cleaned up, the weather conditions during cleanup efforts, and the presence of ice or debris in the water. [16]

Weir skimmers use a dam or enclosure positioned at the oil-to-water interface. Oil floating on top of the water will spill over the dam and be trapped in a well inside, bringing with it as little water as possible. The trapped oil and water mixture can then be pumped out through a pipe or hose to a storage tank (Fig. 3) for recycling or disposal. These skimmers are

prone to becoming jammed and clogged by floating debris.

FIGURE 1. Mini skimmer [17]

FIGURE 2. Multiskimmer [18]

FIGURE 3. Floating tank for collected oils [13]

Oleophilic skimmers use belts, disks, or continuous mop chains of oleophilic materials to blot the oil from the water surface. The oil is then squeezed out or scraped off into a recovery tank. Oleophilic skimmers have the advantage of flexibility, allowing them to be used effectively on spills of any thickness. Some types, such as the chain or "rope-mop" skimmer, work well on water that is choked with debris or rough ice.

Suction skimmers operate similarly to a household vacuum cleaner. Oil is sucked up through wide floating heads and pumped into storage tanks. Although suction skimmers are generally very efficient, they are vulnerable to becoming clogged by debris and require constant skilled observation. Suction skimmers operate best on smooth water, where oil has collected against a boom or barrier. [16]

Sorbents can be used to recover oil through the mechanisms of absorption, adsorption, or both. Absorbents allow oil to penetrate into pore spaces in the material they are made of, while adsorbents attract oil to their surfaces but do not allow it to penetrate into the material. [4], [5]

Sorbents need to be both oleophilic and hydrophobic. Although they may be used as the sole cleanup method in small spills, sorbents are most often used to remove final traces of oil, or in areas that cannot be reached by skimmers. Sorbents must be removed from the water and properly disposed or cleaned for re-use. Any oil that is removed from sorbent materials must also be properly disposed or recycled.

Sorbents can be natural organic (peat moss, straw, hay, sawdust, ground corncobs, feathers, and other readily available carbon-based products), natural inorganic (clay, perlite, vermiculite, glass wool, sand, or volcanic ash), and synthetic (polyurethane, polyethylene, and nylon fibers). Organic sorbents can soak up between 3 and 15 times their weight in oil, but they do present some disadvantages. Some organic sorbents tend to soak up water as well as oil, causing them to sink. Many organic sorbents are loose particles such as sawdust, and are difficult to collect after they are spread on the water. Adding flotation devices, such as empty drums attached to sorbent bales of hay, can help to overcome the sinking problem, and wrapping loose particles in mesh will aid in collection. [4], [19]

Natural inorganic sorbents can absorb from 4 to 20 times their weight in oil. Most synthetic sorbents can absorb as much as 70 times their weight in oil, and some types can be cleaned and re-used several times. Synthetic sorbents that cannot be cleaned after they are used can present difficulties because arrangements must be made for their temporary storage prior to disposal.

The characteristics of both sorbents and oil types must be considered when choosing sorbents for cleaning up spills:

- *Rate of absorption - The rate of absorption varies with the thickness of the oil. Light oils are soaked up more quickly than heavy ones.*
- *Oil retention - The weight of recovered oil can cause a sorbent structure to sag and deform, and when it is lifted out of the water, it can release oil that is trapped in its pores. Lighter, less viscous oil is lost through the pores more easily than are heavier, more viscous oils during recovery of absorbent materials.*
- *Ease of application - Sorbents may be applied to spills manually or mechanically, using blowers or fans. Many natural organic sorbents that exist as loose materials, such as clay and vermiculite, are dusty, difficult to apply in windy conditions, and potentially hazardous if inhaled. [19], [5]*

Chemical and biological methods can be used in conjunction with mechanical means for containing and cleaning up oil spills. Dispersants and gelling agents are most useful in helping to keep oil from reaching shorelines and other sensitive habitats. Biological agents have the potential to assist recovery in sensitive areas such as shorelines, marshes, and wetlands. [15]

Dispersing agents (dispersants) are chemicals that contain surfactants, or compounds that act to break liquid substances such as oil into small droplets. In an oil spill, these droplets disperse into the water column where they are subjected to natural processes - such as wind, waves, and currents - that help to break them down further. This helps to clear oil from the water surface, making it less likely that the oil slick will reach the shoreline. Heavy crude oils do not disperse as well as light- to medium-weight oils. Dispersants are most effective when applied immediately following a spill, before the lightest materials in the oil have evaporated. The effectiveness of dispersants is being tested in laboratories and in actual spill situations, and the information collected is being used to help design more effective dispersants. Dispersants used today are much less toxic than those used in the past. [11], [5]

Gelling agents (solidifiers) are chemicals that react with oil to form rubber-like solids. The gelled oil is removed from the water by nets, suction equipment, or skimmers, and is sometimes recovered and reused after being mixed with fuel oil. The drawback of gelling agents use is that the large quantities of the material must often be applied, as much as three times the volume of the spill. [12]

Physical methods are used to clean up shores. Natural processes such as evaporation, oxidation, and biodegradation can start the cleanup process, but are generally too slow to provide adequate environmental recovery. Physical methods, such as wiping with sorbent materials, pressure washing, and raking and bulldozing can be used to assist these natural processes.

Scare tactics are used to protect birds and animals by keeping them away from oil spill areas. Such devices as propane scare-cans, floating dummies, and helium-filled balloons are often used, particularly to keep away birds. [15]

Biological agents are chemicals or organisms that increase the rate at which natural biodegradation occurs. Biodegradation of oil is a natural process that slowly - sometimes over the course of several years - removes oil from the aquatic environment. However, rapid removal of spilled oil from shorelines and wetlands is necessary in order to minimize potential environmental damage to these sensitive habitats. [4], [9]

Bioremediation technologies can help biodegradation processes work faster. Bioremediation refers to the act of adding materials to the environment, such as fertilizers or microorganisms, that will increase the rate at which natural biodegradation occurs.

Fertilization (nutrient enrichment) is the method of adding nutrients such as phosphorus and nitrogen to a contaminated environment to stimulate the growth of the microorganisms capable of biodegradation. Limited supplies of these necessary nutrients in nature usually control the growth of native microorganism populations. When more nutrients are added, the native microorganism population can grow rapidly, potentially increasing the rate of biodegradation. Seeding is the addition of microorganisms to the existing native oil-degrading population. Sometimes species of bacteria that do not naturally exist in an area will be added to the native population. As with fertilization, the purpose of seeding is to increase

the population of microorganisms that can biodegrade the spilled oil. [9]

CONCLUSION

IWT is, in comparison to air and road transport, seen as more environmentally friendly and energy efficient, and can therefore contribute to sustainable socio-economic development of the region. A multimodal use of available transport possibilities (road, rail and IWT) has to be ensured. To achieve highest possible safety and environmental protection in IWT, it is necessary to foster the co-operation between national agencies responsible for water and transport and navigation purposes to ensure integrative policy planning, to monitor the transportation and handling of dangerous goods; and plan, control and manage the emergency preparedness for crisis situations with the consequence of oil spilling into the water, thus minimizing the negative effects of water transport on the river environment.

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WEB SERVICES WITH APPLICATION SERVER ABAP

Abstract:
The Application Server ABAP (AS ABAP) is part of the application layer that belongs to the SAP NetWeaver platform. By using it, we have not only the possibility to create Web Services, but also to easily consume the Web Service created with other technologies. The purpose of the present paper is to present either the way we can create a Web Service by using AS ABAP, or the way we can consume a Web Service in the Web Dynpro ABAP. In this respect, we create a Web Service (inside-out type) that has a Function Module as end point. Then, we use the new SOA Manager application to manage, configure and monitor its definition, we test the created Web Service and we define a proxy and a logical port to consume it in the Web Dynpro ABAP.

Keywords:
Web Service, Application Server ABAP, SAP NetWeaver Platform, Web Dynpro ABAP

INTRODUCTION

The development environment of the Application Server ABAP used to create ABAP–based applications is the ABAP Workbench. This environment offers the possibility to publish, search for and call a Web Service (WS).
Fig. 1 shows the basic architecture of the WS Framework that belongs to the AS ABAP [1].

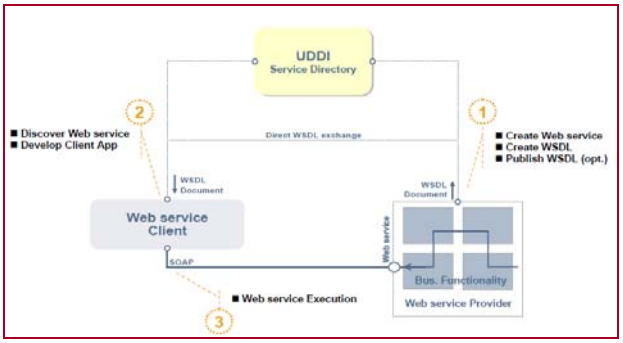

Fig. 1 Basic WS Framework architecture [1]

The WS fundamental technologies are:

- ***SOAP*** *– Simple Object Access Protocol, XML based, extensible protocol that describes how to invoke a Web service;*
- ***UDDI*** *– Universal Description, Discovery and Integration, business registry that can be used to index WSDL documents; so, this is searchable;*
- ***WSDL*** *– Web Service Description Language, special form of XML that contains all the information that a client needs to invoke the WS;*
- ***WS-security*** *– security standard as X.509, Kerberos, Secure Socket Layer Protocol SSL, etc.*

The service provider creates the implementation of the WS and provides the WSDL document. He is responsible for the execution of the functionality provided by the WS.
In ABAP, we can create a service provider for an ESR Service Interface, the so-called „outside-in" provider, or for an existing ABAP object, the so-called „inside-out". A service required can be Enterprise Service Repository, URL/HTTP destination or a local File.
A WS can be used in many situations, from email validation to automation. As an example of using a WS in SAP NetWeaver, we can mention the communication between AS ABAP and

Adobe Document Services (ADS) that run on Java stack, communication that is made via a WS. Fig. 2 schematically shows this communication and the HTTP connection to the External Server [2].

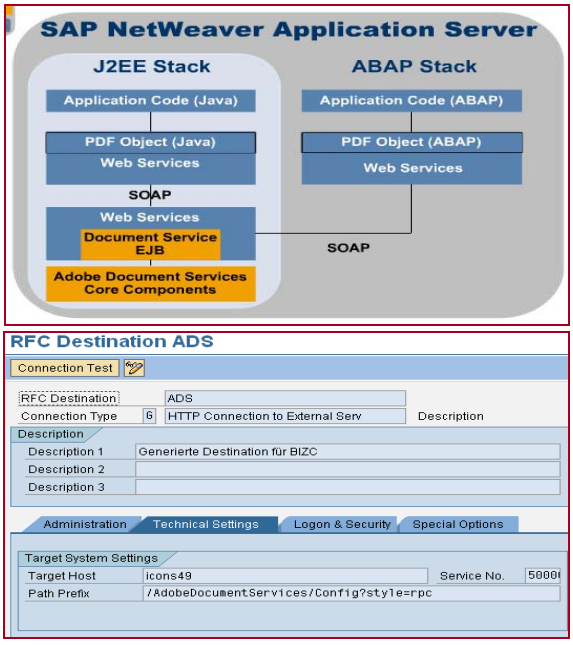

Fig. 2 Web Service example [2]

Some advantages of the WS are presented below [3]:

- *There are defined independently of programming platforms and languages;*
- *The WS definitions are expressed in XML syntax;*
- *They can be developed in any programming language;*
- *They can be published in a common directory based on the UDDI standard;*
- *They can be easily executed over the internet.*

We can store released Web Services in a UDDI registry. For the purpose of this paper, we have used our service provider landscape.
There are many organizations that offer web services for free (for example, the reference [4]). At the reference [5], we can find the web address of the public UDDI service directory that offers SAP.

CREATING AND TESTING A WEB SERVICE

With the ABAP Workbench, we have many options to create a WS. For example, we can use a BAPI, a Function Module, a Function Group or a Message Interface.

We want to provide selection access to a database table. A Function Module implementation will be used as the Web Service end point. After the implementation of the Function Module, we create the Web Service definition with only a few mouse clicks. In this case, we have created an inside-out service provider, because we have started with the existing functionality and interfaces from inside our system and used them as the basis of a new system.
In our case, the WS will require the customer ID and deliver the selected information. Fig. 3 shows the structure of our Function Module and the created Web Service, by using the Service Definition Wizard.

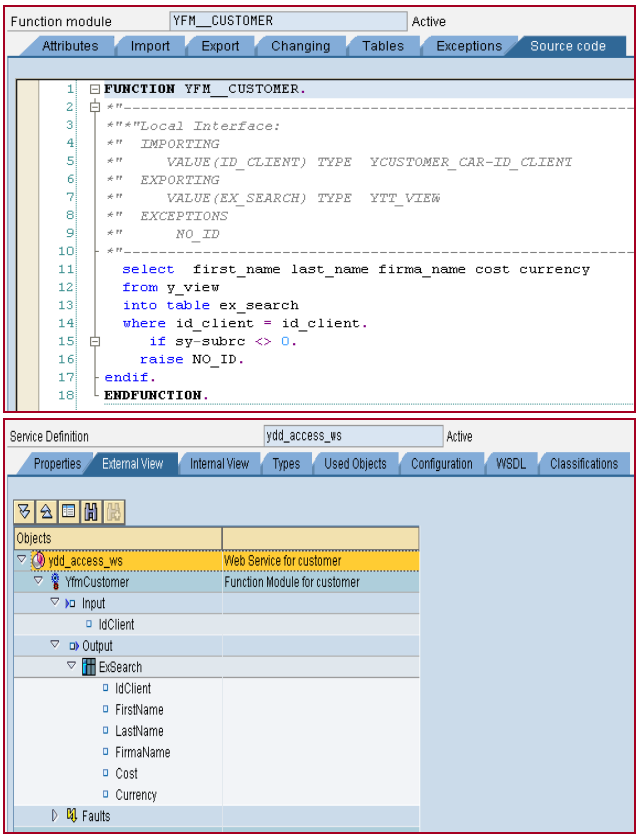

Fig. 3 Function Module and Web Service structure

In the WSDL Tab, we can find the XML representation of the WS definition. Fig. 4 shows the structure of this file.
From the SAP NetWeaver 7.0, the SP14 Web Services in the ABAP development environment are no longer managed with the transactions WSADMIN and WSCONFIG. We can use these transactions only for the old WS. To manage the new WS, we use the transaction SOAMANAGER. This transaction represents a new Web Dynpro

ABAP application that helps us to manage, configure and monitor the service definitions.
The Service-Oriented Architectures (SOA) enables the effective management of an SOA implementation, represents a concept that offers much more than a WS [6]. Fig. 5 shows our WS into the Web Service Administration option from the SOA Manager.

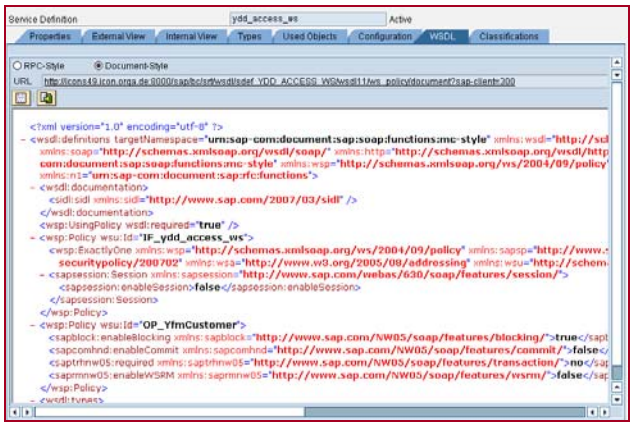

Fig. 4 The WSDL structure

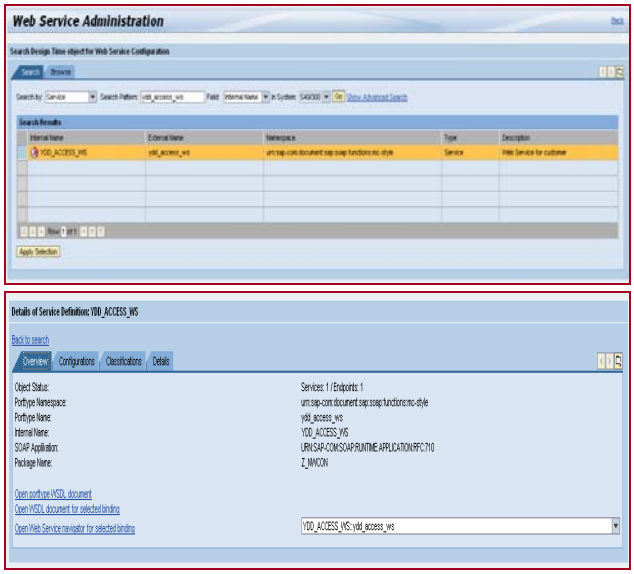

Fig. 5 Web Service administration

To configure a Web service, we must create an end point that contains a runtime configuration. We have created only an end point, but we have the possibility to create more than one if we want to provide the same service with different runtime configurations.
AS NetWeaver offers the possibility to create secure WS; we can speak about security at the transport layer and security at the message layer. Fig. 5 shows the Security Provider specially created for our service.

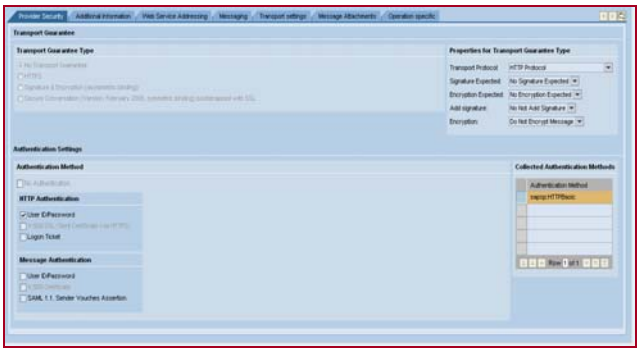

Fig. 5 Security Provider

As we have seen, our transport protocol is the HTTP protocol, authentication through user ID and password. For this kind of protocol, we can choose one of the following security functions [7]:

- *Server-side authentication;*
- *Client-side authentication;*
- *Mutual authentication;*
- *Encryption and integrity.*

Before developing the client application for our WS, we have to test it. With this test, we ensure that it works correctly and can be consumed in the Web Dynpro ABAP without any problems.

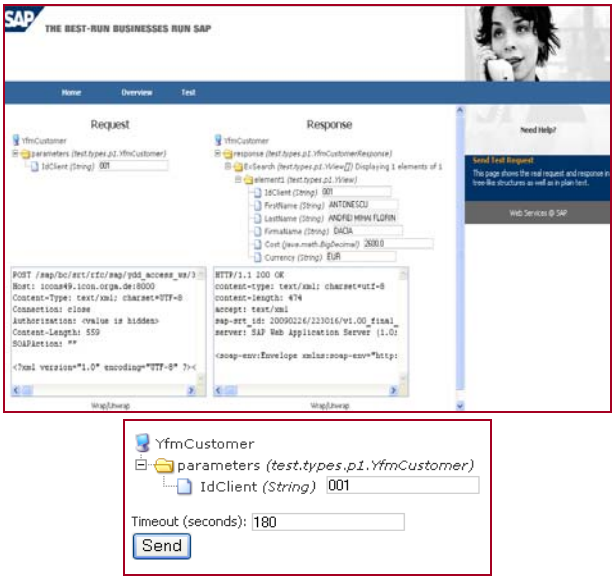

Fig. 6 Testing the WS

To test our WS, we use "Open Web Service navigator for selected binding" from the SOA Manager, after we have set the address of the application server on which the J2EE is running. The Web Service Navigator is open. Then, we enter the user ID and the password, to be able to test it. Fig. 6 shows the way we can see if the WS works correctly. We enter our WS parameter idClient that will be passed as a request to the Application Server. The Web Service Navigator

sends us back the response, including all the records for the searched ID. Another possibility to test our WS is to use the WS navigator via URL http://<host>:<port>/wsnavigator.

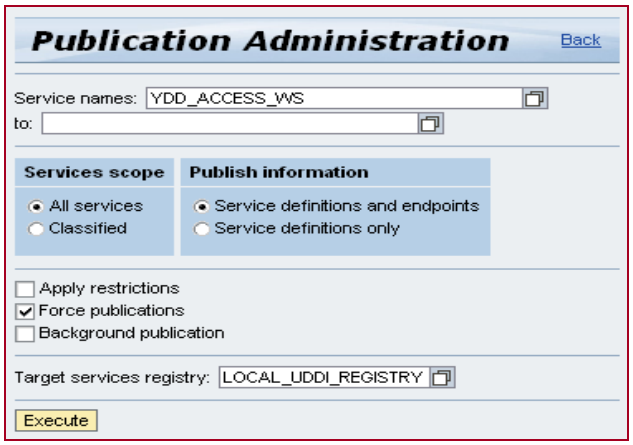

Fig. 7 Publishing the Web Service

The Service Registry is a central Register for the WS. Here, we can publish our WS by using the WSPUBLISH transaction, or the Publication Administration from the SOA Manager (Fig. 7). The Service Registry offers the possibility to search for a WS by using some Categories. To classify a WS, we can use the WSCLASS transaction.

CONSUMING A WEB SERVICE IN THE WEB DYNPRO ABAP

Web Dynpro ABAP is the SAP technology used to create web business applications in accordance with the Model View Controller (MVC) paradigm. According to this paradigm, the application data and their user interface are separated.

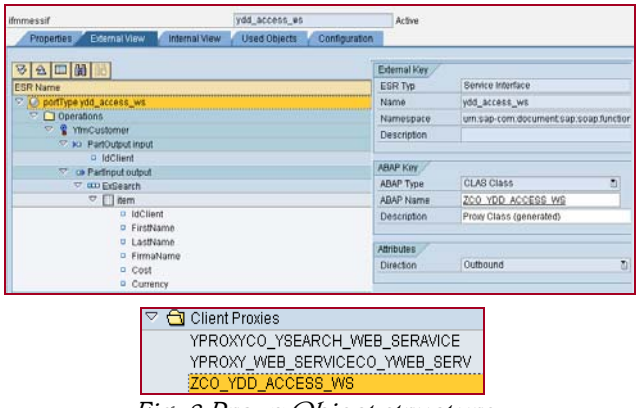

Fig. 8 Proxy Object structure

The Model represents the business logic, the View represents the user interface and the controller has certain responsibilities, as the communication between the model and the view. More details about the Web Dynpro ABAP can be found at the references [8-10].
As we have seen, the WSL document describes our WS. To be able to consume this WS, we have to create a client proxy and a logical port for him. Fig. 8 shows the proxy structure.

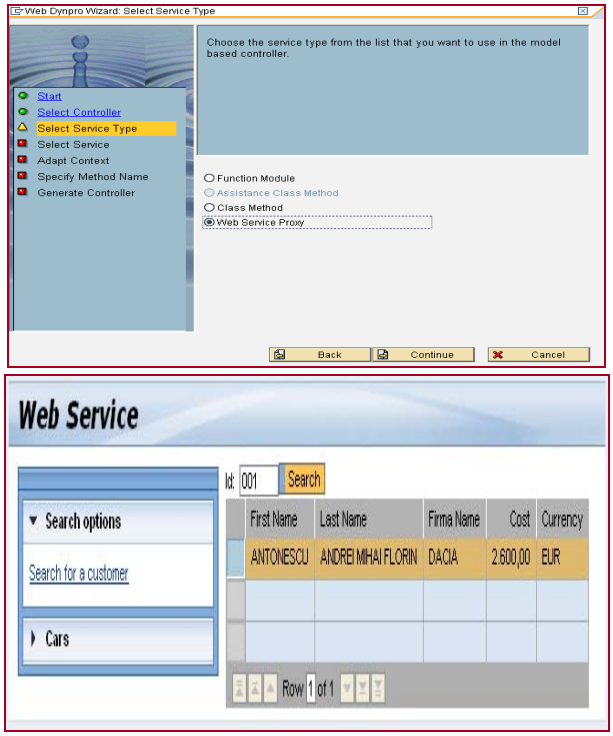

Fig. 9 Consuming the WS Wizard and the User Interface

We consume our defined Web Service as a model in the Web Dynpro. In this way, we are not interested about the way to implement the business logic, but we use only its functionality. Fig. 9 shows the proper User Interface and how we can consume a WS in the Web Dynpro ABAP.

CONCLUSION

WS are modules in service-oriented software architectures; they are executable units that can be called in heterogeneous system landscapes.
In this paper, we have used some of the WS concepts with the Application Server ABAP. Through an example, it has been examined the inside-out approach for generating WS and consuming them by using the Web Dynpro ABAP. In the same time, we have used the Web Service navigator to test our WS. So, we have seen that a WS can be tested without being necessary to have a consuming application.
The new "trend" in SOA is the Enterprise Services, and that's why we have a new

SOAMANAGER transaction that incorporates the functionality of the old WSCONFIG and WSADMIN and adds new capabilities required to integrate a WS in this concept.

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ACTA TECHNICA CORVINIENSIS
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HARDENED STEEL GRINDING REPLACEMENT BY HARD TURNING TECHNOLOGY

Abstract:

This article solves the problem of functional surfaces creation machined without and with coolant after mixed cubical boron nitride application. Workpiece material is tool steel C120U. The hardness value is within HRC = 49÷62. Various cutting speeds at constant feeds and depths of cut are chosen in depending on hardness in turning. The research article studies quality ratios according machined surface integrity is considered:

- *Microgeometry of machined surface,*
- *The changes of physical-mechanic properties in surface layer,*
- *Microstructure of the surface layers,*
- *Physical-chemical condition of surface functionality,*
- *Residual stresses beneath the machined surface,*
- *Tribological characteristics of the surface functionality.*

These ratios creates the influence of fatigue strength assumption against wear, anti corrosion stability, fit quality etc.

Keywords:

Hard turning, cubical boron nitride, grinding, surface integrity, residual stresses beneath the surface, surface microgeometry, microstructure of surface layers, surface functionality, tool wear

INTRODUCTION

The assignment of surface integrity investigation is new theory creation in term of new trends in technological praxis. Its very important to improve surface functionality of machined parts in qualitative aspect. The hard turning replacement is also possible to apply instead of roug and finish grinding. Tard turning technology requires stabile and solid machine tool with minimal allowances in guiding and last but not least techological system Machine Tool – Cutting Tool – Workpiece – Fixture stiffness. It was applied the polycrystalline cubical boron nitride CBN, as cutting material which is advisable to hard turning. Composition of CBN consists of BN (50 ÷ 75%) and ceramics binder. Hard turning technology of hardened parts is very useful, because maching time is really shorter, lower invested costs, lower amount of operating sections and integrated shape. Workpiece geometry is realized for one clamping. Minimal charges for ecology – dry machining.

THE EXPERIMENTAL PROBLEM PURPOSE

The main purpose of this experimental method was considered surface layers aspect of specimen samples made of C120U hardened steel. All samples were manufactured by dry hard turning, grinding and turning with coolant in term of surface integrity. C120U steel is alloyed tool steel with medium capacity of

Carbon. This type of steel was chosen as a compared material, by reason to reach high hardness after hardening (64 HRC) and which is then tempered for 60±2 HRC. C120U achieves good core toughness, worse heat texturization, good machinability and hardening disruption insensibility.

In experimental process were evaluated following aspect of machined surface by hard turning and grinding on specimen samples:

1. *microgeometry of machined surface (Ra, Ry, Rz, Rq), machine SURFTEST SJ-301,*
2. *The change of physical-mechanic surface layer properties (hardness HV0,1 a HV0,2) on LECO machine.*
3. *Surface layer microstructure, at devices OLYMPUS IX70 and NEOPHOT 32,*
4. *Residual stress of I.st. type measurement beneath the surface on HZG 4 apparatus.*
5. *Machined surface wearing on tribological apparatus.*

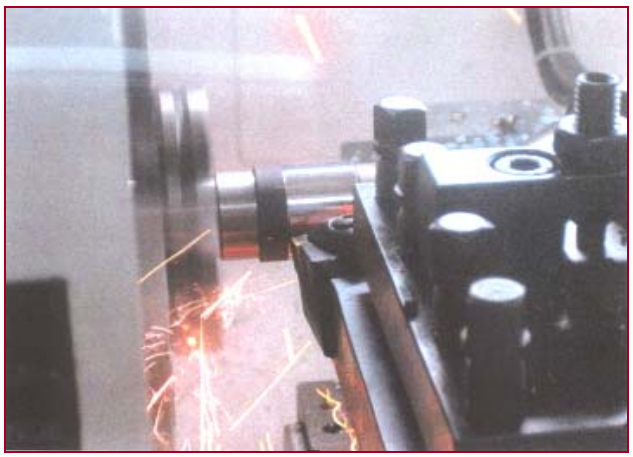

FIG. 1: Hard turning process with CBN insert at HARRISON ALPHA 1400 S machine tool

HARD TURNING AND GRINDING PARAMETERS

Machine tool: *HARRISON ALPHA 1400S,*
Tool holder: *DCLNR 2525 M12 – T – MAX – P (Sandvik COROMANT),*
Cutting tool: *VRP – CNGA 120408 T01020 – cubical boron nitride 7020 (Sandvik COROMANT),*
Clamping: *workholding device in universal chuck, upbear by centre, sample clamping for ø20H8 an to face side by nut and washer,*
Coolant: *emulsion E5% or without coolant (DASCOL 2500)*
Hard turning parameters: *C120U without and with coolant (G) HRC = 60±2*
$n = 1345\ min^{-1}$, $f = 0,15$ mm, $a_p = 0,17$ až $0,2$ mm, $v_c = 120\ m.min^{-1}$

Grinding parameters:
$n_o = 155\ min^{-1}$, $v_o = 0,23\ m.s^{-1}$, $v_k = 30,6\ m.s^{-1}$ $n_k = 1670\ min^{-1}$
$a_{p1} = 0,05$ mm (roughing), $a_{p2} = 0,01$ mm (finishing)
Grinding wheel: *ø350 x 40/127 – A9960K9V, coolant E5% emulsion (EMULZIN-H)*

METALOGRAPHIC EVALUATION

The microsturcture of surface layers evaluation was executed on OLYMPUS IX7 microscope. You can see in all microstructures of dry turned hardened steels thin white layer over the whole surface with 0,002 ÷ 0,003 mm width. See on Fig.2. Under the white surface layer can see influenced area by cutting temperature. Its dark layer of temperable martensite with 0,002 ÷ 0,004 mm width.

The next layer is situated bold martensite with residual austenite and metal carbides. The same white laeyr can see also in hard turned sample with coolant, but on the grinded sample cannot see this, or is very thin and very unstable. It is caused by grinding technology and very high cutting conditions during grinding.

The microstructure of grinded surface shows us the high tempered area. This argument is also confirmed by HV0,2 microhardness measured on C120U steel after grinding.

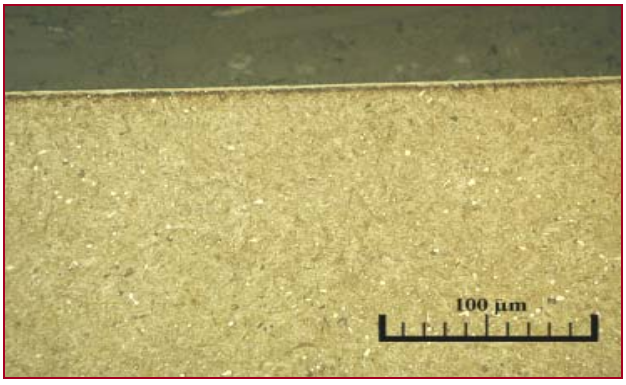

FIG. 2: Microstructure of C120U hardened steel after hard dry turning process – see continuous white layer of residual austenite on sample surface. White layer width is 0,002 ÷ 0,003 mm. Influenced area is situated under white layer (see dark cauterized layer) up until 0,004 mm. (tempering martensite)

TRIBOLOGICAL CHARACTERISTICS MEASUREMENT

The experimental samples made of heat treatment materials hard dry turned, hard turned with coolant and grinded were realized on tribological apparatus. Time duration of one tribological testing was designated to 300 min. Testing tribological arrangement continually evaluated reaction force and temperature in frictional event. We have emanated from friction ratio and driving force from frictional event construction during the calculations. Experiment approved that whereby the part surface is harder, therethrough wear is really slower.

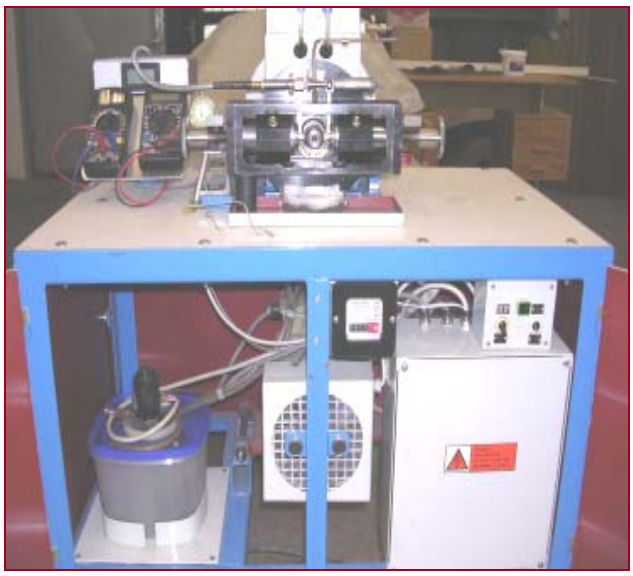

FIG.3: Tribological arrangement for radial wear testing

From individual tribological characteristics of individual hardened steels measurement and from graphs comparison comes the following knowledges:

6. *radial wearing ΔD of measured samples is always the biggest after grinding, because its done by little bigger surface roughness of grinded surfaces and heat influence where occurs to martensitic structure tempering. That is different at hard turned surfaces,*
7. *there is not difference between dry hard turned and hard turned with coolant samples in radial wear,*
8. *There are the biggest friction force and friction ratio at grinded surfaces.*

From experimental measurement results that surface wearing in tribosystems influences microgeometry and material surface average profile or surface influencing during the cutting process. Its stabilization let you say small tempering after hard turning, or big tempering of surface layers after grinding. It is also the surface hardness.

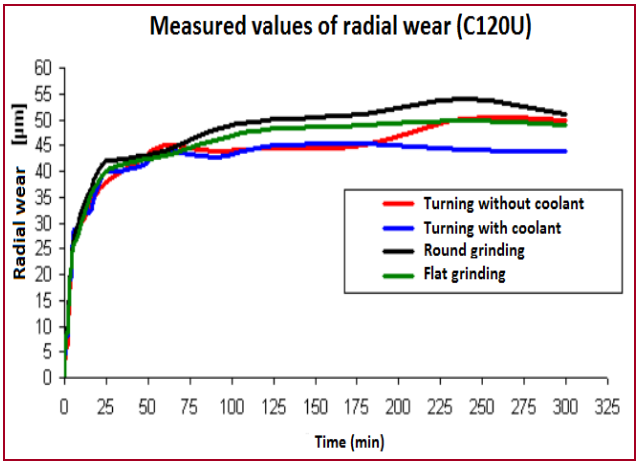

FIG. 4: Measured values of radial wear results

CONCLUSIONS

It was appreciated surface layer aspect of experimental samples made of hardened C120U steel hard turned with CBN and grinded. Experimental measurement were accomplished by microgeometry, microhardness, metalographic evaluation of surface layers and also tribological characteristics. These aspects of surface integrity are very important for surface functionality and operation durability of machined parts. Machined surface, its investigation, evaluation and technological process improvement creates important way to make better quality of production process.

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ACTA TECHNICA CORVINIENSIS
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[1.] ALEXANDER HOŠOVSKÝ

HYBRID ADAPTIVE CONTROLLER FOR HSM60

Abstract:
Most of the servomotors used in practice are controlled by common PI controllers having clear and distinct effects on the controlled plant yet suffering from rather poor robustness in terms of changing parameters of a plant or load variations. The variations in both the plant parameters and the load necessitate adjusting controller gains to meet the performance indices. In this paper, a fuzzy controller with reference model is used for forcing a plant to behave as a first-order reference showing good results even for drastic changes of the plant parameters. The results are compared to a common PI controller with P and I gains tuned according to symmetric optimum criterion. The whole control scheme is implemented in Fuzzy Logic Toolbox under Matlab/Simulink.

Keywords:
adaptive controller, adaptive signal, fuzzy rule table, response, PI controller

INTRODUCTION

HSM60 servomotors are used in applications where superior dynamic properties are of utmost importance. They are suited for sophisticated and fast control tasks with possibility for simple logic control or speed control using variations in magnitude of voltage applied to the armature winding or PWM technique. HSM60 are usually controlled by means of a common PI controller, which can be tuned to achieve satisfactory performance but only for given plant parameters. Despite the fact that a small range of plant parameter variations is manageable even with PI controller, more significant changes of the plant parameters (inertia moment for instance) might cause large deviations from required responses for given inputs. It was shown in [1] that implementing minor acceleration control loop may improve the performance of such control system even under conditions of inertia moment variation. With digital control techniques fully available for servomotor control, it is natural to apply advanced control algorithms, which might improve the responses of a control system under conditions of parameter variation even more.

METHODOLOGY

In order to model the control system for HSM60 servomotor, the model in Fig.1 was used [5], where L_m – winding inductance, R_m – winding resistance, $C\Phi$ - electromagnetic coefficient, J – inertia moment, M_m – motor moment, M_z – load moment. According to the HSM60 manufacturer datasheet the values for these parameters are as follows [6]:
$L_m = 60.10^{-6}$ H, $R_m = 0,42\ \Omega$, $C\Phi = 0,0184$ V.rad^{-1}.s^{-1}, $J_n = 38.10^{-7}$ kg.m^2
This model neglects the effects of stray magnetic flux in excitation winding, mutual influence of particular windings, eddy currents and so on. Nevertheless, it can serve as a buildblock for a comparative study of qualitative aspects of the relevant control methodologies under conditions of inertia moment variation. As was mentioned before, this type of a servomotor is commonly controlled by a conventional PI controller. The aforementioned model was

tested also with this type of controller (the results are depicted in experimental part).

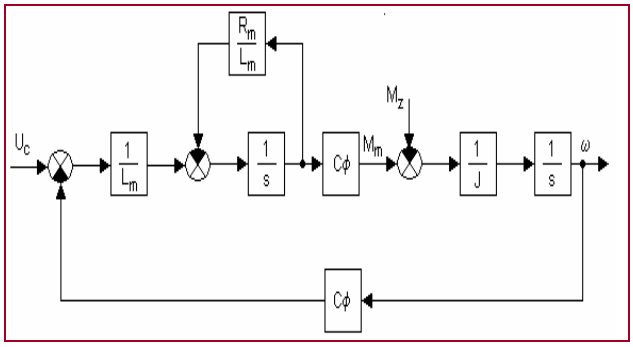

Figure 1. The model of HSM60

The motors of this type traditionally include also current controllers, which try to provide desired value of a motor moment by means of voltage acting upon the armature winding as a response to error between actual and desired value of a current. This controller is usually also of PI type [8]. In this case, the current controller was omitted. It is also supposed that the feedback signal is transferred without any delay (implying unity transfer function between actual speed and signal fed to the subtracting unit). The whole control system could be then represented in the form in Fig.2.

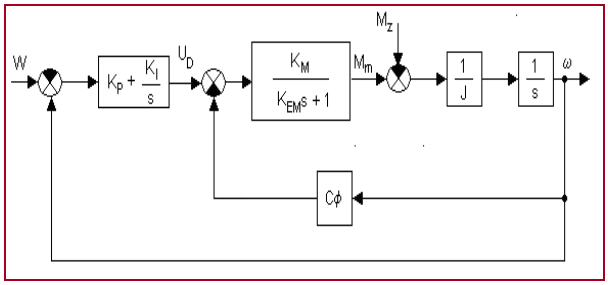

Figure 2. The whole control system of HSM60

The torque actuator is modelled by first-order delay transfer function with $K_M = \frac{C\phi}{R_m}$ *and* $K_{EM} = \frac{L_m}{R_m}$. *The friction of the mechanical subsystem was considered negligible. The overall transfer function is:*

$$G(s) = \frac{\frac{K_P}{K_I}s + 1}{\frac{JK_{EM}}{K_M K_I}s^3 + \frac{J}{K_M K_I}s^2 + \left(\frac{C\phi}{K_I} + \frac{K_P}{K_I}\right)s + 1} \qquad (1)$$

where K_P *and* K_I *are proportional and integral gain. According to the denominator of this transfer function (i.e., the characteristic equation), this system is of the third order. Due to extremely low values of* K_M, K_{EM} *and J (0.0438, 1.42857.10^{-4} and 38.10^{-7} respectively) the absolute values of first two coefficients in characteristic equation are several orders lower than the value of the third coefficient, which implied the possibility of using the first-order reference model. The reference model was thus chosen in the following form:*

$$G_R(s) = \frac{1}{0.025s + 1} \qquad (2)$$

FUZZY CONTROLLER DESIGN

The idea was to use an adaptive control methodology, which would provide the desired response (dictated by the reference model) even under conditions of plant parameter variations. Using the first-order reference model would provide non-oscillatory response for step changes in desired speed. In this case two controllers are actually implemented, one for eliminating the error between the actual and the desired speed while the other one for eliminating error between the response of the reference model and the response of the plant. Since the adaptation controller reacts directly to the difference between the desired and actual response (without first identifying appropriate parameters), this adaptation was indirect.

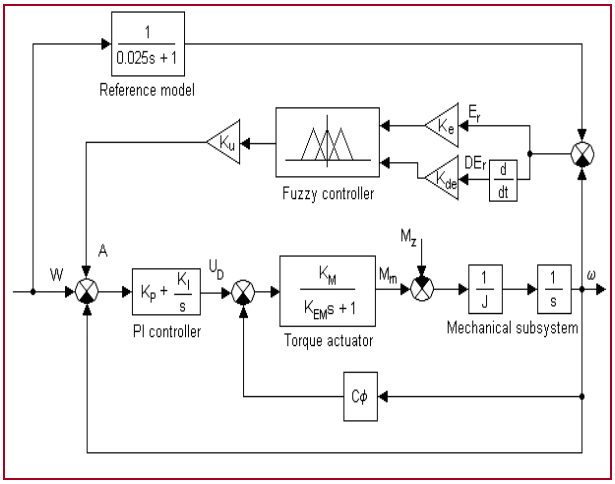

Figure3. Fuzzy signal adaptation with reference model for HSM60

In Fig.3 the schematic diagram for HSM60 control system with fuzzy adaptation is depicted. According to [4], two basic adaptation techniques are possible: parameter adaptation and signal adaptation. There are several factors to consider when choosing between these two as

either of them possesses distinct advantages as well as disadvantages. The signal adaptation is said to be faster yet it might suffer from the higher oscillations. Nevertheless, this technique was selected for experimenting due to its adaptation speed with the assumption that the negative effect (oscillations) might be possibly suppressed by careful tuning of the fuzzy controller scaling gains.

The two input variables for fuzzy controller were the response trajectory error and its derivative and the one output variable was adaptation signal acting at the place of differentiator so that the error between the reference model response and actual plant response would be minimal.

$$A_e^j = \left\{\left(x_1, \mu_{A_e^j}(x_1)\right) : x_1 \in X_e\right\}$$
$$A_{de}^k = \left\{\left(x_2, \mu_{A_{de}^k}(x_2)\right) : x_2 \in X_{de}\right\} \quad (3)$$
$$B_u^l = \left\{\left(y, \mu_{B_u^l}(y)\right) : y \in Y_u\right\}$$

where A_e^j, A_{de}^k *are j-th and k-th fuzzy sets on response trajectory error and its derivative universes* X_e, X_{de} *respectively,* x_1, x_2 *are inputs on these universes (error and derivative) where the crisp values are fuzzified using singletons.* B_u^l *is l-th fuzzy set on adaptation signal universe of discourse* Y_u *with y being crisp output value [7].*

In this case, sum-min aggregation was used that could be written in this form

$$\mu_u(x_1, x_2, y) = \mu_{\cup_{i=1}^r FR^i}(x_1, x_2, y) = \sum \min_{i=1}^r \left[\mu_{R_{jk}}(x_1, x_2), \mu_{B_l}(y)\right] \quad (4)$$

where FR^i *is i-th activated fuzzy rule and* R_{jk} *is a fuzzy relation meaning the combination of p-th and q-th fuzzy sets on reference model response error and its derivative universes and* B_l *is l-th fuzzy set on adaptation signal universe of discourse. As a defuzzification method, COG was used (COA with sum aggregation) so that in case of several fuzzy rules having the same consequent part, those with lower membership value shall not be disregarded in the computed control signal. The output signal is then computed from the following formula [4]*

$$y(x_1, x_2) = \frac{\sum_i y_i \sum_{j=1}^r \mu_{FR^j}(x_1, x_2, y_i)}{\sum_i \sum_{j=1}^r \mu_{FR^j}(x_1, x_2, y_i)} \quad (5)$$

All three variables were normalized to the range <-1,1>. The fuzzy sets were of trapezoid shape as this is considered to make the resulting system more insensitive to a parameter variation [4]. Their distribution was determined based on the trial-and-error experimentation. The distribution of fuzzy sets over respective universes of discourse is depicted in Fig.4. The fuzzy controller was of Mamdani type with symmetric fuzzy rule table.

RESULTS

The P and I gains were set according to the symmetric optimum criterion. This criterion should provide sufficiently fast and well-damped responses by extending the bandwidth. Formulas for calculating optimal gains are given in the following form [8]:

$$K_P^{opt} = \frac{J}{2K_{EM}}; K_I^{opt} = \frac{J}{8K_{EM}^2} \quad (6)$$

The resulting values were $K_P = 0.0133$ *and* $K_I = 23.27$*. Experiments shown that the P gain had to be altered in order to get better damping in case the inertia moment varied and it was set to 0.2. In Fig.5, the responses of conventional PI controller for a step change in desired speed with varying value of J is shown.*

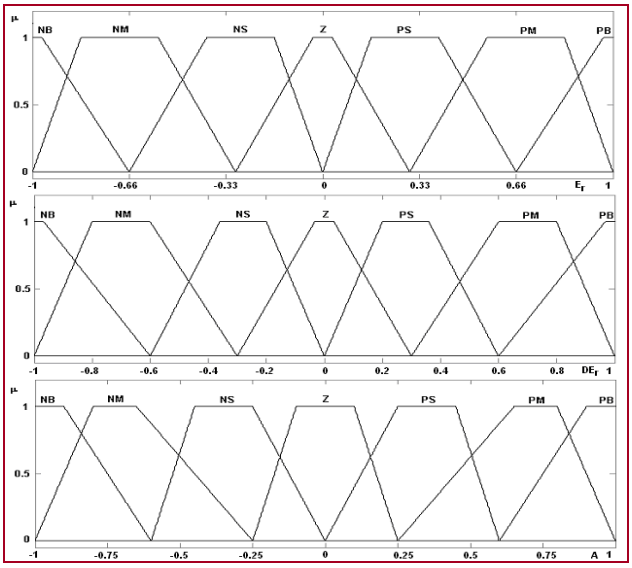

Figure4. Fuzzy membership functions distribution

For $J = 15J_n$ *the overshoot was* $\sigma = 21.3\%$ *while the settling time for 1% error was* $t_r = 0.56s$*. In case of* $J = 45J_n$*, the overshoot was increased to* $\sigma = 38.3\%$ *and the settling time to* $t_r = 1.41s$*. In case of* $J = 75J_n$*, the overshoot was increased to* $\sigma = 46.6\%$ *and the settling time to* $t_r = 2.33s$*. It is evident that the variation of inertia moment had*

a profound effect on the responses of the control system, resulting in strong discrepancies between the desired and actual performance.

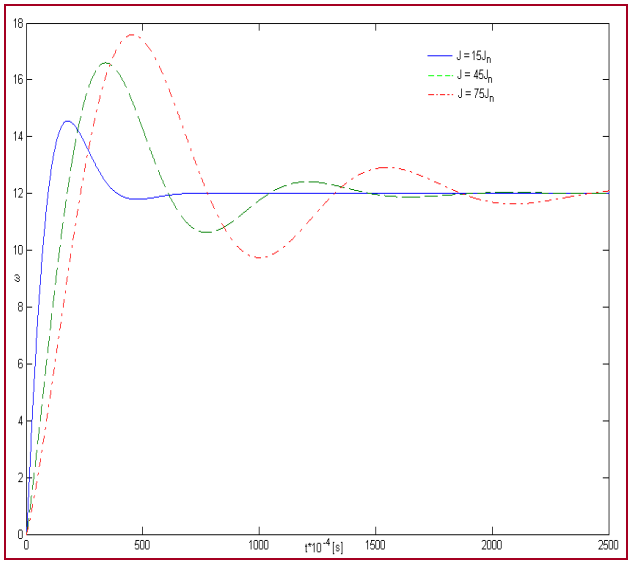

Figure5. Responses of HSM60 with PI controller for three different inertia moment values

In Fig.6, the responses of adaptive control system are depicted. The responses are slower compared to the case with PI controller due to time constant of the reference model (0.025). In all three cases the settling time is around t_r = 1.05s. The response for J = 15J_n is comparable to the response of reference model in its time course with slight lead (0.013 s). In two remaining cases, the more distinct differences can be visible evidently due to a different responsiveness of the plant to the controller efforts (its derivative component) (the maximum value of reference model response error was 0.02 s for J = 45J_n and 0.03 s for J = 75J_n). Changing the adaptation signal scaling gain could alter these responses but not without introducing some oscillations and thus creating the upper bound for its magnitude with given membership function distribution. It is clear from Fig.6 that no overshoot was present in any of the recorded responses.

In Fig.7 the load rejection capabilities of conventional PI controller for HSM60 are depicted. In t_s = 3s, a step change in load moment was applied ranging from 0 Nm to 0.1 Nm. The responses are shown from this particular moment on. In case of J = 15J_n the maximum change of actual speed was 54% and the settling time for achieving 1% error was 0.053s. For J = 45J_n, the maximum change was reduced to 39.9% but the settling time increased to 0.151s. Finally for J = 75J_n the maximum change was decreased again to 33.8% with settling time being 0.207s.

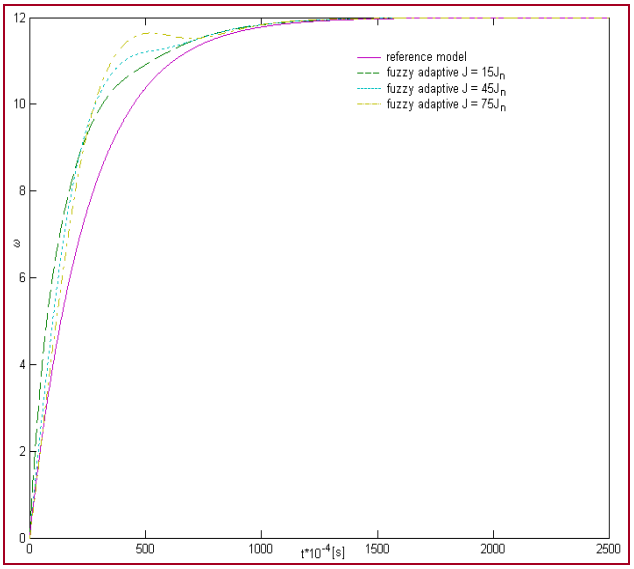

***Figure6.** Responses of HSM60 with fuzzy adaptive controller with reference model*

In Fig.8 the responses for HSM60 with hybrid fuzzy adaptive controller are shown. In this case, the same step change in load moment from 0 Nm to 0.1 Nm was applied in t_s = 3s. It is clearly visible that the system with hybrid fuzzy adaptive controller is less disturbed by changes in load moment compared to PI controller. For J = 15J_n the maximum change of actual speed was 14.6% and the settling time for achieving 1% error was 0.029s. After changing the inertia moment parameter to J = 45J_n, the maximum change in speed decreased to 11.75% while the settling time increased to 0.032s. The small overshoot in t_s = 3.036s did not exceed 1% error band around the desired speed. In case of J = 75J_n, the maximum change of actual speed was 10.4% and the settling time was 0.036s. Once again, the small overshoot in t_s = 3.039s did not exceed 1% error band around the desired speed.

DISCUSSION

The presented responses corroborate the idea that the robustness of conventional PI controller in terms of plant parameter variation (inertia moment) is rather poor. There are several criteria for tuning the gains but meeting the requirements for desired performance under drastic parameter changes with only PI controller would be hardly achieved. Increasing the inertia moment 15 times compared to the

nominal case produced relatively good response (Fig.5), but in two other cases the responses were much less favorable. It is obvious from (1) that the only option for decreasing the sensitivity to inertia parameter variation is to increase integral gain but this limited by the risk of instability. The responses in Fig.6 show that it is possible for the HSM60 control system with hybrid fuzzy adaptive controller to follow the response of first-order reference model with rather small error. This error naturally increases with the higher inertia moment, but it is still able to provide far better responses compared to PI controller. It must be said that there is a much higher number of parameters to tune for fuzzy controller than for PI controller, thus offering highly superior flexibility but at the cost of more difficult tuning. Since the design of fuzzy controller was completely heuristic, it must be considered suboptimal (especially the membership distribution). Using some method of optimization in the process of fuzzy controller design offers some space for improvement of the responses. From Fig.7, it is quite clear that the change in load moment (0.1 Nm) disturbs the control system with PI controller quite significantly. It restores the previously attained desired speed after at least two overshoots that exceed 1% error band. Moreover, the maximum deviations from the desired speed are quite large (more than 50% in case of $J = 15J_n$). The hybrid fuzzy adaptive controller is much less sensitive to the aforementioned step change in load moment and it restores the desired speed in much shorter time (the second overshoot remain in 1% error band even for $J = 75J_n$).

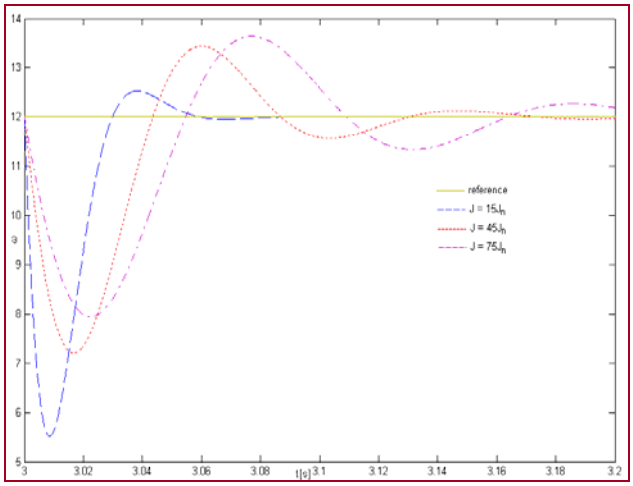

Figure7. Responses of the HSM60 control system with PI controller for a step change in load moment

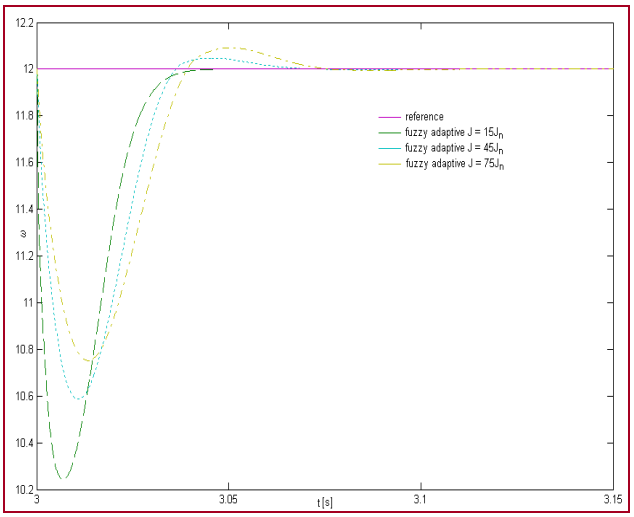

Figure8. Responses of the HSM60 control system with hybrid fuzzy adaptive controller for a step change in load moment

Again, the fuzzy set distribution optimization could further improve this load rejection capability.

CONCLUSION

The results in this paper strongly favor the use of fuzzy controller in addition to a conventional PI controller to create a hybrid fuzzy adaptive controller. Fixed gain settings for PI controller cannot meet the requirements put on control system performance under conditions of large parameter variations. Extending the conventional control system with adaptive fuzzy controller retains the desired capabilities of PI controller while adds a better insensitivity to load and plant parameter variations. It is worth mentioning that one has to consider the effects of unmodelled dynamics (e.g. feedback delay, current controller etc.) on the performance of such control system. This in turn might render a first-order reference model unsuitable for such task (in case the higher order coefficients were not negligible). Moreover, a lot of space for improvement remains due to the suboptimal fuzzy controller design. Further work should lie in finding a suitable way of optimizing the design of fuzzy controller (e.g. genetic algorithms), which could accentuate the positive effects of applying fuzzy adaptive controller and also in testing this method for a real HSM60 with all its subtleties.

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THE FUTURE OF ENTREPRENEURSHIP

Abstract:
Entrepreneurship, as a key development activity and as a source of major competitive advantage of individual countries compared to others, with its manifestations, such as entrepreneurial activity and climate, has become an indispensable element represented in the development strategies of all world countries regardless of their current development. It has been generally accepted that entrepreneurship, with minimum theory and basic knowledge of the profession, is learned by the examples of good and bad world practices. This paper reveals a fundamental change in the importance of entrepreneurship and small business functions in generating employment, competition, innovation and overall economic progress, and answers to the questions: How will entrepreneurship expand in the future in terms of fields of activities and types of businesses and which branches and activities will be particularly attractive? What will consumers expect from products and services and how entrepreneurs and their businesses will respond to their needs? How will demographic trends affect the structure of future entrepreneurs?

Keywords:
Entrepreneurs, entrepreneurial economy, entrepreneurial education, competitive advantage, innovation

INTRODUCTION

With all the difficulties of objective prediction of the future due to constant changes, discontinuity and uncertainty, futurologists estimate that there will be a lot more opportunities for entrepreneurial activities and entrepreneurship will be significantly more attractive for the involvement of individuals than before. It has been estimated in a number of publications that competition will be much fiercer which will favor customers and their requirements, considering the fact that the offer will be far more diverse and of higher quality. The dominant factor of development and competitive advantage will be knowledge, i.e. intellectual, human capital and intangible assets. Business and economic development and growth will affect the increase of the wealth of society and individuals and intensify technological progress, which will significantly change the living and working conditions of people, especially in the most developed parts of the world. People will have more free time and interest to its design and use, whether for leisure and entertainment or for starting up, organizing and developing their own personal business. This will open up chances and opportunities for entrepreneurial ventures in all areas, especially in the fields of services.

According to Peter Drucker, principles that are nowadays contributed to entrepreneurship won't operate in the future. Planning as a generally clear concept is, in fact, incompatible with entrepreneurship and entrepreneurial economy. Innovation really needs to be purposeful, while entrepreneurship should be managing. However, innovation must be decentralized, ad hoc, autonomous, specific and microeconomic phenomenon. As a rule, it is far

better that it starts from a small, modest, temporary, flexible. Indeed, the possibilities for innovation are, generally, just on the way and manner that are close to the event. They will not be in mass aggregates, which are counted as necessities by a planner, but in their deviations - in the unexpected, in discrepancies, in the difference between "the glass is half full" and "the glass is half empty", in the weak link of the process. Usually it is already too late, when a deviation becomes "statistically significant" and therefore visible for a planner. Innovative opportunities do not come with the storm, but with the breeze rustle (Drucker, 1991, page 324).

CONTRIBUTION TO ENTREPRENEURSHIP IN DIFFERENT COUNTRIES

Besides undoubtedly the most important achievements in development that entrepreneurship has reached in the U.S.A. and the most favorable conditions for its further affirmation and expansion, there is a growing number of countries that are - in their national development ambitions - turned to entrepreneurship and the creation of a supportive and stimulating environment for the application of entrepreneurial strategies as the most effective ways to reach the goals of economic development. The most developed economies such as those of Japan and European countries have gone the furthest in this aspect. That has traced the path into developed entrepreneurial economy and new entrepreneurial society that is both stimulating for strengthening the entrepreneurial potential and for the development of national economies.

JAPANESE ENTREPRENEURIAL INVENTIVENESS

Japan's economic and technological development is, to a large extent, based on the principles of entrepreneurial business and expressed inventiveness and creativity of entrepreneurial management of small and medium-sized enterprises. Japanese government contributes maximally to the creation of conditions and a climate conducive for the development and implementation of entrepreneurial initiatives. It applies it not only at the national, but also regional and local levels, especially through legislation and financial incentives and benefits of different forms, such as the use of credit guarantee system as well as credit insurance. There are credit guarantee associations in more than fifty cities of Japan, which help small and medium-sized businesses in securing loans from private banks, guaranteeing that the association will return debts if companies are not able to. Especially stimulating is the Law on economic measures for the revitalization of small and medium-sized enterprises in sectors of particular importance from the 1985 regarding granting special loans, tax incentives and different treatment of gained profits (Group of authors, 2004, page 250).

Japanese state ensures, through various organizations and institutions, provision of competent professional assistance through a variety of advisory and consulting arrangements, as well as technical assistance in equipping and operation of small and medium-sized companies of entrepreneurial profiles. In particular, it stimulates and enables the free circulation and exchange of necessary information as new knowledge in various fields, the transfer and use of technology and other business factors, the development of permanent education system, the establishment of business directories for small and medium-sized enterprises, etc.

EU ENTERPRISE POLICY

Developed European countries also work intensively on creating a business climate that will encourage entrepreneurial initiatives and the establishment and launch of a number of new companies able to adapt more quickly to economic changes, to more effectively and successfully take advantages of the opening of large market opportunities, entering into creative or innovative ventures related to commercial exploitation on a larger scale. The changes that occurred in the economy and the economic structure of European countries have moved sources of comparative advantage to innovation and knowledge, as the most important business factors. The result of this orientation was in diversification of business programs, the emergence of new products and expanding service sector. Strengthening entrepreneurial initiatives contributed to this process, and EU Member States separately and institutions of the Union and their policies create a suitable environment and climate for the recognition of entrepreneurship and releasing of

entrepreneurial energy, which can – with correct direction and exploitation – significantly contribute to the creation of new jobs, new employment and a rich and diverse offer to consumers. The Internal Market created by the European Union, which increased to 450 million people with the last enlargement, favors the development of entrepreneurship through the ability to use a large potential market opportunities and chances, the harmonization of regulations and increase the availability of resources for various business activities, in particular knowledge and technologies as key sources of new business ideas and business projects.[1]

Europe needs to motivate more strongly the manifestation of entrepreneurial charge and needs to express – through their own businesses or within other organizations – and turn into useful new outputs creative potentials that are not used in the existing economic structure. The challenge for the European Union is to identify the key factors for creating a climate in which entrepreneurial initiative and business activities can be developed. The goal is to raise the level of entrepreneurship in the EU and accept it as the dominant approach that favors the creation of more entrepreneurs, more entrepreneurial ventures and companies that are growing. The EU has already implemented all this.

In Lisbon in 2000 the European Council defined its objectives in the areas of employment, economic reform and social cohesion. Until 2010 the EU should become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion. This should create much more attractive business opportunities and involve active recruitment. The European Council established a strategy for sustainable development and added an environmental dimension to Lisbon goals in 2001. The need for radical economic transformation in order to create 15 million new jobs by 2010 was recognized. Even though the Lisbon Agenda is generally evaluated as a failure, certain progress has been made. A favorable environment for employment and business development has been established thanks to the EU Charter for Small Enterprises, which covers the following key areas: Education and training for entrepreneurship; Cheaper and faster start-up, Better legislation and regulation, Availability of skills, Improving online access, Getting more out of the Single Market, Taxation and financial matters, Strengthening the technological capacities of small enterprises; Making use of successful e-business models and developing top-class small business support, Developing stronger, more effective representation of small enterprises' interests at Union and national level.

At the meeting in 2003 the special attention of the Council was focused on entrepreneurship, with particular importance of encouraging investments and business development through knowledge, innovation and business dynamism. Foundations for macroeconomic policy oriented to growth and stability have been established, which is a prerequisite for the creation of a climate which accelerates entrepreneurial initiative. The European Council publishes an annual "Economic Policy Guidelines", which recommends measures to foster entrepreneurship through taxes and regulations for new and existing businesses, through legal reforms and the promotion of efficient financial markets.[2] *The European Union, compared to the U.S., remains late on its entrepreneurial path. National regulations, less mobility, and, above all, the culture of unsparing marking of the failure in Europe are holding back entrepreneurial revolution.*

ENTREPRENEURIAL EXPERIENCES OF BOSNIA AND HERZEGOVINA

Although most of the countries work on improving conditions to increase entrepreneurship, the administration in our country is far from it. So, not only the citizens of BiH, but also the Europeans (citizens of the EU Member States) still see administrative barriers as the main obstacle to starting a business. When starting a business, the problem arises in the provision of money and finance at an early stage. The division of risks between the public and private sectors can help increase access to finance.

When the Eurobarometer survey asked Europeans to express their views on obstacles to starting businesses, 69 percent agreed that the

[1] *www.knowledge-bank1.org/preduzetnistvo*

[2] *http://europa.eu.int/com/enterprise/index.en.htm*

existing administrative procedures are complex, and 76 percent pointed to the lack of available finance.

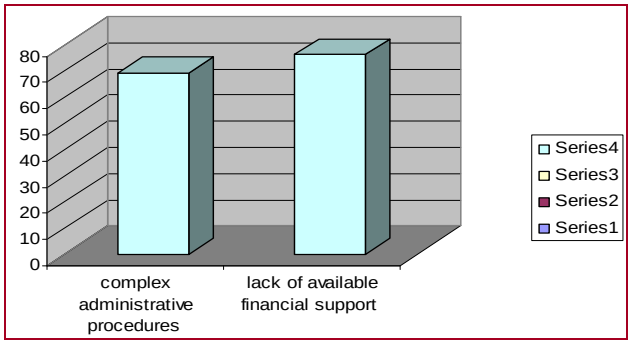

Figure 1. Barriers in starting a business in Europe

According to our survey among 70 citizens in the Republic of Srpska, i.e. those who would like to start their own business, 80 percent find administrative procedures the obstacle to start up a business, while the lack of financial support is seen as a barrier by even 98 percent of respondents, as it is shown in the following diagram.

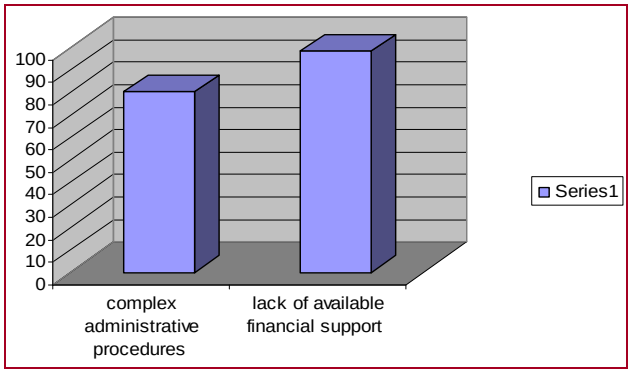

Figure 2. Barriers in starting a business in the Republic of Srpska

Administrative procedures for the creation of companies have already received significant attention in EU. The European Commission has noticed favorable trends in terms of time it takes to start a business. However, some member states have yet to work on reducing the time and costs of establishment an enterprise. There is still room for further improvement in terms of multiple procedures, contacts, forms, required licenses and permits, as well as costs. Centres for business formalities have been established in Portugal since 1997 in order to facilitate the registration of new companies. These centers bring together representatives of all public agencies responsible for various formalities required when registering a new company (concerning, for example, the statute of the company or business registers and registers of social insurance). Future entrepreneurs can get advice from the office for assistance in the same center. At the same time, procedures are simplified. As a result, the time to set up a business was decreased for 80% compared to the mid-nineties. Portugal aims to reduce the time for the additional 50% in the future.

Access to finance still remains a major barrier for new entrepreneurs: they have difficulties in securing bank loans or finding risk capital. Banks seek positive balance and collateral warranty – which new firms, especially those that develop activities based on knowledge, usually do not have. Start-ups also have serious difficulties to cover the needs for working capital. In addition to bank loans, new firms should have better access to alternative sources of funding. Besides venture capital, it is necessary to further explore the potential of informal investors – family, friends or business angels. GEM survey reveals that the informal support of the new enterprises was five times higher than the support of the local venture capital, and while venture capital support declined sharply between 2000 and 2001, the informal support has been consistent. In order to increase its interest in risky companies, private investors have expressed the need for incentives such as tax breaks. The division of risk between banks and investors in the private sector and public financial institutions specialized for small and medium-sized enterprises (SMEs) is an effective way to strengthen the scarce public funds, which proved successful to increase the funding of new enterprises.

In Europe, risks associated with entrepreneurship are not adequate counterweight to the prospects of success. This calls for reconsideration of the balance between risks and rewards of entrepreneurship. The failed entrepreneur meets shame of failure. When the Eurobarometer asked Europeans to identify what worries them most about the risks of entrepreneurship, bankruptcy and loss of personal property prevailed. Potential entrepreneurs in the Republic of Srpska are also, when it comes to the risks of entrepreneurship, mostly concerned about the bankruptcy and the loss of property, in 75 percent of cases, lack of market and fierce competition worries 15 percent of the respondents, while 10 percent of

them would not dare to start a business in the current economic environment which they consider as the riskiest factor.

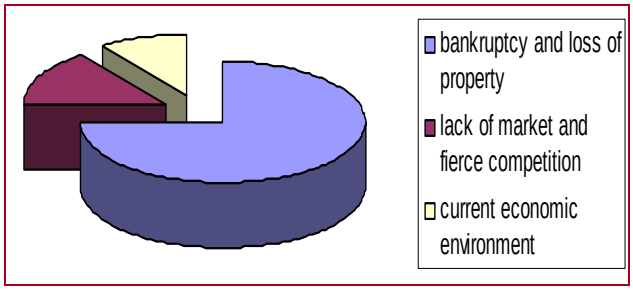

Figure 3. Risks in entrepreneurship for RS citizens

In addition to social stigma, personal bankruptcy involves serious legal consequences. Repayment of debts can take years; those people may lose their personal property and are subject to certain restrictions. Such consequences are justified in cases of fraud or dishonesty, but failure is an integral part of economic life and a significant number of entrepreneurs go into bankruptcy because they cannot compete in the market. Insolvency laws could be revised to reduce barriers to re-start for honest entrepreneurs. That, of course, should not unreasonably affect the interests of creditors, who could become reluctant to invest in small and new ventures. Belgium has adapted the insolvency laws so that they allow entrepreneurs to save their business when they meet temporary problems and to liquidate non-sustainable business as soon as possible. The courts may "forgive" honest entrepreneurs who are in bankruptcy by allowing them to re-start the business.[3] People might be willing to accept the risk of entrepreneurship if it could be compensated with the prospect of reward in case of success. A recent trend to reduce taxes for the self-employed and small businesses is considered in the European Union and steps are taken in order to minimize the taxation of potential self-employed people. However, in some Member States, such tax rates remain high, reducing the chances of entrepreneurs to create and maintain profit. If someone becomes a self-employed, one has to opt for a reduced social welfare. The system of social protection that would be tailored to the needs of entrepreneurs could make entrepreneurship more attractive.

Education and training should contribute to encouraging entrepreneurship, nourishing the right mind-set and awareness about the progress of entrepreneurs and new career opportunities. Therefore, Eurobarometer has found that 37 percent of Europeans are or were thinking of becoming entrepreneurs, and yet only 15 percent achieved their aspirations.

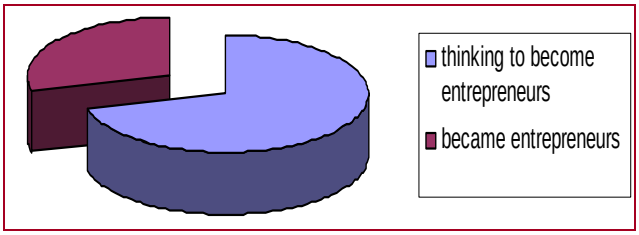

Figure 4. Readiness and outcomes of becoming entrepreneurs

It appears that surveys emphasize the fact that knowledge about starting a business increases the likelihood of becoming an entrepreneur. The survey carried out by the Eurobarometer has found that respondents of self-employed parents are more "oriented towards self-employment" than those whose parents are civil servants. The GEM's survey has found that people confident in their skills and experience are between two and seven times more likely to be involved in starting or managing a new business, those who know someone who has recently started a business are three to four times more likely to do the same. The survey among British households has revealed that those who have previously been exposed to entrepreneurship (through friends, family or education) tend to think seriously about starting a business. The educational system can provide the skills and expertise as a contribution to fostering entrepreneurship.
Establishing a business requires enthusiasm, creativity and persistence, while developing a business gradually requires more management skills, such as efficiency, effectiveness and reliability. Bearing in mind that personality and management skills are key elements of success, it is necessary to develop personal skills from the earliest times and to cherish them up to university level, where the focus could be on building management capacity. The European Commission has revealed that the majority of member states are, in varying degrees, dedicated to the promotion of teaching entrepreneurship in their educational systems. Entrepreneurship courses at universities shouldn't be only the

[3] *http://europa.eu.int/com/enterprise/index.en.htm*

privilege of MBA students, but they should be available to students of other fields as well. For example, teaching entrepreneurship at technical universities can contribute to the merger of entrepreneurial and technological potentials. Entrepreneurship education in combination with public research programs includes components to merge scientific excellence with the commercialization of results.

HOW TO STRENGTHEN ENTREPRENEURSHIP

Eurobarometer experts argue that entrepreneurship should be more promoted, with special emphasis on women and other underrepresented groups. Ethnic minorities show a high level of sense for entrepreneurship and even a greater potential. Available services for business support do not seem to fit very well to their special needs. There are significantly fewer female than male entrepreneurs in Europe: the percentage of self-employed women ranges from 16 percent in Ireland to 40 percent in Portugal. Women entrepreneurs face the same difficulties as all entrepreneurs, but in some cases, it seems that some problems for them, such as finding finance, are more difficult to be solved. Women also often lack the necessary confidence and skills to start and lead business successfully. There are different reasons for this, including the selection of activities, lack of information, visible discrimination, and the lack of networks or difficulties in harmonizing work with family responsibilities. The European Commission has facilitated the exchange of good practices on policies in order to promote entrepreneurship among women through the "WES Network", which brings together government officials who are responsible for the promotion of women entrepreneurs. Nutek in Sweden has started the project Business consultants for women, under which women consultants provide advices and non-financial assistance to women entrepreneurs. This is a response to evidence indicating that many women prefer to turn to other women for guidance regarding the conduct of business. Consultants give advices on business issues and broader requirements, such as the question of how to reconcile family life with running a business. Nutek provides training and exchange of experience for consultants.

Ethnic minority businesses in Europe show a strong entrepreneurial capacity and potential. Ethnic entrepreneurs are a heterogeneous group in terms of language, culture and socio-economic position, which is reflected in the nature of their business activities. However, many of them are concentrated in the initial low-level activities and have difficulties to get out of them. The problems faced by ethnic entrepreneurs are, fortunately, in general, similar to those that all entrepreneurs meet, but they seem to have less benefits from public services that support business and they are less involved in business organizations. Networks of ethnic entrepreneurs throughout Europe could try to facilitate the sharing of experiences and propose legal remedies for identified problems. In the context of its policy on immigration, the European Commission put forward two proposals that will contribute to the facilitation of entrepreneurs in third world countries to open businesses.[4]

Some Member States are, in many aspects of entrepreneurship, better than others and may serve as an inspiration. The European Commission helps them learn from each other through the "open method of coordination", where the Commission creates a platform for member states to share examples of good practice and standards. It must be borne in mind that different national or regional concepts affect the effectiveness of political measures and that, during the identification and implementation of policy priorities, a country or a region should take into account its specific context. Common guidelines should be adapted to national or regional circumstances. Since the availability of comparable and relevant indicators is a prerequisite for the success of these applications, the Commission seeks to coordinate actively the development of necessary statistical data. European standards that governments should reach are determined according to time and costs needed for starting a business. When they do that, governments should be sure that the public is aware of their efforts to reduce initial barriers.[5] *The French government, for example, intends to facilitate the reorientation of their employees into entrepreneurs. This action, which is a part of comprehensive initiative to promote the*

[4] *www.knowledge-bank1.org/preduzetnistvo*
[5] *http//europa.eu.int/com/enterprise/index.en.htm*

creation of companies, includes measures to reduce barriers for employees who want to set up a company, either independently, either with their employer. It will also remove discriminatory fiscal and social attacks against the new entrepreneurs who still have the status of civil servants.
Furthermore, it is good to mention that twice as many Europeans would rather start a new business than take over the existing one. However, the takeover can be an attractive alternative with less risk. For example, in Austria 96 per cent of successful business transfers survive the first five years after the transfer, compared to 75 percent of new ventures. It is expected that about one third of companies in the European Union will need new owners in the next ten years, either because of retirement, or for other reasons. This will provide many opportunities for taking over existing enterprises. An ongoing work on the improvement of the internal market functioning and reducing red tape requires a further removal of barriers to business and the promotion of the "think small first" principle. Efforts to improve the access to finance and skilled workers must also be strengthened. Entrepreneurs need to be supported in developing skills they need to adapt their business to changing conditions. The exchange of experiences and mutual work, through clusters or networks, can help entrepreneurs to find inspiration and advice, to have access to technology and knowledge or to find partners. Maintaining and nurturing networks could have particular impact on support of specific sectors or groups of entrepreneurs, such as ethnic minority businesses.

CONTEMPORARY WORLD OF AMERICAN ENTREPRENEURSHIP

Talking about entrepreneurship without mentioning American experiences would be too conceited and in fact, extremely frivolous and this paper will lose its quality. Small businesses are an important and growing driver of US economic growth and dynamism. By 2017, small businesses will be formed and run by a new and more diverse group of entrepreneurs, with a new outlook based on the changing nature of the American business landscape. The Intuit report examines three emerging trends that will impact small business formation and operations over the next decade. Entrepreneurs will be far more diverse than their predecessors in age, origin and gender. Recent studies show aging baby boomers, Generation Y, women and immigrants joining the ranks to start small and personal businesses at increasing rates. The last decade has seen substantial growth in the small and personal business sector of the U.S. economy, and technology has been a major contributor to this trend. The growing digital infrastructure has reduced the costs of starting and running a small business, lowered competitive barriers, opened new markets and industries to small businesses, and led to the creation of new, and often disruptive, business models. The Internet will become a platform that provides small businesses with a wide range of new tools, services, and capabilities. Technology will become cheaper, easier to deploy and use, and pervasive.

DEMOGRAPHIC TRENDS CHANGING AMERICAN ENTREPRENEURS

Over the next decade, entrepreneurship will continue to increase, with more entrepreneurial-specific education in academics, more freelancers than ever and more diversity among small business owners. The white, middle-aged men who traditionally start small businesses will be outnumbered by other types of entrepreneurs like the mompreneur and, until we can come up with a better name, those young folks known as Generation Y. Immigrant entrepreneurs will help drive a new wave of globalization. Immigrants are increasingly turning to entrepreneurship as a way to steer around traditional barriers of entry to the workplace. Immigrant entrepreneurs also have the skills, contacts, and technology to exploit the global marketplace. According to the U.S. Census Bureau, immigrant entrepreneurs are the fastest-growing segment of small business owners today. Data from the Kauffman Foundation also show that immigrants form small businesses at a much higher rate than non-immigrant Americans, and a recent study by Duke University shows the importance of immigrants in the U. S. technology industry. The Intuit study notes that even though immigrants often have education, professional experience and even a network of friends and family when they come to United States, it's still not the

easiest transition. "Starting a business is often easier than finding a job," the study found. The U.S. Census reports that immigrants are currently the fastest-growing segment of small business owners. Khorramian, the company's president, adds, "You also start with nothing, so you have nothing to lose, and that's another advantage." Women will increasingly see entrepreneurship as an alternative to corporate life and a means to break through the glass ceiling or balance family and work demands. Working moms who want to have a career and still be available for their children have found that virtual companies often provide the solution to their dilemma. They can parent, wear their bathrobe and slippers and ship out 58 orders a day to customers around the world.

Generation Y (ages 5 to 25) or the digital generation will emerge as the most entrepreneurial generation ever (Belmont University entrepreneurship professor Jeff Cornwall) since they are the first generation to grow up with digital technologies rather than having to adapt to them; thus, they have a unique approach to information, society and the workplace. They see traditional big company jobs as both constraining and risky. They have a clear wish to be the captains of their own destiny. They see entrepreneurship as a way of maintaining independence, of owning their own careers. Several nationwide surveys reflect Generation Y's interest in entrepreneurship. A recent Gallup poll showed that a majority of teens would prefer owning their own businesses over working for a large company. They are inspired by entrepreneurial heroes such as Steve Jobs and Bill Gates, and they like working on their own.

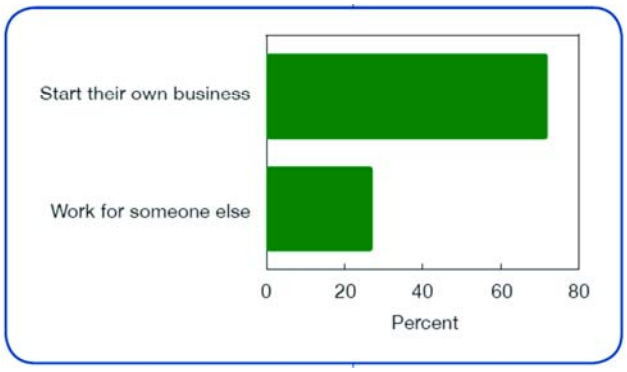

Figure 5. Teens and Young Adults Want to Start Small Businesses (percent of respondents age 18-29 who want to …..) Source: CNN/USA Today/Gallup Survey, April 2005.

Personal businesses are one-person shows. Typically they do not have employees, and usually they are home-based. Personal businesses include contract employees, part-timers, hobbyists, do-it-yourselfers, and early-stage social entrepreneurs. Personal businesses are often formed as an extension of previous work relationships or "accidentally" as extensions of hobbies or other passions. People with personal businesses rarely consider themselves small business owners. Yet, as the personal business takes shape and grows, it may indeed become one. The breakdown of the traditional employment contract and the lack of large company jobs are resulting in new and more independent ways of working. Small business employment continues to climb in absolute numbers and as a percentage of total employment. The old employment contract will not return; large corporations simply cannot afford it. This will continue to make personal businesses attractive - and necessary - to workers set loose by large companies.

THE EMERGENCE OF ENTREPRENEURIAL EDUCATION

Entrepreneurial training and education is spreading quickly in the United States. Entrepreneurship used to be seen as something one learned only through experience and mentoring. The growth and success of entrepreneurial education has changed this view. Entrepreneurship programs are in place at elementary, secondary, and tertiary levels of education. Vocational schools are adding entrepreneurial education; online information and training on small business is expanding; and small business skills are being taught to artists, musicians, and others not traditionally exposed to business education. Entrepreneurship will be a widely adopted curriculum at educational, trade, and vocational institutions. Currently, there are over 1,600 colleges and universities offering programs in entrepreneurship. The number of academic chairs that have been funded specifically for entrepreneurial education at these institutions grew from 237 to 406 in less than four years. Demand for these programs is strong. The only limitation in expansion has been access to faculty with both the entrepreneurial experience and the academic background to teach entrepreneurship effectively. With the increasing

demand by mid-career professionals and small business oriented college students, the roll-out of entrepreneurial programs at the university level is expected to continue.

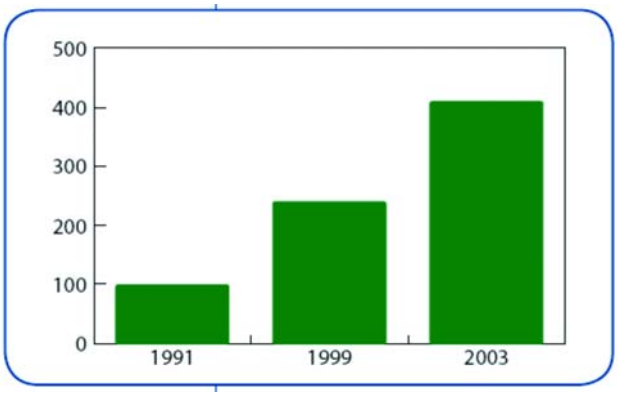

Figure 6. Entrepreneurial Education is on the Rise (number of endowed positions in entrepreneurship at U.S. universities) Source: Kauffman Foundation, 2004.

Dr. Peter Vaill, a leading organizational theorist, coined the phrase "permanent whitewater" to describe the rapidly changing and highly competitive business environment. Small businesses are under continuous 24/7, "always-on" customer and market pressures. While emerging analytical tools and intelligent devices will increase the sophistication and capabilities of small business operations, they will not necessarily decrease the pressures on small businesses and entrepreneurs. In fact, the next decade will likely see even stiffer small business competition. However, the adoption of these new technologies will allow greater flexibility about when, where, and how work is done. Instead of being "always-on," small business management will increasingly become "on my time" and "on my terms." Being onsite will become much less important. Vacation homes and automobiles will double as offices, and increased flexibility will make participation in family activities easier. While most small business owners will continue to work long hours, they will often be able to pick the times and places that best suit their needs and better fit their work–life balance objectives. Moreover, at this point, social networks play a very important role in spreading information and influencing customers decisions. Social networks are the collective system of relationships among people who have met each other through family, work, school, religious, or political activities, hobbies, sports, or other contexts. Social networks form an extended set of relationships that can be called on for a variety of purposes. Social networks can help a person get a job, find a date, or decide what movie to see. As social networks grow in size, they become communities and take on broader roles in the lives of community members. Social networks are also used by people to discuss products, services, and companies. "Word of mouth" social network discussions are both common and powerful. Social networks do not just spread raw data; they also act as information filters and often assist participants in making decisions. Information outsourcing is also common among members of social networks, with people turning to trusted friends or network members for advice and information in areas where they have limited knowledge.

CONCLUSION

Everyone is involved in the creation of entrepreneurial society. Attitudes about entrepreneurial initiative and failure should become more positive. Current and future entrepreneurs depend on those who can help to achieve this goal. The EU Council considers that entrepreneurship deserves the promotion because society has other benefits of entrepreneurial skills and attitudes besides their application to business activities. In order to respect entrepreneurship, society must value and celebrate successful entrepreneurs and tolerate failure. Positive attitudes about entrepreneurship are particularly important among those from whom today's and future entrepreneurs depend on, such as schools, universities, investors, local communities, regions, businesses, consultants and the media. One way to encourage such positive attitudes is to provide role models through "showcase stories" on success.

Acceptance of risk should be rewarded, not penalized. Social security and tax conditions should be reviewed in light of their impact on the willingness of entrepreneurs to take risks in starting or developing a business. The takeover of existing companies should also be encouraged and it is necessary to further explore the potential of "intrapreneurship". In order to reduce the negative effects of bankruptcy, it is smart to consider appropriate measures, such as earlier discharge of debts, keeping certain

property, or remove certain restrictions on bankruptcy.
Although many people express a desire to become entrepreneurs, many lack confidence and skills to launch their ambitions. Young people should be supported and exposed to entrepreneurship, along with teachers, in an effort to develop entrepreneurial skills. Entrepreneurs could get an insight into the role models and stories, throughout campaigns that would emphasize the benefits entrepreneurs bring to society. This would particularly need to be directed towards those who play a key role in supporting future entrepreneurs, such as schools, universities, investors, local communities, regions, businesses, advisers and the media.

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THE COMPETENCY REQUIREMENTS FOR QUANTITY SURVEYORS: ENHANCING CONTINUOUS PROFESSIONAL DEVELOPMENT

Abstract:
Quantity surveyors are construction economists who fulfill varied and comprehensive duties to support cost-effective construction and property development projects. The core competencies of quantity surveyors include determining project budgets, measuring project quantities, preparing contract documentation (such as Bills of Quantities and cost control documents), administering contracts, and preparing final accounts. Despite being recognised as a professional discipline distinct from architecture and civil engineering since 1836, quantity surveyors are not immune to the threats and changes in their operating environment. Some parties in the construction industry have been critical about the quality of works and services provided by quantity surveyors. Some even question the importance of appointing quantity surveyors as project consultants. Because of these challenges, the profession needs to regroup and take stock of the whole situation so that they will not become extinct in the future. All parties who have vested interest in the development of the profession, be it the students, educators, registered as well as unregistered quantity surveyors must find an answer to arguably, the declining roles of quantity surveyors and the lack of recognition they receive in construction projects. However, recognising the importance of professional competence, this paper has looked into issues relating to quantity surveyors' competency. As results, this paper was revealed that, quantity surveying educators and practices alike, are still deeply entrenched in the 'traditional' core competencies rather than the newer and more novel services and skills.

Keywords:
Competency, training, continuous professional development, occupational skills, quantity surveying

INTRODUCTION

Quantity surveyors are key professionals in the construction industry and their clients include developers, government bodies and agencies, building proprietors, architects and contractors. They can be involved in cost planning, cost management, project procurement, contract administration, feasibility studies and asset financial management. The wide array of quantity surveyors' responsibilities means that they have to be educated, trained, and highly skilled in diverse subjects. Lenard (2000) argued that the changing nature of the construction and development industry such as the adoption of innovative technological processes and development, the emergence of highly focused professionals and the full range of advanced technologies will necessitate a much stronger emphasis on job competencies than ever before. However, competence, in any sphere of work, can be a difficult concept to pin down. It is particularly difficult when it relates to professional occupations where roles can be complex, and the knowledge and skills involved

many and varied (Cheetham and Chivers, 1996). In order to arrive at a suggested model of competencies and skills for quantity surveyors, it is important to elaborate and discuss the job scopes and varying roles of quantity surveyors, be it in professional firms, contracting organisations, and construction client bodies. This paper will firstly, describe the profession of quantity surveyors, then followed by discussion on quantity surveyors' job competencies, deliberation on the research findings and lastly, description on the suggested model of competencies for quantity surveyors.

QUANTITY SURVEYING PROFESSION

The origins of quantity surveyors can be traced back to the ancient Egyptian civilisation who used dedicated personnel to carry out estimates and costing for their magnificent structures and buildings. It developed into an occupation during the 17th century restoration of London after the Great Fire. In 1836 the profession entered its new age when the new Houses of Parliament of Great Britain, designed by Sir Charles Barry, became the first major public contract to be fully measured and tendered using detailed bills of quantities for financial accountability (RICS 2005). A quantity surveyor is a professional in the construction industry who has the ability to analyse both cost components and practical physical construction works of a project in a successful way so as to be able to apply the results of his analysis in solving problems peculiar to each project (Badu and Amoah, 2004). In general, the principal services that could be offered by any quantity surveying firm are (John Austen Associates 2004):

- *Preliminary cost advice and feasibility estimates.*
- *Cost planning.*
- *Advising on contractual methods.*
- *Advising on selection of other consultants.*
- *Advising on contractor selection.*
- *Preparing tender documents.*
- *Obtaining or negotiating tenders.*
- *Reporting on tenders received or package deal/design and build offers.*
- *Evaluating construction work.*
- *Preparing and agreeing accounts for/with contractors.*
- *Preparing expenditure statements for tax accounting purposes.*
- *Periodic financial reporting*
- *Technical auditing.*
- *Assessing replacement value for insurance.*
- *Project management related services.*
- *Giving expert evidence in arbitrations, adjudications and legal disputes.*
- *Preparing/defending against construction contract claims.*

From being a trade-based vocation, quantity surveying had developed into a full-fledged profession widely accepted in the construction industry. The quantity surveyors, in its present day construction industry, uses his ability to analyse cost components of a construction project in a scientific way and apply the results of his analysis to a variety of financial and economic problems confronting the developer and the designer. Badu and Amoah (2004) held that these changing roles had been redefined by the educational system received by the quantity surveyors.

DIFFERENT ROLES OF QUANTITY SURVEYORS

There are several options in the quantity surveying field. A qualified quantity surveyor can usually gain employment in quantity surveying firms, construction companies, or property developers. Some large public or private organisations that deal with a significant amount of building or construction procurement as part of their activities normally employ quantity surveyors among other construction professionals to become their project managers. Quantity surveyors working in consultant firms are retained by the construction clients to ensure that what is eventually built is what the clients want or could afford (National Commercial Services UK, 2004). The responsibilities of the client's quantity surveyor include the preparation of Bills of Quantities and the giving of advice on what a project would cost. He also does cost planning during the design stage of a project, examine tenders, price quantities and report his findings. He also negotiates rates with contractors on negotiated contracts, valuing work in. The distinctive skill of a quantity surveyor lies in his ability to analyse a project using the above knowledge and apply it to the following areas like progress payment and making recommendations as to payments to be made to the contractor including advising on the financial aspects of variations (Badu and

Amoah, 2004). The contractor's quantity surveyor on the other hand engages himself in matters relating to costs and estimates from the perspective of 'entrepreneurial' contractor, and agrees on measurements with the client's contractor for any specific project. The principle role of the quantity surveyor here is to look after the financial interests of the contractor. He will calculate and record the financial value of the work carried out and ensures that the contractor is paid properly and on time. During the currency of the contract, he will be involved in measurements on site and from drawings in order to establish the true value of wok done in the interim period (National Commercial Services UK 2004). He also collects information about cost of various operations or method of construction from which the contractor can prepare future estimates. He might also be tasked to prepare the project report and assists the contractor in his management scheduling plans (Badu and Amoah, 2004).

A DISCUSSION ON COMPETENCY

The issue of workers' competencies had been discussed by industrialists, management practitioners and academics alike since the 1960's. Concerns had been raised by them about the difficulty in transferring core competencies to the next generation of employees, and the resultant effect of this transfer to the firm's ability to sustain its competitive advantage across diverse environments (Hamel and Prahalad 1990; Siddiqi, 2000). However, the thinking on competencies and corporate strategy remained dormant during during the 1970s and early 1980s, the reason being that management practitioners and academics paid more attention to other approaches of strategy (Anjana-Kak, 2002). In the late 1990s the idea of competence had gained greater credence and widely used by industries. Rankin (2000) reported that a significant number of companies in the UK are using competencies to improve individual and corporate performance. Baker et al., (1997) observed that companies were starting to look into workers' competencies when they realised that providing a framework which brings greater clarity to the idea of competence in business in general, and operations and technology management in particular, would bring competitive advantage to their organisations. What is competence? In this paper, the term is not to be likened with the concept of 'core competence' as developed by the likes of Hamel and Prahalad (1990), Stalk et al., (1992), and Tampoe (1994). For them, core competence refers to an integrated set of core technologies and core skills that provide an organisation with its competitive advantage. It is more organisationally driven rather than individually focused. But Boyatzis (1982), Schroder (1989) and Burgoyne (1993) are more interested in the 'individual' aspect of competence. The concept is widely used in human resource management. Individual competence refers to the set of skills that an individual must possess in order to be capable of satisfactorily performing a specified job. Holmes and Joyce (1993) defined competence as action, behaviour or outcome which a person should be able to demonstrate, or the ability to transfer skills and knowledge to new situations within an occupational area. Meyer and Semark (1996) have added two new dimensions into this definition i.e. personal attributes and value orientation. Roggema-van Heusden (2004) attempted to define competence from professional personnel point of view. They held that, competence is the ability to perform well in a professional situation that involves the accomplishment of a certain task or the dealing with a problem, in a manner that can be observed and be judged by others. That is to say: a competent professional is capable of applying the necessary expertise in confluence with effective behaviour.

THE COMPETENCY MODEL

As the needs and expectations of construction clients have changed, particularly since the decade of the nineties, so have their expectations of professional services in the built environment. Whereas professional services have been engaged without hesitation in the past, questions about relevancy in terms of value added to the project are now being asked (Procter, 1997). Because of the more discerning clients, the profession needs to regroup and take stock of the whole situation so that they will not become extinct in the future. Prokesch (1997) argued that knowledge base of the profession could be the key in unlocking the potential of the profession and meeting the changing client

needs. He believed that, one way of updating and leveraging the profession's knowledge base is to ensure that the constituent skills, abilities and values of the profession are subjected to periodic auditing to highlight critically important competencies. The proficiency levels of practitioners in these competencies can then be assessed to identify areas of focus for relevant education and training for quantity surveyors.

Table 1. Competencies required of Quantity Surveyors for professional Competency (RICS)

Basic competencies	Core competencies	Optional competencies
Personal and interpersonal skills	Construction contract practice	Arbitration & other dispute resolution procedures
Business skills	Construction technology and environmental services	Development appraisal
Data, information and information technology	Economics of construction	Facilities management
Professional practice	Procurement and financial management	Insolvency
Law		Insurance
Measurement		Project management
Mapping		Property investment funding
		Research methodologies and techniques
		Valuation
		Taxation allowances & grants

In 1998, The Royal Institution for Chartered Surveyors (RICS) had put forward a model of competencies for quantity surveyors. The model, as shown in Table 1, was presented under three categories of basic, core and optional competencies.

The Australian Institute of Quantity Surveyors (AIQS) also attempted to define and develop a model of competencies for the quantity surveyors (AIQS 1998). They had proposed 31 competency standards that need to be adhered to by the professional body in producing competent quantity surveyors. Apart from the competency standards, the Australian Institute of Quantity Surveyors also recommended the basic characteristics of abilities that lead to a competent quantity surveyor. These basic abilities in turn, form the platform from which a competent quantity surveyor can develop and are an integral part of the 31 units of competency standards. The basic abilities are:

- *Quantification/measurement – the ability to quantify and enumerate.*
- *Analysis – the ability to observe, assess, identify problems and find innovative solutions.*
- *Appraisal/evaluation – the ability to assess value.*
- *Communication – the ability to impart knowledge, ideas and concepts through oral, written and visual means.*
- *Interpersonal skills – the ability to effectively work with others and to be part of a team.*
- *Leadership – the ability to lead and motivate.*
- *Self-development – the ability to set goals, display enthusiasm, self motivate and undertake research.*
- *Management – the ability to organise, monitor, control and plan the effective use of resources.*
- *Documentation – the ability to prepare written information in a format which clearly conveys meaning.*
- *Synthesis – the ability to combine fact or ideas into a complex whole.*
- *Computer literacy – the ability to understand and apply basic computer skills.*
- *Construction technology – the ability to understand basic construction technology.*
- *Construction law and regulation – the basic knowledge of national laws and regulations related to construction.*

In 1999, The Pacific Association of Quantity Surveyors (PAQS) had analysed a full range of competencies required by a modern quantity surveyor. In principle they agreed to accept 10 competency standards for their quantity surveyors. Those are:

- *Strategic planning.*
- *Budgetary process.*
- *Cost estimating.*
- *Cost planning.*
- *Procurement advice.*
- *Documentation.*
- *Tendering process.*
- *Construction account management.*
- *Construction change management.*
- *Feasibility studies*

COMPETENCY STANDARDS FOR THE MALAYSIAN QUANTITY SURVEYORS

The quantity surveyor competency model developed by the AIQS, RICS, and PAQS had been used to formulate the theoretical framework for this study. The competency standards models developed by these three organisations model were perceived to be the most comprehensive ever developed to date. The research aims is to put forward a model of competencies for professional quantity surveyors in Malaysia. Literature search conducted in the earlier stage of the research revealed that a Malaysian model of competency standards for the quantity surveyors had not been developed before. A sample of 50 quantity surveying firms registered with The Board of Quantity Surveyors, Malaysia was randomly selected for this study. Postal questionnaires were sent to these firms in January 2005. By the 20th of February 2005, 12 firms had returned completed questionnaires to the researcher. A small number of filled questionnaires received after the cut off date (20th February) was not analysed due to time limitation of the research. Hence, the effective research respondents are 12 (N=12), a response rate of 24%.

BASIC CHARACTERISTICS, ABILITIES AND KNOWLEDGE OF A COMPETENT QUANTITY SURVEYOR

The respondents were asked to give their opinion on a given list of characteristics, abilities, and knowledge of a competent quantity surveyor. The list, adapted from the Australian Institute of Quantity Surveyors' competency model contained 13 characteristics, abilities, and knowledge. The results are shown in Table 2, as follows.

Overall, all the respondents were agreeable to the list of basic characteristics, abilities and knowledge of a competent quantity surveyor proposed to them. This is because, the lowest importance index reading is 81.67 (for 'computer and information technology literacy'). Hence, it could be deduced from the result that, the respondents are generally accepting the importance of all the items in the list provided to them.

Table 2. Basic characteristics, Abilities and Knowledge of a Competent Quantity Surveyor

Characteristic	Respondent Scoring* (%)					Imp. Index
	1	2	3	4	5	
Quantification / Measurement	0	0	0	25.00	75.00	95.00
Analysis	0	0	0	25.00	75.00	95.00
Interpersonal skills	0	0	11.11	58.33	41.67	95.00
Communi-cation	0	0	0	50.00	50.00	90.00
Documen-tation	0	0	0	50.00	50.00	90.00
Construction technology	0	0	0	50.00	50.00	90.00
Management	0	0	0	58.33	41.67	88.33
Appraisal / Evaluation	0	0	0	66.67	33.33	86.67
Construction Law and regulation	0	0	0	66.67	33.33	86.67
Self-development	0	0	11.11	66.67	25.00	85.00
Leadership	0	0	0	75.00	25.00	85.00
Synthesis	0	0	11.11	75.00	16.67	83.33
Computer and information technology literacy	0	0	8.33	75.00	16.67	81.67

** 1- Not important, 2- Less imp., 3- Neutral, 4- Important, 5- Very imp.*

The respondents stated that, the most important characteristics, abilities and knowledge for quantity surveyors to possess are quantification/measurement, analysis, and interpersonal skills. Communication, documentation, and construction technology are also regarded as highly important for quantity surveyors to achieve an accepted level of competency. Other less important characteristics, abilities and knowledge to acquire are management, appraisal/evaluation, construction law and regulation, self-development, leadership, synthesis, and computer and information technology literacy.

Three pertinent points came out from this result. Firstly, the respondents widely accepted that interpersonal skills are one of the three most important abilities to acquire for any would-be competent quantity surveyors. This finding shows that apart from quantity surveying related knowledge, it is important for quantity surveyors to acquire the 'soft' skill such as interpersonal skills to help them carry out their work in a competent manner. Secondly, it is interesting to note that documentation did not come up top in the ranking of characteristics, abilities and knowledge importance. According to popular belief, the knowledge of documentation should be one of the most important aspects of quantity surveying work. Apparently, the respondents disagreed with such a belief and did not place documentation in a higher position of importance. Similarly, construction law and regulation – popularly perceived as one of the most important scope of quantity surveyors did not make it to the most important or even highly important list of characteristics, abilities and knowledge for quantity surveyors. Thirdly, computer and information technology literacy was not ranked high enough by the respondents as important in the pursuit of quantity surveying competency. This is despite the nature of quantity surveyors work that relies heavily in cost estimates and quantitative-based activities. With the help of computers and advanced designer software, surely it would make their work much faster, accurate and error-free.

COMPETENCY STANDARDS FOR QUANTITY SURVEYORS

The study was based on the AIQS' model of competency standards for quantity surveyors. In all, there are 13 competency standards to be tested by the study (as shown in the preceding page). Early findings indicate that 'contract documentation', budgetary process' and 'tendering process' are consistently ranked higher than the other standards by the respondents. This warrants further scrutiny during the next round of data collection. At the time of writing, the Board of Quantity Surveyors Malaysia and the Ministry of Higher Education Malaysia had just released their final draft of 'Criteria and Standards for Educational Programmes in the Field of Quantity Surveying' to be used by all public universities offering degrees in quantity surveying programmes. The criteria and standards are prepared as part of the Ministry of Higher Education Malaysia's ambition to assure the quality of higher education in the field of built environment. Other field of studies within the built environment disciplines are which have formulated their own respective criteria and standards are architecture, interior architecture, landscape architecture, land surveying, building surveying, urban and regional planning, valuation and real estate management, and construction. The Board of Quantity Surveyors Malaysia agreed that, the general education goals for quantity surveying educators in Malaysia are to educate, train, and produce graduate quantity surveyors who are competent, creative and versatile, guided by high moral and ethical values for God and Mankind. After completing the quantity surveying education programme, the graduates should possess knowledge, understanding, skills and competencies in:

1. *Meta-competencies – versatile and adaptable, pro-active and positive thinking, able to communicate effectively, high self-esteem, highly creative and innovative with problem solving ability, able to work in team, high ethical and moral value lifelong learning outlook.*
2. *Construction economics, cost and financial management – including project cost estimating and cost plans, preparing project budget and cash flows, administration of project cost and finance, carrying out feasibility and viability studies including collecting, preparing, analysing, and interpreting project cost and financial data and related information.*
3. *Management of construction project procurement and contract – inclusive of identifying, collecting, processing and interpreting data and information for the evaluation and selection of appropriate procurement system and contractual arrangement, preparing tender and contract documents, administration of tendering processes and managing the implementation of construction contract.*
4. *Measurement, quantification and documentation – inclusive of measuring and quantifying construction works for project costing, cost planning and control, preparation of bills of quantities, work*

programme, resources planning and control, valuation for interim payment, and preparation of project account.

5. *Construction technology and engineering – inclusive the use of construction technology and engineering, knowledge of materials, plant, machinery and manpower in quantity surveying functions, cost and financial management, and contract administration.*
6. *Information and communication technology – not only to utilise the latest ICT in carrying out the quantity surveying functions but also to design and/or develop e-systems for quantity surveying work, processes and procedures.*
7. *Project management principles and practice – in providing quantity surveying services and the management of project cost, finance, procurement and contract.*
8. *International QS practice – inclusive of local and international construction and quantity surveying technology, work process and procedure and their changes and development.*

The 8-points criteria and standards as proposed by the Board of Quantity Surveyors Malaysia are already in final draft stage. Barring major changes by the higher authority, it is expected that all local universities would adhere to these proposed competency framework in educating the future generations of quantity surveyors. The joint efforts made by the Board of Quantity Surveyors and The Ministry of Higher Education to educate the quantity surveying students according to a set of competency standard can only be lauded. The next challenge to be fronted by the Boad of Quantity Surveyors Malaysia is to follow through the education and training standards for the practicing quantity surveyors. Devoid of competency standards-based education during their tertiary study days, these generations of quantity surveyors are in great needs of a comprehensive 'continuous professional development'. This programme should specifically train them on all the critical competency standards discussed in this paper earlier. Nearly all the research respondents (N=10) indicated their agreement towards using competence-based training and education approach in the professional development of post-university quantity surveyors. They accentuated their point by agreeing that, this approach should become the keystone in the Board of Quantity Surveyors' continuous professional development programme.

CONCLUSION

The study revealed that the quantity surveying fraternity is serious in establishing their own competency standards to improve and maintain the services provided by professional quantity surveyors. Various professional quantity surveying organisations such as RICS, AIQS, and PAQS had already established the competency standards for their own use. Whatever model they follow, the Malaysian quantity surveyors were found to be very receptive towards the idea of adhering to these prescribed standards in producing competent quantity surveyors. The next challenge in the profession would be to improve the competency standards models a step further, and to extend their use to a larger number of quantity surveying practices. In view of the competency framework proposed by the Board of Quantity Surveyors Malaysia in August 2005, more research works need to be done to see the benefits of the prescribed competency standards coming from the various professional quantity surveying bodies.

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HIGH POWER QUALITY, REGULATED DC POWER SUPPLY FOR AUTOMOTIVE APPLICATIONS

Abstract:
Power electronics based power systems are being increasingly considered for transportation systems such as land, sea/undersea, air, and space vehicles due to their advantages in efficiency, performance, flexibility, and power density. In order to have superior performance, the rectifier-converter systems need to be rigorously regulated. The DC power supply is ingredient part in the automotive industries because it has been used as a DC power supplies for a wide range of loads. Meanwhile, it is mandatory for battery charging. These types however, cause many problems such as poor power factor, high input current harmonics distortion and uncontrolled DC voltage.
In this paper, an improved input power factor correction with low input current total harmonics distortion that uses a combined control system consists of two nested loops with a feedback of the DC voltage and input current as long as a feed forward from the output power. The system has been analyzed, modeled, simulated and experimentally verified.
The novel feature of the proposed control scheme resides in fact that it is not only achieve nearly unity power factor with minimum input current total harmonics distortion only but it also introduce superior performance in DC voltage transient conditions.

Keywords:
Rectifier; Power quality; DC voltage regulation; transient response

INTRODUCTION

With the growing of electrical power demand and introducing of 42 volt systems in modern vehicles, new factors should be considered in ordered to cope with the new standards. [1,2]
At present the diode rectifiers along with their traditional voltage regulators are dominant in most vehicles. Those systems although they have the advantages of being economical and reliable but they have some problems including:

1. *High alternator current total harmonics distortion.*
2. *Low input power factor.*
3. *Poor DC voltage transient performance.*

These problems could be more significant with the upcoming higher voltage such as 42 V systems. [3,12]
Trying to overcome those problems the active current wave shaping using a single switch boost converter will be used in this paper based on the proposed control combined control system.
The focus of this paper is on the analysis and modeling of the proposed circuit concentrating on DC voltage transient response and alternator power quality. Also the effect of the control circuit design on the system transient performance will be studied. Then the circuit had been simulated using the produced model and an experimental prototype had been built and tested. The experimental results confirm the

validity of both mathematical study and simulation results.

PRINCIPLE OF OPERATION

This circuit type was explained severally in literature. So, we will focus on the basics of this type. Fig (1) shows the proposed system block diagram including the vehicle alternator, full wave rectifier and boost converter.

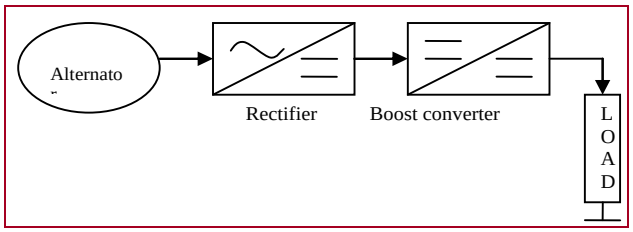


Fig 1.Overall system block diagram

The boost converter power circuit that consists of boost inductor L, boost switch S, boost diode D and boost capacitor C as shown in Fig. (2).

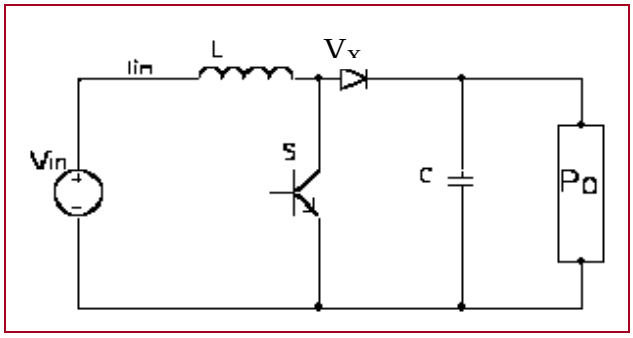


Fig 2.Boost converter power circuit

With continuous conduction, the voltage of the node connected between the transistor and reactor V_x *is equal to the input voltage* V_{in} *when transistor is on and the output voltage* V_o *is equal to* V_x *when the transistor is off.*

The boost converter has two modes of operation.

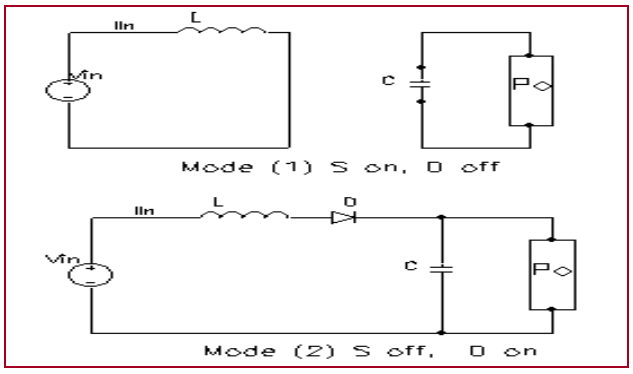


Fig 3.Boost converter modes of operationt

Mode (1) when the boost switch (S) is turned on as explained in Fig. (2), the inductor current builds up and the energy is stored in the magnetic field of the inductor. At this time the boost diode (D) is off and the capacitor (C) supplies power to the load.

Mode (2) when the boost switch is turned off and the stored energy in the inductor together with the energy coming from the AC supply is pumped to the output circuitry consists of the capacitor and the load.

In mode (2)

$$V_{in} - L\frac{dI_{in}}{dt} - V_o = 0 \qquad (2)$$

The control system consists of two nested loops, the outer is to control the DC output voltage and the error produced from this loop is multiplied by a sample of the input voltage to get the input current reference required by the inner current control loop as shown in Fig (4).

In order to obtain a sinusoidal input current in phase with the input voltage the control system should act in such a way that V_{in} *sees a resistive load equal to the ratio of* V_{in} *and* I_{in}*. This has been achieved by the already produced current reference to the actual current passing through the inductor. The error is then compared to a triangular waveform to generate the necessary boost switch gating signal.*

In this way the error is forced to remain between the maximum and minimum of the triangular waveform these results in that the inductor current follows the reference current very closely. Therefore, the inductor current is always restricted within the amplitude margin defined by the reference with the superimposed triangular waveform.

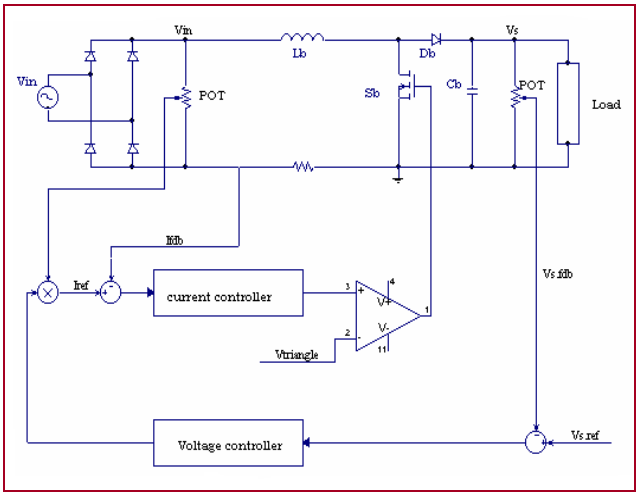


Fig 4. Boost converter complete circuit diagram

BOOST CONVERTER DESIGN CONSIDERATION

The power components of boost converter include the boost inductor L_b, the boost capacitor C_b, boost diode D_b and the boost switch S_b as shown in Fig (2) which explains the boost converter circuit diagram. The following design procedure will include two main elements which are the boost inductor and capacitor. The inductor of the boost converter should be chosen to minimize the current ripple. While the capacitor design is based on the permissible output voltage ripple [5].

There are two voltages controlling the inductor current. One is the rectified sinusoidal input voltage which is applied to one side of the inductor, and the other one is the voltage across the boost switch S_b, which varies between zero and V_o due to switching process and is applied to the other side of the inductor. The voltage that contributes to the ripple is the voltage across the switch.

To consider the worst case for ripple, the duty cycle of the switch is taken to be 50% for this analysis. Based on the above assumption and considering that;

V_s is the output voltage

F_{sw} is the boost switching frequency

I_{Ir} is the rms value of the fundamental component of current ripple at 50% duty cycle

The following equation can be written:

$$(V_s / 2)(4/\pi\sqrt{2}) = (2\pi F_{sw} L_b) I_{ir} \qquad (3)$$

Where;

$(V_s / 2)(4/\pi\sqrt{2})$ is the rms value of fundamental component of switched voltage for 50% duty cycle.

$(2\pi F_{sw} L_b)$ is the reactance impedance of L_b

Considering that the maximum permitted amount of ripple is 5%, therefore, I_{Ir} = .05I, (where I is the rms value at 100Hz the inductor current). Then;

$$L_b = (1.433)\,(V_s) / (F_{sw})\,(I) \qquad 4)$$

To find the value of C_b for the desired output voltage, it can be noted that the capacitor-resistor combination at the output of the converter acts as a low-pass filter for the current through the boost diode. This current can be considered as being supplied by a current source I_s, whose value is controlled by the output voltage controller. Furthermore, Fourier analysis of the diode current shows that this current is of a sinusoidal nature, considering only its dc and fundamental components. Therefore;

$$I_s \cong K(1 - \cos 2\omega t) \qquad (5)$$

The gain of the filter for the dc component of the current I_s is K_v, where its gain for the ac component is;

$$|G_{AC}| = \frac{K_v}{((2K_v C_b \omega)^2 + 1)^{1/2}} \qquad (6)$$

Therefore;

$$r = 2\frac{|G_{AC}|}{G_{DC}} = \frac{2}{((2K_v C_b \omega)^2 + 1)^{1/2}} \qquad (7)$$

Where r is the output voltage ripple, which is defined as the ratio of the peak to peak value of the ripple component to the dc component of the output voltage. As a result, C_b can be found in terms of r to be;

$$C_b = \frac{(4 - r^2)^{1/2}}{2rK_v\omega} \qquad (8)$$

Using equations (4) and (8) the main power elements of boost converter can be determined [5].

SIMULATION RESULTS

In order to verify that the proposed control system performs as expected numerous simulations were conducted to investigate the system performance.

Fig. (5) shows the system transient response at 50% step load increase, the upper one is the output power and the lower is the DC voltage using the proposed combined control system. It is clear that the system performance is highly improved compared to the same system using the DC voltage feedback only shown in Fig.(6) which arranged in the same manner as Fig. (5).

From Fig. (7) it is evident that as the capacitor value increased the transient response is improved on the account of the initial cost. So, this capacitor value can be chosen to maintain the transient response and minimize the initial cost.

To study the system frequency response, a Bode plot is constructed for different control systems including open loop, DC voltage feedback and combined system as shown in Fig. (9). It is noticed that the system using either the DC voltage feedback or the proposed combined control system is stable and the later suppresses

very effectively the variation of the DC output voltage.

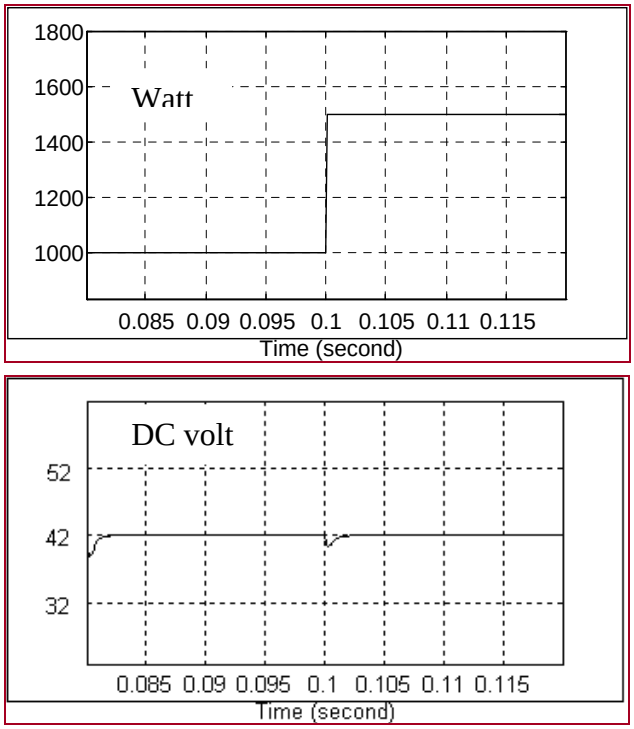


Fig (5) System transient response using the combined control system. Load power Upper trace & DC voltage lower trace

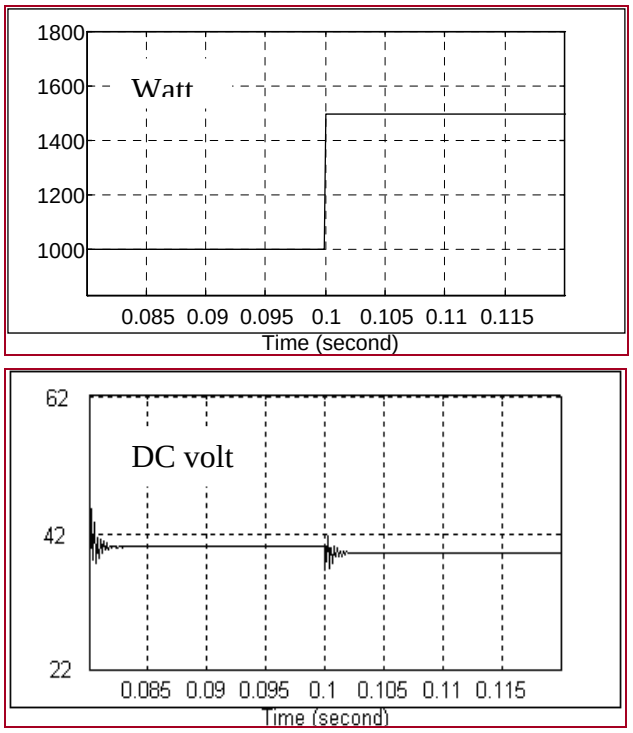
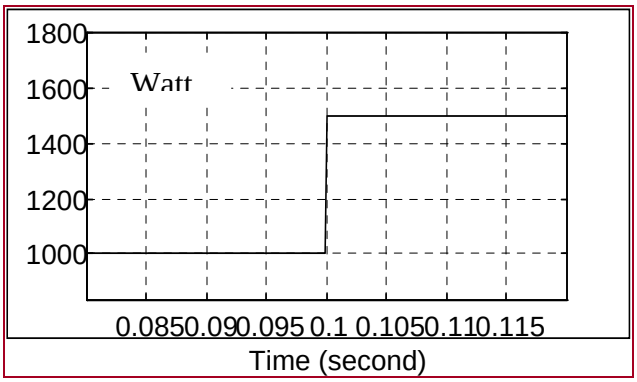
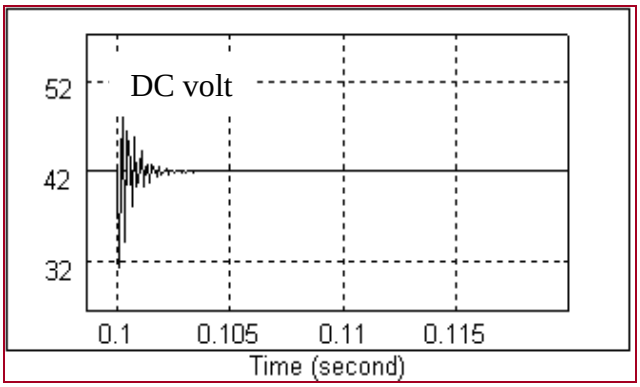


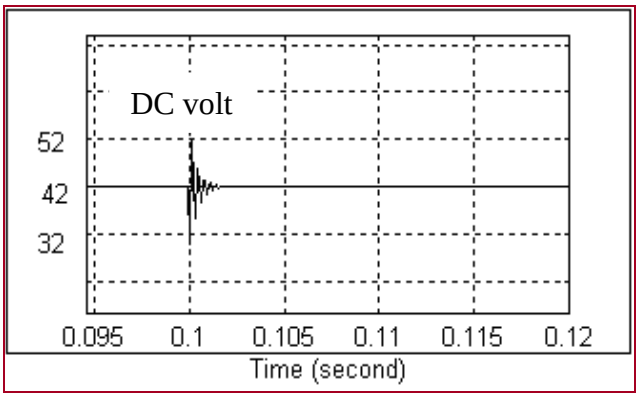
Fig (6) System transient response using the DC feedback only. Load power Upper trace & Dc voltage lower trace.



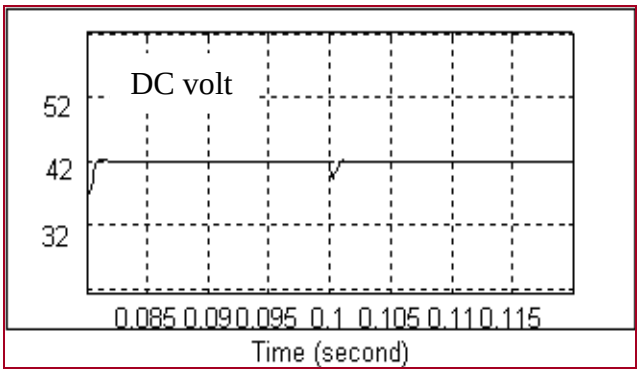
Output power



DC voltage at C= 10 uF

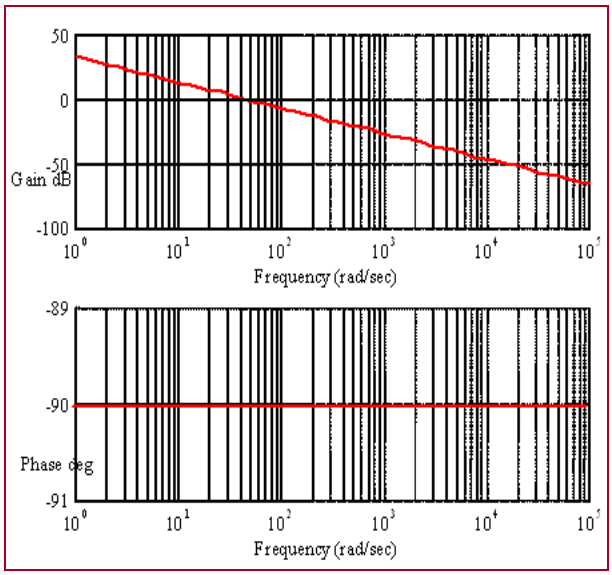


DC voltage at C= 20 uF

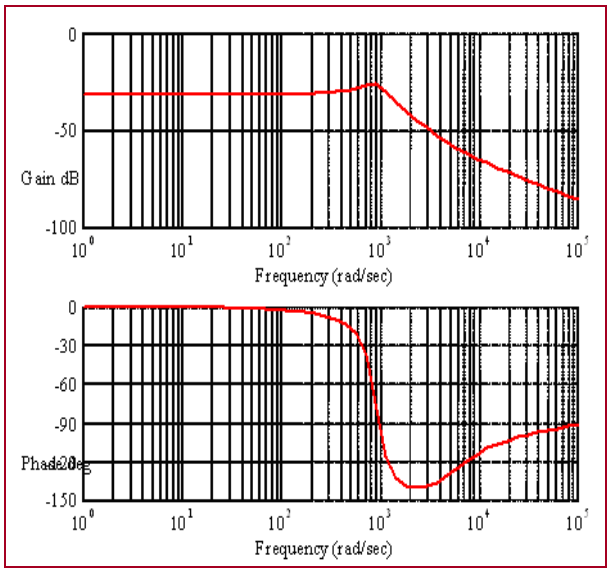


DC voltage at C= 100 uF

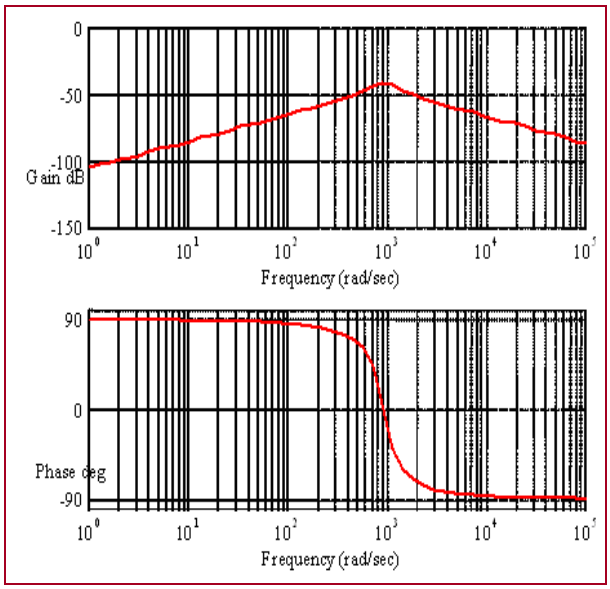
Fig (7) Effect of capacitor value on the system response



Open loop system



Feedback system



Combined system

Fig (8) System frequency response

EXPERIMENTAL RESULTS

The boost converter had been built and tested. It shows a promising results, considering the input current wave shaping the attention has been paid to the input power factor improvement and the input current total harmonic distortion minimization. Those two points can be covered if the control system acts in a way that makes the input source sees the load as a resistive load. This resistive load will draw a current with a unity power factor and minimum input current total harmonic distortion.

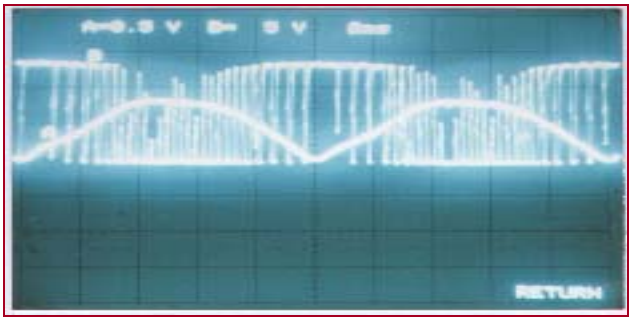


Fig (9) Boost switching device drive signal with input reference current.

The output of the two nested loops control system is shown in Fig (9) which explains the boost converter switching device gating signal in addition to its input current reference. It can be noted that; at the input voltage zero crossing area the on duty ratio of the boost switching device is approaching unity. While it is minimum at peaks of the input voltage waveform.

To demonstrate the effect of the boost converter on the input current wave shaping the input current of the regular diode bridge rectifier is shown in Fig (10). It can be noticed that input current is pulsed current out of synchronism with input voltage.

The boost converter AC input current waveform with the input voltage is shown in Fig.(11). The transient response improvement using the proposed control system is shown in Fig (12). The input current harmonic spectrum has been practically measured at three rectifier configurations. The first is the regular diode bridge rectifier THD is approaching 34%., the second is the boost converter using the conventional control system gave a total harmonic distortion around 3.5% and the last

one is the boost converter using the proposed control system The total harmonics distortion is highly reduced and becomes lower than 0.7%.

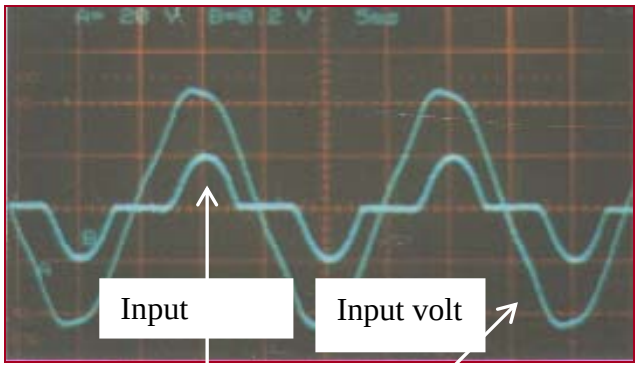


Fig (10) Diode bridge rectifier input current and voltage.

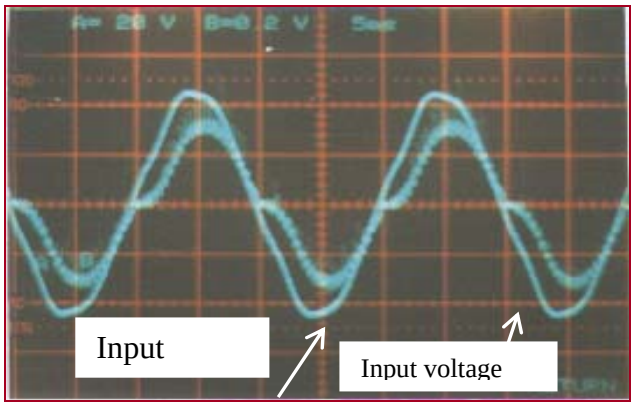
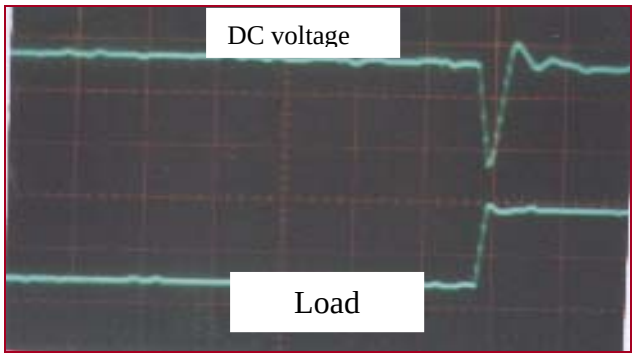
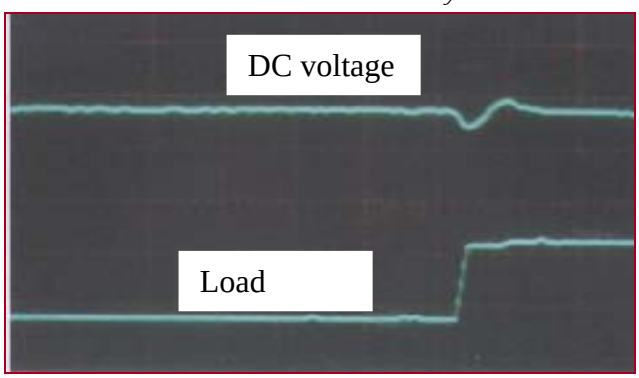


Fig (11) Boost converter input current and voltage.



Feed back control only



Proposed control system

Fig (12) Boost converter transient response

CONCLUSION

A new high power quality DC voltage regulator for vehicles applications has been proposed, simulated, and prototyped and tested successfully.

It is shown throughout this paper a simple boost converter based combined control system that achieved the following

Nearly unity power factor operation with minimum input current total harmonic distortion is obtained using a single switch boost converter based on the proposed combined control system.

The system transient response is highly improved thanks to the combined control system including Dc out voltage feedback along with output power feed forward control scheme.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] ÁRPÁD FERENCZ, [2] MÁRTA NÓTÁRI

EVALUATION OF ORGANIZATION AND ECONOMICS OF REGIONAL APPLE ORCHARD

Abstract:
In our research we examined an apple orchard trained to intensive canopy forms from work organizational and economic aspects. We determined the organizational tasks and also the worktime demand of orchard planting by using norms. In our model calculations we tried to evaluate how far the profitability of production can be increased by enhancing its intensively. We calculated the operational norms of the production using the appropriate methods: handwork norm by workday survey and machine norm by Working-process-cyclic time method. It can be stated, that intensive apple production is characterized by low profitability. The high historical cost, the payback period is extremely long, the rate of returns is very unfavourable, the low annual income determines weak profitability. In our calculations we tried to evaluate how far the profitability of production can be increased by enhancing its intensively. It can be concluded, that beyond a certain level, enhancing intensively spoils the profitability of the orchard, thus – according to our calculations - selecting the greater distance production method is the favourable option.

Keywords:
regional products, work organization, economic evaluation

INTRODUCTION

In Hungary, among the fruit species, apple has been produced in the largest quantities for decades. Up to present days, this sector of horticultural production went through fundamental economic changes and even crises (Ferencz et al., 2009). During our accession to the European Union, it is an excessively important objective for us to develop the whole fruit – and primarily the apple – sector to the level of the EU (Gonda, 2005). By shaping intensive orchards, the most important goals to achieve are: rapid spatial development of the canopy, early fruit bearing, controlling canopy height, spatial stability of the canopy and setting long-time productivity. Slender spindle canopy form is most prevalently used in newly planted orchards (Soltész, 2007). Its application is – depending on soil and ecological characteristics, rootstock and variety vigour – more or less successful. For studying the possibilities of enhanced growth-reduction, early fruit-bearing and great production potential we conducted experimental observations on a less known and used canopy form; the SX spindle. This canopy form enables the production on very short tree distances. But how far is it profitable to reduce tree distance? To answer the question, we needed to conduct some economical studies (Nótári et al., 2009).

MATERIAL AND METHOD

Description of SX spindle canopy form. This canopy form is widely spread in France, but rarely used in Hungary. The virus-free, highly-bud apple trees on M9 rootstocks, were planted 1.5×3 and – on the experimental field 0,75×3 m tree distances. The one-year sapling was bent and tied at 75 cm under horizontal level towards the dominating wind-direction. The expected

effect of bending down is to inhibit the strong growth of the upper shoots. A fully developed SX spindle has three stairs, which are separated by empty parts. Fruits are very close to the central lead, so a better nutritional supply will better reduce vertical growth. To upkeep the SX spindle canopy form with this extremely low tree distance, support system, irrigation and intensive caring technology is needed, which significantly raises production costs.

Methods of economy. To evaluate the aspects of decision-making, we conducted the Capital cost, productive period of the orchard, average net income, playback period, the profitability of the investment, the rate of returns

Methods of work organization. The handwork norm by workday survey, the machine norm by Process-cyclic time method were calculated.

RESULTS AND DISCUSSION

Historical cost of the orchard with 1,5m and 0.75m tree distance are shown at Table1. and Table2.

Table 1: Historical cost calculation (2006-2010)

Operation	Wages + taxes and rates (Euro)	Contri-butory services (Euro)	Costs of materials used (Eoro)	Total (Euro)
Soil preparation		340	888	1228
Planting	933,24	30	5331,2	6294,44
Support system	1260	110	2150	3520
Trickling irrigation system	15	30	5200	5380
Caring operations				
1. year	313,24	320	320	953,24
2. year	403,12	320	585,6	1308,72
3. year	469,76	320	585,6	1375,36
4. year	546,48	320	320	1186,48
Caring operations (1-4 years)	1732,6	1280	1811,2	4823,8
Other costs:				1548,82
Total costs:	4075,84	1790	15380,4	22795,1
Value of by-products:	4 tons x 240 Euro/ton			960
Historical cost:				21835,1

Source: own calculation

To calculate average net income we divided the costs into yield-related (variable) and area-related (fix) expenses. We considered costs related to fertilizing, irrigation and harvesting as variable costs. Pruning, soil cultivation and plant protection were attributed as area-related costs.

Table 2: Historical cost calculation in case of 0,75 m tree distance (2006-2010)

Operation	Wages +taxes and rates (Euro)	Contri-butory services (Euro)	Cost of materia ls used (Euro)	Total (Euro)
Soil preparation		340	888	1228
Planting	1013	30	10658	11701
Support system	1260	110	2150	3520
Trickling irrigation system	150	30	5200	5380
Caring operations				
1. year	547	320	320	1187
2. year	727	320	854	1901
3. year	860	320	854	3088
4. year	1013	320	320	1653
Caring operations (1-4 years)	3147	1280	2349	8429
Other costs				2117
Total costs:				26881
- Value of by-products:	8 tons x 240 Euro/t			1920
Historical cost:				28800

Source: own calculation

Annual technology costs of apple produced on trees with SX spindle canopy form is shown at Table 3. Tables 4-5 consist the distribution of costs.

Table 3: Annual technology costs of apple produced on trees with SX spindle canopy form

Category	1,5 m tree distance	0,75 m tree distance
	Costs (Euro)	
Cost of materials used	1268	1268
Wages	1100	1767
Taxes and rates	418	671
Depreciation	1238	1656
Contributory services	900	940
Total costs:	4924	6302

Source: own calculation

Table 4: Variable and fix costs at 35 t/ha yield (tree distance:1,5 m)

Costs	Costs of materials	Wages	Taxes and rates	Depreci-ation	Contributo ry services	Total (Euro)
Fix costs	600	633	241	1238	500	3212
Variable costs	19	13	5		11	49

Table 5: Variable and fix costs at 45 t/ha yield (tree distance:0,75 m)

Costs	Costs of materials	Wages	Taxes and rates	Depreci-ation	Contributory services	Total (Euro)
Fix costs	600	1167	443	1656	500	4366
Variable costs	19	13	5		10	47

Source: own calculation

The profit calculation at 1,5m and 0.75m tree distance are are shown at Table 6. and Table 7.

Table 6: Profit calculation at 1,5 m tree distance

Produc-tive years	Yield t/ha	Fix cost Euro/ha	Variable cost Euro/ha	Total cost Euro	Sales revenue Euro	Profit Euro
1. year	20	3212	978	4190	4800	610
2. year	25	3212	1223	4435	6000	1565
3. year	30	3212	1467	4679	7200	2521
Total:				13304	18000	4696

Source: own calculation
Average net profit: 4696/3 years = 1565 Euro /year.

Table 7. Income calculation at 0,75 m tree distance

Produc-tive years	Yield t/ha	Fix cost Euro/ha	Variable cost Euro/ha	Total cost Euro	Sales revenue Euro	Profit Euro
1. year	30	4 366	1 417	5 784	7 200	1 416
2. year	35	4366	1 654	6 020	8 400	2 380
3. year	40	4 366	1 890	6 256	9 600	3 344
Total:				18 059	25 200	7 141

Source: own calculation
Average net profit: 7140/3 years = 2380 Euro /year.

Economic analysis of the investment

The tested culture was compared with a model plantation with 0.75 tree distance. The economic analysis of the investment – based on static indicators – is shown at Table 8.

Table 8: Economic analysis of the investment by static indicators

Category	1.5m tree distance	0.75 m tree distance
Average net income	1 565.45 Euro	2 380.18 Euro
Payback period	14 years	12 years
Profitability of investment	7.2 %	8.3 %
Rate of returns	1.6	1.8

Source: own calculation

CONCLUSION

- Intensive apple production can also be characterized by low profitability in Hungary.
- Due to the high historical cost. the payback period is extremely long. the rate of returns is very unfavourable. the low annual income determines weak profitability.
- Returns differed only slightly in the two cases. however the profitability of the higher investment value orchard was found to be minimally greater.
- It can be concluded. that beyond a certain level. enhancing intensivity spoils the profitability of the orchard. thus – according to our calculations - selecting the greater distance production method is the favourable option.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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ACCURACY AND CALLIBRATION OF MICROPOSITIONING ROBOTIC SYSTEMS

Abstract:
The subject of this paper is robotisation of cell-injection process and in particular development of an accuracy analysis, virtual model of micro-nano robot and calibration of the structure. To cover all requirements as high-speed, fine positioning and orientation preloaded stack piezo-actuators with closed loop are selected. Main issues of methodology for accuracy analysis and microrobot calibration are presented. Virtual model of micromanipulator is realized according to the synthesized kinematical structure with 3 DoF. The future work is related with development and calibration of real prototype of microrobot with 3 DoF according to the realized virtual model and obtained results.
Microrobot, subject of this paper could cover the working space presented by the cell size between 10μm and 30μm. It has to position and orientate the needle close to the cell membrane and finally to realize cell-injection penetrating the cell membrane with high speed thus preventing the cell from damage.

Keywords:
Robotisation, cell-injection process, structure calibration, virtual model

INTRODUCTION

Robotisation of any micro- and nano-manipulation process needs of analysis and specification of all specific parameters and requirements found in every stage of the whole process. Cell-injection, subject of this paper contains several stages that could be robotized as follows. Cell selection could be realized by fluid driven through a glass channel transferring cells to the immobilization stage. Using two digital cameras control parameters as cell size and shape will be obtained.
Microrobot, subject of this paper could cover the working space presented by the cell size between 10μm and 30μm. It has to position and orientate the needle close to the cell membrane and finally to realize cell-injection penetrating the cell membrane with high speed thus preventing the cell from damage.

ACCURACY PROBLEMS OF MICROPOSITIONING ROBOTIC SYSTEMS

a. Way accuracy:

Any moving object has six available degrees of freedom. These consist of translation, or linear movement, along any of three perpendicular axes (X, Y, and Z), as well as rotation around any of those axes. The function of a linear positioning way is to precisely constrain the movement of an object to a single transitional axis only. Any deviations from ideal straight-line motion along that axis are the result of inaccuracy in the way assembly. There are five possible types of inaccuracy, corresponding to the five remaining degrees of freedom: translation in the Y-axis; translation in the Z-axis; rotation around the X-axis (roll); rotation around the Y-axis (pitch) and rotation around the Z-axis (yaw). Since there are interrelations between

these errors, it is worthwhile to carefully examine the effects of each type of error and its method of measurement.

b .Linear positioning accuracy:

This is simply the degree to which commanded moves match intentionally defined units of length.

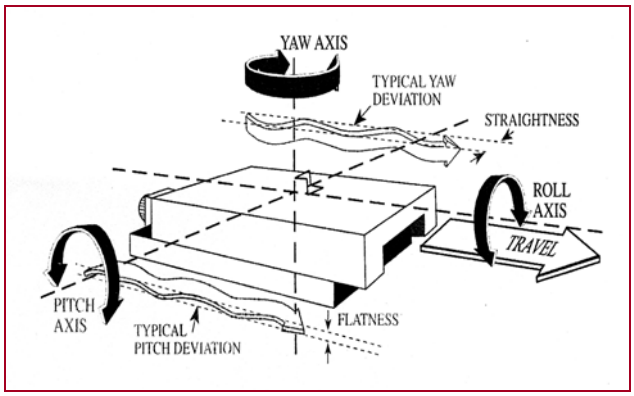

Figure 1– Possible Way Inaccuracies

Lead screw-Based Systems: Low to moderate accuracy systems typically depend on a lead screw or ball screw to provide accurate incremental motion. Such systems are often operated open loop via stepping motors; if closed loop operation is employed, it is frequently with a rotary encoder. In either case, the leads crew is a principal accuracy-determining element. Leads crews exhibit a cumulative lead error, which is usually monotonic in nature, together with a periodic component, which is cyclic and varies over each revolution of the screw. In addition, there can be backlash in the nut, which will reveal itself upon direction reversal.

Linear Encoder-Based Systems: Use of a linear encoder eliminates concern over the leads crew cumulative error, as well as friction induced thermal expansion. In many systems, the leads crew can be dispensed with altogether and replaced with a non-contacting linear motor.

c. Resolution *- Resolution is defined as the smallest positional increment, which can be commanded of a motion control system. The mechanical positioning components, motor, feedback device, and electronic controller each play a role in determining overall system resolution. In stepping motor systems, the resolution is set by the lead screw pitch, motor step angle, and drive electronics. For any given pitch, two full step resolutions can be achieved through the use of either 1.8 degree or 0.9 degree stepping motors. This full step resolution can be further increased by micro stepping (electronical subdivision of each full step into 10 or 50 micro steps, producing 2000 or 10000 micro steps per revolution with 1.8-degree steppers for example).In general, it is appropriate to specify a resolution that is about five times smaller than the position error that is required by the application. The resolution of servo systems incorporating linear encoders is independent of the screw pitch, and is strictly a function of the positional feedback device.*

d .Repeatability of micropositioning systems *: The repeatability of a positioning system is the extent to which successive attempts to move to a specific location vary in position. A highly repeatable system (which may or may not also be accurate) exhibits very low scatter in repeated moves to a given position, regardless of the direction from which the point was approached.*

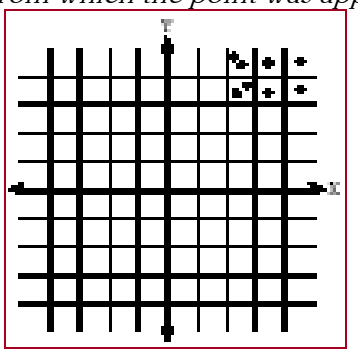

Figure 2. Low accuracy, Low repeatability

A distinction can be drawn between the variance in moves to a point made from the same direction uni-directional repeatability) and moves to a point from opposing directions (bi-directional repeatability).

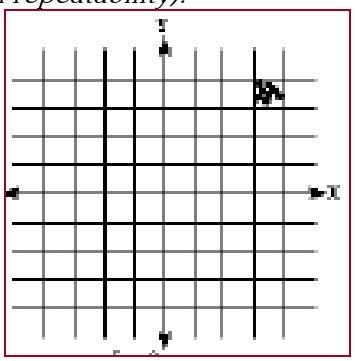

Figure 3. Low accuracy, High repeatability

In general, the positional variance for bi-directional moves is higher than that for uni-directional moves. Quoting uni-directional repeatability figures alone can mask dramatic amounts of backlash.

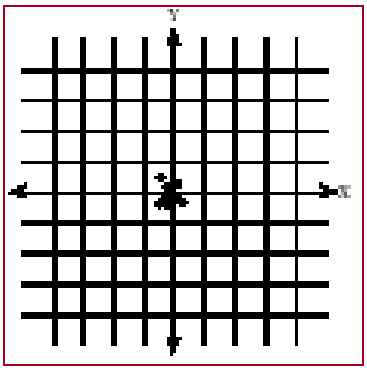

Figure 4. High accuracy, High repeatability

Measuring the stage dynamics: For measuring the dynamic response of X – Y tables and providing real-world feedback it is necessary to use a tool with both high spatial and temporal resolution: the laser interferometer. It's combination of 1.25 nm resolution, 100 kHz position update

KINEMATIC STRUCTURE AND CALLIBRATION OF MICROROBOT FOR CELL INJECTION

Mechanisms with closed kinematic chains are suitable for high-precision tasks in 3D space. The high accuracy of such mechanical systems comes from the very high structural stiffness. Generally, there are 3 types of joints between the links: kinematic, elastic and rigid. The stiffness of the mechanical construction increases in the same order. Taking account the type of the micro-manipulation process, required working space, cell size, high speed and precision a parallel kinematical structure with 3 DoF actuated by 3 stack piezo-actuators is selected (fig. 5).

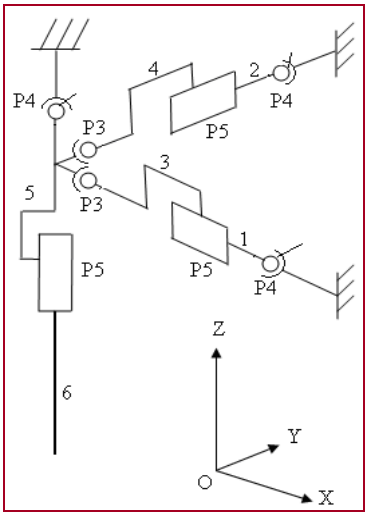

Figure 5. Kinematical chain of micro-manipulator with 3 DoF

Corresponding kinematic scheme is chosen mostly to fulfil the requirements of compact construction, high stiffness and enough working space.

In the calibration process, several sequential steps enable the precise kinematic parameters of the micro-nano robot to be identified, leading to improved accuracy. These steps may be described as follows:

1) A kinematic model of the robot and the calibration process is developed and is usually accomplished with standard kinematic modeling tools. The resulting model is used to define an error quantity based on a nominal (manufacturer, s) kinematic parameter set and an unknown actual parameters set which is to be identified.

2) Experimental measurements of the robot pose (partial or complete) are taken in order to obtain data relating to the actual parameter set for the robot.

3) The actual kinematic parameters are identified by systematically changing the nominal parameter set so as to reduce the error quantity defined in the modeling phase. One approach to achieving this identification is determining the analytical differential relation ship between the pose variables P and the kinematic parameters K in the form of a Jacobian,

$$\delta P = J \delta K \qquad (1)$$

and then inverting the equation to calculate the deviation of the kinematic parameters from their nominal values

$$\delta K = [J^T J]^{-1} J^T \delta P \qquad (2)$$

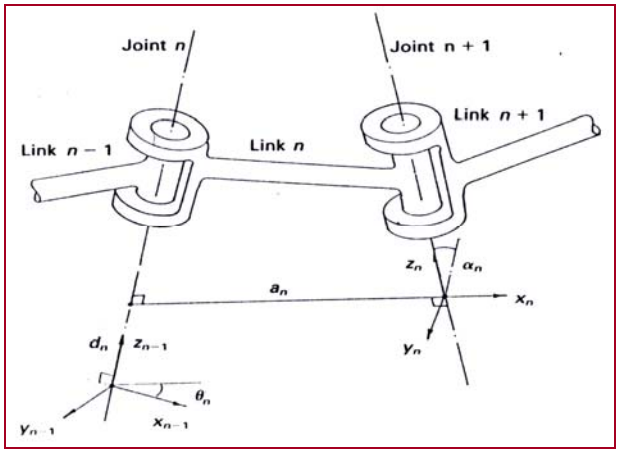

Figure 6 .Link coordinate frame allocation

Alternatively the problem can be viewed as a multidimensional optimization task, in which

the kinematic parameter set is changed in order to reduce some defined error function to zero. This is a standard optimization problem and may be solved using well- known methods.
4) The final step involves the incorporation of the identified kinematic parameters in the controller of the robotic systems, the details of which are rather specific to the hardware of the system under study. In the method described here, for each position in which the robot is placed, the full pose is measured, although several intermediate measurements have to be taken in order to arrive at the pose. The device used for the pose measurements is a coordinate measuring machine CMM) with 3 axis, prismatic measuring system with a quoted accuracy of 3 microns.

ROBOTIC KINEMATICAL PARAMETERS

The fundamental modeling tool used to describe the spatial relationship between the various objects and locations in the robot workspace is the Denavit – Hartenbeg method with modifications proposed by Hayati and Mooring to account for disproportional models when 2 consecutive joint axes are normally parallel. As shown in Fig. 6 this method places a coordinate frame on each object or robotic link, and the kinematics are defined by the homogeneous transformation required to change one coordinate frame into the next.
This transformation takes the form

$$A_n = rot(z,Q_n)trans(z,d_n)trans(x,a_n) \; rot(x,\alpha_n)rot(y,\beta_n) \qquad (3)$$

The above equation may be interpreted as a means to transform frame n-1 into frame n by means of 4 out of the 5 operations indicated. When consecutive axes are not parallel, the value of β_n is defined to be zero, while for the case when consecutive axes are parallel, d_n is the variable chosen to be zero. Using Denavit-Hartenberg method, the matrix form is usually expressed. For a serial linkage, such a robots a coordinate frame is attached to each consecutive link so that both the instantaneous position together with the invariant geometry are described by the previous matrix transformations. The transformation from the base link to the nth link will therefore be given by

$$T_n = A_1 A_2 \ldots . A_n \quad . \qquad (4)$$

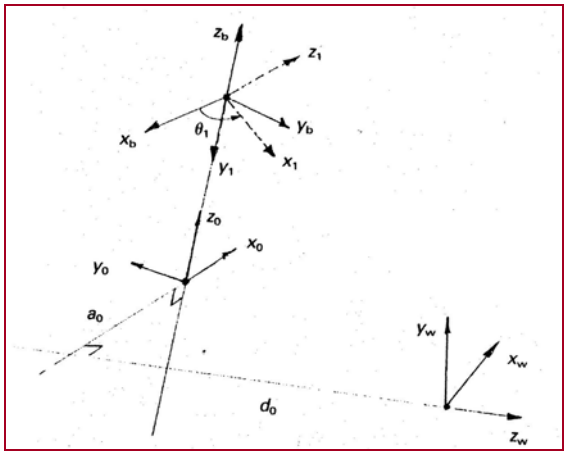

Figure 7 . Base transformations

We are interested in determining the minimum number of parameters required to move from the world frame to the frame x_1,y_1,z_1. There are 2 paths that will accomplish this goal:
1) A DH transform from x_w,y_w,z_w to x_0,y_0,z_0

$$T_0^b = rot(z_0,\phi')trans(z_0,d') \qquad (5)$$

It requires only 8 independent parameters to go from the world frame to the first frame, using this path.
2) As an alternative a transform may be defined directly from the world frame to the base frame x_b,y_b,z_b, by using of 6 parameters, such as the Euler form

$$A_b = rot(z,\phi_b)rot(y,\theta_b)rot(x,\psi_b) \; trans(p_{xb},p_{yb}.p_{zb}) \qquad (6)$$

In this study the second path is chosen the tool transform is an Euler transform wchich requires the specification of 6 parameters.

$$A_6 = rot(z,\phi_6)rot(y,\theta_6)rot(x,\psi_6) \; trans(p_{x6},p_{y6},p_{z6}) \qquad (7)$$

METHODOLOGY OF KINEMATICAL IDENTIFICATION

The kinematic parameter identification will be performed as a multidimensional minimization process, since this avoids the calculation of the system Jacobian. The process is as follows :

1. *Begin with a guess set of kinematic parameters ,such as the nominal set*
2. *Select an arbitrary set of joint angles for the micro-nano robot*
3. *Calculate the pose of the robot end – effector*
4. *Measure the actual pose of the end-effector for the same-set of joint angles. In general*

the measured and predicted pose will be different.

5. Modification of the kinematic parameters in an orderly manner in order to best fit (in a least – squares sense the measured pose to the predicted pose.

The suggested algorithm is applied not to a single set of joint angles but to a number of joint angles. The total number of joint angle sets required, which also equals the number of physical measurement made, must satisfy

$$K_p > N_x D_f \qquad (8)$$

where

K_p – is the number of kinematic parameters to be identified;

N – is the number of measurements (poses) taken;

D_f – represents the number of degrees of freedom present in each measurement;

In the system described here, the number of degrees of freedom is given by $D_f = 6$ since full pose is measured. In practice many more measurements should be taken to offset the effect of noise in the experimental measurements. Piezo-actuators realise positioning and orientation of the pipette around X and Y axes and penetration into the cell membrane by piezo-actuator along Z axis. They are modeled by prismatic joints P5 closing the mechanical construction through spherical joints (P3) and elastic hinges (P4). According to equation (1) it is possible to calculate the DoF of the end effector (link 6):

$$h = 6n - 5p_5 - 4p_4 - 3p_3 \qquad (9)$$

Where h – number of DoF; n – number of mobile links; P5, P4, P3 – kinematical joints with 1, 2, 3 DoF respectively. After replacement of known parameters into the equation (1) the DoF become equal to 3. Stack piezo-actuators with strain-gauges from PI are selected like actuation modules covering all requirements for robotization of cell-injection process. Piezo-actuators along X and Y axes (P-841.2B) are internally preloaded with maximal range of motion equal to 30μm, resolution – 0.6nm and stiffness equal to 27N/μm. Piezo-actuator realizing injection movement of the pipette along Z axis (P-841.40) is also internally preloaded with maximal range of motion equal to 60μm, resolution – 1.2nm and stiffness equal to 15N/μm. According to the kinematical structure synthesized before a virtual model of micro-manipulator with 3 DoF (fig. 8) is developed. Actuated chains along X, Y axes contain 1 piezo-actuator, pointed as A1 and A2 respectively. Third actuation chain containing piezo-actuator A3 along Z axis is fixed to the primary chain used only for injecting the pipette into the cell membrane. First and second actuation chains are used for positioning and orientation of the pipette.

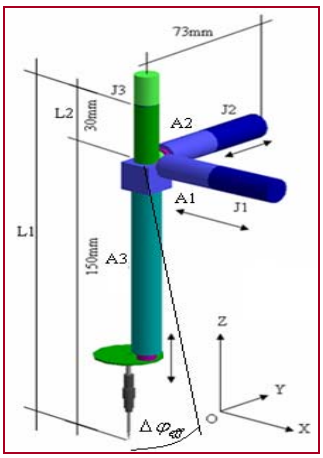

Figure 8. Virtual model of microrobot

The angular deflection of the end-effector could be obtained according to the equation (10):

$$\Delta\varphi_{eff} = \frac{\Delta l_{A1}}{L1} = \frac{\Delta l_{eff}}{L2} \qquad (10)$$

Where $\Delta\varphi_{eff}$ - angular deflection of the end-effector; Δl_{A1} - linear deflection of actuator A1 or A2; Δl_{eff} - linear deflection of the end effector;

Gear ratio is obtained by equation (11):

$$n = \frac{\Delta l_{eff}}{\Delta l_{A1}} = \frac{L2}{L1} = \frac{180}{30} = 6 \qquad (11)$$

According to the range of used stack piezo-actuators $\Delta l_{A1} = \Delta l_{A2} = 30\mu m$, the range of end effector motion on X and Y direction is $\Delta x = \Delta y = \Delta l_{eff} = 180\mu m$. The range of end effector motion on Z direction is determined of used actuator P-841-67 as $\Delta z = 60\mu m$.

The working space of the micro-manipulator represents part of a sphere with maximal range of motion along X and Y axes equal to 0.18mm and along Z axis respectively 0.060mm.

For improving the dynamic parameters and removing backlashes in the manipulator the structure must be tensed. By this reason the elastic joint of the primary chain is tensed by means of X and Y arrangement of the two actuators. The angular stiffness of this joint (P-176.60) is $k\varphi = 40$ Nm/rad. When the joint is deformed up to the admissible rotation angle

$\Delta\varphi_j = 0.5^0 = 0.008726$ [rad], the strain forces of the actuators are:

$$F = k_\varphi \Delta\varphi_j / L_1 = 11.63[N]. \qquad (12)$$

The actuators must be displaced on X and Y direction as $\Delta l_X = \Delta l_Y = L_1 \Delta\varphi_j = 0.2618[mm]$.

The effective displacement of the end effector will be $\Delta X = \Delta Y = L_2 \Delta\varphi_j = 1.5708[mm]$.

As a regional structure moving micro-manipulator into the working space is used macro-manipulator with 4 DoF. The whole system is modeled into the interactive environment of SDS 2004+ for investigation of its kinematics (fig. 9).

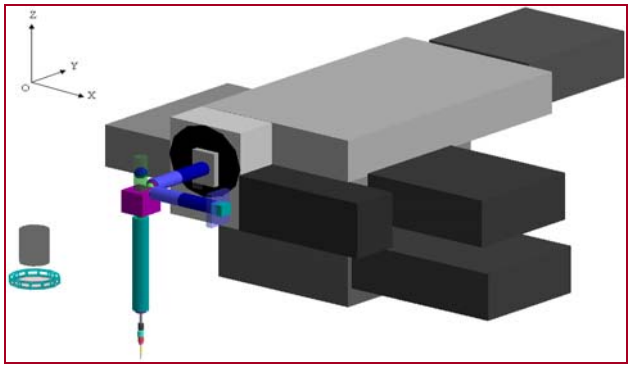

Figure 9. Virtual model of microrobot mounted to the regional structure with 4 DoF

The linear resolution of the macro-robot is around 0.1mm, maximal range of motion on X and Y axes are equal to 50mm and along Z axis is 30mm. Rough positioning and orientation is realized by macro-manipulator and fine displacement and cell-injection are performed by micro-manipulator respectively. We have to use the device for pose measurements, such like a coordinate measuring machine CMM) with 3 axis, prismatic measuring system with a quoted accuracy of 3 microns. In order to maximize the joint motion for the experimental poses the common working volume of the microrobot and CMM was regarded as a parallelepiped with 12 points, where pose measurements have to be taken. The calibration on the base of suggested methodology required to take the data and type in the results for parameters - $\Delta\varphi_{eff}$, Δl_{eff}, L1 and L2 as more important for the high precision robotic movements.

CONCLUSION

Virtual model of micromanipulator is realized according to the synthesized kinematical structure with 3 DoF. As actuation, modules are selected preload stack piezo-actuators with closed loop suitable for applications with high-dynamics. By elastic hinges closing the mechanical construction are reduced backlashes and the precision of the robot is increased as a result. The future work is related with development and calibration of real prototype of microrobot with 3 DoF according to the realized virtual model and obtained results.

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IMPROVING THE QUALITY IN INDUSTRIAL AREAS WITH ADAPTED METHODOLOGY FOR A BETTER ENTERPRISE DATA

Abstract:
In engineering and manufacturing, quality control and quality engineering are involved in developing systems to ensure products or services are designed and 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. Quality assurance is the activity of providing evidence needed to establish quality in work, and that activities that require good quality are being performed effectively. All those planned actions necessary to provide enough confidence that a product or service will satisfy the given requirements for quality. 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 management, production, and inspection processes.

Keywords:
quality assurance, cast-iron rolls, improvement, manufacturing, research

INTRODUCTORY NOTES

Today's demands for flexible and economic production of industrial sectors can only be met by automation solutions which are based on in-depth technological process modeling know-how, high-performance control systems and a comprehensive understanding of the logistics.
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.
Logistics activities are searching constantly for ways to improve process capabilities, shorten throughput times, improve quality, and cut costs. Many manufacturing and quality engineering books describe the specifics of defining process capabilities or optimally designing logistics systems. In many cases, the need for improvements may be obvious. In fact, to many private or public sector organizations, these improvements may be necessities.
The production logistics, as an important component of logistics systems in production companies, covers planning, management and monitoring of the material flow – from raw-material warehouses and various production stages to warehouses for finished goods. In the complete value cycle, production logistics follows procurement logistics and precedes distribution and reverse logistics.
The quality assurance research fields can be defined through the general research area, thought the different experiments effectuated in the laboratories, and, also, thought the modern calculation programs, optimization technologies and the better capitalization of the manufacturing data.

IMPROVING THE QUALITY IN INDUSTRIAL AREAS

Improving quality involves applying appropriate methods to close the deficiencies between current and expected levels of quality as defined by standards. This activity can use the quality management tools and principles to understand and address technical system deficiencies and improve the future technological processes. A range of quality improvement approaches exist, from individual problem solving, rapid team problem solving, and systematic team problem solving to process improvement and redesign and organizational restructuring or reengineering. The improving quality must include:

- *the approach to quality improvement*
- *the spectrum of quality improvement approaches*
- *the performance improvement*
- *analyses of efficiencies*

Quality improvement methodology has evolved over the years. Early quality assurance efforts assumed that improvements could be readily attained by adding new or more things, such as new machines, procedures, training, or supplies. It was believed that simply adding more resources or inputs would improve quality. People working to improve quality learned that increasing resources does not always ensure their efficient use and, consequently, may not lead to improvements in quality. In fact, in many cases, the quality can be improved by making changes into the systems without necessarily increasing resources. Interestingly, improving the processes not only creates better outcomes, but also reduces the cost of delivering services by eliminating waste, unnecessary work, and rework. Inspecting main activities or processes is another approach that managers have used to identify and solve problems. These methods tried to increase the control over the technological processes, in scope to avoid the eventually mistakes inefficient processes, or imperfections. The approaches can examine how activities can be changed for increase the performance. The role of approach is recognizes that both the resources (inputs) and activities carried out (processes) must be addressed together to ensure or improve the quality of products. The methods which define the quality improvement are consisting in following steps:

- *identify, also determine what to improve;*
- *analyze, also understand the problem;*
- *develop, also hypothesize about what changes will improve the problem and develop solution strategy based on these changes;*
- *test and implement, also test the hypothesized solution.*

Figure 1. The Steps in the Quality Improvement

The quality improvement is not limited to carrying out these four steps, but rather emphasizes continuously looking for ways to further improve quality. When improvements in quality are achieved, teams can continue to strive for further improvements with the same problem or address other opportunities for improvement that have been identified.

1 Step one: Identify

The goal of the first step, identify, is to determine what to improve. This may involve a problem that needs a solution, an opportunity for improvement that requires definition or a process or system that needs to be improved. This first step involves recognizing an opportunity for improvement and then setting a goal to improve it.

2 Step two: Analyze

Once areas for quality improvement have been identified, the second step is to analyze what we need to know or understand about this opportunity for improvement before considering changes. The objectives of the analysis stage can be any combination of the following:

- *clarifying why the process or system produces the effect that we aim to change*
- *measuring the performance of the process or system that produces the effect*
- *formulating research questions, such as the following:*

To reach these objectives, this step requires the use of existing data or data collection. The extent to which data are needed depends on the quality

improvement approach chosen. Techniques to analyze problems include clarifying processes through flowcharts or cause-effect analyses, reviewing existing data, and, when needed, collecting additional data.

3 Step three: Develop

The third step, develop, uses the information accumulated from the previous steps to explore what changes would yield improvement. A hypothesis is formulated about which changes, interventions, or solutions would reduce the problem and thus improve the quality of products. A solution strategy is then developed based on this hypothesis. It is important to remember that at this point the hypothesis remains a theory, as it has not yet been tested. A hypothesis is a tentative assumption made in order to test its consequences. It is based on roll makers knowledge and beliefs about the likely causes and solutions of the problem.

4 Step four: Test and implement

This step, test and implement, builds on the first three. A hypothesis is tested to see if the proposed intervention or solution yields the expected improvement. Because interventions that prove to be effective may not yield immediate results, allowing time for change to occur is important in the testing process. The results of this test determine the next step, also the start the improvement process (if the proposed change did not produce an improvement), the modify the proposed change (if the proposed change yields improvement that is not completely satisfactory) or begin the implementation of the change or intervention (if the proposed change yields satisfactory improvement).

THE SPECTRUM OF QUALITY IMPROVEMENT APPROACHES

1 Rapid Team Problem Solving

Rapid team problem solving is an approach in which a series of small incremental changes in a system is tested—and possibly implemented—to improve quality. Like individual problem solving, this approach could be used in any setting, although it generally requires that teams have some experience in problem solving this approach quickly. Rapid team problem solving may involve cause analysis, but implemented in a less rigorous fashion than in systematic problem solving.

2 Systematic Team Problem Solving

Systematic team problem solving is often used for complex or recurring problems that require a detailed analysis. It frequently results in significant changes to a system or process. This approach is a detailed study of the causes of problems and then developing solutions accordingly. This detailed analysis usually involves data collection and therefore often requires considerable time and resources.

PROCESS IMPROVEMENT

The most complex of the four approaches, process improvement, involves a permanent team that continuously collects, monitors, and analyzes data to improve a key process over time. Process improvement is often used to assure the quality of important services in organization. Since this approach is often used to respond to core processes of a system, various stakeholders contribute to the analysis stage.

In sum, experience with quality improvement has rendered it a simpler, more robust methodology, and the application to a wide range of settings has become clearer. In all of these approaches, the methodology and principles remain unchanged, though their specific methods may vary.

ANALYZE, IMPROVE AND CONTROL

The data profiling, sometimes called data discovery or data quality analysis is the essential first step in any data improvement program. Data profiling provides a wealth of information about the integrity of the technical data specific for the processes and illuminates potential problems in the workflows. An effective data profiling approach allows structuring a data quality solution to address the specific nature of the data quality issues.

After identifying the data issues in the data profiling phase, it's time to begin correcting these issues. In the data quality phase, is necessary start to improve the quality of information throughout the enterprise by creating business rules to correct, standardize and validate the data. The high-quality data is essential to successful technical operations.

An effective data integration strategy can lower costs and improve productivity by ensuring the consistency, accuracy and reliability of data

across the enterprise. In this sense, ensuring the source data is consistent, accurate and reliable through a data quality process is the foundation for any successful business initiative.

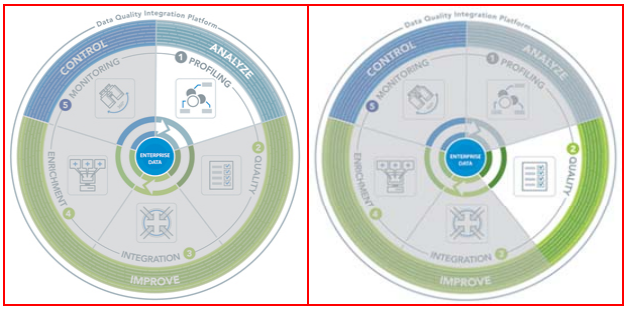
After data quality establishes corporate standards for information and data integration creates a unified view, the enterprise (foundry) is ready to begin expanding on the value of its data and enriching its view of the specific customers, products and partners.

When the data enrichment is complete, the enterprise (foundry) has a unified, high-quality, and value-added view of its corporate data, and a solid base to make sound, informed business decisions. But the company will always be getting new data. Without the capability to maintain the integrity of that data, the benefits of all integrated system work start to disappear. Data monitoring builds on initial data quality and integration initiatives by providing the technology to examine data over time, enforce continued adherence to business rules, and prevent good data from going bad. Data monitoring helps you maintain consistent, accurate and reliable data.

Figure 2. Methodology for a better enterprise data

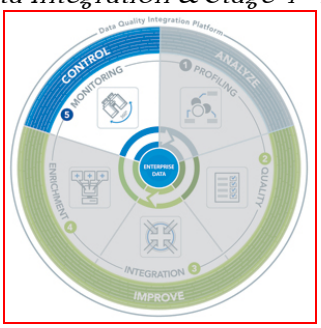
The entire methodology can built a better enterprise data and will make various analyze, improve and control data (Figure 2). This is achieved through five methodological building phases (stages – see Figure 3):

- *Stage 1, also data profiling stage, also inspect data for errors, inconsistencies, redundancies and incomplete information*
- *Stage 2, data quality stage, also correct, standardize and verify data*
- *Stage 3, data integration stage, also match, merge or link data from a variety of disparate sources*
- *Stage 4, data enrichment stage, also enhance data using information from internal and external data sources*
- *Stage 5, also data monitoring stage, also check and control data integrity over time*



Stage 1 - Data Profiling & Stage 2 - Data Quality

Stage 3 - Data Integration & Stage 4 - Enrichment



Stage 5 - Data Monitoring

Figure 3. The five methodological building stages

CONCLUSION

This methodology can helps any technical and technological analyze, can improve and can control data in the any enterprise area. The methodology provides the foundation to understand and improve the quality of data in any metallurgical organization. These mission-critical efforts require a complete, end-to-end approach to data quality. In this sense, the implementation of this methodology can help the general enterprise activity. We can enounce the following advantages:

- *drastically reduce the time and resources required to find problematic data;*
- *catalog and analyze data and discover data relationships;*
- *discover the quality, characteristics and potential problems of information before beginning the processes;*
- *verify and validate data accuracy to improve the overall accuracy of customer records, product data and other information;*
- *ensure that high-quality information;*
- *enhance the value of product data with commodity coding and categorization details;*
- *detect when data exceeds pre-set limits.*

Data monitoring has become a key component of a complete data-quality and data-integration practice, giving organizations the tools they need to understand how and when their data strays from its intended purpose. Monitoring also helps identify and correct these inefficiencies through automated, ongoing enforcement of customizable business rules. Data monitoring ensures that once data becomes consistent, accurate and reliable, it remains that way, giving confidence to professionals who make information-based decisions in any organization.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

INTERNATIONAL SYMPOSIUM on ADVANCED ENGINEERING & APPLIED MANAGEMENT – 40th ANNIVERSARY in HIGHER EDUCATION (1970-2010)

4 – 5 NOVEMBER, 2010
HUNEDOARA, ROMANIA

INVITATION

*It is our privilege and pleasure to extend a cordial invitation to you and your colleagues to attend the **Symposium**, which will ensure an exchange of scientific information and didactical opinions in fields with an impressive dynamic considering the research and the technological progress.*
The Symposium is an open invitation for all specialists, professors, researchers and experts in all scientific fields, who can produce a free presentation of the results in their scientific activities.
*For more information please contact the **Secretary Office of the Organizing Committee**. An e-mail address was be opened to receive your correspondence: symposium@fih.upt.ro*

MAIN TOPICS:

- *MATERIALS SCIENCE & ENGINEERING*
- *ELECTRICAL ENGINEERING & ENERGETICS*
- *INFORMATICS & COMPUTER SCIENCE*
- *MECHANICAL ENGINEERING & DESIGN*
- *MANAGEMENT IMPLEMENT POLICIES & STRATEGIES*
- *ENVIRONMENTAL ENGINEERING & ECOLOGY*

IMPORTANT DATES:

- *For the paper selection, you are kindly invited to submit a maximum 200 words abstract and post it to the address of the Symposium by **15 July 2010**, stating the section in which the papers will be presented.*
- *Notification of acceptance, instructions for preparing camera-ready manuscripts, financial and other details will be sent by **15 September 2010**.*
- *The camera-ready manuscript of your paper must be sent to the **Secretary Office** by **01 October 2010**.*
- *The final announcement of confirmation for publishing and the day of your paper presentation will be sent by **30 October 2010**.*

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- *Lect. dr. eng. **Vasile George CIOATA***
- *Lect. dr. math. **Dan LEMLE***

LOGISTICAL SUPPORT:

*All accepted papers of **Symposium** will be published into the Symposium Proceeding. Selected and expanded papers which were orally presented at the Conference will be considered for publication in **ANNALS of F.E.H. – INTERNATIONAL JOURNAL OF ENGINEERING** and **ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING** as full-length research papers after reviewing and appropriate revisions.*

*The logistical support will be assured by the **ANNALS of F.E.H. – INTERNATIONAL JOURNAL OF ENGINEERING** and **ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING** (B+ International Scientific Journals according with the CNCSIS classification, indexed in Index Copernicus, Evisa and JournalSeek Genomics)*

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

THE 6TH INTERNATIONAL SYMPOSIUM "SHAPE, MECHANICAL AND INDUSTRIAL DESIGN OF PRODUCTS IN MECHANICAL ENGINEERING 2010"

KOD
Konstruisanje • Oblikovanje • Dizajn
2010

29 - 30 September 2010, Hotel Prezident, Palić, Serbia

INVITATION

Dear colleagues,
We kindly invite You to join the 6th International Symposium "KOD 2010" which will take place on 29th and 30th September 2010 in Hotel Prezident in Palić, near Subotica, Serbia.
The basic goals of this symposium are:

- *to assemble famous investigators and practitioners from faculties, scientific institutes and different enterprises or other organizations,*
- *to enable presentation of new knowledge and exchange of practical experience in mechanical engineering, industrial design and shaping, and*
- *to propose theoretically developed and practically tested solutions for improving the quality of products in mechanical engineering in order to achieve the highest possible position on the international market.*

PAPER SUBMISSION:

Abstracts (with paper title, names of the author and coauthors with addresses and contacts) should be submitted before May 20st 2010. The content of the abstract should not exceed 200 words.
The number of papers is limited. One person can sign two papers at the most, but only one paper as the first author. Detailed editing requirements concerning papers to be printed will be sent to participants upon receiving preliminary applications.
All abstracts of papers with payed participation fee will be printed in symposium proceedings of abstracts and published in symposium CD. A significant number of papers that pass reviewing of Journal of Mechanical Engineering Design will be published in the next few issues of the journal.
The official languages of the symposium is English.

ORGANIZERS:

University of Novi Sad, Faculty of Technical Sciences Novi Sad
ADEKO – Association for Design, Elements and Constructions Belgrade
Honorary Chairman of the Symposium KOD 2010: Kosta KRSMANOVIĆ
Faculty of Applied Arts and Design, Belgrade
Chairman of Organizing committee: Siniša KUZMANOVIĆ
Faculty of Technical Sciences, Novi sad
Chairman of Scientific committee: Vojislav MILTENOVIĆ
Faculty of Mechanical Engineering, Niš

IMPORTANT DATES:

Abstracts submission deadline 20.05.2010.
Notification of acceptance of the abstracts and instructions for preparing the papers with participation conditions 01.06.2010.
Final paper submission deadline 01.08.2010.
Confirmation the acceptance of the papers 20.08.2010.
Payment of the Registration fee and Final programme 10.09.2010.
Registration 29.09.2010

MAIN TOPICS:

The major subject of this Symposium is design of product, researched regarding to its:

- *function,*
- *purpose,*
- *structure,*
- *size,*
- *material,*
- *mass,*
- *ergonomics requirements,*
- *worker protection measures,*
- *aesthetic demands,*
- *production volume,*
- *delivery date,*
- *quality,*
- *reliability,*
- *operating life,*
- *efficiency,*
- *price,*
- *production method,*
- *assembling,*
- *numeration,*
- *testing,*
- *conservation,*
- *package,*
- *storage,*
- *transportation,*
- *deconservation,*
- *mounting,*
- *handling,*
- *exploitation,*
- *service,*
- *maintenance,*
- *hygienic reguirements,*
- *repair,*
- *atmospheric influence,*
- *biological factors,*
- *recycling,*
- *ekology,*
- *unexpected breakdowns,*
- *special demands,*
- *personal demands.*

CORESPONDENCE ADDRESS:

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

5th INTERNATIONAL ICQME CONFERENCE
(QUALITY, MANAGEMENT, ENVIRONMENT, EDUCATION, ENGINEERING)
ICQME 2010

Center for Quality
Faculty of Mechanical Engineering in Podgorica
University of Montenegro
16th – 17th August 2010
TIVAT, MONTENEGRO

INVITATION

It is our pleasure to invite you, on behalf of the Organizational Committee, to the Fourth International ICQME Conference that will be held in Paris between 16 and 17 September, 2010.
The idea of Conference has first come to life when a need was felt to have the eleweenth traditional National Conference on Quality Management System (SQM) with the international participation evolve into an international conference, with an extension of thematic areas to be covered.
National Conference on Quality Management System (SQM) with the international participation has been gathering prominent experts from the field of quality over the last twelve years. In addition to the local, Montenegro experts, the participation lists included a number of well-known scientists and experts from France, Spain, Canada, England, Italy, Denmark, Slovenia, Serbia, Bosnia-Herzegovina, Croatia, and 5th International ICQME Conference some of the vital issues of quality, management, engineering, education, and environmental protection will be discussed, and the participants will be from both the university and the commercial fields, which will contribute to a more productive exchange of ideas and experiences.
The conference intends to shed further light on the complex and potentially conflicting choices firms take in order to acquire, exchange, and create knowledge in order to improve its performance.
This theme relates to quite a wide variety of aspects relating to the increasing complexity (e.g. economic, management, engineering, sociology) of systems for knowledge creation and innovation.
This complexity implies a more intensive and more frequent need to embrace as well as to connect both internal and external source of knowledge in the search for new technological achievements.

MAIN TOPICS:

- *International Quality Standards ISO 9000*
- *Voluntary approaches for quality improvement*
- *International Environmental Standards ISO 14000*
- *Voluntary approaches for environmental regulation*
- *OHSAS 18000- Occupational Health and Safety Zone*
- *International standard ISO 22000-Food safety Management Standard*

- *New Technologies*
- *Benchmarking*
- *Six Sigma*
- *Supply Management Chain*

IMPORTANT DATES:

Notification of abstract acceptance: 01.04.2010.
Paper submission: 01.06.2010.
Notification of paper acceptance: 01.07.2010.

ORGANIZERS:

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ACTA TECHNICA CORVINIENSIS
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SCIENTIFIC EVENT

4TH INTERNATIONAL CONFERENCE ON MASS CUSTOMIZATION AND PERSONALIZATION IN CENTRAL EUROPE (MCP - CE 2010)

22 – 24 SEPTEMBER 2010
NOVI SAD, SERBIA

INVITATION

*On behalf of the Organizational Board and Scientific Committee of the **4th International Conference on Mass Customization and Personalization in Central Europe (MCP - CE 2010)**, we would like to invite you to participate and to share your research ideas, efforts and results with other scientists, dedicated to the idea of Mass Customization, Personalization and Open Innovation.*

Mass Customization and Personalization (MCP) aims to provide goods and services that best serve individual customers' personal needs with near mass production efficiency. Open Innovation is focused on cooperation between manufacturers and customers and extends conventional model of closed innovation taking place just within the boundaries of a manufacturer. These new strategies are beginning to emerge in many enterprises as profitable business models.

Organized for the fourth time, the biannual MCP-CE Conference is the leading event in the field of Mass Customization and Open Innovation in Central European Region. After meetings in Rzeszow/Poland (2004/2006), and Palic/Serbia in 2008 the organizers are taking the conference to Novi Sad/Serbia. MCP-CE 2010 provides an interactive platform for learning more about Mass Customization and Open Innovation strategies and the possibility to discuss the latest technologies and enablers like Product Configurators and Toolkits for User Innovation. The main goal of the conference is to bring the Mass Customization and open Innovation concept closer to companies and scientists in Central Europe. Join us for MCP-CE 2010 in Novi Sad, where developers, business people, and researchers interact with entrepreneurs and corporate managers looking for applications in order to gain competitive advantage in times of financial crisis.

We wish you very warm welcome to the Conference and hope that together we will make the MCP concept more popular and useful.

MAIN TOPICS:

- *MCP and Open Innovation in times of financial crisis*
- *MCP Strategies and Economics*
- *MCP Product and Process Design*
- *MCP Manufacturing and Logistics*
- *MCP Information Systems*
- *MCP Communities and Personalization in E-commerce*
- *MCP and Services*
- *MCP and CRM/Branding*
- *MCP Case Studies: Industrial Goods, Consumer Goods, Services*
- *Open Innovation Models*
- *Open Innovation Tool-Kits*
- *Open Innovation Case studies*

IMPORTANT DATES:

Final paper submission deadline: ***15th July 2010***
Final notification: ***31st July 2010***
Registration and payment deadline: ***1st September 2010***

CONFERENCE PROGRAM:

22nd September, Wednesday
Pre conference workshop
Ice breaking meeting
23rd September, Thursday
Conference opening
Plenary session
Conference sessions
Official banquet
24th September, Friday
Conference sessions
Conclusions and Conference Closing
Trip to Fruška Gora Monasteries

CORESPONDENCE ADDRESS:

Chairman: ZORAN ANIŠIĆ,
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http://www.ftn.ns.ac.yu/MCP-CE2010/info.php

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

INTERNATIONAL RESEARCH CONFERENCE
EDUCATION, RESEARCH & DEVELOPMENT

SEPTEMBER 9 - 13, 2010,
SUNNY BEACH RESORT, BULGARIA

ORGANIZERS:

Organized by: *Bulgarian Academy of Science, Union of Scientists in Bulgaria and Foundation Science & Education*
Sponsored by: *Info Invest – Bulgaria (www.ScienceBg.Net)*
Scientific media partner: *Journal of International Research Publications: Educational Alternatives*
The symposium is part of the scientific events organised annually by Info Invest, the Science and Education Foundation and its partners. www.science-edu.eu

SYMPOSIUM ANNOUNCEMENT AND CALL FOR PAPERS:

*We are pleased to invite you to take part in the **EDUCATION, RESEARCH AND DEVELOPMENT** Conference, which will be held on 9 – 13 September 2010 in Sunny Beach, Bulgaria.*

TOPICS:

The scope of ER&D 2010 includes the following topics:

KNOWLEDGE - A PRIMARY FACTOR FOR PRODUCTIVITY AND ECONOMIC GROWTH

- *Education under market economy. Competitive education.*
- *The role of education in creating an information society and technologies*
- *Education and research, demographic processes and labour market*
- *Equal access and wider participation in education*
- *Government regulation and legislation*
- *Structure, management and funding*
- *Intellectual property education and research*

SOCIALIZATION OF YOUTH IN CONTEMPORARY SOCIETY

- *Problems of a humanisation of education*
- *Problems of safety of education*
- *Creative activity*
- *Technologies of continuity in education.*
- *Art education*
- *Training in multicultural education space*
- *Intercultural communication. The system of values in the dialogue of cultures*

EDUCATION, INDIVIDUAL AND SOCIETY

- *Pedagogics and Methodology of Education*
- *Psychological and pedagogical content of educational activities*

- *Integration of cross-cultural studies in the curriculum*
- *General and vocational education*
- *Pre-school education*
- *Extra-curricular and out-of-school activities*
- *Education through life*
- *Alternative Education*
- *Education of children and pupils with special educational requirements and / or chronic diseases*
- *Personnel, scientific, information and library services*
- *Quality of teaching, training programs and assessment*

HIGHER EDUCATION: GLOBALIZATION AND INTERNATIONALIZATION

- *Higher and Further Education: new challenges*
- *Students and Teachers: exchange programs*
- *Higher Education and Bologna Process*
- *Application of European system for accumulation and transfer of credits (ECTS)*
- *Erasmus: implementation and results at universities*
- *The internationalization of Universities*
- *Research and Education Networks*
- *International projects and innovations*
- *University-Industry: Partnership, Programs, Experience*
- *Assessment of students*

SCIENTIFIC RESEARCH: RESULTS AND PERSPECTIVES

- *Scientific Research centers: achievements and new ideas*
- *Research of Technologies in Education*
- *International cooperation in the sphere of research*
- *Research of various aspects of innovative society*
- *Research methodologies*
- *Academic research projects*
- *Interconnection between education and research*
- *University/Industry/Government: collaborative partnership in research*

E-LEARNING AND VIRTUAL INNOVATIONS

- *E-learning: projects and results*
- *E-learning: pedagogical strategies and tactics*
- *Developing e-learning methods for specific fields*
- *Online laboratories and classrooms*
- *Virtual universities*
- *Electronic library: information and searching technologies*
- *Electronic journals and books: projects and prospects*

Note: Only those who have submitted their registration form, fulfilled all the requirements in the present Call for Papers and present at the symposium are regarded as symposium participants.

DATES AND VENUE:

9 - 13 September 2010, the Imperial Hotel, Sunny Beach
Registration of participants: 5 – 6 pm, 9 September; 9 – 10 am, 10 September
Inauguration of the conference: 10 September
Closing of the conference: 13 September

PARTICIPATION FORMS:

- *oral and poster presentations;*
- *online presentations: for people who can not attend in person. All these participants receive all the certificates and documents after the Symposium through the Internet. All their contributions are also included in Publications.*

CONFERENCE LANGUAGES:

English, Russian and Bulgarian. The main conference language is English.

SUBMISSIONS:

There is a limit of two contributed submissions per registered author. They may be presented as a talk or as a poster. Oral presentations are 10 minutes long and a poster session lasts one hour.

PRESENTATION EQUIPMENT:

Participants can use a PC and a multimedia projector. Presentations have to be prepared using PowerPoint and stored on a USB flash drive. Presentations are emailed to the organisers prior to the conference with the file name displaying the participant's name and surname.

PUBLICATION:

Submissions, no matter whether presented as talks or posters, will be published in the ***International Scientific Publications: Educational Alternatives*** *journal in cooperation with the Science and Education Foundation. You can get more information about the journal at www.science-journals.eu.*

Journal description: *750 MB CD-ROM disc in a box; papers are in Flash format, allowing for full-colour printouts. To see what a published paper looks like, please go to www.science-journals.eu*

Protection and identification: *The journal is reliably protected using special technologies. It is identified with an ISSN (International Standard Serial Number).*

Editing and reviewing: *Every paper is reviewed by two independent, anonymous reviewers.*

Journal languages: *English*

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IMPORTANT DATES:

- *30.03.2010: Registration form and abstract (up to 10 lines) submission deadline. You will be notified about acceptance/rejection with an email from the organising committee within five working days of receiving the submission. You can register online at*
- *http://www.sciencebg.net/symposiums/registration/registration-form.html*
- *If you should receive no reply, please contact the organisers by email or telephone;*
- *30.04.2010: Deadline for transferring the registration fees to the account given in the email sent to the participant by the organising committee. All bank charges and commissions are paid by the participants. Please inform your bank about this when ordering the transfer. Payment on site is not allowed;*
- *30.04.2010: Final paper submission deadline. Please send your paper written according to the formatting requirements to the organisers for publication at symposium@sciencebg.net. You will be notified whether the paper is accepted for publication with an email from the organising committee within five working days of receiving the paper. If you should receive no reply, please contact the organisers by email or telephone;*
- *Deadline for booking accommodation for the participants and their accompanying persons. After this deadline, the organisers have no responsibility to arrange accommodation for the participants.*
- *5 pm – 6 pm, 9 September and 9 am – 10 am 10 September: Registration of participants;*
- *10 September: Opening of the symposium;*
- *13 September: Closing of the symposium*

PARTICIPATION AND REGISTRATION:

Participation: *Only fully registered participants, their accompanying persons and special guests of the Organising Committee can take part in the symposium. Unregistered attendance is not allowed.*
Registration: *5 pm – 6 pm on 9 September and 9 am – 10 am on 10 September. Please tell your country, name and surname at the registration desk. Accompanying persons do not have to register, but they receive a badge saying VISITOR.*
Name Badges: *The badge with your name that you get together with the symposium materials at registration is personal. It is the only document giving free access to the symposium hall and should be clearly visible at all times. You may be denied access to the symposium if you cannot show it. The organisers have the right to demand a proof of your right to attend the symposium.*

SOCIAL ACTIVITIES:

The social programme is of paramount importance for the success of the symposium. The informal atmosphere of the activities helps you to expand your social contacts with the rest of the participants. You will be informed about the events and times of the social programme additionally. A complete description of the provided activities will be published at http://travel.sciencebg.net.

TRAVEL AND JOINING INSTRUCTIONS:

There are three main international airports in Bulgaria: in Sofia (430 km from Sunny Beach), Varna (90 km from Sunny Beach) and Burgas (35 km from Sunny Beach).
There are several different ways to get from Sofia, Varna or Burgas to Sunny Beach.

- *by bus: Please note that you can take a bus from Sofia or Varna to Sunny Beach, but there is no public bus service from Burgas Airport to Sunny Beach. To go to the bus station in Sofia or Varna, take a taxi from the airport. It is advisable to ask the taxi driver approximately how much the trip will cost before getting into the car as he may overcharge you later.*
- *There are buses from Sofia or Varna to Burgas on the hour. Take those buses which stop at Sunny Beach or Nesebar. Alternatively, you can travel to Burgas, but then you will have to take another bus to Sunny Beach (45 km away). The journey from Sofia to Sunny Beach is approximately 7 hours and from Varna to Sunny Beach approximately 1 hour 30 min.*
- *by car: you can order a car from the selected hotels which we offer to book for you. Please inform us by email to send you the necessary information. The hotel will issue an invoice for the amount you pay.*
- *by taxi: we recommend that you use a taxi from Burgas Airport to Sunny Beach. It will be too expensive to travel by taxi from Sofia or Varna, unless you are a group of three or four.*

FURTHER INFORMATION:

Further information will be periodically available on this website. Any queries about the organisation and programme of the symposium should be addressed to Mr Ivan Genov, symposium coordinator and director of Info Invest Ltd, Burgas. Please visit http://www.facebook.com/ivan.genov1
email: *office@sciencebg.net*
Send your materials to: *symposium@sciencebg.net*

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

11TH INTERNATIONAL SYMPOSIUM ON "INTERDISCIPLINARY REGIONAL RESEARCH"

ISIRR 2010

HUNGARY - ROMANIA – SERBIA

SZEGED, HUNGARY

CALL FOR PAPERS

The Szeged Regional Committee of the Hungarian Academy of Sciences, the Association for Multidisciplinary Research of the West Zone of Romania (ACM-V)- Timisoara, the Polytechnic University of Timisoara, and the University of Novi Sad will jointly organize the 11th International Symposium "Interdisciplinary Regional Research" in Szeged, Hungary, on ***13-15 October, 2010.***

TOPICS

The conference organizers welcome papers and poster presentations from the fields of:

- *medical science,*
- *chemistry,*
- *biology,*
- *agriculture,*
- *engineering, and*
- *sociology.*

GENERAL INFORMATIONS

The official language of the conference: English
The length of the presentations: max. 15 minutes, followed by a 5-minute discussion
Size of posters: 90 cm wide x 140 cm long

APPLICATION DEADLINE

15 August 2010

REFERENCES

Conference participants will receive soft drinks, coffee, lunch and dinner, the printed abstracts and the programme of the conference, as well as an opportunity to have their papers published in academic journals appearing in Szeged.
The abstracts of the papers, which should not exceed 1500 characters, must be submitted by the application date, by way of directly uploading them on the conference website.
We invite with special attention to the conference and wait for those who take part in European Union projects.
The conference application form can be found on the website of the Szeged Regional Committee of HAS. ***www.isirr2010.hu***
The participants can reserve accommodation on the undermention website:
[1] http://magyar.szegedhotels.com/index.php/
[2] http://www.iranymagyarorszag.hu/keres/magyarorszag/szallasok-p1/

CONFERENCE FEE

***30 EUR**, to be paid by bank transfer to the following account number.*
***Bank account number:** 10028007-01738928-000000000*
***IBAN:** HU68 1002 8007 0173 8928 0000 0000*
***SWIFT:** MANEHUHB*

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

13 TH INTERNATIONAL SCIENTIFIC CONFERENCE MECHANICAL ENGINEERING 2010

ME 2010

70th ANNIVERSARY OF FOUNDING THE FACULTY OF MECHANICAL ENGINEERING SLOVAK UNIVERSITY OF TECHNOLOGY

October 21, 2010
BRATISLAVA, SLOVACIA

INVITATION

The 13th INTERNATIONAL SCIENTIFIC CONFERENCE - MECHANICAL ENGINEERING 2010 on the occasion of the 70th Anniversary of founding the FACULTY OF MECHANICAL ENGINEERING which will take place on October 21, 2010 and is organized under the auspices of His Spectabilis Prof. Ľubomír ŠOOŠ, PhD., the dean of THE FACULTY OF MECHANICAL ENGINEERING, SLOVAK UNIVERSITY OF TECHNOLOGY.

CONFERENCE FOCUS

The conference covers the synergic integration of mechanical engineering with electronics, intelligent control and design and manufacturing of industrial products and processes. Topics of interest include, but not limited to:

- *APPLIED MECHANICS AND MECHATRONICS,*
- *AUTOMATION, MEASUREMENTS AND APPLIED INFORMATICS,*
- *MANUFACTURING SYSTEMS, ENVIRONMENTAL ENGINEERING AND QUALITY MANAGEMENT,*
- *PROCESS, FLUID AND POWER ENGINEERING,*
- *PRODUCTION PROCESSES AND MATERIALS,*
- *TRANSPORTATION TECHNIQUES AND DESIGN.*

IMPORTANT DATES

till August 16, 2010
Sending preliminary conference registration including name of paper and abstract in English
till August 26, 2010
Acceptance of the conference registration, call for sending the conference paper
till September 30, 2010
Covering the conference fee
till September 10, 2010
Sending
till September 20, 2010
Paper reviewing, confirmation of its acceptance and selection of a proper section a conference paper; use an e-mail me2010@sjf.stuba.sk
October 21, 2010
International conference Mechanical Engineering 2010

CONFERENCE FEE

*The conference fee is **100,- EUR** and **50,- EUR** for participants from FME STU. The conference fee is **50,- EUR**, for PhD. Students and **30,- EUR** for PhD. students from FME STU. The fee covers conference materials, conference proceedings on CD, printed conference proceedings, refreshment during the conference and rental of the conference locations. The fee should be forwarded via bank transfer to the following bank account before July 6, 2010.*

INFORMATIONS

Conference proceedings will be issued as scientific proceedings of Faculty of Mechanical Engineering in printed and CR-ROM form with registered ISBN. Paper maximum length should not exceed 8 pages including figures and tables and/or paper file size should not exceed 4 MB.
Preliminary registration form is available at the conference web site. State names of paper authors, paper title in English as well as suggest proper section for the paper. After on-line registration send short abstract in English, use an e-mail me2010@sjf.stuba.sk. Conference program committee decides on acceptance of each paper and its definite section or a poster presentation. Paper acceptance will be announced to authors via e-mail.
Paper presentation within a thematically workshop is restricted to 15 minutes including discussion. Presentation technology will be available – PC with a data projector, overhead projector and slide projector if necessary. Please mark your requirements regarding presentation tools on the final registration form.
*Full texts of papers and abstracts (in English) are to be delivered by authors to the organizers' e-mail address in accordance with the instructions, exclusively in *.pdf or post-script format.*
The conference language will be English.

CORRESPONDENCE ADDRESS - ME 2010 Conference Secretariat

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Faculty of Mechanical Engineering, STU
Nám. slobody 17, 812 31 Bratislava
Slovak Republic
phone: ++421-2-572 96 244
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http://www.kpp.sjf.stuba.sk/me2010

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

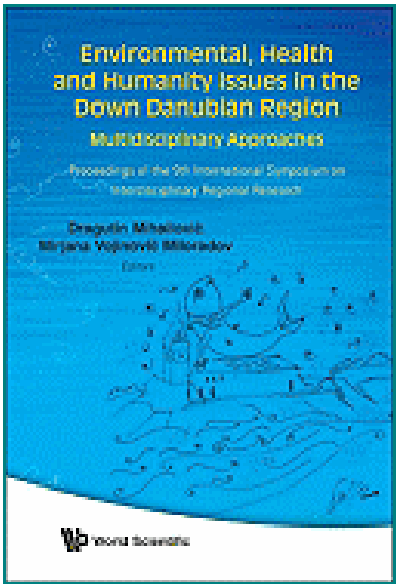
BOOK REVIEW

ENVIRONMENTAL, HEALTH AND HUMANITY ISSUES IN THE DOWN DANUBIAN REGION

– MULTIDISCIPLINARY APPROACHES

PROCEEDINGS OF THE 9TH INTERNATIONAL SYMPOSIUM ON INTERDISCIPLINARY REGIONAL RESEARCH

edited by
DRAGUTIN MIHAILOVIĆ
(UNIVERSITY OF NOVI SAD, SERBIA)
& MIRJANA ***VOJINOVIĆ MILORADOV***
(UNIVERSITY OF NOVI SAD, SERBIA)



ISBN: 978-981-283-439-3
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ISBN: 978-981-283-440-9 (ebook)
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REVIEW:

The book: Environmental, Health and Humanity Issues in the Down Danubian Region: Multidisciplinary Approaches, by editors: Dragutin Mihailovic and Mirjana Vojinovic Miloradov, published by World Scientific Publishing Co in 2009, consists of selected papers from the Proceeding of the 9th International Symposium on Interdisciplinary Regional Research, held on University of Novi Sad, Serbia in june, 2007. This Symposium is the result of tripartite regional cooperation between the University of Novi Sad, Regional Committee of the Hungarian Academy of Sciences — Szeged (Hungary) branch and Interdisciplinary Committee for Research and Development of the Romanian West Zone — Timisoara (Romania), a cooperation that has been ongoing since 1996. The results of joint research projects are presented at the international symposia "Interdisciplinary Regional Research — ISIRR", which are being held cyclically in one of the three countries

THE BOOK — IN SHORT PRESENTATION

The awareness about the changing world always introduces an amount of anxiety into man's life that can be defined by the following question: Can man preserve the existing world for the future of his children)

To preserve this world for the future of our children, we must all strive for sustainable development — a development that meets the needs of the present generation without compromising options and resources the future generations will use to meet their own needs. It implies environmentally sound development in societies and regions free from threats to life and property. Human security is an essential ingredient of sustainability, which is increasingly threatened by extreme events, both natural and human-induced.

Regardless of the word balance being used either globally or locally in any given context, it is undoubtedly the keyword in the increasing number of environmental problems. The underlined sketch is a proper introduction to the question: Why are the environmental problems in focus now) One particular answer can be found in the hierarchy of the main scientific problems for the 21st century as seen by the scientific community. According to them, in the 21st century the world of science will be occupied by the problems linked mainly to superconductivity, quantum teleology, extra-terrestrial contacts and environmental problems primarily expressed through the climate change problems. A unique characteristic of those problems is the question of different aspects of the existence of an individual human being. Those questions are: technological capability, origin of the consciousness and survival on the Earth. This is the first time in the history of science that the environmental problems take place at the frontline of science. The question of why this happening now is and why it will go on happening in the future could be answered by the well known fact that in the scientific as well as other worlds the main "drama of the event" takes place at the interface between either two media or two states.

Damages in lives lost and destroyed property are increasing in frequency and magnitude. Increased pollution in the atmosphere is causing gradual increase of the temperature. The slowly rising sea level is threatening low lying countries with more severe storm surges and some scientists suspect that recent large floods, heat waves and drought in Central Europe and the lower Danubian region are indicators of more severe hazardous events in the future. Even more dramatic are human-induced environmental changes caused by population growth, uncontrolled urbanisation and development, and regional conflicts. They result in changes of social and cultural structures, public health, changes of land use and related phenomena, and generating environmental refugees. The environment becomes increasingly endangered, especially when man encroaches on and modifies fragile environments.

THE BOOK — CHAPTERS

The book has 371 pages and it is thematically structured in 37 Chapters covering following topics: Part One – Medical Issues, Part Two – Agricultural and Food Technology Issues, Part Three – The Ecological Issues, Part Four – Humanity Issues.

THE BOOK — PART ONE

Part One deals with the medical problems in the lower Danubian region. Keynote papers consider medical imaging in general and Positron Emission Tomography (PET). The following chapter papers are devoted to various problems related to the application of DICOM/JPEG2000 Client/Server Architecture, radionuclide application in therapy and diagnostics and densi tome try measurements. Other papers consider problems related to traveler's thrombosis, acute limb ischemia and dentures technology.

THE BOOK — PART TWO

Part Two considers the agricultural, technological and developmental open horizons in natural resources of the lower Danubian region. Through applied and fundamental disciplines ranging from biochemistry to physiology, microbiology, applied genetics and food technology, the authors searched for innovations that promote sustainable management of crops and other natural resources in this agriculturally developed region of Europe. The first paper is devoted to the plant antioxidant activity of wild and cultivated Allium species, while the second one deals with the antioxidant systems in some rare and endangered species from the southern part of the Pannonian plain. The group of biochemistry papers is closed with the studies of (i) distribution of different forms of cadmium in the intercellular space and cadmium content in roots, stems and leaves of young sugar beet plants and (ii) effect of nickel, cadmium and molybdenum on sugar beet nitrate and protein metabolisms.

THE BOOK — PART THREE

The first paper that comes from the physiological background deals with the effect of short-term water deficiency on vascular tissue of petiole and leaf lamina of sugar beet, while the other three treat the effect of nitrate concentrations on physiology of different leaf age groups of poplar. Following is the processes within current or future climate, such as the impact of different methods on uncertainties in lake water budget and (ii) modeling efforts in the pharmacokinetics system with time delay. The last two papers of Part Three, without direct modeling efforts, give examples of investigations, e.g. dealing with characterization of gas/ particle partitioning polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) in the area of Kragujevac during the NATO operation in Serbia, and the importance of possible corn production in Hungary in the future, seen through the lens of the climate change.

THE BOOK — PART FOUR

In Part Four, the papers deal with several aspects of interdisciplinary relation of humanity issues and society through ecology, economy, language and literature. The very first paper analyses statements of interviewed citizens of the city of Novi Sad (Serbia) on measures of local environmental policy and stakeholders who participate in environmental policy actions. Following are two papers based on economic issues. They consider (i) job satisfaction in the state-owned sector of Serbia and (ii) the first public private partnership in Serbia whose socio-economic environment is fruitful for the implementation of new university-industry-government partnership. The last group of papers

concern gender relations, Balkan culture and literature. They are a kind of pioneering work which addresses the struggle of getting gender studies recognized as a degree programme in the lower Danubian countries over the past two decades. The first paper from this group focuses on the role of male/female addresses on the same and opposite sexes and investigates how these addresses reflect today's Balkan culture, where women are traditionally in the background and men are in the foreground. The next paper deals with metaphors of cannibalism and the role they play in the female protagonists' reconsideration of their identities in several novels, while in the last one the author discusses two novels from a double perspective: the feminine condition and the role that art plays in the life of the characters.

THE BOOK — GENERAL BACKROUND

The book gives the scientific review and correct approach to the Environmental, Health and Humanity issues in a comprehensive and critical way.
Multidisciplinary approaches of considered problems in the Down Danubian Region have been published for the first time for this part of the Western Balkan Region.

MIRJANA VOJINOVIĆ MILORADOV
&
IMRE KISS

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ACTA TECHNICA CORVINIENSIS
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GENERAL GUIDELINES FOR PREPARATION OF MANUSCRIPTS FOR REVIEW IN ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING

Abstract:
a maximum 100 words abstract will be written, simple spaced, in ***ENGLISH***

Keywords:
a maximum 10 representative words for the paper

THE TEXT

The submitted manuscript must be content ***INTRODUCTIVE NOTES (INTRODUCTIONS)****, follow by the* ***METHODOLOGY****, the* ***PRELIMINARY RESULTS*** *or the* ***FINAL RESULTS****, and, in final, the* ***CONCLUSIONS*** *about the presented notes.*
Also, the paper included the ***ABSTRACT****,* ***KEYWORDS****, and* ***REFERENCES****.*
The conclusions must be clear, relevant and must be indicate some the empirical, theoretical, methodological or scientific aspects of the research, and the author's contributions, or the future preliminaries of our research. It will publish empirical, theoretical and methodological articles.

THE TABLES, FIGURES, GRAPHS AND EQUATIONS

Tables and Figures should be numbered, titled and the resource should be mentioned below them. Photographs in the text are preferable to be in black and white, but must be clear, with a high contrast. Under each figure there will be typed, centered, "Figure X. Name of the figure".
Tables will be part of the text, designed as "Table y. Name of the table", written above the table, centered.
The equations will be inserted in the text – left aligned – and will be numbered with Arabian figures, in round brackets, right aligned. Before and after the equation a blank line will be left.

SUBMISSION OF MANUSCRIPTS

The original of the technical paper will be sent through e-mail as attaché document (.doc, Windows 95 or higher).*

ACKNOWLEDGMENT

If is necessary, please write yours works based research [Title, Contract no., Team, Year etc]

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AUTHORS & AFFILIATION

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[2.] NAME SURNAME

[1.] DEPARTMENT, FACULTY, UNIVERSITY, COUNTRY
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