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CONTENT

the area of tools development, changes in the design and construction of engines and designing optimum technological procedures result in more dominant status of machining technologies. Present state of machining technology and prospective trends prove machining core position in engineering manufacturing.There is a perpetual task for increasing production efficiency. One of the principal preconditions of achieving it is effective machining process. In order to attain efficiency it is necessary to find optimum formation of chips especially in drilling materials with specific properties.

Abstract:
In the paper is described use of the draft method for optimal setting values of the filter length M and of the step size factor μ of the adaptive filter with LMS algorithm in the application of the suppression of additive noise from the speech signal. In the application of voice communications with control systems for operational technical functions controlling in buildings was implemented the adaptive filter with LMS (Least mean square) algorithm on the signal processor DSK TMS320C6713.

Abstract:
The paper presents the analysis of thermal stress field distribution that occurs in the mill rolls, using finite element method. The finite elements method or the analysis with finite elements is based on the concept of building complicated object out of simpler ones, or dividing complicated objects into simpler ones, for which known schemes of calculation can be applied. The main idea in the method of finite element is to find the solution of a complicated problem by replacing in with a simpler one. The analysis of the thermal strains in rolling rolls, using finite elements method, has been carried out on Adamit-type rolls, cast of hypereutectoid steel and used in rolling profile I on the middle profile rolling train of Arcelor Mittal Hunedoara branch. The industrial experimental data (rolling temperature, cooling water temperature, material characteristics etc.) are the basics for simulation program.

Abstract:
The correct design and setup of cooling channels of injection molds make possible a small energy loss during an injection process. The cooling channels are designed yet in design of tool and it is not easy changing them by complete tool. But what is possible to change by complete tool, is a setup and a connection of circuits. It means a flow rate and water temperature at system. To optimalization is possible use cooling simulations which works on FEM principle. The article describes an optimalization of a cooling setup for real part

Abstract:
Working parameters of fan flat nozzles which affect drop tracks size were the subject of the study. New nozzles and nozzles after laboratory wear were tested. The influence of nozzles wear on drop tracks size was examined. It was found that increase in liquid flow rate results in higher values of mean diameter of drop track. Then increase in working pressure or working speed respectively cause decrease in drop tracks size and reduce merging of drops on spray surface. Increase in wear degree was followed by increased

coverage rate. This phenomenon is especially dangerous then using nozzles with a considerable degree of wear for agricultural spray since it ecological threat to the environment.

Abstract:
As an expression of periodic law, the structure of periodical system created by Mendeleev embodied many forms in time. For the present form of the periodic table, knowing the electronic configuration of each element and of outermost electrons in particular is of great importance.
The periodic table contains 110 elements organized in groups and periods, and recently elements with atomic numbers 111, 112, 114, 116, 118 have been discovered.
The most important properties are presented for each element (discovery, natural state, source, use and biological role), physical properties (atomic number, atomic weight, melting and boiling point, density, electron configuration, electron affinity), information on isotopes (nuclei, atomic mass, range, life duration), ionization energy.
The aim of this paper is to use a Microsoft Access study program for teaching purposes. This application is intended for high school pupils and for 1^{st} and 2^{nd} year college students as well, thus they will enlarge the perspective upon physical and chemical properties and electronic configuration of elements in periodical system.

Abstract:
The paper deals with the options of simulation means exploitation in the applications usable for the aid of the manufacturing systems controlling. There are shown the aspects recommended for building, validation and verification of the simulation model as also the procedures of exploitation of simulation outputs in practice. The paper deals with advantages and disadvantages of described software technology with respect to the concrete environment and conditions of simulated model.

Abstract:
By help of numerical analyses it is nowadays possible to simulate the whole technological welding process and to better understand, on the basis of the acquired results, how the individual input parameters affect the whole technological process, mainly the quality of the resulting material structure and the level of the final deformations and distortion. The submission presents the so called local-global approach method, which enables to solve even complicated constructions with more welds. By applying this method we can obtain final deformations or distortions, including the overall effect of individual welds. Thanks to the characteristics described above, this method is often successfully applied to predict distortions and deformations before the welding itself.

Abstract:
Primordial method for the decrease of the superheat of the steel of the in of the crystallizer, consist in the introduction of consumable micro-coolers, which can be exterior or internal.The mathematical molding of the solidification and cooling phenomenon of continuously cast half-products, presented the in afterwards, is based on the mathematical description of phenomenon. This solution problem is, practically, the heat solving equation in of non-steady regime. For defined the heat conduction between

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ACTA TECHNICA CORVINIENSIS
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[1.] STANISLAV FABIAN, [2.] MILOŠ SERVÁTKA

THE EXAMPLE OF TECHNOLOGICAL PARAMETERS INFLUENCE ON QUALITY PARAMETERS AT CUTTING STEEL HARDOX WITH TECHNOLOGY AWJ

Abstract:
The article presents the specimen of technological parameters influence simulation on cut area quality parameters with help of mathematical model created on the basis of experiments and transformed into programs set enabling model utilizing in real time.

Keywords:
cutting, simulation, technological parameter, quality model, programs set

INTRODUCTION

To factors that decisively influence cut area quality, total working cost and also economical efficiency of working belong technological parameters of manufacturing system with technology AWJ. Therefore we devote to technological parameters influence research always greater effort. The important part of this effort is aimed at manufacturing system technological parameters influence simulation on cut material surface quality on the basis of mathematical models.

Simulation rests in this that with substitution of concrete values for certain combination of technological parameters we can obtain with calculation values of cut area roughness corresponding to substituted concrete combination technological parameters values without cutting samples.

Simulation enables with utilizing program where is transformed mathematical model to calculate in real time also extensive sets of cutted area quality parameters values for more demanded combinations of purpose choice sets manufacturing systems technological parameters values.

The article presents the specimen from solution of dissertation work elaborated by doctorand on training working-place-chair of manufacturing processes working Faculty manufacturing technologies Technical University in Košice with seat in Prešov.

EXPERIMENTS

Mathematical model for simulation is compiled on basis of the experiments set evaluation proposed on foundation of experiments planning theory.

The number of watched values combinations of choice technological parameters is stated on basis of experiments plan.

For stating is used the formula:

$$y^x = k \qquad (1)$$

- *y = 3 (number of technological parameters levels)*
- *x = 3 (number of factors – technological parameters)*
- *k = 27 (resulting number of technological parameters values combinations) it is 3^3 = 27*

It is 3-level fully 3-factor experiment with total number of technological parameters values combinations 27. These 27 combinations were exercised on every from 4 various thickness of sheets (6,10,15,40 mm) and like wise on the thickness of sheet 6 mm+ that was cut with increased speed by 50 percent against the speed "v". From this it follows that from every sheet thickness 9 samples with 3 cut areas were cut. Therefore the most suitable form of samples was choice the form with plan of equilateral triangle.

Planed experiment 3^3 supposes for every set of experiments:

- *27 dependences with one parameter – (1 technological parameter on 1 qualitative parameter, further 2 technological parameters are constant)*
- *9 dependences with two parameters – (2 technological parameters on 1 qualitative parameter, 1 technological parameter is constant)*
- *3 illustrations of third technological parameter activity – (3 technological parameters on 1 qualitative parameter)*

In the case of one parameter dependences it goes for expressing relation of choice technological parameter (e.g. speed of cut head "v") on 1 choice parameter of cut area quality (e.g. roughness of surface Ra) while the other 2 technological parameters (mass flow of abrasive "m_A", pump pressure "p") and 1 material parameter (sheet thickness "h") will be constant.

In the case of dependences with two parameters it goes for expressing relation of 2 choice technological parameters (e.g. mass flow of abrasive "m_A" and pump pressure "p") on 1 choice parameter of cut area quality (e.g. roughness of cut surface Rz), 1 technological parameter (speed of cut head "v") and 1 material parameter (sheet thickness "h") will be constant.

In the case illustration of the third technological parameters activity it goes for expressing dependence of 3 technological parameters (mass flow of abrasive "m_A", pump pressure "p" and speed of cut head "v") on 1 qualitative parameter (e.g. roughness of surface Rz), material parameter (sheet thickness "h") is constant. It is possible to express such a dependence of parameter e.g. by sequence illustration of some following graphical dependences with 2 parameters. So a graphical animation arises that shows activity of third technological parameter together with further 2 technological parameters in dependence on choice qualitative parameter.

MATHEMATICAL MODEL FOR SIMULATION

The models (1), (2) are stated on the basis of experimental measurements evaluation with favourable value of coefficients of correlation.

$$Ra:\ y = 7{,}905 - 0{,}012x_1 - 0{,}007x_2 + 0{,}011x_3 \quad (R^2_u = 0{,}872) \qquad (1)$$

$$Rz:\ y = 39{,}103 - 0{,}049x_1 - 0{,}027x_2 + 0{,}046x_3 \quad (R^2_u = 0{,}902) \qquad (2)$$

The verifying was performed for two mathematical models with three parameters of choice technological parameters functional dependences m_A (x_1), p (x_2), v (x_3) on the surface qualitative parameter of cut area Ra, Rz (y) at sample thickness 10 mm.

Tab. 1 Example of program utilization at simulation

Number of calculation	Thickness h [mm]	Technological parameters	Qualitative parameters				
		Mass flow of abrazive	Pump pressure	Cutting speed	Calculated values		
		m_A (x_1) [g/min]	p (x_2) [MPa]	v (x_3) [mm/min]	Ra^ (y)	Rz^ (y)	
1	15	150	440	30	3,8	21,4	
2		250	360	50	3,5	21,1	
3		330	270	90	4,9	27,7	
		m_A (x_1) [g/min]	p (x_2) [MPa]	v^+ (x_3) [mm/min]	Ra^ (y)	Rz^ (y)	
4	6	160	410	20	2,7	20,3	
5		190	330	55	3,2	21,5	
6		200	260	80	3,7	22,8	
		m_A (x_1) [g/min]	p (x_2) [MPa]	v^- (x_3) [mm/min]	Ra^ (y)	Rz^ (y)	Ø^ (y)
7	40	155	400	19	4,3	22,4	21,3
8		340	290	23	3,3	18,9	16,2
9		210	280	124	5,3	24,3	26,6
		m_A (x_1) [g/min]	p (x_2) [MPa]	v (x_3) [mm/min]	Ra_4^ (y)	Rz_4^ (y)	
10		160	260	24	3,5	21,8	
11		240	300	74	3,7	22,8	
12		150	260	145	5,2	29	

For utilization of mathematical models in real time these models are transformed into program set in programable language C # scribed in programable medium Visual Basic.
In table 1 some examples of program utilization possibilities for simulation is stated (theoretical calculation) of choice qualitative parameters values in dependence on applied values of choice technological parameters that are other than at experimental measurements.

VERIFYING SIMULATION & MATHEMATICAL MODEL

Simulated (calculated) values of surface roughness for competent combinations of technological parameters values were experimentally verified (measured values) as follows. The result of verifying certificated correctness of verified mathematical models and performed simulation as follows (tab. 2).

Tab. 2 The values Ra, Rz simulated - calculated from mathematical models and their experimentally measured values

Number of calculation	Technological parameters			Qualitative parameters Ra, Rz					
	Mass flow of abrasive	Pump pressure	Cutting speed	Calculated values		Measured values		Variation calculated against measured value [%]	
	m_A (x_1) [g/min]	p (x_2) [MPa]	v (x_3) m/min	Ra (y)	Rz (y)	Ra	Rz	for Ra	for Rz
1	160	270	35	4,48	25,58	4,70	26,91	-4,7	-4,9
2	180	285	38	4,17	24,34	4,41	25,22	-5,4	-3,5
3	190	310	45	3,95	23,49	3,84	24,04	2,9	-2,3
4	200	320	50	3,82	22,96	3,95	22,90	-3,3	0,3
5	210	330	57	3,70	22,53	3,90	22,85	-5,1	-1,4
6	230	350	65	3,41	21,37	3,48	22,27	-2,0	-4,0
7	250	360	68	3,13	20,26	3,11	20,95	0,6	-3,3
8	260	370	77	3,04	19,92	2,88	20,08	5,6	-0,8
9	280	390	85	2,75	18,76	2,81	19,55	-2,1	-4,0

The deviation between the values Ra, Rz obtained from simulation and the values from followed verifying experiment is in range – 5,4 up to +5,6 %.

CONCLUSION

The article describes actual and for firms working manufacturing systems with technology AWJ also acute problematics of modelling and simulation of technological parameters influence of manufacturing systems with technology AWJ on cut area quality parameters. It goes out from experiments plan and states two mathematical models and the concrete example of their utilization or cut area quality indicators values simulation on basis of manufacturing systems technological parameters applied values. It contains also specimen from simulated mathematical model verifying. From it is follows that model is with demanded accuracy utilizing for manufacturing systems with technology AWJ and cut material – abrasion resisting steel HARDOX 500 for technological parameters. Their values are from within of the range bounding validity of mathematical model. The solution stated in the article is a part of activities of chair of manufacturing processes working aimed at modelling, simulation and diagnostics of working states of manufacturing and systems

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The contribution presents the part results of the task VEGA 1/0544/08 solution

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[1.] PETR LEPŠÍK

DYNAMICAL MODEL OF CAPACITIVE PLANNING

Abstract:
The workers of companies form the essential part of producing systems. Especially today, the question of right number of workers is still more and more discussed. Nowadays, we are able to determine the necessary number of manufacturing workers precisely and relatively easily. The new challenge of industrial engineers it is to develop a method for sufficiently exact capacitive model in the area of indirect labour. A new approach based above all on the statistical methods and the time series forecasting will be introduced in this paper. This introduced model has been tested in the real processes of producing companies.

Keywords:
capacitive planning, indirect labour, time series forecasting, work mesuarement

INTRODUCTION

Nowadays we are able to determinate a number of human resources quite easy in a manufacturing. Human resources planning in the field of indirect labour it is next significant step at capacity planning. We are still not able to determinate the right number of machine adjusters, maintainers, technologists etc. The reason it is above all a stochastical nature of these activities. Today we use usually methods for capacity planning like:

- benchmarking [1],
- backlog management [2],
- work measurement [3],
- budget management [4],
- ratio coefficient planning [5],
- computer simulation.

These methods have sure disadvantages, that is why industrial engineers look for another suitable method. The developed dynamical capacitive model is another approach, which can provide sufficient results. [6]

SUBSTANCE OF THE DYNAMICAL CAPACITIVE MODEL

The substance of this dynamical model is descripted on the figure 1. The needed number of workers in h^{th} week is possible to count from quite simply equation (1).

$$K_h = \frac{T_h}{TF} = \frac{A}{60\ TF}\sum_{j=1}^{m}\sum_{i=1}^{N_{j,h}} t_{i,j} \qquad (1)$$

Where T_h is a total supposed required time (in minutes) for a fulfilment of all tasks in h^{th} week, TF is the week time fond of one worker, A is a time allowance, which includes occasional tasks to the computing , $t_{i,j}$ are generated durations of tasks, m is the number of main tasks, $N_{j,h}$ is the *forecast number of j-type task requirements in h^{th} week.*

If we are able to term work tasks and measure durations of tasks, then we need to know only numbers of task requirements in the future. Then we are able to determinate the necessary number of workers. This is describe by equation (1).

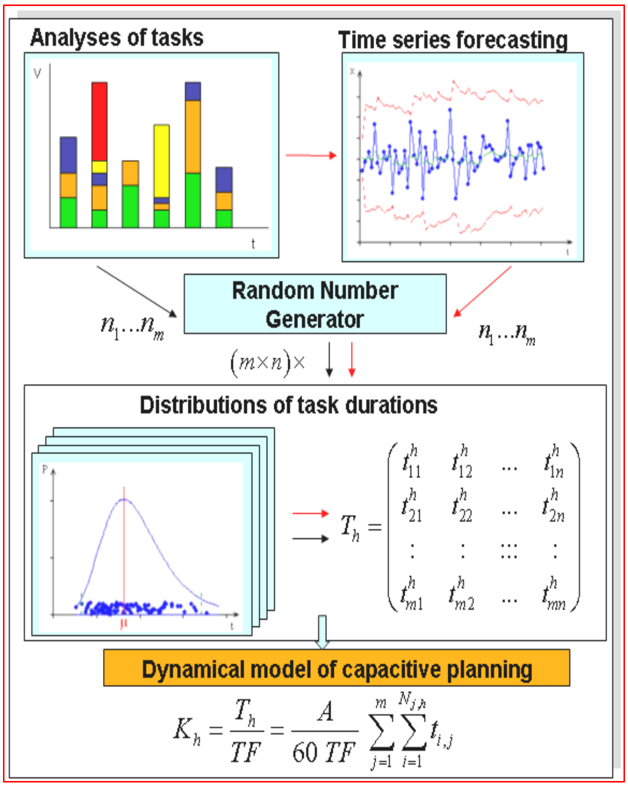

Fig. 1 Substance of the dynamical capacitive model

The needed input data for the model are obvious from the figure 1 and from the equation 1. They are:

- *list of tasks,*
- *structure of working day and tasks ratio,*
- *durations of chosen tasks,*
- *time series of task requirements,*
- *time fond of one worker.*

PROCESS OF DYNAMICAL CAPACITIVE MODEL APPLICATION

List of Tasks

Create a list of worker´s tasks. The list should include all the main tasks which the worker does. A base of the list can be created via interview with the worker. The rest of list will be created during recording of working day.

Structure of Activities During Working Day

Determination of working day structure is the main aim of the observation. There are usually divided activities according to value added in the area of manufacturing activities. The experience gained show that dividing according to frequency of task repetitiveness is more suitable in the area of indirect labour. The structure of working day of machine adjusters is shown on the figure 2. We can see that the main hight frequent tasks create 51% of working day, the another low frequent tasks create 11% and the waste create 38%.

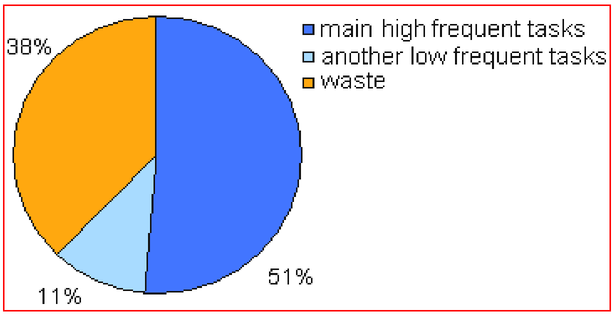

Fig. 2 Structure of Working Day

The 11% of working day which adjusters do low frequent task will be include to the capacitive model via coefficient allowance A, which is given by the equation (2).

$$A = \frac{HF + LF}{HF} \tag{2}$$

Distributions of Main Tasks Durations

One of the basic stones of the dynamical capacitive model it is determination of distributions of main tasks durations. First we have to mesuare the durations of each main tasks. When we have enough mesuarements than the goodness of fit tests can be done. These tests will show us from witch kind of distribution an experimental data comes.

If we have more than 30 measurements and there is no empty interval in the histogram, we can use Pearson´s chi-squire test. In case we have only a few mesuarement it is suitable to use the Kolmogorov-Smirniv test. [7] These tests provide us the information if an experimental data comes from tested distribution. We will *choose the most suitable distribution according to the highest p-value.*

The performed experiments shows that the task durations come usually from a normal, lognormal or multi modal distributions. The histogram of experimental mesuared durations of machine adjusting is shown on the figure 3. We can see that these durations come from the normal distribution, which is given by equation (3).

$$f_N(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \quad (3)$$

Where μ is the average duration and σ is the standard deviation.

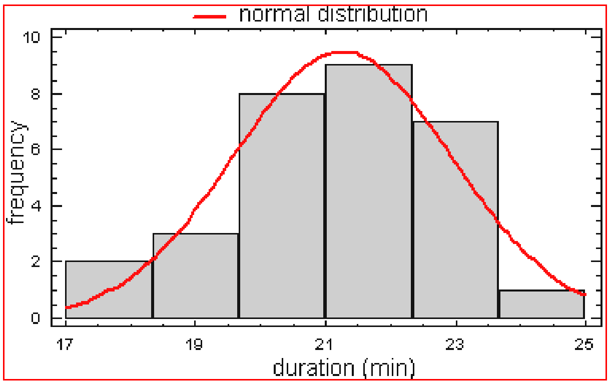

Fig. 3 Histogram of durations with normal distribution

The histogram of experimental mesuared durations of machine adjusting is shown on the figure 4. We can see that these durations come from the normal distribution, which is given by equation (4).

$$f_{LN}(x) = \frac{1}{x\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{\ln x-\mu}{\sigma}\right)^2} \quad (4)$$

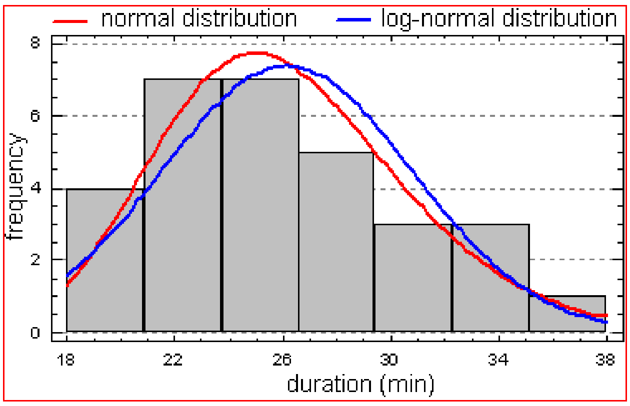

Fig. 4 Histogram of durations with lognormal distribution

The found distribution will be of serve to pseudo-random numbers generation. Now we already know with witch distribution we have to generate expected durations of mashine adjusting but we still do not know how many numbers we should generate. The required numbers of generated random numbers depend on forecast numbers of task requirements. This second basic stone of the dynamical capacitive model is introduced in the following sub chapter.

Time Series of Task Requirements and their Forecasting

This sub chapter is focused on the principles for the number determination of reguiered tasks n_i in the future. We suppose, that n_i from past are known from an information system of company. We can use common methods for analyze time series like an approximation, smoothing or seasonal decomposition. In case that the time series have variable seasons it is more suitable to use Box-Jenkins methodology.

The Box-Jenkins methodology and its complex model SARIMA is used for analyze and forecast of complicated time series with variable seasonal components. The complex model SARIMA consist of six processes. Three type of processes described the trend and three type of processes described the seasonal component of time serie. Autoregressive processes AR (p), Moving Average processes MA (q) and Integrated processes I (d) belong to processes for trend description. We can describe them by equations (5), (6) and (7). [8]

$$x_t = \varepsilon_t + \sum_{i=1}^{p} \phi_i x_{t-i} = \varepsilon_t + x_t \sum_{i=1}^{p} \left(\phi_i B^i\right) \Rightarrow \varepsilon_t = \phi_p(B) x_t \quad (5)$$

$$x_t = \varepsilon_t - \sum_{i=1}^{q} \theta_i \varepsilon_{t-i} = \varepsilon_t \left(1 - \sum_{i=1}^{q} \theta_i B^i\right) = \varepsilon_t \theta_q(B) \quad (6)$$

$$\varepsilon_t = (1-B)^d x_t = \Delta^d x_t \quad (7)$$

Where the x_t are members of time series, the ε_t is residuum, the B is the lag operator, the p, q, d are integers, which mean degree of process and the ϕ_t, θ_t are the parameters of processes.

If we combine processes AR (p) and MA (q), we will obtain Autoregressive Moving Average model ARMA (p,q) for stationary time series. If *we include also I (d) process, we will obtain Autoregressive Integrated Moving Average model ARIMA (p,d,q). They are descripted by equations (8) and (9). [9]*

$$\phi_p(B)x_t = \theta_q(B)\varepsilon_t \qquad (8)$$

$$\phi_p(B)\Delta^d x_t = \theta_q(B)\varepsilon_t \qquad (9)$$

Seasonal character is included to Box-Jenkins models by seasonal processes such as Seasonal Autoregressive processes SAR (P), Seasonal Moving Average processes SMA (Q) and Seasonal Integrated processes SI (D). These processes are analogously described by equations (10), (11), (12), where P,Q,D are integers, which mean degree of process and the S is number of time units, which means seasonal character.

$$\varepsilon_t = \Phi_P(B^S)x_t \qquad (10)$$

$$x_t = \Theta_Q(B^S)\varepsilon_t \qquad (11)$$

$$\varepsilon_t = (1-B^S)^D x_t \qquad (12)$$

Complete model SARIMA (p, d, q) (P, D, Q) s is described by equation (13), where the member in the sum includes nonzero average value of the time series. [10]

$$\phi_p(B)\Phi_P(B^S)(1-B)^d(1-B^S)^D x_t = \\ = \sum_{j=1}^{S}\delta_j^* D_{j,t} + \theta_q(B)\Theta_Q(B^S)\varepsilon_t \qquad (13)$$

The described equations show only slight part from large linear stochastical processes, Box-Jenkins methodology and all the topic of time series. These issues are explained in more details for example in the monograph [11] or on the thesis [12].

Today is usually used some of statistical software for creating time serie model and time serie forecast. Statistical software Statgraphics Centurion XV has been used for analyzing time serie of task requirements. The model with the lowest value of the Akaike Information Criterion (AIC) is model ARIMA (2,0,2) with constant. This model has been used to generate the forecasts. This chosen model ARIMA (2,0,2) with constant is shown on the figure 5.

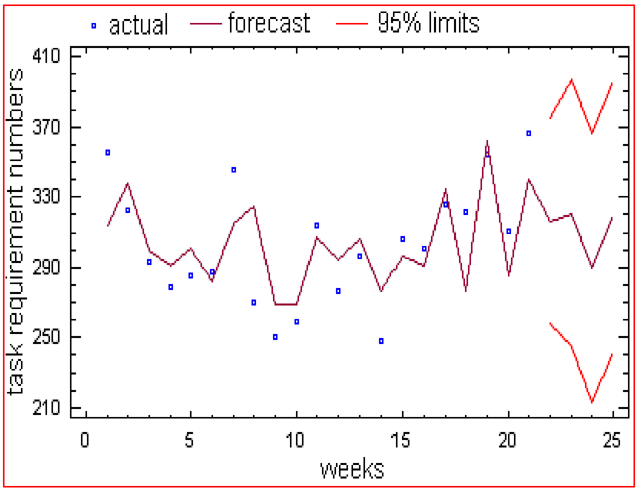

Fig. 5 The model ARIMA (2,0,2) with constant

This model show us expected numbers of adjusting in next weeks. Now we know how many pseudo-random numbers (the durations) we should let generate.

Capacitive Counting

At this moment we have all the necessary input variables for capacitive counting trough equation (1). This capacitive model has been used and verified for counting needed number of machine adjusters in one producing company. The counted number of needed adjusters is showed on the figure 6.

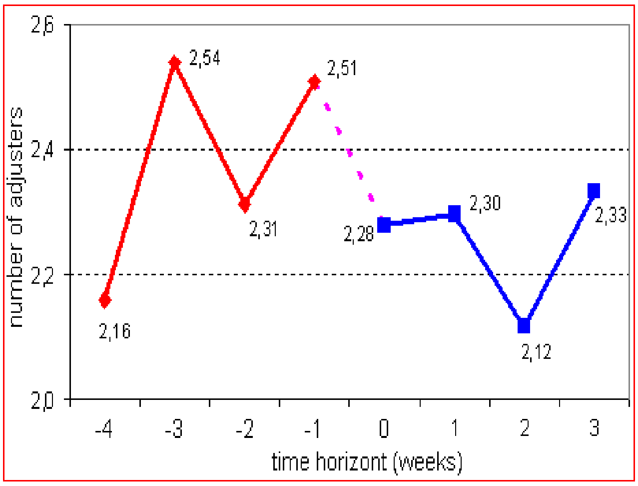

Fig. 6 Needed number of adjusters

The red points and line mark needed numbers of adjusters at the last 4 weeks. This counting comes from the real numbers and the generated expected durations of adjusting.

The blue points and line mark needed numbers of adjusters at the next 4 weeks. This counting comes from the forecast numbers and the generated expected durations of adjusting.
The results show that the necessary number of adjusters is between two and three for this case study, that means we have to count with three adjusters.
Currently, four adjusters are employed in that workshop. The group productivity of 3 (the dash polyline) and 4 (the full polyline) adjusters is shown on the picture 7.

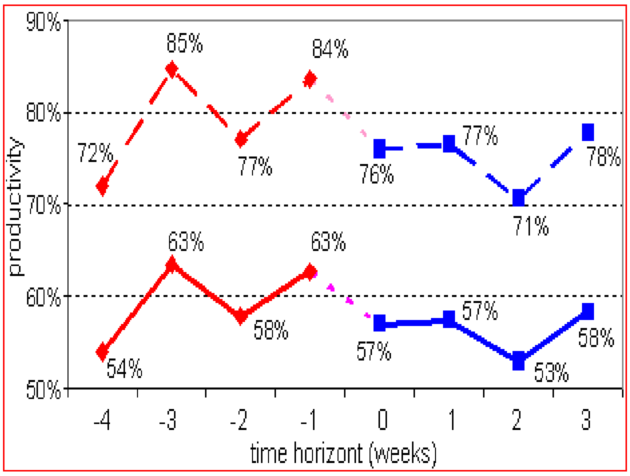

Fig. 7 Productivity of group 3 and 4 adjusters

It is obvious from the figure 7, that one of the adjusters can be moved to another workshop. The rest of three adjusters will be able to adjust all the machines with the productivity between 71% and 85% at the mentioned workshop.

CONCLUSION

The question, how many workers a company needs in a workshop, it is the high actual issue of today in the field of indirect labour. The conventional methods used originally for direct labout do not give satisfactory results above all thanks a stochastical nature of indirect labour. In the paper has been introduced the new approach to solving capacitive planning. This approach is based on usage advance statistical methods and time series forecasting. The developed dynamical capacitive model has been verified in the workshop of the producing company. The usage of this algorithm is reducing a cost about 500.000,- CZK (20.000,- €) per year to the company. The dynamical model and its algorithm will be tested also in another companies. At this time, a software for easier usage of introduced dynamical model is developed.

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ACTA TECHNICA CORVINIENSIS
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1. VÁCLAV ŠTROBACH

DESIGN OF EXPERIMENTS FOR THE PRESSURE DIE CASTING PROCESS

Abstract:

Due to the car-making industry development, the foundry work, especially pressure casting technology has known an important growth. This technology enables the fabrication of thin-walled castings with a high precision which are based on aluminium alloy.

Such exact and light parts are one of the premises for the car-making industry – parts with a low weight and exact products directly influence the fuel consumption of an automobile, and consequently the users are satisfied.

This article describes one of the ways for the design of experiment in foundry work-design of experiment for the technology of pressure die casting process. Modern methods are used in that, i.e. Ishikawa diagram and Central Composion then, the process is applied to real conditions which are involved in the process and affect it considerably. Afterwards, the experiment is tested.

Keywords:

experiment, Ishikawa diagram, casting parameter, pressure dies casting

INTRODUCTION

Recently, due to the car-making industry development, the foundry work, especially pressure casting technology has known an important growth. This technology enables the fabrication of thin-walled castings with a high precision which are based on aluminium alloy.

Such exact and light parts are one of the premises for the car-making industry – parts with a low weight and exact products directly influence the fuel consumption of an automobile, and consequently the users are satisfied. Pressure die casting methods in %, see fig. 1. [1]

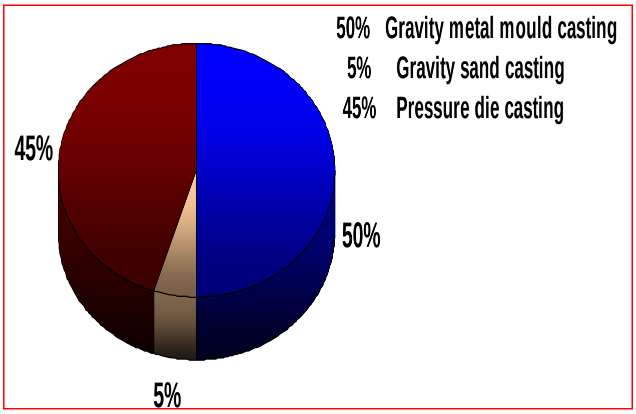

Fig. 1 Pressure die casting technology methods in %

FACTORS INVOLVED IN THE PRESSURE DIE CASTING PROCESS

A detailed analysis of each factor entering in the fabrication of a high pressure casting is necessary to carry out, since each factor is susceptible to influence the ready casting in a negative way. The pressure die casting technology produces the thin-walled castings having a high dimensional and geometric precision. So, we try to manage the whole die casting process – to control all factors involved in the process in order to prevent waste castings. The casting which doesn't fulfil the dimensional, geometric, structural and superficial requests is considered as a waste. The factors involved in the process are described by Ischikawa diagram – causes and consequences, see fig. 2. The diagram presents in detail the factors influencing directly the final quality of a high pressure casting.

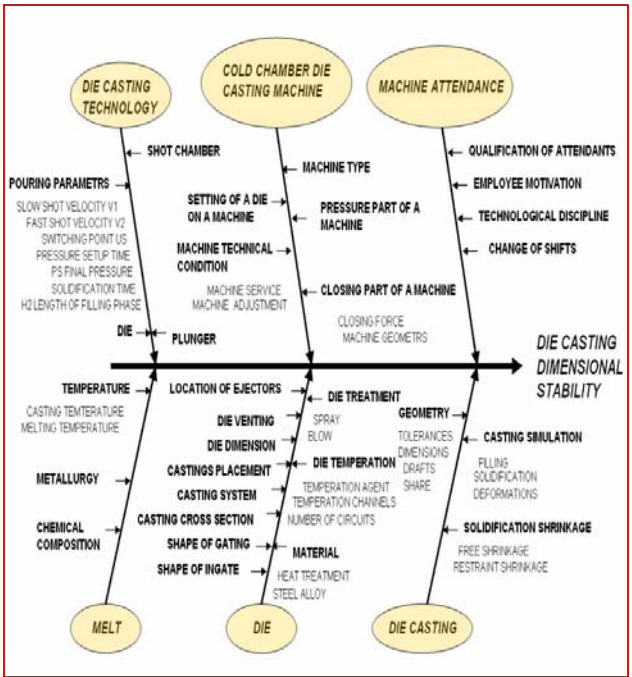

Fig. 2 Ischikawa diagram

EXPERIMENT - PREPARATION

The experiment is aimed to find out how, in which degree the casting dimensional stability depends on the pouring parameters. Based on experiences, among many parameters, the following parameters have been chosen:

- *Liquid alloy temperature;*
- *Working temperature of the mould;*
- *Filling velocity 2. phase;*
- *Solidification time.*

The method of the central composition is followed (one of the DOE methods). It permits to define the minimal number of the experiments including all possible combinations of the requested parameters.

Before carrying out this method the limits within the parameters will move, have to be defined. The parameters ranges are established according to the worksite, in part, and according to the quality of the castings. The parameters values are written in the table 1.

Tab.1 Pouring parameters ranges

Pouring parameter	Identification / Unit	Level				
		-2	-1	0	1	2
Alloy temperature	T_L [°C]	660	675	690	705	720
Mould temperature	T_F [°C]	100	125	150	175	200
Filling velocity	V_2 [m.s-1]	2,1	2,35	2,6	2,85	3,1
Soldification time	t_t. [s]	5	6	7	8	9

Tab. 2 Groups of pouring parameters

Measurment no.	T_l [°C]	T_f [°C]	V_2 [m.s^{-1}]	t_t [s]
1	675	125	2,35	6
2	705	125	2,35	6
3	675	175	2,35	6
4	705	175	2,35	6
5	675	125	2,85	6
6	705	125	2,85	6
7	675	175	2,85	6
8	705	175	2,85	6
9	675	125	2,35	8
10	705	125	2,35	8
11	675	175	2,35	8
12	705	175	2,35	8
13	675	125	2,85	8
14	705	125	2,85	8
15	675	175	2,85	8
16	705	175	2,85	8
17	660	150	2,6	7
18	720	150	2,6	7
19	690	100	2,6	7
20	690	200	2,6	7
21	690	150	2,1	7
22	690	150	3,1	7
23	690	150	2,6	5
24	690	150	2,6	9
25	690	150	2,6	7
26	690	150	2,6	7
27	690	150	2,6	7
28	690	150	2,6	7
29	690	150	2,6	7
30	690	150	2,6	7

During the carrying out the method, the level from -2 to 2 including 0 is assigned to each parameter. After have introduced in a 5level, 4factor matrix containing combinations of singular levels, the values of the parameters are inserted behind the levels. In this way, the groups of pouring parameters are defined, it means 30 groups. Such an experiment includes 7 groups of the identical pouring parameters, see tab. 2.

ALLOY

The alloy EN 1706 AlSi12Cu1(Fe), identification number EN AC 47100 is used for the casting fabrication The chemical composition of the alloy is in the table 3. This chemical composition was identified by the spectral analysis.

The charge (new and recuperative material, proportion 60/40) was melted in the gas-fired crucible Morgan filled with a graphite crucible whose volume is 800 kg. While melted, the liquid had been enriched with the refining salt COVERAL GR 2410. Have been melted and warmed up until 780°C, the alloy was transferred into a transport crucible and degasified by nitrogen in the FDU – FOSECO. The degassing took 3 min, the rate of gas flow being 20 l.min-1. Degasified, the alloy was removed into a holding furnace STRIKO WESTOFEN W 650 SL ProDosand. From this one the doses of the requested alloy quantity passed automatically into the pouring chamber of a pressure die casting machine. The temperature of the alloy in the holding furnace was measured by a built-in thermocouple NiCr-Ni.

Tab. 3 Chemical composition of the alloy, spectral analysis

Elements contained in the alloy AlSi12Cu1(Fe) (%)					
Al	Si	Fe	Cu	Mn	Mg
85,18	11,58	0,759	1,13	0,238	0,274
Cr	Ni	Zn	Pb	Ti	
0,039	0,066	0,537	0,068	0,115	

FINDINGS

All pressure castings are casted at a working site where a pressure casting machine with a cold horizontal chamber CLH 400.03 are. The working site is connected to the control system ELAP RSE 10.52. The pressure casting mould is put only once. Its temperature is hold by a thermoadjusting device Thermobiehl.

There is a necessary condition for the experiment – the setting up of the pouring parameters. The parameters are set up following the table 2.

When the parameter setting up is finished, 5 castings are always done in order to stabilize the parameters and then, 10 castings necessary for the experiment are effectuated. During the melting of each casting the real values of the parameters are read and written. When the casting is out of the mould, there is no cutting at the press to avoid casting strains and consequently distorted results. When all the castings are ready and cold, the preparatory operations for the measurements are done. Flashes are carefully taken out and the ingate is cut by a frame saw. Then the castings are submitted to a dimensional analysis by the coordinate measuring machine. The results are evaluated with the objective to determinate the optimal casting parameters in the die casting process.

CONCLUSION

During the preparatory phase of the experiment the results are practically verified. Pouring parameters responding to the parameters 22, ie melt temperature 690°C, mould temperature 150°C, filling velocity of mould cavity 3,1 m.s-1 and solidification time 7s. When these parameters are set up at the pressure die casting machine, there is a dimensional stability of the castings. They have requested dimensions. This is also able to be used for an other type and quantity of the casting parameters. We can say that using modern statistic methods for the preparation of the experiment, a saving time in the production and a reduction of the direct costs spent on an accidental search of the optimal parameters, so both these aspects are reached. More specialists must participate in Ishikawa diagram setting up because the view of the problem is then objective.

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ACTA TECHNICA CORVINIENSIS
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[1.] DAVID VEJRYCH

OPTIMALIZATION OF BATCHING PLANT POLYMER WORKING IN HIGH-VOLTAGE FIELD

Abstract:
This report is talking about optimalization of batching plant which is working under high-voltage field. The evaluation of suitable material for constructions hopper and tube batching the polymer into the tub. This solution of batching plant is dimension for a rated durability and amount of polymer. The aim of the methodology is to concept an optimized device batching polymer, heating at 200°C.

Keywords:
High-voltage, the polymer,optimalization,ansys

INTRODUCTION

This report is talking about optimalization of batching plant which is working under high-voltage field. The evaluation of suitable material for constructions hopper and tube batching the polymer into the tub. This solution of batching plant is dimension for a rated durability and amount of polymer. The aim of the methodology is to concept an optimized device batching polymer, heating at 200°C.

PRESENTATION OF THE BATCHING PLANT

Suggested machinery is constructively limited by inner proportions of current machine. The space between baths for addition polymer and the high was fully limited by the space of (100x200x1500mm). Necessary limits were made because of observing safe separation distance for values of 100kV with descending reduction 5kV = 1 inch = 25,4 mm.

Basic element of the injector is made by readily available percussion roller with upstroke of 30 mm with the diameter of servo piston 16mm. The pressure of compressed air is 6 Bar used in percussion repudiation of whole machinery. Primal suggestion of percussion roller with pull-back spring was canceled and it was replaced by double-acting piston because of the mason of small reversing power. The body is made of aluminum and its piston is made of stainless steel.

The temperature isolation is made by block of PTFE which recently makes the function of regulator of the stainless piston which compresses molten material. On the stainless body of the injection, there is located jet rating unit with longitudinal fading output with its functional temperature under 300°C, which accomplishes requirements of the submitter with maximal potential temperatures of melting under 250°C.

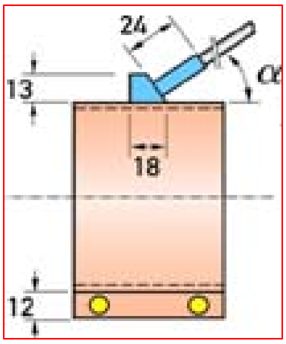

Fig. 1 Heating body

The piston of the injecting machinery is made from stainless steel with the diameter of 16h6. The piston is fasten-down to the working piston by female screw made of stainless steel because of observing accurate distances and safety. On the injector body there is fasten-down adjusting sleeve with feeding hopper made from the stainless lamination with the strength of 1mm. Each of these components are chosen out of stainless steel materials because of its higher resistance in aggressive atmosphere. The only exception is injecting tube which is made of copper. Copper has much better heat-transmission value considering the possibility of caking of the polymer in its ending part.

THE SYSTEM OF FEEDING

The most important part which is necessary for correct function of the injector is the space where the polymer is molten. In this part of the body there is a change in the state o matter and consequently the change in the capacity which is necessary to respect in next construction. Polymer is cut with diameter of 2mm.

MKP - TEMPERATURE ANALYSIS

The temperature analysis is elaborated because of the reason of figuring thermal insulating character of PTFE block, which has the function of isolation for percussion roller because of confined running temperature, suitable use of the material for output tube and for the verification of the storage of the heating body. In the simulation there is visible decrease of the transmission of the heating to the body of the percussion roller altogether with the combination of suitable diffusion of the warmness in heating body.

The extract of the marginal conditions of the warmness analysis: The temperature of the heating body is always 200 °C, the temperature of the surrounding is assessed in the first simulation to the value of 20 °C with enduring result value of 74 °C in the coldest part, average load was selected on 40 °C with the result value of 87 °C and for the highest running load it was increased to the value of 80 °C with the result value of 115 °C. Polymer is in work place of the roller melted to chosen temperature, in this state of matter it is enabled the running of the smelt into disposed bath.

At the same analysis is developed for the alternative model, using the tube 8x1mm place 6X1mm. The tube has better conditions for the batching, the polymer has a lower tendency dries. The speed benefits of the polymer is reduced.

Stainless steel hopper is replaced with copper. Granules using a higher temperature for melting. Overall, the increase in temperature hopper.

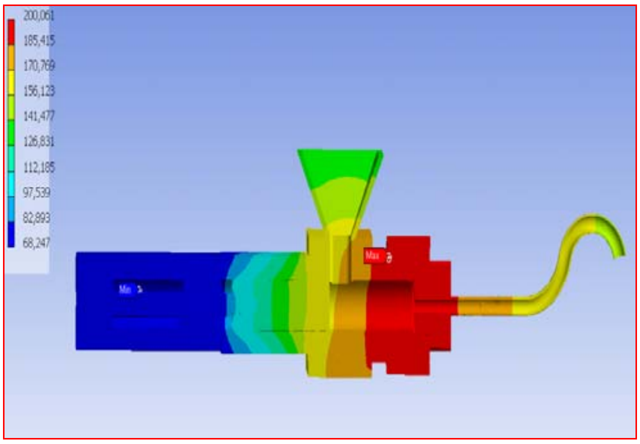

Fig. 2 Temperature analysis for surrounding temperature of 20°C

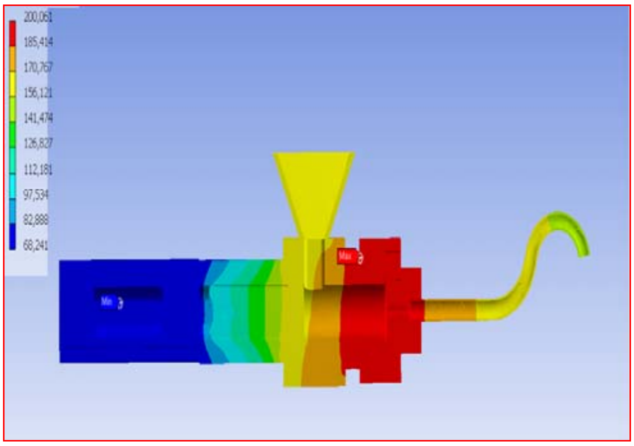

Fig. 3 Temperature analysis for surrounding temperature of 20 °C (new)

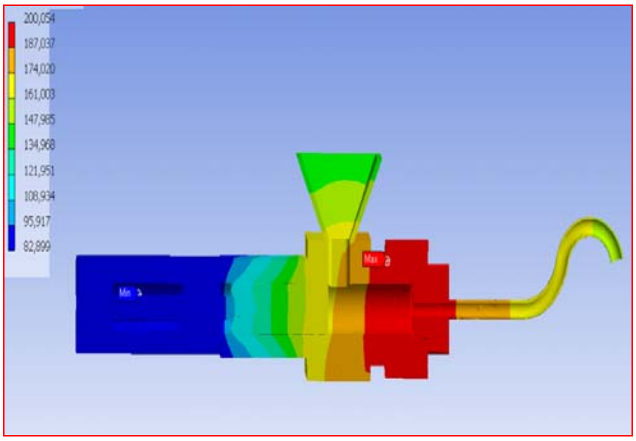

Fig. 4 Temperature analysis for surrounding temperature of 40 °C

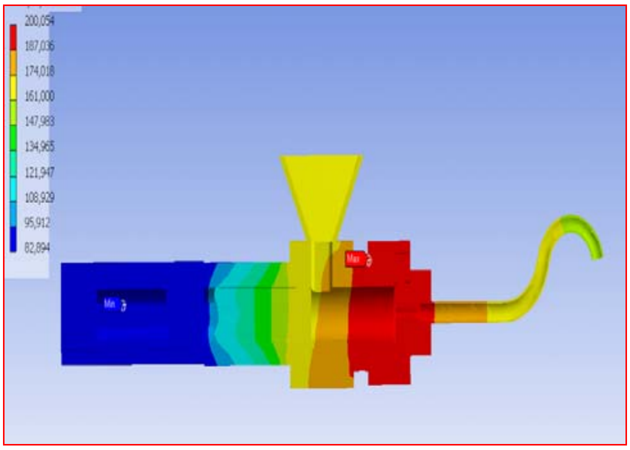

Fig. 5 Temperature analysis for surrounding temperature of 40 °C (new)

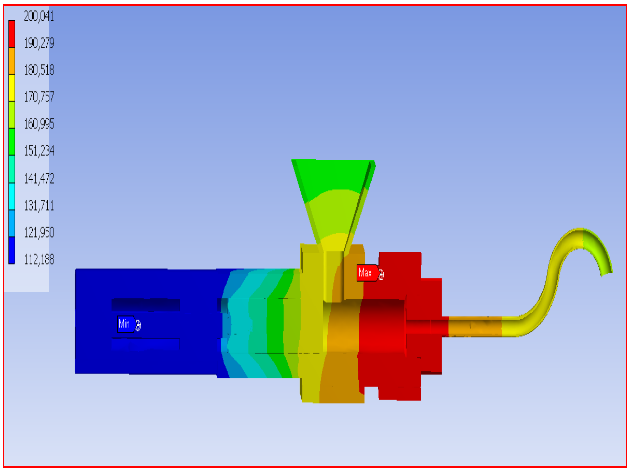

Fig. 6 Temperature analysis for surrounding temperature of 80 °C

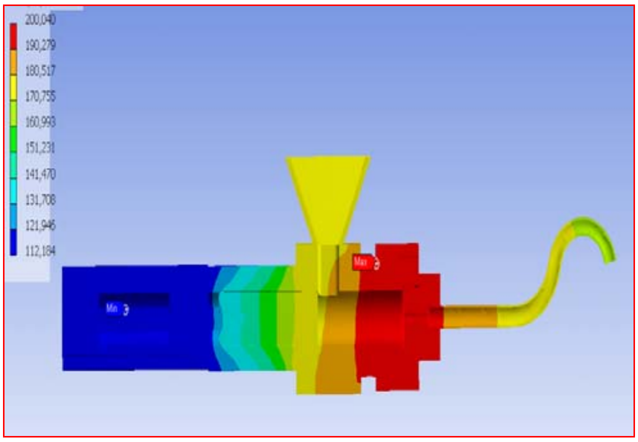

Fig. 7 Temperature analysis for surrounding temperature of 80 °C (new)

CONCLUSION

Introduced report presents one of the possibilities of the solving batching plant of polymerization production in high-voltage field. In this case, this resolution can´t be considered to be optimal. To set pre-conditions can be argued that the proposal is conforming but the final option will be subject to long-term burden.

ACKNOWLEDGMENT

This report was originated on the basis for solving project MPO-2A-3TP1/120/2008 The machinery for preparation of nanofibre made of melting polymer.

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ACTA TECHNICA CORVINIENSIS
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[1.] LUBOŠ BĚHÁLEK, [2.] JIŘÍ BOBEK

CONTACT-LESS ANALYSIS OF POLYPROPYLENE TENSILE STRAIN AND INFLUENCE OF LOADING RATE

Abstract:
Paper deals with analysis real deformation of polymers injection parts measured by contact-less optical measurement system ARAMIS. Observed is influence of loading rate (with regard to viscoelastic behavior of polymers) on surface specific deformation of injection part and deformation properties of chosen part on its surface – under uniaxial tensile loading. In chosen areas of injection part surface are its deformation properties describes by means of dependences of displacement and loading rates (chosen areas) on elongation of sample in the loading direction.

Keywords:
viscoelastic properties, tensile strain, ARAMIS, polypropylene

INTRODUCTION

Mechanical properties of plastic parts are given namely by used material [1], i.e. its chemical composition, structure and added additives. To a great extent are however (especially in injection technology) influenced by process conditions of processing and design of mould [2], [3]. With respect to viscoelastic properties of polymers is clear that their mechanical properties also depends on time or more precisely on loading rate. With increasing loading rate, plastic part will exhibit e.g. higher ultimate tensile strength. That is reality, which is absolutely apparent for technical public [4]. The aim of this paper is however describe for four different loading rate distribution of surface deformation of plastic part under tensile loading with the help of contact-less measuring system ARAMIS both in the loading direction (direction x) and also in the direction perpendicular to this direction (direction y). Conventional tensile test which is using strain gauge does not enable to monitor surface deformation of part.

CONTACT-LESS ANALYSIS OF TENSILE STRAIN

Material, preparation and experiment

For experimental measuring was by injection technology prepared normalized testing samples from homopolymer PP Mosten type 1A according ISO 527-2 in agreement with ISO 294-1 and ISO 1873-2 on injection machine Engel Victory 80/25. Before tensile loading were testing samples conditioning in standard conditions 23/50 according ISO 291.

For contact-less analysis of surface deformation distribution was used 3D measuring system ARAMIS 2M [5] based on principle of scanning deformed part by two cameras (see fig. 1). On measured sample was dabbed stochastic pattern (see fig. 2), after setting cameras was system calibrated on the measuring accuracy 0,01% and *from scanned frames during loading of sample were by means of image processing computed 3D coordinates of points placed on its surface.*

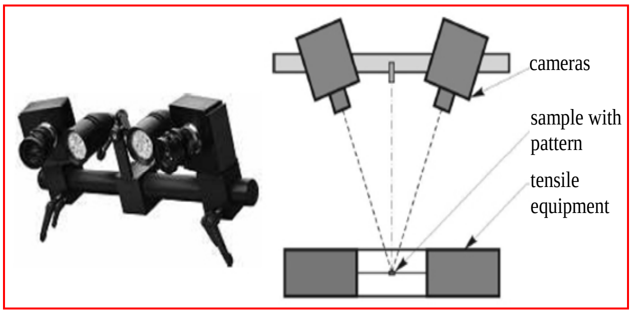

Fig. 1 Sensing system of ARAMIS

Testing samples (always five samples for each loading rate) were loaded by static tensile mode in the direction of its major longitudinal axis on device Hounsfield H10KT and with four different constant loading rates: 5 mm/min up to 200 mm/min. With regard to reality that under different loading rates is also changing value of specific elongation for the moment of fracture, is for evaluation of specific elongation distribution in different directions used comparison limit which for this case is elongation of virtual strain gauge of ARAMIS system to the value 9,3 mm.

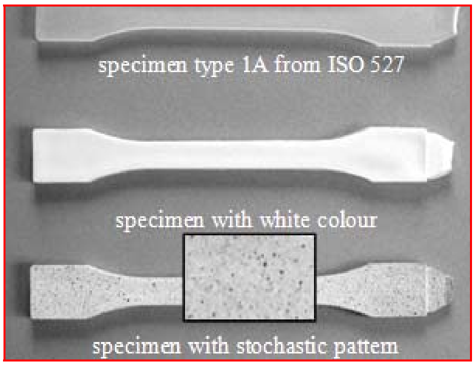

Fig. 2 Preparation of pattern

Technical strain distribution of part in dependence on loading rate

Figures representing technical strain distribution in the individual directions „x" and „y" in dependence on loading rate are given in fig. 3. Further is in fig. 4, respectively in fig. 5, shown graphic dependence of technical strain in the direction „x", respectively „y", along the length of testing sample between jaws (110 mm) onto which was created mesh of points (for already written elongation 9,3 mm).

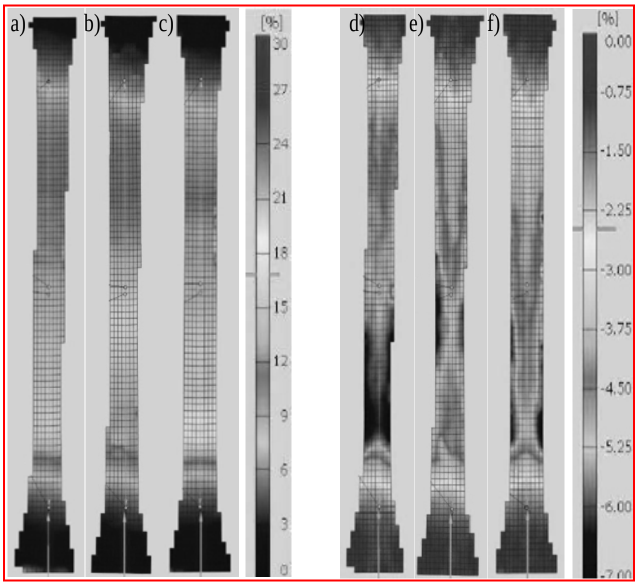

Fig. 3 Comparison of loading rate for technical strain distribution of Mosten GB 005
a,b,c) direction "x"; d,e,f) direction "y";
loading rate: 5 mm.min^{-1} (a,d); 100 mm.min^{-1} (b,e); 200 mm.min^{-1} (c,f)

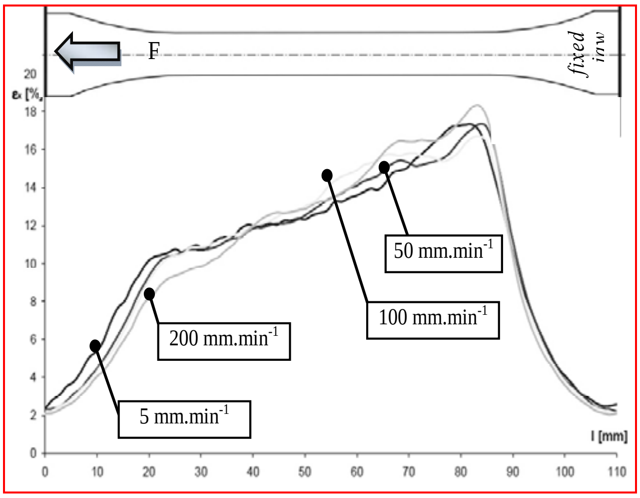

Fig. 4 Technical strain in „x" direction - specimen length chart

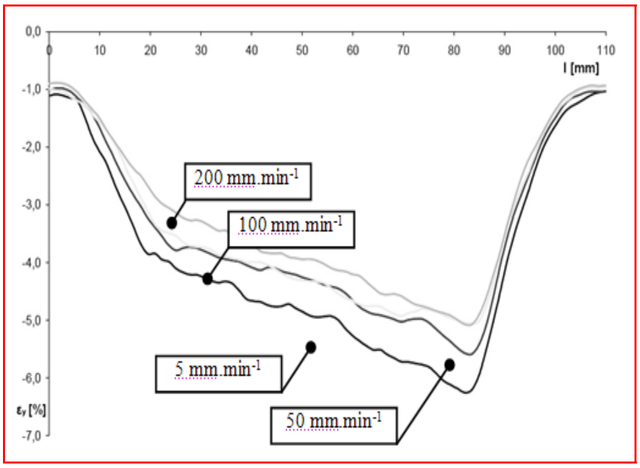

Fig. 5 Technical strain „y" direction – specimen length chart

Behavior of three chosen points on the testing sample surface xy is given in time dependence of displacement of these points in the direction „x" in fig. 6 and in fig. 7 are given dependences of these points displacement rate in the same direction „v_x" on elongation „ΔL_x".

CONCLUSION

Based on the results of contact-less deformation analysis of polypropylene Mosten GB 005 under tensile loading is possible to state following:

- *Strain distribution in the direction „x" is for all used loading rates very similar (see fig. 3a, fig. 3b and fig. 3c), on the contrary strain distribution in the direction „y" is dependence on loading rate (see fig. 3d, fig. 3e and fig. 3f). The highest strain in the direction „y" is achieved under the lowest loading rate 5 mm/min (see fig. 5), which can be explain by means of viscoelastic behavior of plastics.*
- *Also Poisson ratio is changing not only in dependence on temperature, but also on loading rate (see table 1). With higher loading rate is Poisson ration decreasing. Difference of Poisson ratio between the lowest and the highest loading rate is 24%. So with increasing value of Poisson ration there is increasing of necking and decreasing of elongation.*

Table 1 Poisson ratio for Mosten GB 005 and different tensile loading rates

Loading rate	Poisson ratio
5 $mm.min^{-1}$	0,37 ± 0,01
50 $mm.min^{-1}$	0,34 ± 0,02
100 $mm.min^{-1}$	0,30 ± 0,01
200 $mm.min^{-1}$	0,28 ± 0,01

- *From time displacement dependence of chosen points on sample's surface in longitudinal direction (see fig. 6) is clear that points 1 and 3 under the lowest loading rate displace onto given value at higher time segment than for higher loading rates. Point 1, placed in the moveable jaw, achieves higher values of elongation than point 3 placed in the fixed jaw (evidently as a result of nozzle intake location, which was always on the side of moveable jaw) after future neck which was observed to appear close to fixed jaw.*

From chosen points displacement dependence on change of strain gauge (see fig. 7) is for point 3 evident that with higher elongation of virtual strain gauge of ARAMIS system is displacement velocity of points decreasing and on the contrary for point 1 is displacement velocity of points increasing (for the case of higher loading rate). It follows certain in homogeneity of material, when all loading rates should be constant up to yield strength (just as is evident from loading rate 5 mm/min), when is created neck and strain is concentrated only into this area and other points are not more in motion.

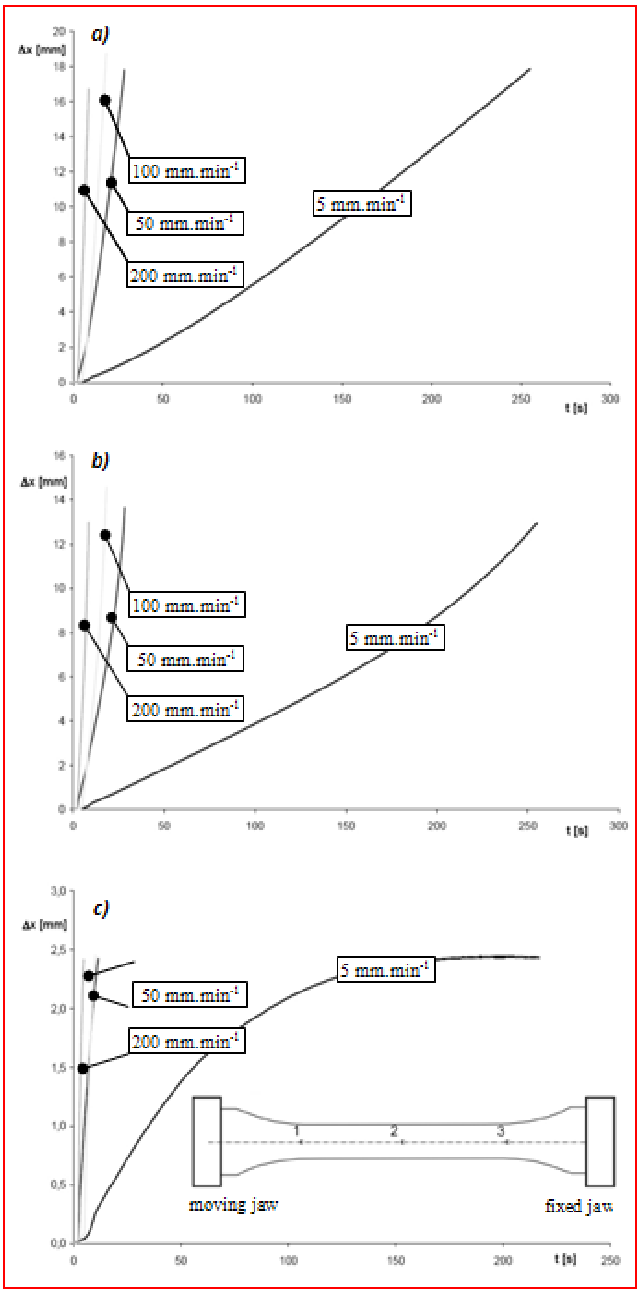

Fig. 6 Time dependence of point displacement 1 (a), 2(b) and 3 (c) in the loading direction (axis - x) in dependence on loading rate

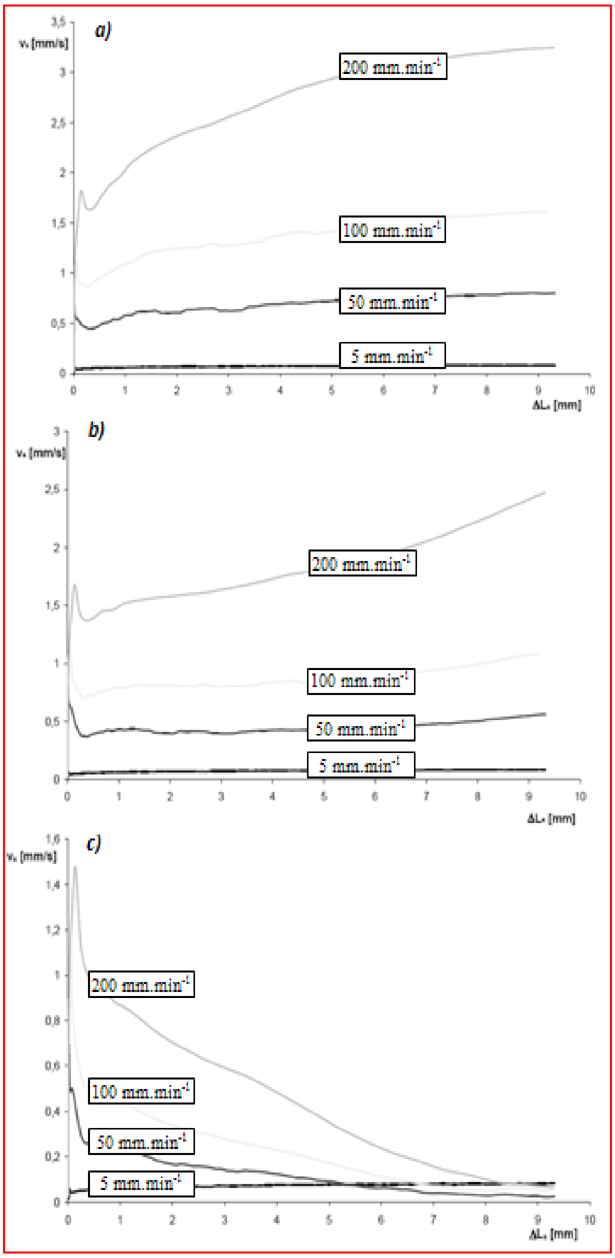

Fig. 7 Dependence of displacement rate of points 1(a), 2(b) and 3 (c) in the loading direction (axis - x) on elongation for different loading rate

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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VIBRATION DIAGNOSIS OF CAR MOTOR ENGINES

Abstract:
In the article the results of the tests are presented, which were to detect the mechanical damages of an internal combustion engine with the use of vibration methods. One of the main sources of inputs in an internal combustion engine is an impact of the piston on the cylinder wall. The results of the vibration signals analysis registered for an engine before and after repair are presented here. The engine repair consisted of the exchange of the used pistons and due to it a decrease of the clearance in piston-cylinder system was achieved.

Keywords:
fault diagnosis, engine vibration, internal combustion engines

INTRODUCTION

Growing expectations concerning the durability and the dependability of the internal combustion engines as well as the cost minimising and the bad influence on the surrounding cause that the necessity arises to get information about the engine condition during exploitation. The introduction of an obligation to produce car vehicles according to the OBDII norm caused that there are possibilities of access to data stored in controllers of separate systems [15]. In case of an engine the highest efficiency of the board diagnostic system is provided in the field of toxic substances emission control. However, some damages such as, for example: growing consumption of the valve seats and the faying faces of the valves, shift of timing gear phase, consumption of cylinder bearing surface even over the sizes allowed for a given engine, in many cases confirmed in practice do not serve as a basis for the diagnostic system to react. The most common cause of such a condition are the used algorithms of the adaptation steering of the internal combustion engine.

Adaptation steering of the engine may lead to the stage, when the appearing errors will be hidden or adapted [1,2,8,9]. The mechanical defects and the exploitation consumption, particularly in the early stages of development, are compensated by the adaptive regulation systems due to the approved ranges of regulation. The changes of the technical state of the engine caused by the early stages of its consumption are difficult to detect with the use of presently used diagnostic methods.

DIAGNOSIS OF THE INTERNAL COMBUSTION ENGINES WITH THE USE OF VIBROACOUSTIC METHODS

One of the methods of gaining diagnostic information is monitoring of the vibrations level generated by the sub-assemblies of the engine. In a description of the vibroacoustic symptoms of the mechanical damages of an internal combustion engine one should take into account the fact, that a high level of nominal vibrations is generated, resulting from the target function realisation. Internal combustion engine is an object under the influence of internal and external inputs [7]. Among them there are mainly: burning pressure, the movement of the piston-crank mechanism, inputs from the timing gear system, inputs resulting from the work of the fittings of the engine (that is alternator, compressor, etc.), inputs transmitted from the motor-car body and the drive transmission system. One of the most important inputs during the work of the piston-crank mechanism are the impacts of the piston by the change of its work direction. The value of input is significantly dependent on the clearance between the piston and the cylinder wall, caused by the exploitation consumption of the engine [3-6,11-14]. The power value is a burning pressure function and the rotational speed of the engine function. The most important aspect is to identify the frequency bands in which the maximums of power generated by the defect are to be found. Because of the construction the most commonly chosen vibrations measurement point is the piston or the engine body.

The received signal is strongly interfered by various vibration sources and that is why there is a necessity to use advanced methods of signal selection. Due to the impulsive character of the inputs, the spectral diagnostic bands are in the area of high frequencies. That is why there is a need to use the acceleration sensors with high transfer range and their proper fastening on the body or the piston of the engine. The engine body is characterised by the low coefficient of dumping and that is why the vibrations of low and medium frequencies up to a few kHz are only slightly dumped on the propagation way. Stronger dumping effects appear only for frequencies of 10 kHz or more [10]. Dissipated energy in time of one vibration cycle for a given material is approximately stable.

For higher frequencies in the same period of time a bigger number of cycles appear and that results in higher dissipated energy. The fact, that the amplitude of elastic waves decreases with moving away from the input source, should also be taken into account. By high vibration frequencies in engine block there is a possibility of formulation of sinusoidal elastic waves. Their amplitudes decrease inversely proportional to the distance from the point of reception from the source and that is why the choice of fastening the converter of the acceleration is the more important, the higher frequencies are generated by the defect. The diagnostic signal is received in any place of the engine construction is weighted sum of its answers to all elementary events $x_i(t,\theta)$, where as a balance we have here a convolution with impulse transition function $h(r_i,t,\theta)$ from the point of its generation to the reception of the diagnostic signal [10].

In an internal combustion engine single events occur in a cycle sequence, and their repetition in each next cycle is a symptom of the working engine. Elementary events occurring in kinematic pairs occur also in an order. That is why, according to the place of impact impulse in respect of reference signal one can define an engine kinematic pair which created the impulse. It is then possible to isolate a summary signal of a tested kinematic pair (tested cylinder of a multi-cylinder engine) with the use of time selection.

Spectral selection of signals, however, is an efficient diagnostic tool, particularly in case, when the defect development stimulates vibrations in a tested system on its own frequency. In vibroacoustic diagnostics of internal combustion engines, among other methods, the comb filtering, synchronic averaging and selection in the field of time and rotation angle of the crankshaft are the methods used. Due to the fact, that the acceleration converters are characterised by big direction selectivity, the proper sensor placement enables the spatial selection of the diagnostic signal.

RESEARCH EXPERIMENT

Data in the experiments carried out is derived from time runs of the vibration accelerations in the engine body. The subject of tests was a Fiat

Panda with SI engine 1.2 dm³. The tests were carried out in the roller bench. The vibration acceleration signal of the engine body was measured perpendicularly to the cylinder axis with a sensor placed at the 4th cylinder. The vibration acceleration transducer type ICP and data acquisition card controlled by a program developed in LabView environment were used for the measurements. The signals were recorded at the velocity of 2500 rpm, at the sampling frequency of 40 kHz. During the tests, 23 runs of accelerations of the engine body vibration were recorded before the repair, and 27 runs of accelerations of the engine body vibration were recorded after the repair, including full operating cycles within the rotation angle of 0-720°. The engine repair involved the replacement of worn pistons which reduced the clearance in the piston-cylinder assembly.

Refer to figure 1 for examples of vibration signals recorded before and after the repair.

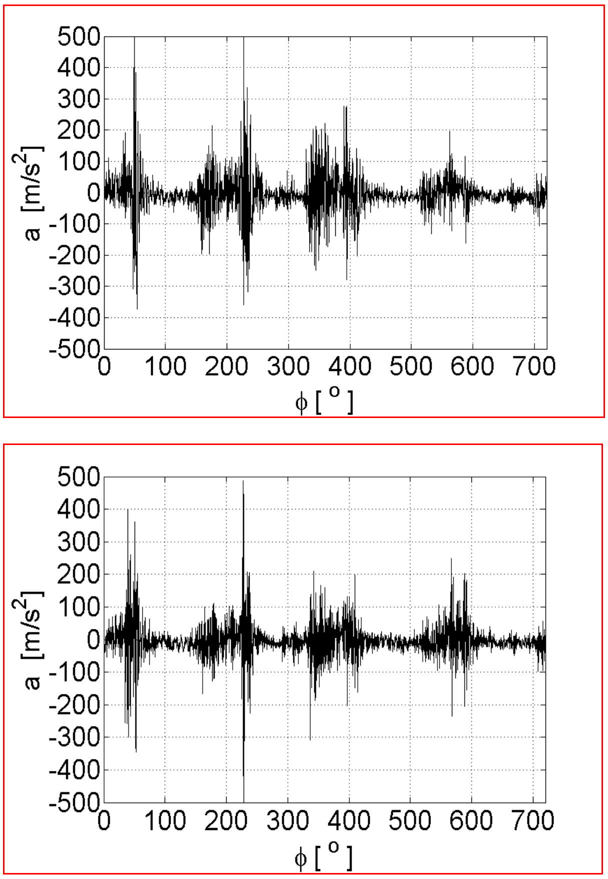

Fig. 1 Vibration acceleration runs recorded on the body before (a) and after (b) the engine repair.

The repair of the engine did not explicitly affect the character of changes in local measurements derived from the vibration signals (Table 1). Both, the measurements of average position, differentiation, the group of slope measure and the distribution kurtosis of measurable variants of vibration accelerations in time domain did not allow the clearance in the piston-cylinder assembly to be explicitly identified.

Tab. 1: Selected measures obtained from vibration accelerations

Parameter	Value of measure for engine	
	before repair	after repair
Root mean square	101,3	95,3
Mean value	50,3	48,4
Mean absolute deviation	49,9	48,2
Kurtosis	13,8	14,1
Crest factor	9,9	10,5
Clearance factor	1,4	1,4
Shape factor	2,0	1,9
Impulse factor	19,9	20,7

According to the studies carried out to date, wherever the vibro-accoustic signal can be presented as a series of elementary events, the cepstrum analysis can be useful:

$$C(\tau) = \sqrt{\left| FFT\left[\log\left(G_{uu}(f)\right)\right]^2 \right|} \qquad (1)$$

where $G_{uu}(f)$ – densities of spectral power.

Occurrence of noise, especially of periodic nature, is possible to be identified with that analysis [1]. It allows separating the series components respectively to the pulse response of the system and the initiation [11]. Series identity is used here in the time domain with the product of Fourier transforms in the frequency domain. For the diagnostics of technical facilities, the cepstrum analysis is used for all applications in which the change of state results in the appearance or disappearance of harmonics.

Cepstrum was determined from the recorded accelerations of engine body vibrations.

Refer to figure 2 for examples of cepstrum derived from the vibration signal for two different states of the engine.

According to the studies, signal analysis in two selected representative frequency ranges is required to evaluate the piston-assembly wear. Therefore, in the next stage of model construction, the cepstrum range achieved was divided into 5 sub-ranges:

- *sub-range I: 0 to 0.01 [s],*
- *sub-range II: 0.01 to 0.02 [s],*

- *sub-range III: 0.02 to 0.03 [s],*
- *sub-range IV: 0.03 to 0.04 [s],*
- *sub-range V: 0.04 to 0.05 [s].*

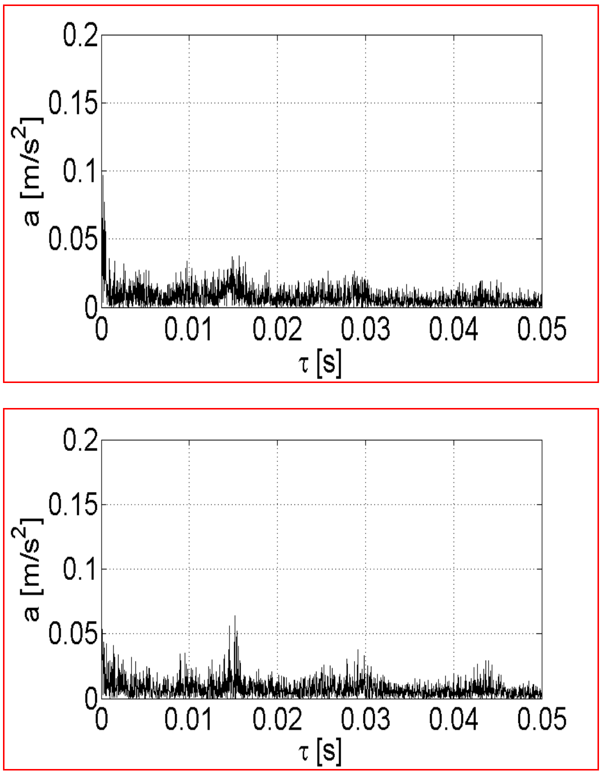

Fig. 2 Cepstrum of vibration accelerations recorded on the body before (a) and after (b)the engine repair.

A histogram was prepared to enable the description of the character of cepstrum changes for each sub-range. The limits of the histogram ranges were assumed by dividing the amplitude of cepstrum (determined for the maximum value of a given sub-range) into 5 equal parts. Based on the initial experiments, it was found that better results are obtained by assuming the value of the maximum cepstrum amplitude range, separately for signals recorded prior to and after the engine repair, than for the range determined based on all recorded signals, either before, or after the repair. The histogram ranges assumed for further experiments are as follows:

- *range 1: 0 to 20 % maximum cepstrum amplitude in a given sub-range,*
- *range 2: 20 to 40 % maximum cepstrum amplitude in a given sub-range,*
- *range 3: 40 to 60 % maximum cepstrum amplitude in a given sub-range,*
- *range 4: 60 to 80 % maximum cepstrum amplitude in a given sub-range,*
- *range 5: 80 to 100 % maximum cepstrum amplitude in a given sub-range.*

Refer to figure 3 for an example of cepstrum histogram for accelerations of engine body vibrations with various clearance values in the piston-cylinder assembly.

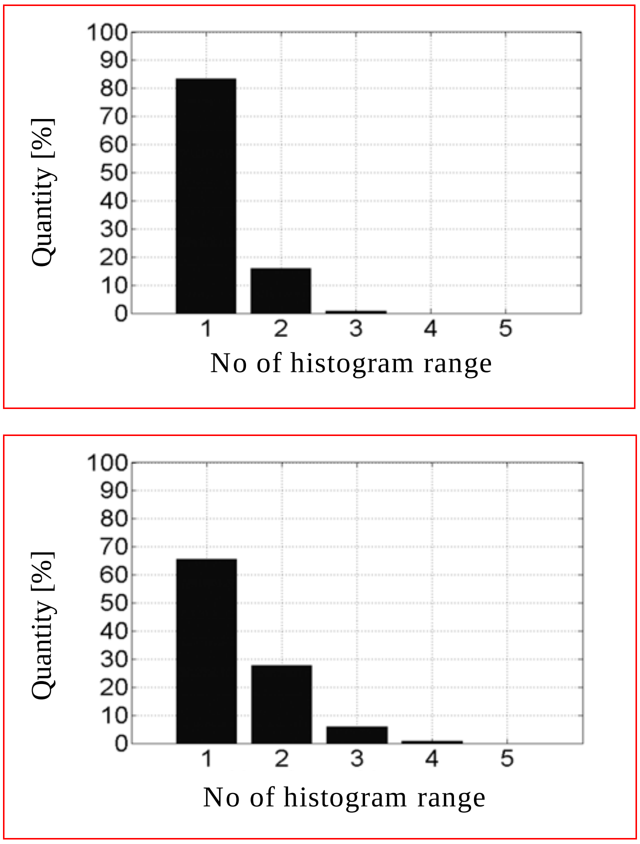

Fig. 3 Sample cepstrum histogram of vibration accelerations recorded o the body before (a) and after (b) the engine repair.

For all recorded time runs of the accelerations of vibration measured prior to and after the engine repair, cepstrum histograms were determined according to the procedure described.

Another stage of the modelling process was to select only those ranges of cepstrum amplitude (range 1 – 5) and only such cepstrum sub-ranges (sub-range I – V) for which the separation for classes referring to the worn and new pistons was visible.

As a result of selections which best separate the states prior to and after the engine repair, 15 comparisons between the cepstrum sub-range and histogram range were selected.

Refer to figure 4 for a sample comparison of cepstrum sub-range and histogram range for correct and incorrect classes separation.

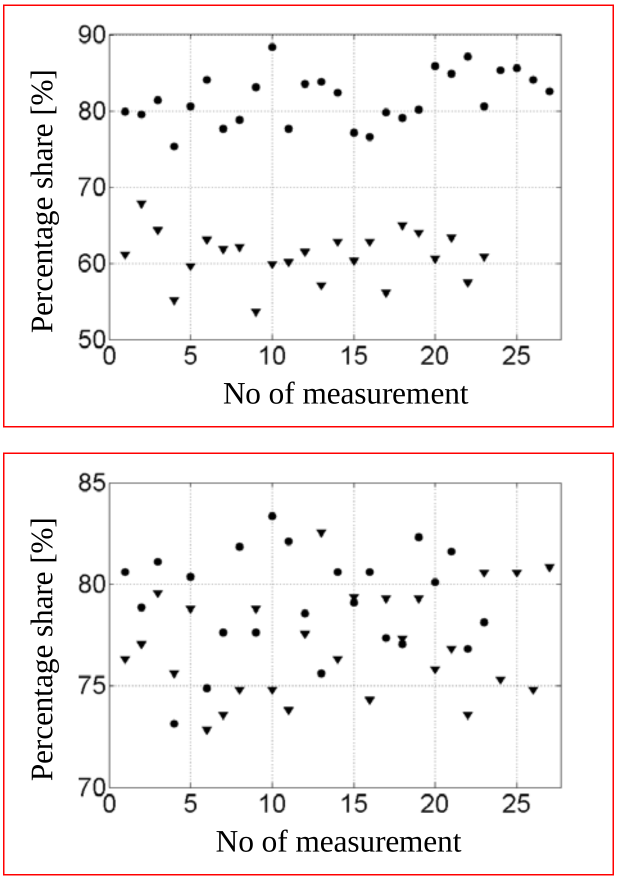

Fig. 4 Sample comparison between the cepstrum sub-range and histogram range for the correct (a) and incorrect (b) separation of wear classes of the piston-cylinder assembly („triangle" – engine prior to repair, „circle" – engine after repair)

CONCLUSION

The block and head vibrations of a given engine are caused by many inputs connected with its rotational speed. Their intensity rises with the appearing mechanical defects, exploitation consumption and the occurring anomalies in the burning process.

From the tests conducted so far, one can gather that adaptive systems of engine steering can cause masking of some mechanical defects, particularly in the early development stages. That is why, in the diagnostic of internal combustion engines, one searches new processing methods of damage development sensitive signals.

In the conducted tests the signals of vibration acceleration were used to define the influence of the state of simulated clearance in the piston-cylinder combination. Due to the fact, that the internal combustion engines are complex diagnosis objects, the use of traditional analysis methods does not provide the precise identification of the characteristic inputs.

The tests show, that on the basis of cepstrum selection one can select the required measures of vibration signals, sensitive to the exploitation consumption of the piston-cylinder system. Such measures can be used to build a properly functioning diagnostic system based on artificial intelligence methods [12].

It is necessary to create the proper algorithms completing the OBD systems which would enable to detect the mechanical defects of an engine, which may be masked by the electronic steering devices of the presently used car vehicles

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ACTA TECHNICA CORVINIENSIS
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TECHNICAL AND ENVIRONMENTAL ASSESSMENT OF CURRENT OPPORTUNITIES AND TREND IN END-OF-LIFE VEHICLES DISPOSAL

Abstract:
The paper deals with the analysis of state of art in end-of-life vehicles recycling in the European Union and worldwide, descripts briefly the legislation on ELVs recycling, ELV material composition and current technological processes for car disassembly and shredding. The objective is to depict the problems connected with the waste prevention, re-use, recycling, and recovery of the end-of-life constituents; automobile shredder residue disposal. Based on analyses, the optimum shredding facilities are shown. At the conclusion, technical and environmental aspects of ELV recycling are evaluated.

Keywords:
end of life vehicle (ELV), shredder, automobile shredded residue (ASR), recycling

INTRODUCTION

Vehicles, essential to society, are continually increasing in use. However, throughout their life cycle vehicles impact the environment in several ways: energy and resource consumption, waste generation during manufacturing and use, and disposal at the end of their useful lives. About 75% of end-of- life vehicles, mainly metals, are recyclable in the E.U. The rest of the vehicle is considered waste and generally goes to landfills. Environmental legislation of the E.U. requires the reduction of this waste to a maximum of 5% by 2015. [1]

Every year, end of life vehicles (ELV) generate between 8 and 9 million tonnes of waste in the Community which should be managed correctly. [2]

Automobile manufacturing has increased in the last 20 years, reaching about 58 million units (excluding commercial vehicles) in 2000. According to estimates by the OECD, the total number of vehicles in OECD countries was expected to grow by 32% from 1997 to 2020. Automobile production is more or less equally distributed between North and South America, Europe, and Asia. [3]

LEGISLATION ON END-OF-LIFE VEHICLES RECYCLING

The main document is the Directive 2000/53/EC of the EP and of the Council on End of Life Vehicles. ThE Directive lays down measures which aim at the prevention of waste from *vehicles and at the reuse, recycling and other forms of recovery of ELVs and their components so as to reduce the disposal of waste, as well as at the improvement in the environmental performance of all of the economic operators involved in the life cycle of vehicles and especially the operators directly involved in the treatment of ELVs. The ELV Directive states, that no later than 1 January 2015, for all end-of life vehicles, the reuse and recovery shall be increased to a minimum of 95% by an average weight per vehicle and year. Within the same time limit, the re-use and recycling shall be increased to a minimum of 85% by an average weight per vehicle and year. The Directive also defines the minimum technical requirements for ELV treatment. [2], [4].*

CURRENT ELV RECYCLING IN THE E.U.

Considering the material composition of a car, it is necessary to take into account the average lifespan of a car; ELV in the recycling chain today were manufactured in the 1980s–1990s.

An overall schema [5] of the vehicles' paths starting from automakers to disposal of the shredder residue is shown in Figure 1. The last car owners (i.e., users) are the starting point for the ELV chain. After de-registering the vehicles, the users can deliver their old cars to the dealers and/or to used-car dealers. The dealers, in turn, deliver the used cars to collectors/dismantlers. Deregistration of used cars can be done by users, dealers, collectors, and/or dismantlers, depending on the regional rules. [4]

PROBLEMS RELATED TO ELV SHREDDING

Collecting and dismantling companies focus on removing valuable spare parts and other components such as engines, batteries, oils and fuels, and airbags. These companies are mostly interested in ELV parts that are suitable for reuse, recycling, or sale. The ELV dismantling is often done improperly, increasing the amount and toxicity of ELV waste. After dismantling, the remainders of the ELV are processed by shredding companies. [2]

After the hulks are shredded, the obtained materials undergo a series of mechanical and physical separations in order to recover the ferrous and non-ferrous metals. The residual of the shredding process, automobile shredder residue (ASR), represents about 20–25% of the ELV weight. Its average composition is given in Figure 1. [5]

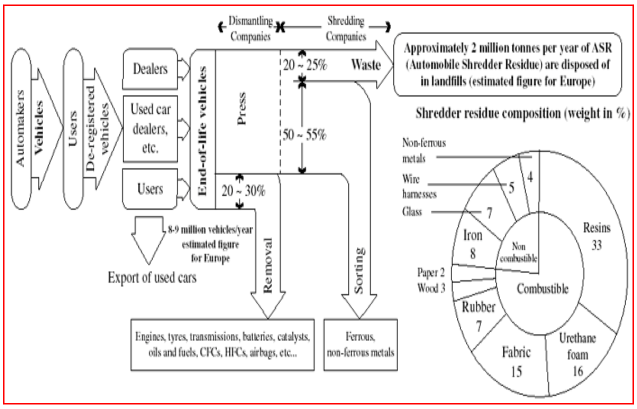

Fig. 1 The disposal route for end-of-life vehicles [5]

The ELV recyclable rate of 75–80% is higher than that of simpler products such as glass containers, newspapers, and/or aluminium beverage cans. [6]

The ASR is the weak point of ELV recycling not only in the E.U. but also in the worldwide automobile industry. About 2 million tonnes of ASR are generated per year in E.U. countries. In fact, it represents less than 1% of the total waste generated in the E.U. The ASR, while toxic enough to be classified as hazardous waste in many countries, could be considered an energy source as it contains more than 7% combustible matter. [1], [3]

Two options will be considered for the ASR: recycling/recovery and waste disposal. Although many alternatives have been researched (physical separation, incineration, pyrolysis, and composite materials), it seems that the landfilling of ASR was the most appropriate option.

Shredding and separation line is a device for ELV bodies processing in the original or pre-pressed form (Fig. 2). The material is shredded into pieces of 150 - 200 mm in size, and is partially compacted and got rid of dust, other impurities and non-ferrous metals. The final product of the line is a block of steel waste containing 92% of iron with a specific weight of 1.0 to 1.1 t.m^{-3}. [7]

By further separating, two types of grain can be achieved (as required by customers) – with the average diameter 4 cm and 9 cm. Hourly output of the equipment is dependent on the type of processed material and varies from 20 - 40 t.h^{-1} of pure steel waste.

Fig. 2 Car bodies before and after shredding [8]

Shredding and separation unit is a facility that treats steel waste hitherto bundled in the original form, which was of very low quality due to its impurities content. Shredding and separation line is a system of several individual technological units that are interconnected by conveyer belts. The principal activity is the grinding of light steel waste, which is performed in enclosed hammer crushers. Material is inserted into crusher by means of two cylinders with the power of up to 20 t, and it is gradually chipped by rotating hammers made of special steel. Hammers are fit radially on the rotor and create a circle with a diameter of 1900 mm (Fig. 3).

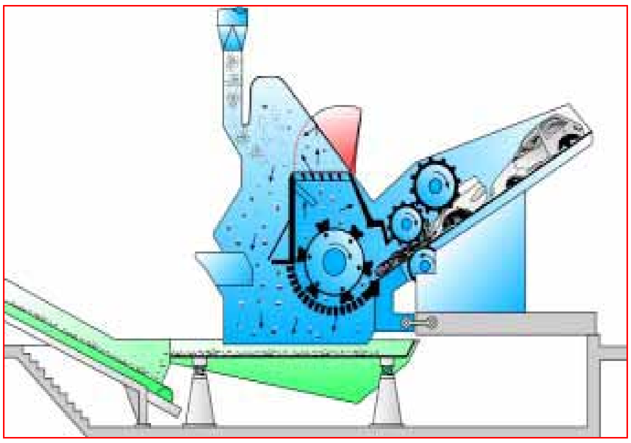

Fig. 3 Top and bottom discharge shredder [9]

At the process, certain amount of dust is produced, which is collected by radial fan already in the shredder unit itself. Fine dust fractions are drawn by pipe into a wet scrubber (with water content of 18 m^3), where the dust is sprinkled with water and incurred sludge is carried by special conveyor into the container. Heavy fraction of the dust is collected by dry precipitator and delivered by conveyor into container.

Another device, where the coarse and light impurities are separated, is the device placed after the shredder. It is a cyclone, where all the shredded material falls through. Light fractions, i.e. non-metallic fraction are exhausted into the same dry precipitator as the similar fraction from the shredder. Thus, the shredded steel material is separated from dust and light impurities such as parts of rubber, wood, plastics etc. The material is then supplied by conveyor to further separation equipment - magnetic separation. This is a rotating magnet, which sorts shredded material into magnetic (containing Fe) and nonmagnetic portion (containing non-ferrous metals and heavy impurities). The device works automatically. [7]

Magnetic portion is then transported by conveyor to the sorting workplace where they are manually picked pieces of shredded waste, which visibly contain non-ferrous metals. Furthermore, the magnetic portion is transported to the rotating sorting drum, which is located at the end of the equipment and serves only to further sorting of the material (by means of a sieve). The processed steel waste is collected by the conveyor under the crane line and can be immediately dispatched.

After the magnetic separation, the second fraction arises, which contains non-ferrous metals, wood, rubber etc. This is transported by conveyor to a rotating separation drum. The sieve separates the material into three fractions (up to 15 mm, 15 - 80 mm and above 80 mm). Fractions up to 80 mm are stored in the stack. The fractions of above 80 mm are separated manually where non-ferrous metals are visually selected. [7]

The whole device works automatically (except for two manual sorting departments) and is operated from the driving cab by machine operators. They are able to control the light signalling of the individual nodes of technological units and if the failure of the *equipment occurs, the operator disables the equipment. Similarly, the operator controls the dangerous places at the displays. The design of the main shredder section is derived from the Hammermills shredding system. [7]*

ASSESSMENT OF CURRENT OPPORTUNITIES AND TRENDS IN ELV DISPOSAL

In general, the industry is interested in increasing the ELV recyclability. In compliance with this, it is necessary to adopt the vehicles design and construction modifications, such as elimination of a non-recyclable and potentially hazardous materials, reducing the diversity of plastic products used as vehicle components, thus increasing the potential recyclability of plastic components, or reduction of parts, consisting of incompatible materials, such as plastics and metals, or ensure that these different materials are used so that they can be easily separated from each other etc.

In the area of ELV recycling, there is a space for modern separation technologies, which will allow separating mixed plastic waste components from impurities. The application of conventional physical separation technologies used for ore and non-ore raw materials, however, encountered in the plastic waste to its specific physical and chemical properties. Here opens the way for the subsequent use of physical and chemical separation methods, such as flotation, which allows separation of all types of plastics. [10], [6]

FUTURE APPROACH TO ELV RECYCLING

The directive of European Parliament and of the Council of 18 September 2007 organized former national policies and voluntary agreements. It was aimed to harmonize these existing rules and to push the E.U. governments and automobile industry to comply fully with the directive and to translate its key requirements into national law. The ultimate goal of this directive is to put only 5% of ELV residues (ASR) into landfills. [4]

The main actor in the ELV chain, according to the E.U. directive is the producer, a vehicle manufacturer or professional importer of a vehicle into a member state of the E.U. The producer links the upstream (supplier) and downstream in the ELV chain (collector, dismantler, and shredder). On the other hand, collaboration between collector, dismantler, and shredder are necessary to successfully meet the directive goals. [1]

The vehicle produced has to at least meet the following goals: low energy consumption, easy dismantling, suitable recycling, and less toxic metals. To fulfil these goals, the producer has to know the technical and economical facilities, recyclability rate, and efficiencies of the downstream ELV chain. On the other hand, the producer will provide the dismantling information for each new type of vehicle put on the market. The design of vehicles appropriate for dismantling, recycling, and re-use, and free of some hazardous substances (Pb, Hg, Cd, and Cr VI) will significantly improve the cooperation of the supplier-producer chain. [11]

CONCLUSION

The objective of the paper was to evaluate the shredding process and assess the possibilities for performance improvement in ELV recycling. At ELV recycling, it is necessary to comply with exact environmental and technical demands. Separated materials after shredding go to automakers for use in the production of the same components from which they are issued. Energy can be recovered from combustible parts of ELV by using them instead of fossil fuels in industrial operations, such as cement plants. The remaining part of the vehicles, ELV waste, goes to a landfill under strict waste control.

In an increasingly global economy, the goals of the E.U. directives are becoming a sensitive issue for worldwide vehicle production. The car manufacturers have an essential role in the infrastructure system of waste prevention, collection, and treatment of ELV.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] JIŘÍ SOBOTKA

DEFORMATION PROPERTIES OF TWIP SHEETS

Abstract:
*This paper deals with the extraordinary properties of new type of high-strength material – so called **TWIP (TWinning Induced Plasticity)** sheets. Such material exhibits very specific properties mainly from the mechanical and forming point of view – very high yield and ultimate strength but on the other hand elongation up to 60%. In the experimental part this material was measured by means of contactless optical system **ARAMIS**. Results can help for better understanding of deformation behavior such kind of material.*

Keywords:
Twinning, Deformation, Hardening, Optical System

INTRODUCTION

Sheets producers are still under quite large pressure from automotive industry. Because there is requirement for safety of passengers on the one hand and on the other hand quite large requirement for light weight material. Everything is basically oriented on economical and ecological requirements. There are considerable reductions in weight, in fuel consumption and in the emission of exhaust gases. And that is why during last years were developed wide spectrum of materials suitable for automotive industry (Dee-drawing, IF, BH, DP, CP, TRIP steels etc). This paper gives a very short overview about one of the newest materials called TWIP steels (Twinning Induced Plasticity). Such type of steels is suitable for the development and design of the types of high strength lightweight steels. TWIP are high manganese steels where the phase transformation is suppressed and heavy twinning formation is sustained (TWIP effect) – due to high stacking fault energy. So basic of these steels is mechanical twinning formation instead of phase transformation. Mechanical properties of these steels and mentioned trends in automotive industry have led to great interest in these high strength and tough steels. On the other this kind of material is still in the development stage and it is really necessary to describe their behaviour at first. Comparison of different types of material from the static tensile test view is given in fig. 1.

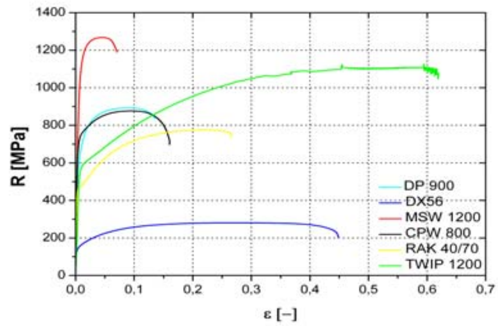

Fig. 1 Static tensile test – comparison of different materials.

TWIP SHEETS

TWIP steels (twinning induced plasticity) are group of materials where the increasing elongation with decreasing temperature is attributed to strain-induced twinning: the TWIP effect. These sheets belong to so-called high-strength steels and are still mainly in the development process. Such kind of materials contains austenite stabilising elements, e.g. Mn or Ni. The developed light weight high manganese steels exhibit an extremely large elongation in combination with quite large yield strength. It is due to reality that with increasing manganese content up to about 20 wt-% Mn the stacking fault energy will be decreased and extensive mechanical twinning occurs and these steels exhibit extraordinary high plasticity.

EXPERIMENTAL PART

First part of experiment was carried out on the static tensile test device and were measured basic mechanical properties ($R_{p0.2}$, R_m, A_{50mm}, C, n). First of all specimens from material marked like TWIP 1200 were cut by water jet. It is both due to their high strength and because of non-heat influenced area by water jet. The results are shown in the table 1 and table 2.

Tab. 1 Static tensile test – results of $R_{p0.2}$, R_m and A_{50mm}

Statistical evaluation	$R_{p0.2}$ [MPa]	R_m [MPa]	A_{50mm} [%]
1	567,21	1118,65	55,02
2	557,19	1125,77	56,42
3	556,45	1125,26	60,69
4	558,63	1131,77	57,25
5	554,47	1126,37	61,34
x	558,79	1125,56	58,14
s	4,94	4,67	2,75
min	554,47	1118,65	55,02
max	567,21	1131,77	61,34

Tab. 2 Static tensile test – results of C and n

Statistical evaluation	C [MPa]	n [-]
1	2331,272	0,425
2	2348,079	0,428
3	2388,208	0,431
4	2376,321	0,426
5	2388,048	0,432
x	2366,386	0,429
s	25,555	0,003
min	2331,272	0,425
max	2388,208	0,432

In September of 2008 was bought on the Department of Engineering Technology one of the optical measurement systems from German company GOM. In this case it was system ARAMIS – v6.1.1-2 which is device enables contactless measuring of deformation. It is much more different approach to material behavior description during deformation than is typical of static tensile test was material TWIP 1200 measured by means of this system.

System ARAMIS using for measuring material deformation scanning of given sample by means of two cameras. Before measuring the system has to be calibrate which enables to get relevant measuring of deformation in given calibration volume. Size of this calibration volume depends on used calibration plate. This plate contains calibration points of predefined coordinates which cameras scanned from different angles. During real measuring is so necessary to be still inside such calibration volume. In fig. 2 is shown workplace lay-out for measuring static tensile test by means of system ARAMIS.

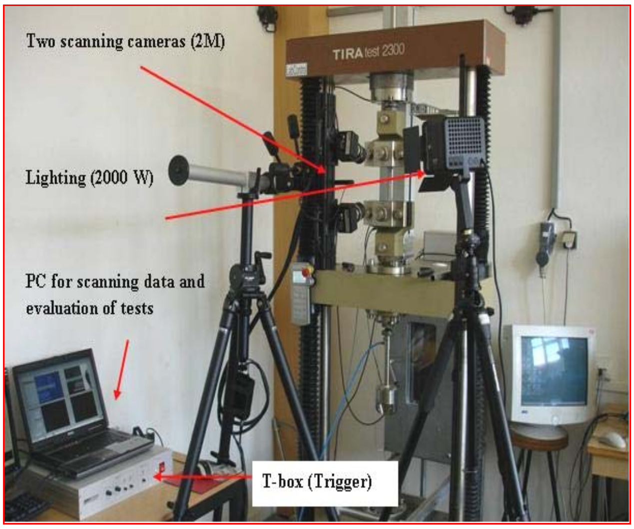

Fig. 2 Workplace lay-out.

In fig. 2 are shown two cameras for scanning measured sample, lighting device with load of 2000 W, T-box (Trigger) for controlling scanning rate and PC for evaluation of tests. On the measured sample is then necessary to apply stochastic pattern. System ARAMIS by the help of this pattern allocates to each point characteristic number (grey shade) and apply own mesh. Deformation measuring is carried out by scanning of these points displacements and deformation of mesh. Tested material TWIP 1200 with applied stochastic pattern is shown in fig. 3.

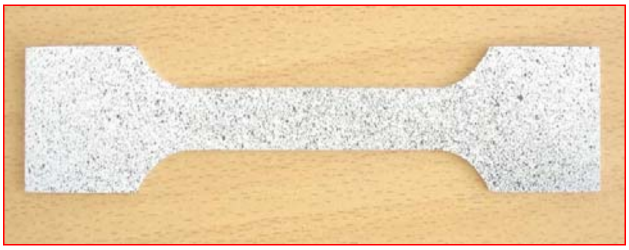

Fig. 3 Material TWIP 1200 with stochastic pattern.

After calibration and creation of stochastic pattern is activated system ARAMIS and measurement can start. The sample is fixture between jaws and parameters for whole experiment are set. It is namely about sensitivity of cameras (set of stop) and choosing the right frame rate. There is tendency to have maximal frame rate (in our case it is 6 frame/rate) at the end of rupture of measured sample.

In the fig. 4 is shown first stage (from left camera) and in fig. 5 calculated strain distribution for this stage. Both of them are without any deformation.

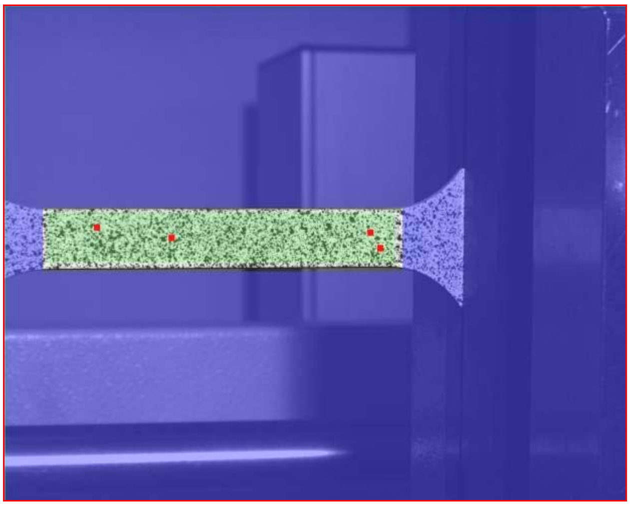

Fig. 4 First stage (left camera) .

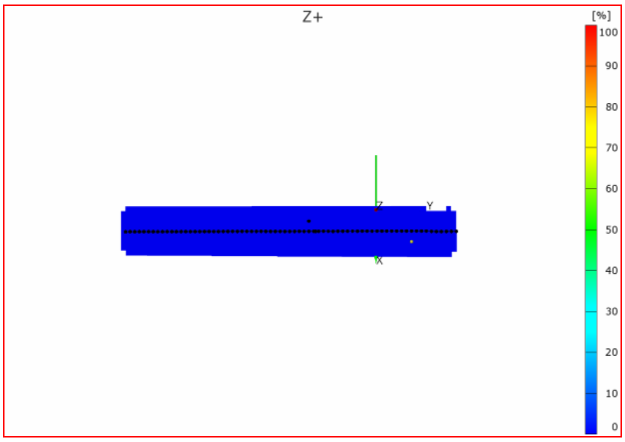

Fig. 5 First stage (left camera) – strain distribution.

Following figures shown development of strain during deformation. It is clear that about ε = 30% there is change of deformation behavior. Till this limit it was already homogenous then there is something like "wave" – whole volume is formed one wave after another until sample ruptures without creation neck. Almost every part of sample is formed so there is a lot of plasticity.

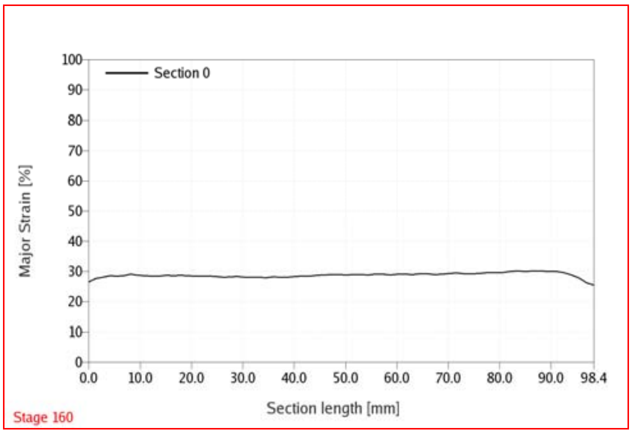

Fig. 6 Strain distribution for ε ≈ 30%.

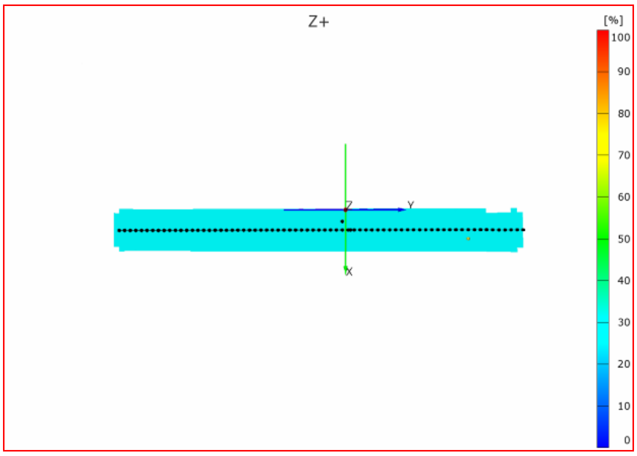

Fig. 7 Strain distribution (graphic) for ε ≈ 30%.

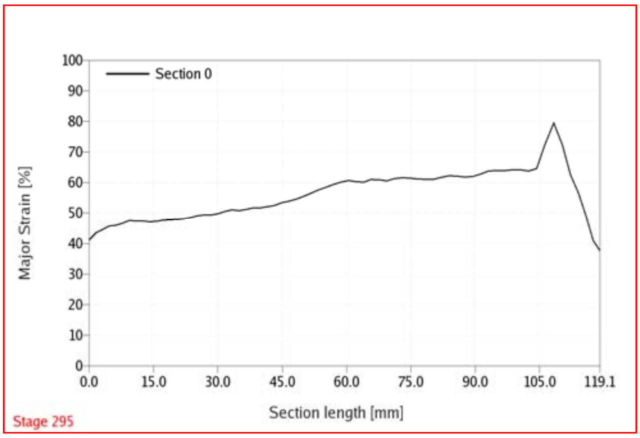

Fig. 8 Strain distribution just before rupture.

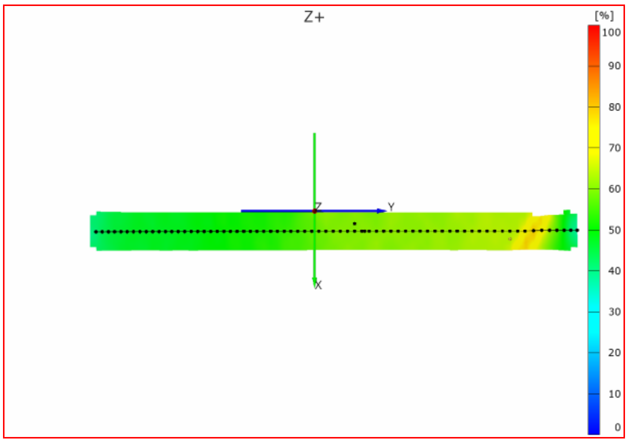

Fig. 9 Strain distribution (graphic) just before rupture.

Situation between fig. 6 and 8 is clear from fig. 10. Here are shown "waves" which increase deformation of whole volume of sample – almost no necking.

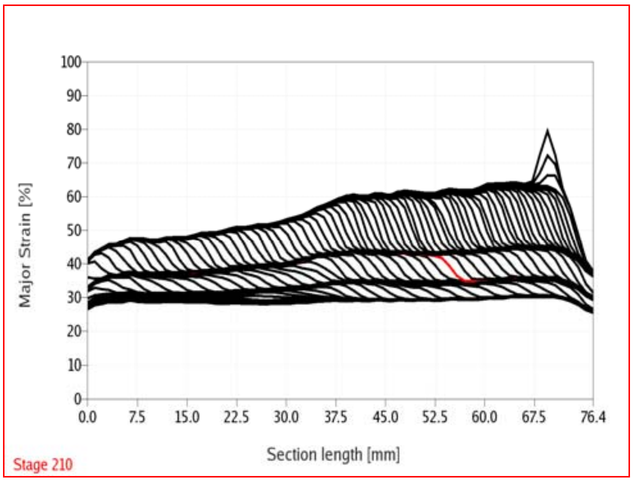

Fig. 10 Strain distribution between ε ≈ 30% and rupture

CONCLUSIONS

At first sight it is evident that TWIP steels represent a material group with extraordinary values which have led to a great interest in these steels. The excellent mechanical properties are due to massive twinning in the austenitic matrix during deformation. According to results of C and n coefficients is evident that these values are extraordinary high. There is still increase in coordinates R-ε which means that there is not almost at all necking part for testing samples. The main advantages of TWIP steels are evident from graphic results of tensile tests. There is a huge measure of the energy absorbed before and during the fracture process. The area under the tensile stress-strain curve provides an excellent value of toughness. There is deep-drawing material (e.g. DX56) with excellent elongation and on the other hand quite lower mechanical values (yield and ultimate strength). High-strength materials (e.g. MSW1200) have very good mechanical properties but are not too suitable for forming processes. The high ductility together with the high strength of these newly developed lightweight TWIP steels could improve the crash resistance of structural body parts. The excellent formability enables deep and stretch forming of parts with complex shape at room temperature. The reduced specific weight leads to an overall weight reduction of the car body. The potential applications of these steels are to be considered as deep drawing sheets, reinforcing bars and beams in automotive vehicles. On the other hand there are of course also disadvantages for processors of these materials. The main of them is probably tendency to fracture after deformation and welding.

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ACTA TECHNICA CORVINIENSIS
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EVALUATION SURFACE ROUGHNESS ON PRODUCT FROM STAINLESS STEELS AT CUTTING

Abstract:
Engineering manufacturing is one of the key factors of dynamic development of our industry. Automated production, reducing of manufacturing costs, new advancements in the area of tools development, changes in the design and construction of engines and designing optimum technological procedures result in more dominant status of machining technologies. Present state of machining technology and prospective trends prove machining core position in engineering manufacturing.There is a perpetual task for increasing production efficiency. One of the principal preconditions of achieving it is effective machining process. In order to attain efficiency it is necessary to find optimum formation of chips especially in drilling materials with specific properties.

Keywords:
cutting, surface roughness, cutting tool, product

INTRODUCTION

Optimum process of machining is a precondition of effective employing of optimal working conditions. When deciding on cutting conditions of various materials it is necessary to take into consideration the characteristics of material properties and cutting conditions. Machinability is one of such characteristics. In the current market there is a demand for high quality products of corresponding properties. Only materials with specific physical, chemical, mechanical and other properties can meet the criteria of resistance to various aggressive environment, thermal and heat influence and high mechanical load. The above class of steel is applicable especially in the following industrial branches: constructing of power reactors, energy blocks, crude oil refinery, basic organic production, food technological devices, transport, civil engineering. Technological processing of the steels assigned to the group of materials with low machinability rating, though brings difficulties in machining [1], [2], [5], [6].

CHARACTERISTIC OF MATERIAL

Defined as special steels with good resistance to corrosion under normal or higher temperature. They contain minimum 12% of chromium, sometimes exceeds 30% nickel or 20% manganese and often many others alloy elements, especially molybdenum, copper, titanium, niobium etc. They are called anti-corrosion or acid resistant steels, stainless steels and non-corroding steels. The development of new types of steel with regards to the growing competitiveness on market customers' demand resulted in adjustments of steel classification.

According to more authors current classification is as follows: martensitic steels, ferritic steels, austenitic-ferritic steels, austenitic steel. Chromium is a basic alloy element. Its impact on resistance to corrosion is multiplied by adding other alloy elements like nickel, molybdenum and copper. Some of the steels may contain high portion of manganese. Nickel as one of austenites is of great importance for its electrical-chemical character. Molybdenum increases passive and active corrosion resistance. One of few austenite elements is copper. Impact of copper is in enhancing effect of molybdenum on resistance to corrosion especially in aggressive environment. Manganese is, similarly to nickel austenite element. Combining main alloy elements it is possible to produce corrosion resistant steels with higher index of resistance to corrosion. Dominant residual element in these steels is carbon. It is contained in most of the steels. Generally, it negatively imparts steels properties since chromium is fixed, thus corrosion resistance is reduced. Manganese and silicon can also be classified as residual elements if their content does not exceed 2%. Increased silicone content reduces weldability in this category of steels. Titanium and niobium are also of great importance. Their affinity to carbon results in creating particular carbides. Content of phosphorus and sulfur is determined by particular type of corrosion resistant steel. In some cases increase in sulfur imparts machinability. Alternatively, selenium can be used. Their content is lesser than few hundredths percent. They are elements as: lead, tin, antimony, bismuth and arsenic. For this category of steel oxygen, hydrogen and nitrogen is also important. Trace elements have no larger effects on corrosion resistance and their content in stainless steel composition is rarely entered. Machinability as complex characteristics of a material in the process of machining is determined by the following factors: mechanical, and physical properties, way of working, material's microstructure. These factors affect the intensity of cutting tool wear, cutting temperature, chip formation, cutting forces and surface finish and integrity of workpiece. According to Sifrin and Reznicky (1964), workability depends on mechanical and physical properties, chemical composition, heat treatment and MFTP-technological system. Cutting process is characterized by accompanying features as cutting forces, tool wear, surface finish, vibration and chip formation. Especially the process of tool's cutting edge wear and its interaction to workpiece [3] is of high importance in cutting process analysis. Experiments results point out at the factors that influence cutting tool wear and its durability. The properties of workpiece are reflected in machinability. The term machinability implies qualitative condition of workpiece from the aspect of its ability to yield to the effects of cutting tool [4]. Machinability can also be articulated in volume of material removed in a period of time under efficient cutting conditions, constant section of removed part and arbitrary working conditions. Variable costs of machining from the aspect of machinability depend on cutting speed, technologically allowed of working feed, power consumption and secondary time for tool change and cleaning working place of chips. It is obvious that machinability can not be articulated by one feature only. When discussing properties which determine machina-bility the two aspects must be differentiated – complex and relative machinability. Complex machinability assumes all factors which can be mathematically formulated in relation to tool life, cutting forces etc. Depending on cutting conditions of explored material. This paper present one criterium from complex machinability, surface roughness on the part from stainless steel at drilling.

EVALUATION AND ANALYSIS OF METAL CUTTING OF HARD MATERIALS

Machinability is not generally valid and defined standardized property, [1], [2], [7]. The term machinabi-lity of material implies the set of material's properties from the aspect of its suitability for manufacturing components of by particular way of working. It is meant how easy it is to machine workpiece with applied cutting tools. The term machinability is not explicitly defined due to variability of machining operations and improving cutting tools. It is also not easy to measure machinability on the basis of data comparison. Considerably more accurate, though more demanding is to compile a working table comprising all workpiece material properties that have impact on *machining process. Not all suppliers dispose with detailed data. Metallurgy, chemistry, mechanics, determines material's machinability of workpiece as well as heat treatment, type of alloy element and character of surface finish. Other important factors imparting machinability are quality of cutting edge and holder, machining device and machining conditions. The valuables irrelevant for machinability can even in profound scrutiny serve only as secondary values for further optimization. It is important for user not only to know detailed properties of workpiece material to be machined but also ways and means which enable evaluation of successful machining performance. There often occur superior priorities as costs per a workpiece, productivity of labour, but also calculated durability of tool bit, which secure specific quality of machined surface and efficiency of machining. These are principles for evaluating machinability in particular concepts of machining depending on manufacturing. Machinability can be improved by enhancing quality of cast, by using automatic steel, change of cutting tool material, cutting wedge geometry, clamping method, cutting fluid etc. In wider sense, machinability is functional value of tool / workpiece relation, for which following criteria apply: cutting edge durability, chip formation, surface finish, power of working, cutting force / power consumption, tendency to buckle. The combination of knowledge about material properties and machinability tests provide a solid base for machinability assessment in relation to either specific cases or whole manufacturing. Other factors to be considered are additives for machinability improvement, microstructure, hard abrasive elements, tendency to adhesive bonding etc. Machinability can be classified as "good" if using particular tool type material it is possible to work certain workpiece material. Main material groups in the domain of machining are SANDVIK: 1.Steel, 2.Non-corrosive steel, 3.Cast-iron, 4.Refractory alloys, 5.Non-ferrous metals, 6.Quenched steels, 7.Titanium. Continuous ribbon-like chips are undesirable from the aspect of operating machining device. They entangle around spindle and can be harmful. Their removal is time consuming and hinders operation. They can also damage the tool (chipping of the cutting edge) or any mechanical failure that increases surface roughness. Prior to machining process start, the machinability of workpiece material should be assessed and verified to establish a degree to material's adaptability to optimal cutting conditions. It is necessary to concentrate on substantial properties with respect to used material and the way they impart to machining process. Following diagrams represent changes in four mechanical properties linear to carbon contents: Tensile Strength, Hardness, Flexure Strength, Ductility. Generally, Low index of hardness and strength is useful with the exception of materials forming long chips which, due to a tendency to buckle, result in poorer quality of surface finish. Low ductility index usually have positive impact on chip formation which enables greater efficiency of machining device. The higher hardness the lower ductility and vice-versa. Good machinability is often a resultant of compromise between hardness and ductility. High thermal conductivity means that heat energy created in machining is swiftly abducted from a shear zone. High index is than from the aspect of machinability beneficial.Thermal conductivity can play a key role with respect to machinability. However, in certain group of alloys it is less effective. Worked area is created as a resultant of geometric and kinetic relations of tool and workpiece. In considering the created area it is necessary to take into account the fact that machining represents technological process in which new surface is created by removing parts in the form of chips. Therefore the identification of processes accompanying chip formation is needed. Chip as a result of complex processes of elastic deformation and heating caused by friction with tool face is curling in various ways and deformed in various geometric shapes. Such mechanism is called chip forming. Suitable form of chip is attained through adjustments of cutting wedge. Accuracy and reliability of mechanisms and devices is affected by qualitative aspects of machined surfaces of particular components. Surface finish represents a set of microscopic irregularities measured at given length. Real profile of machined surface is a result not exclusively of geometric copying of tool's cutting tip but also irregularities in cutting edge. Apart from it, the surface finish is conditioned by plastic deformation of friction and chatter and vibration of MFTP technological system. The* characteristics corresponding to theoretical value Rz is the maximum height of irregularity, defined as a distance between spline and cavity line in the range of basic length. Most widely used characteristic is mean arithmetic aberration of profile Ra. It is mean value of profile aberration within the range of basic length.

EXPERIMENTAL PART

For experimental verification the austenitic corrosion resistant Cr20Ni10Ti steel was chosen, in table 1.

Tab.1 Chemical composition of Cr20Ni10Ti steel

Additive element (%)						
C	Cr	Ni	Ti	Si	P	S
0.07	20.0	10.0	0.50	1.0	0.045	0.03

The WMF 1000 CNC drilling machine was used for experimental measuring Fig 1.

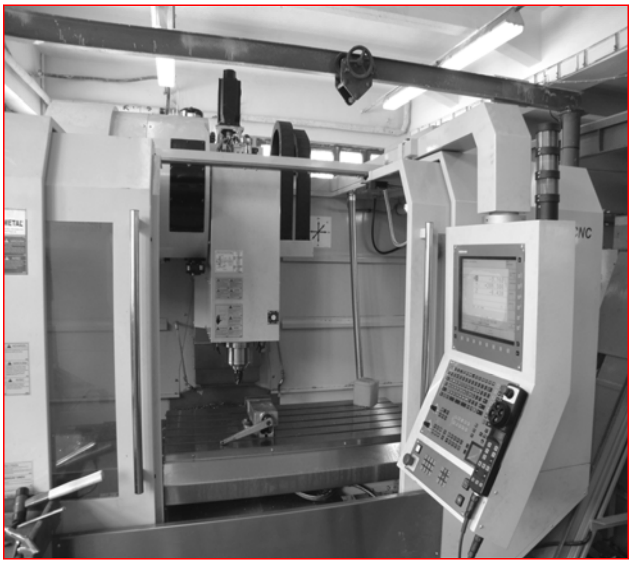

Fig.1 Experimental place WMF 1000 CNC

The following cutting tools were used for experimental tests: twist drills from rapid steel with 10 mm in diameter, by the cutting conditions described in resulting graphs. Experimental measurement underlie because definition and construction graphic depend videlicet: depend surface roughness Ra [μm] about feed f [mm], depend surface roughness Rz [μm] about feed f [mm], depend surface roughnees Ra [μm] about evolution n [min^{-1}], depend surface roughness Rz [μm] about evolution n [min^{-1}].

Fig.2 The cutting tool example for experiments

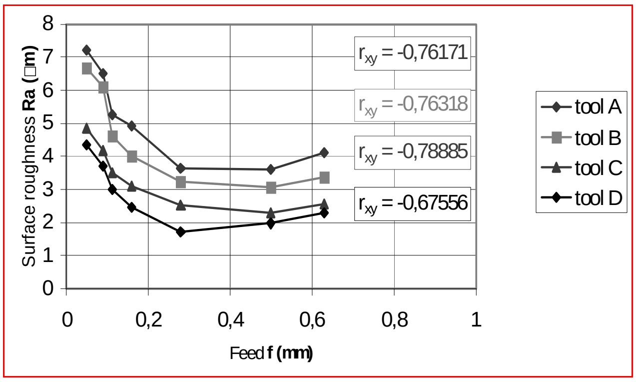

Fig.3 Dependence Ra [μm] - feed f [mm], n=125 min^{-1}

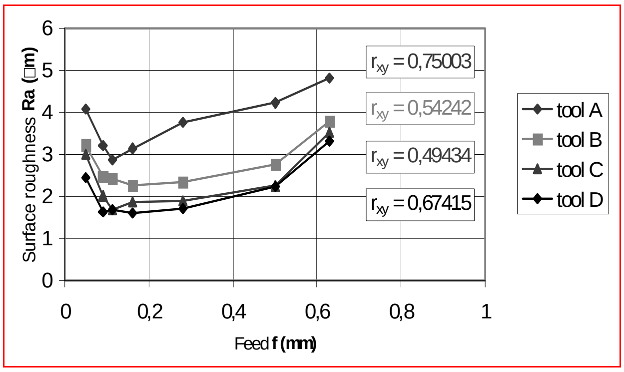

Fig.4 Dependence Ra [μm] - feed f [mm], n=1000 min^{-1}

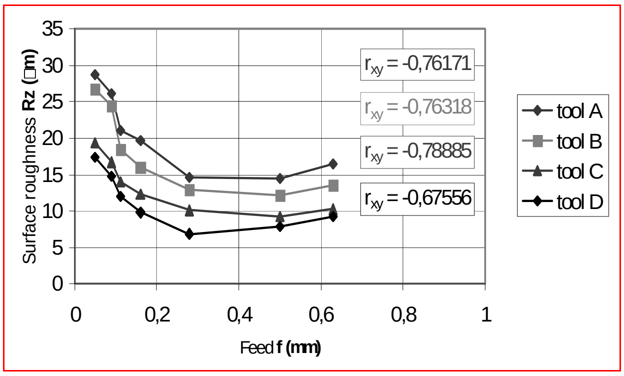

Fig.5 Dependence Rz [μm] - feed f [mm], n=125 min^{-1}

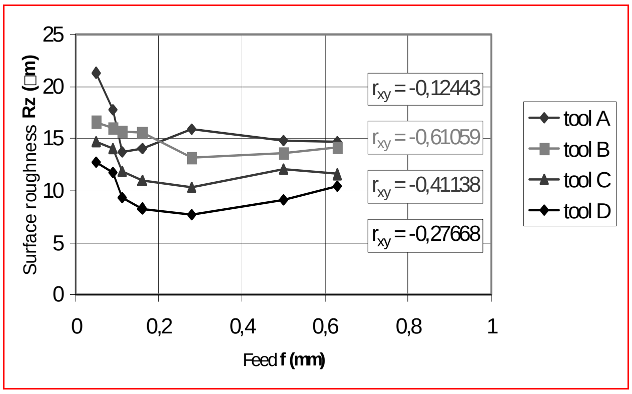

Fig.6 Dependence Rz [μm] - feed f [mm], $n=1000\ min^{-1}$

CONCLUSION

This paper was appreciation machinability of stainless steels about drilling. Know-how is possible applied at general practice, where assistance to superior and machining of stainless steels. Acquest results forth measurements comparatively true allocate cutting conditions about drilling. About accomplishment experimental measurements and comparasion results achieve clear contrast cast up chip at it, that herself bore about a cutting conditions. About analyse wear of cutting edge cant been noticeable contrast against all brand cutting tools. Present contrast herself could negative bounce about formation chip, chip form cast up kindling call accuracy and work security. Best form chip they were achieve using cutting tools businesses. At mechanical general practice these know-how can they capital chiefly about machining of stainless steels. Following these results can they material chemist allocate cutting parameters about those accomplish asked abrasiveness and brand face subduable component. Analyses and adaptation results experimental measurements accredit contrast surface rouhness hours about different cutting parameters. Measure out data they were different because single advice revolution and feeds (depth of cut been constant). Allowing averange arithmetic deviation profile Ra achieve evalues at cycle by 1,41 μm by 7,20 μm, at depend by devices cutting conditions. Account biggest altitude accident Rz have atributes at cycle by 5,64 μm by 28,80 μm, alias at depend by devices cutting parameters. About access tools be needed awake economic costs provision cutting tools. Consist accordingly about decided concrete consumer, what is accommodating back because enhancement brand generating component. In the start account would but she had not decide factor about access tools. The amin assignment have alias additional charges emergent by using certain tools, brand achieve him using, if wear existent tools. The complexity of the wear process may be better appreciated by recognizing that many variables are involved, including the hardness, toughness, ductility, modulus of elasticity, yield strength, fatigue properties, and structure and composition of the mating surface, as well as geometry, contact pressure, temperature, state of stress, stress distribution, coefficient of friction, sliding distance, relative velocity, surface finish, lubricants, contaminants, and ambient atmosphere at the wearing interface. Clearance versus contact-time history of the wearing surfaces may also be an important factor in some cases. Although the wear processes are complex, progress has been made in recent years toward development of quantitative empirical relationships for the various subcategories of wear under specified operating conditions. Adhesive wear is often characterized as the most basic or fundamental subcategory of wear since it occurs to some degree whenever two solid surfaces are in rubbing contact and remains active even when all other modes of wear have been eliminated. The phenomenon of adhesive wear may be best understood by recalling that all real surfaces, no matter how carefully prepared and polished, exhibit a general waviness upon which is superposed a distribution of local protuberances or asperities. As two surfaces are brought into contact, therefore, only a relatively few asperities actually touch, and the real area of contact is only a small fraction of the apparent contact area. even under very small applied loads the local pressures at the contact sites become high enough to exceed the yield strength of one or both surfaces, and local plastic flow ensues. If the contacting surfaces are clean and uncorroded, the very intimate contact generated by this local plastic flow brings the atoms of the two contacting surfaces close enough together to call into play strong adhesive forces. This process is sometimes called cold welding. Then if the surfaces are subjected to relative sliding motion, the cold-welded junctions must be broken. Whether they break at *the original interface characteristics, local geometry, and stress distribution. If the junction is broken away from the original interface, a particle of one surface is transferred to the other surface, marking one event in the adhesive wear process. Later sliding interactions may dislodge the transferred particles as loose wear particles, or they may remain attached. If this adhesive wear process becomes severe and large-scale metal transfer takes place, the phenomenon is called galling. If the galling becomes so severe that two surfaces adhere over a large region so that the actuating forces can no longer produce relative motion between them, the phenomenon is called seizure. Today, the usual parameters are surface texture, accuracy, tool-wear pattern, chip formation and predicted reliable tool-life. the one applied depends upon the type of operation, finishing or roughing, and often the amount of manual control and supervision involved.*

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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IMPLEMENTATION OF THE ADAPTIVE FILTER FOR VOICE COMMUNICATIONS WITH CONTROL SYSTEMS

Abstract:
In the paper is described use of the draft method for optimal setting values of the filter length M and of the step size factor μ of the adaptive filter with LMS algorithm in the application of the suppression of additive noise from the speech signal. In the application of voice communications with control systems for operational technical functions controlling in buildings was implemented the adaptive filter with LMS (Least mean square) algorithm on the signal processor DSK TMS320C6713.

Keywords:
Adaptive filter, additive noise, speech signal

INTRODUCTION

This paper describes a proposition of the method for optimal adjustment parameters of the adaptive filter with LMS algorithm in the practical application of suppression of additive noise in a speech signal for voice communication with control system NIKOBUS. System NIKOBUS is used for operational technical functions controlling in buildings. Adaptive filter with LMS algorithm is implemented in the signal processor DSK TMS320C6713 (DSK - Digital Signal Processor Starter Kit). For optimum settings of the step size parameter μ of the adaptive filter with the LMS (Least Mean Square) algorithm is necessary ensuring the stability and convergence of the LMS algorithm. Optimum value of the length M of the adaptive filter is settings through the use of the DTW criterion (DTW–Dynamic Time Warping). As a result of appropriate setting of the adaptive filter parameters is correct speech signal processing and subsequent correct the isolate words recognition through the use of software MY VOICE with software PROMOTIC in voice communication with control system NIKOBUS. PROMOTIC is a complex SCADA object software tool for monitor, control and display operational technical functions in building by the help control system NIKOBUS.

THE ADAPTIVE FILTER WITH LMS ALGORITHM

The LMS algorithm is a linear adaptive filtering algorithm, which, in general, consists of two basic processes (Fig.1):

a) a filtering process, which involves
- computing the output $y(n)$ of linear filter in response to an input signal $x(n)$ (1),
- generating an estimation error $e(n)$ by comparing this output $y(n)$ with desired response $d(n)$ (2),

b) an adaptive process (3), which involves the automatic adjustment of the parameters $\mathbf{w}(n+1)$ of the filter in accordance with the estimation error $e(n)$.

$$y(n) = \mathbf{w}^{T}(n)\,\mathbf{x}(n), \tag{1}$$

$$e(n) = d(n) - y(n) \tag{2}$$

$$\mathbf{w}(n+1) = \mathbf{w}(n) + 2\mu e(n)\,\mathbf{x}(n) \tag{3}$$

$\mathbf{w}(n)$ is M tap – weight vector
$\mathbf{w}(n+1)$ is M tap – weight vector update [1], [2], [3].

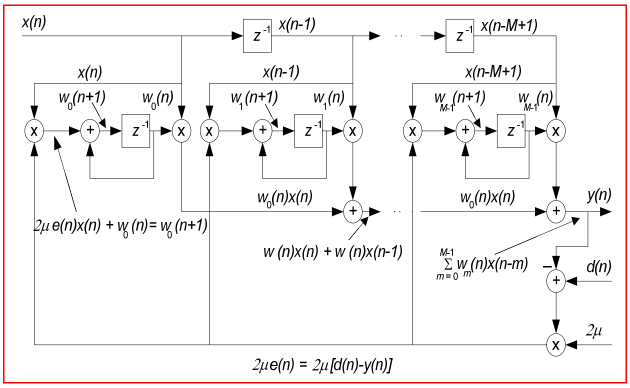

Fig.1. FIR LMS adaptive filter realization [2]

CALCULATING OF STEP SIZE PARAMETER μ

Determination of step size parameter μ is important for conduct of the LMS algorithm. When selecting parameter μ terms of a compromise between the two aspects. Large values μ can lead quickly to the optimal settings of the LMS algorithm for speech signal processing. On the other hand, increase of the value μ can make a mistake of the speech signal processing in further steps. Small value μ ensure stability and convergence of the LMS algorithm. As a result small value μ is possible slow down in the convergence of the LMS algorithm and, consequently, increasing the inaccuracies in the filtration non-stationary signals [1].
For computing of the optimal value of the parameter μ is possible use following equation

$$\mu = \frac{\mathrm{M}}{(1+\mathrm{M}).\mathrm{tr}[\mathbf{R}]} \tag{4}$$

M - *parameter misadjustment,*
μ – *step size parameter,*
tr[R] - *trace of R, which mean sum of the diagonal elements of R.*
R - *autocorelation matrix from input signal*

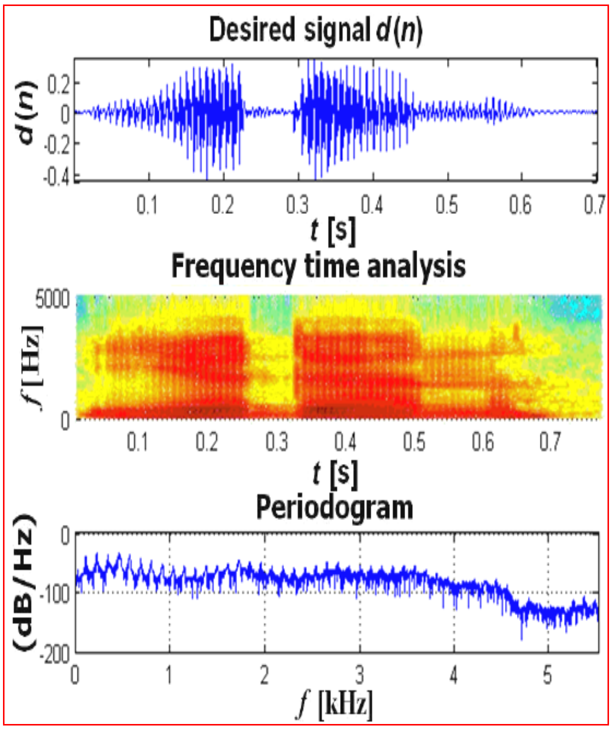

Fig.2. Waveform [5], spectrogram (frequency time analysis) and periodogram of power spectral density estimate [7] of desired speech signal d(n) of isolated word "jeden" to the input of adaptive filter with LMS algorithm implemented on the DSK TMS 320C6713

USE DTW CRITERION FOR DETERMINATION OF THE LENGTH M

The correct determination of the length M of the adaptive filter is very important. When the length M of the adaptive filter is low, the speech signal processing as a result of a small number of parameters of the adaptive filter is inaccurate. High value of the adaptive filter length M lead to inaccurate speech signal processing by influence of the estimator variance increase.
In this work was used DTW criterion for determining value of length M of adaptive filter. Value of the adaptive filter length M is determined by set values of the length M in interval {0 to 150} and calculating of the minimum distance (similarity) between the

*reference vector **R**=[r(1), . . . , r(R)] of the length R (desired signal d(n) (Fig.2)) and the test sequence **O**=[o(1), . . . , o(T)] of the length T (output signal e(n) from adaptive filter). Words are almost never represented by the sequence of the same length R≠ T. The distance d between the sequences **O** and **R** is given as minimum distance over the set of all possible paths (all possible lengths, all possible courses) [4], [7], [9], [10].*

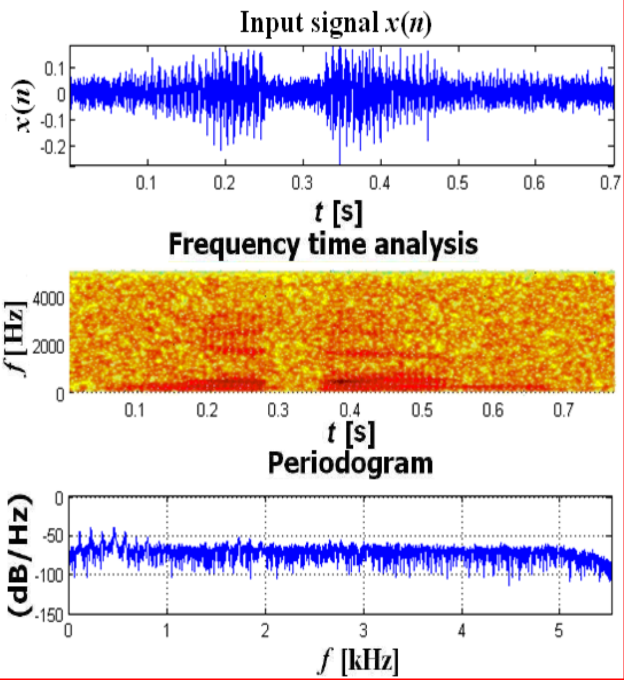

Fig.3. Waveform [5], spectrogram (frequency time analysis) and periodogram of power spectral density estimate [7] of speech signal x(n) of isolated word "jeden" with additive noise to the input of adaptive filter with LMS algorithm, implemented on the DSK TMS 320C6713.

Minimum distance computation

$$D(\mathbf{O},\mathbf{R}) = \min_{\{C\}} D_C(\mathbf{O},\mathbf{R}) \qquad (5)$$

is simple, when normalization factor N_c is no function of path and is possible write $N_c=N$ for $\forall_c$

$$D(\mathbf{O},\mathbf{R}) = \frac{1}{N}\min_{\{C\}}\sum_{k=1}^{Kc} d\left[\mathbf{o}(t_c(k)),\mathbf{r}(r_c(k))\right]W_c(k) \qquad (6)$$

For example are given below (Tab.1) calculated values of distance d between Czech isolated words "jeden" and other isolated words "dva", "tři", "čtyři" by using DTW criterion.

Tab. 1 Calculated values of distance d

jeden–jeden	jeden–dva	jeden–tři	jeden–čtyři
***d*=0**	*d*=0,713	*d*=1,218	*d*=1,415

*Based on the calculated values of distance d between the isolated Czech words (Tab.1) is a cap for recognized isolated word determined on the value of **d<0,2**. If the value of the distance d will greater than d>0,2, compared isolated words are not recognized.*

DRAFT METHOD

Draft method was applied in next steps [10]:

1. Calculation of the step size parameter optimal value μ (4) for desired signal d(n) and input signal x(n) with additive noise (with SSNR (Segmental Signal to Noise) and with parameter misadjustment M) to adaptive filter with LMS algorithm.

2. Values of the adaptive filter length M are set in interval {1 to 150}.

3. For reference vector R is used desired signal d(n) (Fig.2) to the input of DSK TMS320C6713 (adaptive filter with LMS algorithm is implemented on the DSK TMS320C6713) .

4. As a test signal to calculate the distance d (5), (6) between the signals being compared, was used output error signal e(n) (Fig.5), (distance d calculated values are in Tab.2).

As the optimal value of M order adaptive filter with LMS algorithm was chosen value of the filter order M for a minimum distance d of two compared signals (Fig.7) d(n) and e(n) (Fig.5) for corresponding adaptive filter length M, (Tab. 2).

Tab. 2 Calculated values of distance d, length M and parameter μ the set parameter misadjustment M.

Misadjustment M	M=10%	M=20%	M=30%
calculated value of μ	μ_1=0,1025	μ_2=0,1879	μ_3=0,2602
calculated value of M	**M=21,**	M=40,	M=99,
calculated value of d	**d=0,1835**	d=0,2645	d=0,3073

EXPERIMENTAL PART

The proposed method for determining of the order M adaptive filters with LMS algorithm was used in the implementation of LMS adaptive filter algorithm in an application to suppress *noise n(n) from the speech signal out of the DSK TMS320C67113 (Fig. 4).*

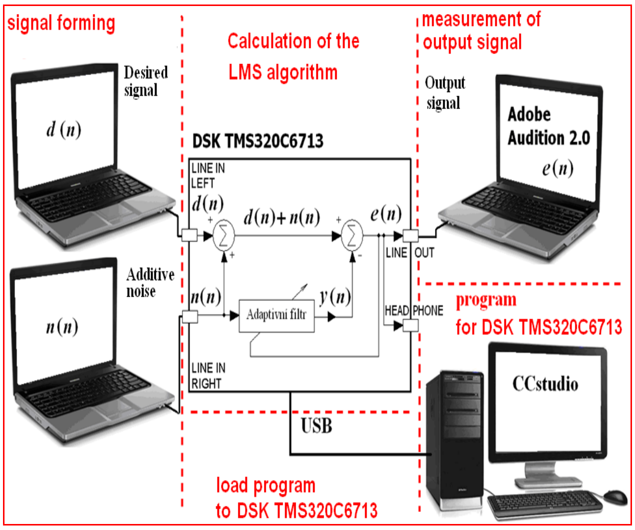

Fig.4 Implementation of two channel structure of adaptive filter with LMS algorithm in an application for the suppression of additive noise on the DSK TMS320C6713 [6].

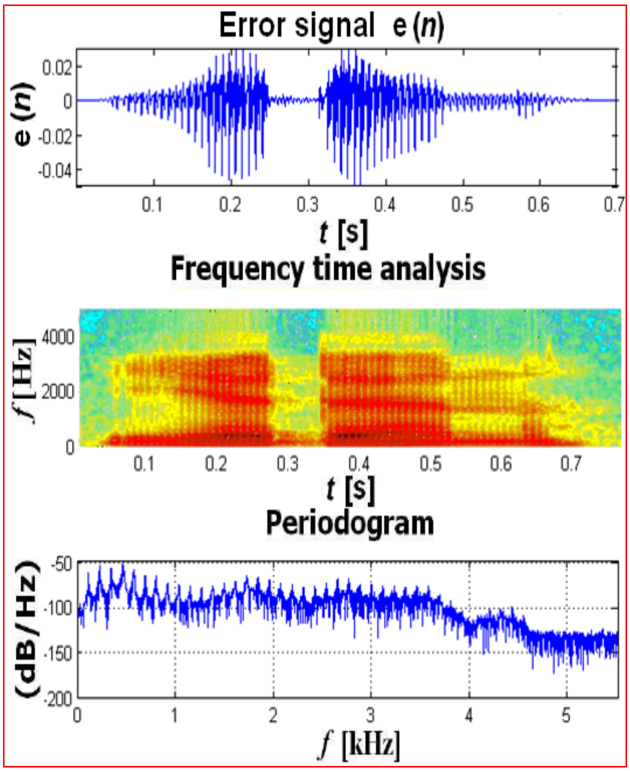

Fig.5. Waveform [5], spectrogram (frequency time analysis) and periodogram of power spectral density estimate [7] of output error signal e(n) from the adaptive filter with LMS algorithm implemented on the DSK TMS320C6713.

Input signal x(n) (Fig.3) is composed of the desired signal d(n) (Fig.2) + additive noise n(n). The segmental signal to noise ratio of input signal x(n) is SSNR=6,6756(dB). Input signal x(n) is generated to the input of DSK TMS320C6713. The block diagram with implementation of the adaptive filter for voice communications with control system NIKOBUS is in Figure 7. In the Table 2 are calculated values d between output signal e(n) from adaptive filter with LMS algorithm and desired signal d(n) for the values parameters set of adaptive filter order M and step size parameter μ.

The calculated values of distance d (Tab.2) in MATLAB shows, that an isolated word "jeden" (Fig.5) from adaptive filter output <u>was recognized</u> (d<0.2), when optimal set parameters of adaptive filter with LMS algorithm are M=21, μ_1=0,1025 and M=10%.

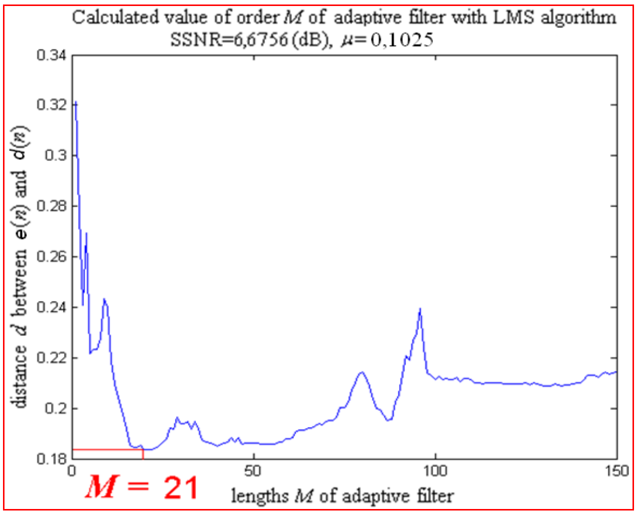

Fig.6. Calculated values M=21 and d=0,1835 of the adaptive filter with the LMS algorithm (μ=0,1025, SSNR=6,6756(dB), M=10%) by using DTW criterion.

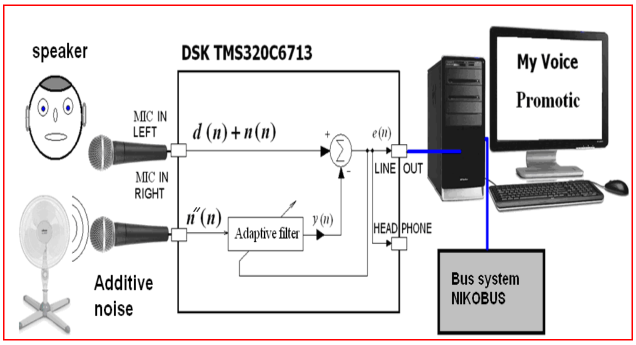

Fig.7 Implementation of the adaptive filter for voice communications with control system NIKOBUS [8].

Empirically was found, that the parameter μ for the implementation of adaptive filter with LMS algorithm implemented on the DSK TMS320C6713 allow set only in the range $\mu = 1.10^{-8}$ to $\mu = 1.10^{-12}$. The adaptive filter length M can be set only in the range M=16 to M=52.

Optimal settings of parameters M=21 and $\mu=1.10^{-8}$ of adaptive filter with LMS algorithm in the application of noise suppression implemented on the DSK TMS320C6713 allow recognition of isolated word "jeden" through the software MY VOICE.

CONCLUSION

In this paper was described the way of verification of the proposed method on the structure of adaptive filter with LMS algorithm in application of suppressing noise from speech signal by simulations in MATLAB software.
The proposed method was verified by the practical realization of the structure of adaptive filter with LMS algorithm in the application for suppressing additive noise in speech signal by implementation on the DSK TMS320C6713. This implementation is used in voice communication with bus system NIKOBUS, which is used for controlling of operating-technical functions in buildings. For speech recognition in voice communication has been used software MY VOICE (Fig.7) with software PROMOTIC.

ACKNOWLEDGMENT

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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THERMAL STRESS ANALYSIS USING FINITE ELEMENT METHOD IN AREA OF THE ROLLING MILLS ROLLS

Abstract:
The paper presents the analysis of thermal stress field distribution that occurs in the mill rolls, using finite element method. The finite elements method or the analysis with finite elements is based on the concept of building complicated object out of simpler ones, or dividing complicated objects into simpler ones, for which known schemes of calculation can be applied. The main idea in the method of finite element is to find the solution of a complicated problem by replacing in with a simpler one.
The analysis of the thermal strains in rolling rolls, using finite elements method, has been carried out on Adamit-type rolls, cast of hypereutectoid steel and used in rolling profile I on the middle profile rolling train of Arcelor Mittal Hunedoara branch.
The industrial experimental data (rolling temperature, cooling water temperature, material characteristics etc.) are the basics for simulation program.

Keywords:
Rolling rolls, Simulation, Thermal Stress Analysis, Finite Element Method

INTRODUCTION

A particularly actual problem for the steel making companies is the low exploitation endurance of the rolling rolls, as they are the most stressed parts in the rolling train.
By taking into consideration thermal strains we could carry out a complete study, very close to the real conditions of rolling roll exploitation, as the thermal influences constitute one of the basic causes leading, even under favourable exploitation conditions, to thermal fatigue fissures, that reduce the use of rolls in rolling sessions [1].

THE EXPERIMENTAL ANALYSE

The analysis of the thermal strains in rolling rolls has been carried out on Adamit-type rolls, cast of hypereutectoid steel and used in rolling profile I on the middle profile rolling train of Arcelor Mittal Hunedoara branch.
The method of the finite element implies the generation of a discretizing lattice on the surfaces previously defined, taking into consideration the fact that all the knots and elements of the lattice are numbered [2], [3]. We mention that, on discretizing, we obtained a total number of 253613 elements and 49768 knots.

The plane discretizing of the rolling rolls and of the rolled profile are given in Figure 1 and Figure 2.

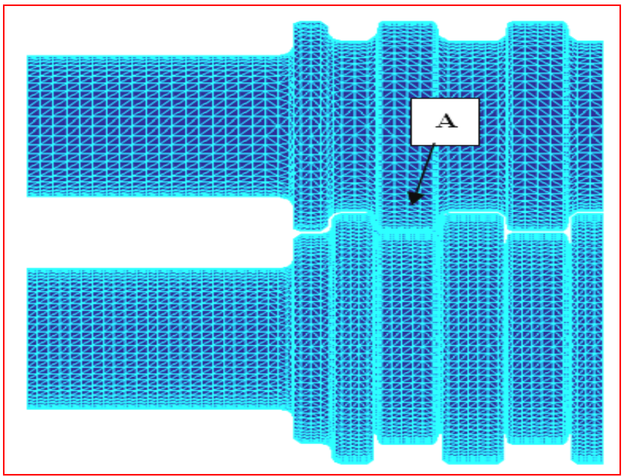


Fig. 1. Diagram of the plane modeling of the rolling rolls and the rolled profile I

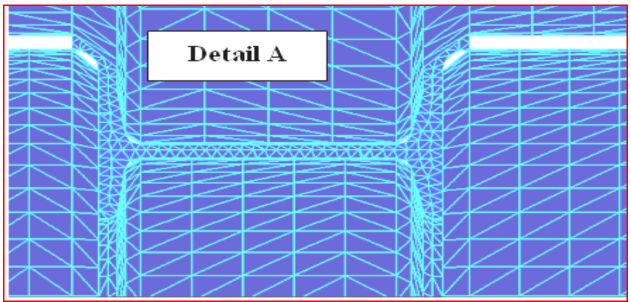


Fig. 2. Diagram of the plane modeling of the rolling rolls and the rolled profile I. Detail A

In order to determine the material thermal-physical properties, we took into account the fact that the steel that the rolling rolls are cast from is an Adamit-type, hypereutectoid steel, grade OT- A3, having the chemical structure given in Table 1. The steel to be rolled is an all purpose steel (OL 37), having the chemical structure given in Table 2 [4].

Table 1. The chemical structure of the Adamit-type, hypereutectoid steel

Steel grade	Chemical structure, %				
	C	Si	Mn	P_{max}	S_{max}
OTA3	1.8…2.0	0.6…0.8	0.7…0.9	0.04	0.02
	Cr	Ni_{max}	Mo	Cu_{max}	Ti_{max}
	1.0…1.2	1.6…2.0	0.3…0.5	0.2	0.06

Table 2. The chemical structure of the steel to be rolled

Steel grade	Chemical structure, [%]				
	C_{max}	Mn_{max}	Si_{max}	P_{max}	S_{max}
OL 37	0.20	0.80	0.07	0.06	0.06

The thermal-physical and material properties of the Adamit-type, hypereutectoid steel that the rolling rolls are cast from are [4]:

- the coefficient of linear expansion:

$\alpha = 13 \cdot 10^{-6} \frac{1}{K}$;

- thermal conductivity:

$\lambda = 31 \frac{W}{m \cdot K}$;

- specific heat:

$c_p = 620 \frac{J}{kg \cdot K}$;

- initial temperature: $T_{initial} = 20^oC$.

The thermal-physical and material properties of the steel to be rolled, i.e. (OL37), respectively of profile I, are [4]:

- the coefficient of linear expansion:

$\alpha_{100^oC} = 12{,}2 \cdot 10^{-6} grdC^{-1}; \alpha_{700^oC} = 14{,}9 \cdot 10^{-6} grdC^{-1}$;

- thermal conductivity:

$\lambda_{800^\circ C} = 25 \frac{W}{m \cdot K}$ $\lambda_{20^\circ C} = 50 \frac{W}{m \cdot K}$;

- specific heat:

$c_{p\,20^\circ C} = 452 \frac{J}{kg \cdot K}; c_{p\,600^\circ C} = 753{,}3 \frac{J}{kg \cdot K}; c_{p\,800^\circ C} = 933{,}3 \frac{J}{kg \cdot K}$

- initial (rolling) temperature: $T_{rolling} = 800^oC$.

DETERMINATION OF THE STRAIN STATE IN CASE OF APPLYING THE COOLING WATER ON TWO SURFACES

In case of calculating the thermal strains at 800°C, the rolling rolls being cooled on two surfaces, we took into consideration the fact that the strains in the neck areas are not relevant because movements were null here ("expansion blocked"), as the bearing clearance was ignored.

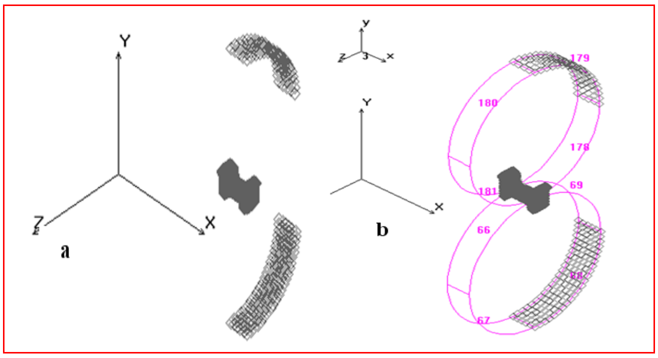


Fig. 3. The rolling roll cooling diagram, without displaying the surfaces the cooling water is applied on (position a) and displaying them (surfaces 68 and 179) (position b)

The diagram of the water cooled surfaces with respect to the position of the rolled section is given in figure 3.

In order to draw the diagrams corresponding to the thermal strains in the knots placed on the critical rolling areas of the roll circumference, it is necessary to place the knots on the circumference of the groove pass. In order to draw the diagrams corresponding to the thermal strains in the knots placed on the critical rolling areas of the roll circumference, it is necessary to place the knots on the circumference of the groove pass.

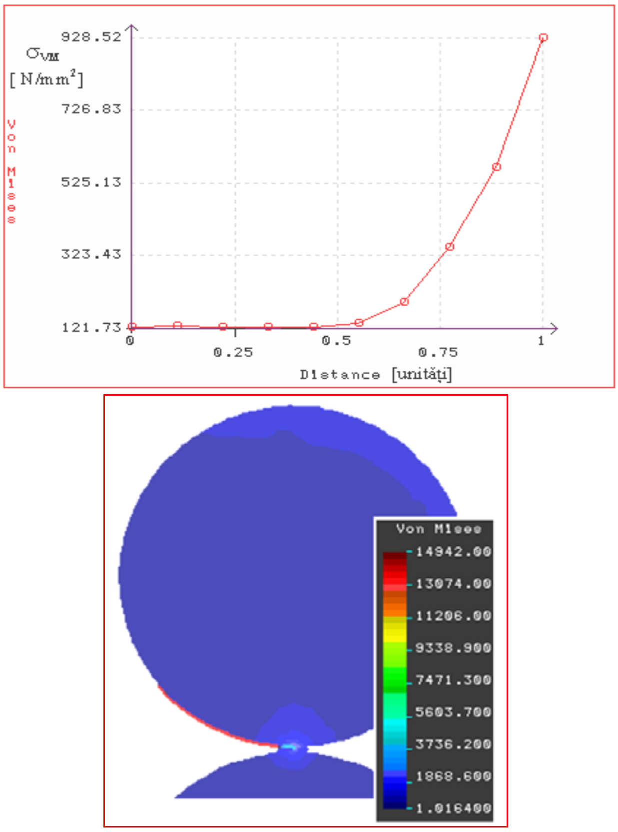


Fig.4. Variation of the Sigma Von Mises strains

In Figure 4 we gave the ensemble of the roll cross-section, as well as the magnitudes of the Von Mises strains for the following knots (schematically pointed out on the surface of the upper roll): 35215, 35218, 35221, 35224, 35227, 35230, 35233, 35236, 35239 and 35242. In the plan given in fig.3, one can notice an increase in the thermal strains towards the rolling area (the profile). Thus, for knot 35215 Von Mises strain is 121.73 N/mm² and for knot 35242, of 928.52 N/mm². The distance between the first and the last knot under study represents 167.88 mm (in the graph given in the figure, it is considered to be equal to the unit).

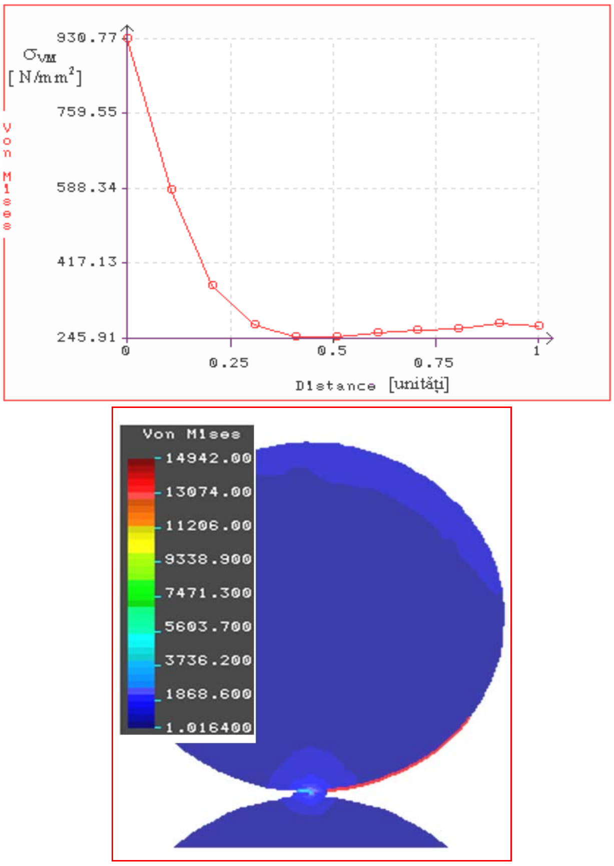


Fig. 5. The variation of Sigma Von Mises strains

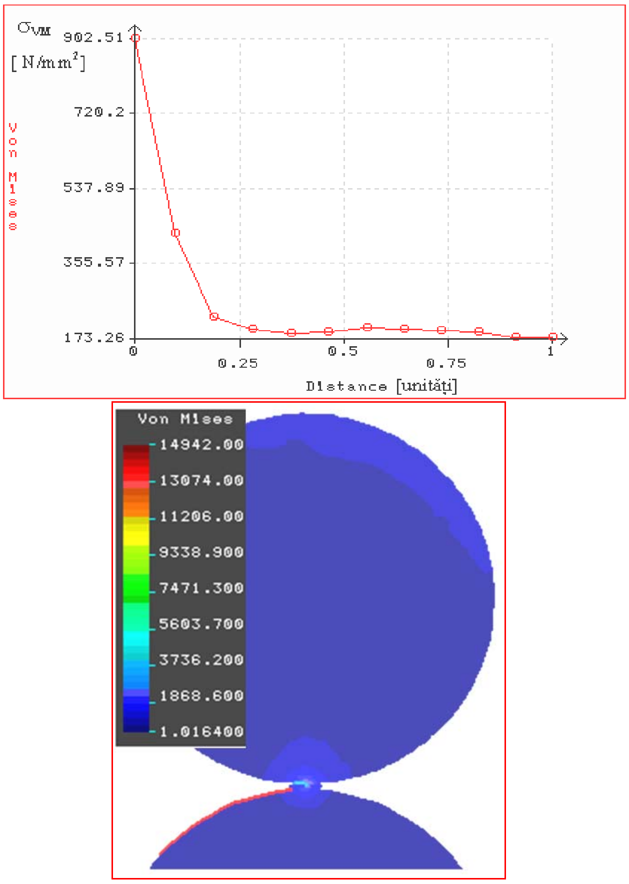
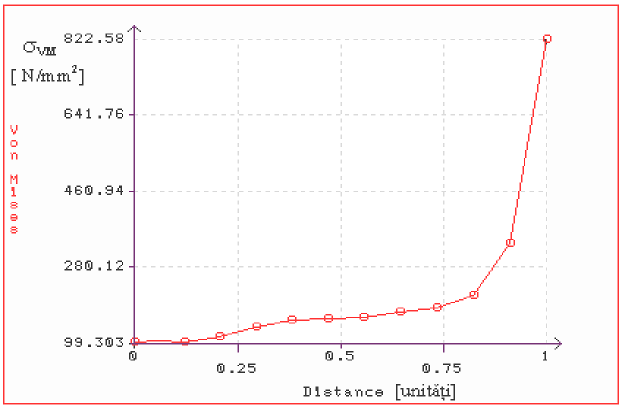


Fig. 6. The variation of Sigma

In Figure 5 we gave the ensemble of the roll cross section, as well as the magnitudes of the Von Mises strains for the following knots (schematically pointed out on the surface of the upper roll): 35126, 35129, 35132, 35135, 35138, 35141, 35144, 35147, 35150, 35153 and 35156. The diagram shows a decrease in the thermal strains away from the rolling area, knot 35126 having a Von Mises strain of 930.77N/mm^2 and knot 35156 of about 246 N/mm^2. In this case, the calculated length is 185.1947mm.



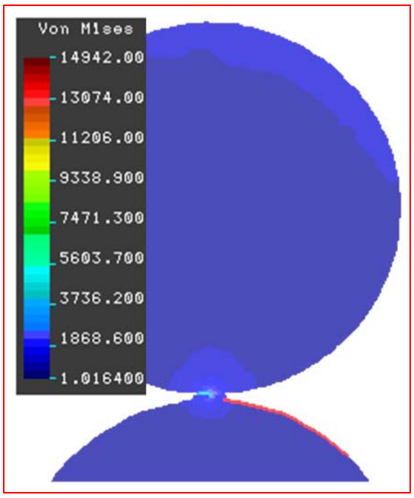


Fig. 7. The variation of Sigma Von Mises strains

Similarly, in Figure 6 we gave the ensemble of the roll cross section, as well as the magnitudes of the Von Mises strains for the following knots (schematically pointed out on the surface of the upper roll): 4277, 4281, 4285, 4289, 4293, 4297, 4301, 4305, 4309, 4313, 4317 and 4321. In the plan given in Figure 6 one can notice a decrease in the thermal strain away from the rolling area. Thus, for knot 4277 Von Mises strain is of 902,51N/mm^2 and for knot 4321 of 173.26N/mm^2 (in this case, the calculated length is 185.1947 mm). In Figure 7 we gave the ensemble of the roll cross section, as well as the magnitudes of the Von Mises strains for the following knots (schematically pointed out on the surface of the upper roll): 4423, 4427, 4431, 4435, 4439, 4443, 4447, 4451, 4455, 4459, 4463 and 4467. Figure 7 shows that for knot 4467 Von Mises strain is of 822.58 N/mm^2 and for knot 4423 of 99.203 N/mm^2 (the calculated length is 185.1947 mm).

CONCLUSION

As a result of simulating the rolling process by means of the finite element method in view of quantitatively and qualitatively determining thermal strains, we came to the following conclusions:

- *thermal strains are the basic cause of fissuring the rolling surface of rolls as a result of thermal fatigue, caused by the high values in the areas neighboring the contact area with the incandescent semi-finished part; the graphs show that the values of the thermal strains in the area under consideration rank within 121,73 and 930.77 N/mm^2 for the upper roll and 99.303 and 902.51 N/mm^2 for the lower roll;*
- *thermal strains have significantly higher values as compared to the mechanical ones and act at relatively short intervals of time (within fractions of a second);*
- *the rolling rolls break during the rolling process because of thermal fatigue;*
- *a most precise knowledge of the character of the strains generated by the complex stresses the hot rolling rolls undergo, allows the determination of the duration in exploitation under safe conditions, by their comparison to certain limit values imposed from the very beginning;*
- *strains in the rolling rolls have a cyclical character and the strain state is mainly the result of the action of the fields of symmetrical and asymmetrical temperatures that cause thermal fatigue on their surface and superficial layer.*

Engineering is concerned with the design of a solution to a practical problem. A scientist may ask why a problem arises, and proceed to research the answer to the question or actually solve the problem in his first try, perhaps creating a mathematical model of his observations. By contrast, engineers want to know how to solve a problem, and how to implement that solution. In other words, scientists attempt to explain phenomena, *whereas engineers use any available knowledge, including that produced by science, to construct solutions to problems.*

The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have a different influence upon the quality and the safety in the exploitation. The proposal approaches the issue of quality assurance of the rolling mills rolls, from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation.

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ACTA TECHNICA CORVINIENSIS
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[1.] JIŘÍ TECHNIK

INJECTION MOLD COOLING CONFIGURATION

Abstract:
The correct design and setup of cooling channels of injection molds make possible a small energy loss during an injection process. The cooling channels are designed yet in design of tool and it is not easy changing them by complete tool. But what is possible to change by complete tool, is a setup and a connection of circuits. It means a flow rate and water temperature at system. To optimalization is possible use cooling simulations which works on FEM principle. The article describes an optimalization of a cooling setup for real part

Keywords:
Reynolds number, cooling channels, simulation, temperature, flow rate

INTRODUCTION

The tools cooling is longest section of injection cycle and his optimalization is possible achieve of a short injection cycle. It is profitable main from an economic aspect and also from a part quality aspect.
The cooling channels in an injection mold can be series or parallel. At parallel circuit is fed by water several parallel circuits from one or several sources. An ideal case is when water is uniformly distributed in all circuits by same temperature and flow rate. The series circuit does not contain any sub-circuit and has one inlet and one outlet. In result has it relative long cooling channel.
For a correct circuit setup should be keep:
1. *Water temperature different between inlet and outlet should not be overrun 5°C.*
2. *Reynolds number at a circuit should be at intervals from 10 000 to 20 000.*

By higher Reynolds number is growing up a hydraulic gradient and a heat removal is not growing up from the tool cavity. The Reynolds number depends on channel diameter, dynamically viscosity and flow rate.

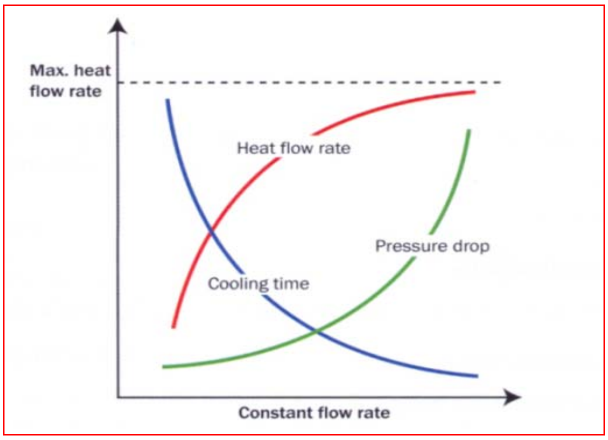

Fig. 1: The relationship of heat flow rate and coolant flow rate

OPTIMALIZATION

By the help FEM simulation was optimized a cooling channels setup of an injection mold for a dish. Main target was effective channels flow rate (Reynolds number) and a homogenized temperature distributed by plastic part. The original flow rates setup of six circuits was unachieved and no effective. Re number was in interval from 5 783 to 43 569. In a core were occurred tree circuits, whereas in two circuits was flowed a water with temperature 11°C and in third circuit with temperature even 50°C. Thereby it was happened to no uniform heat off-take. A matrix was cooled by four circuits, whereas it happened to same effect as by the core (no uniform heat off-take).

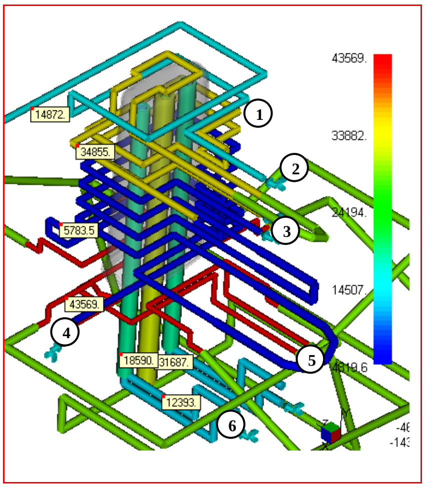

Fig. 2: Re number in circuits – original variant

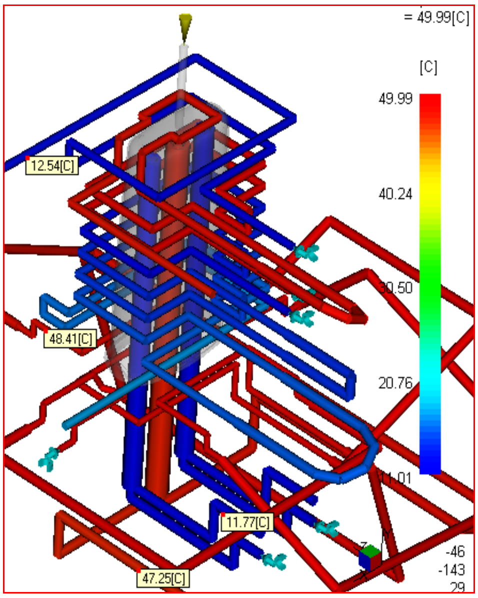

Fig. 3: Water temperature in circuits – original variant

The temperature distribution on the part was not homogenous and so in the part by next cooling was happening to internal stress. The different in the fig. 4 achieve even 27°C. In the fig. 4 right is increased temperature from second baffle and so rise next temperature different.

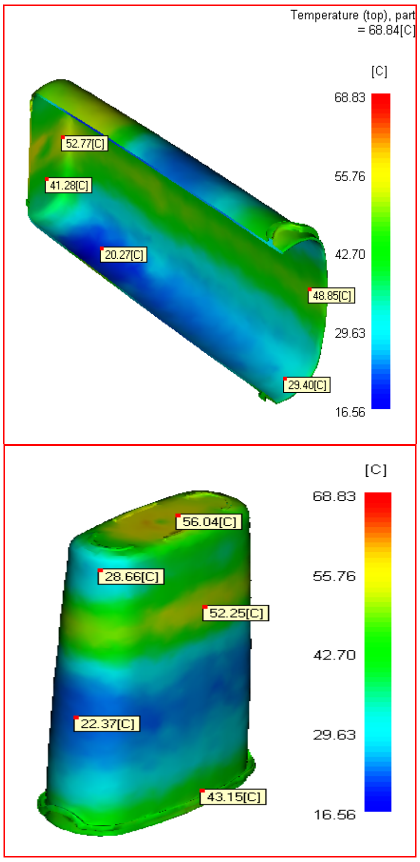

Fig. 4: Temperature – top distribution by part (temperature different is 27°C) – original variant

Tab. 1: circuits settings

Circuit	*Temperature [°C]*	*Flow rate [l/min]*
1	*11*	*9*
2	*11*	*3.5*
3	*50*	*9*
4	*50*	*9*
5	*11*	*9*
6	*11*	*9*

The setting modification consisted in a preferable modification of flow rate, temperature and in reconnection of circuits. The circuits 1, 2, 3 and circuits 5, 6 were merged into one circuit. The circuit no. 4 stayed unmodified, so tree circuits were arisen. The three circuits have optimal flow rate and temperature.
Reynolds number is now in ideal interval 10 000 to 20 000. The temperature distribution after modification is yet homogenized. The

temperature different in distribution is 10°C. The heat is most concentrated in part cavities and higher temperature is so on the top of the core (opposite to hot runner). Therefore is the core cooled on 22°C. For the homogenize temperature distribution is the matrix tempered on 30°C. The circuit cooling slides (has smaller cooling channel diameter) has the flow rate 5,5l/min. So doesn't it happen to high pressure losses.

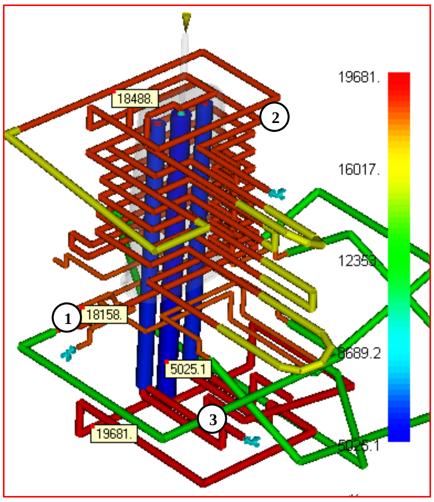

Fig. 5: Re number in circuits – new variant

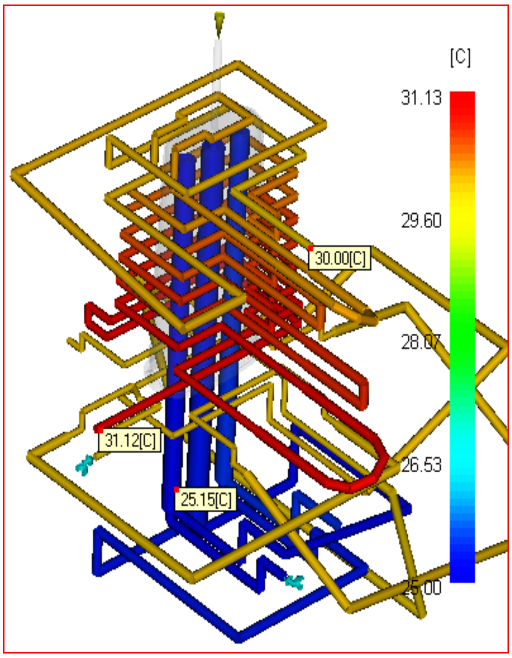

Fig. 6: Water temperature in circuits – new variant

Tab. 2: circuits settings

Circuit	*Temperature [°C]*	*Flow rate [l/min]*
1	*30*	*5.5*
2	*30*	*7*
3	*22*	*7*

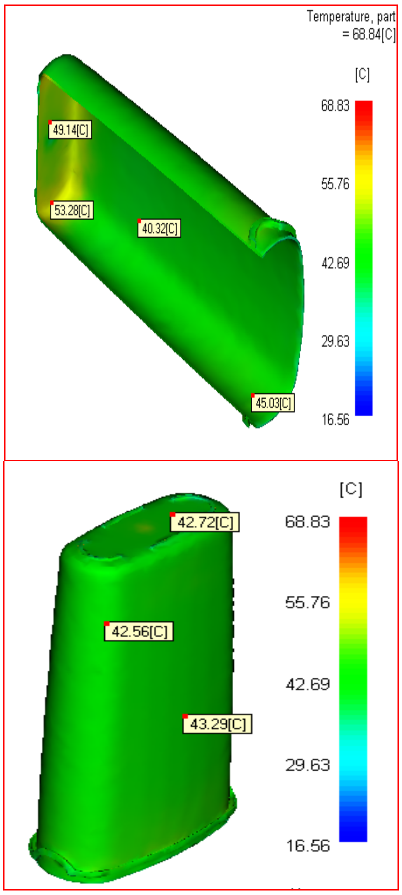

Fig. 7: Temperature – top distribution by part (temperature different is 10°C) – new variant

CONCLUSION

By modification of a cooling system setting can be achieve to improve of mold cooling. Re number should be in the interval 10.000 to 20.000. Thereby we achieve more efficient mold cooling. The water temperature different should be between inlet and outlet max. 5°C. Minimally should be a turbulent flow in cooling channel. Often of that is not possible achieve because we have a low power pump by temperature controller. For a mold design is necessary make sure what will be the pump power of temperature controller and the cooling channels design accordingly. The control of cooling system in FEM software can easy choose fails in connection and it also by molds, where would we it nonscheduled.

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[5] http://www.gwk.com/de/produkte/temperiertechnik/temperiertechnik_ausgabe.phpc onnection and it also by moulds where would we it nonscheduled.

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ACTA TECHNICA CORVINIENSIS
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[1.] MILAN KOSZEL

EXAMINATION OF FAN FLAT NOZZLES TECHNICAL CONDITIONS AFTER LABORATORY WEAR

Abstract:
Working parameters of fan flat nozzles which affect drop tracks size were the subject of the study. New nozzles and nozzles after laboratory wear were tested. The influence of nozzles wear on drop tracks size were examined. It was found that increase in liquid flow rate results in higher values of mean diameter of drop track. Then increase in working pressure or working speed respectively cause decrease in drop tracks size and reduce merging of drops on spray surface. Increase in wear degree was followed by increased coverage rate. This phenomenon is especially dangerous then using nozzles with a considerable degree of wear for agricultural spray since it ecological threat to the environment.

Keywords:
spray, nozzles wear, flow rate

INTRODUCTION

Chemical plant protection is nowadays the basic method of effective eradication of agrofags. In consequence, competent use of plant protection agents rises in importance, i. e. maintaining their effectiveness and reducing threat that such agents pose both to natural environment and people's or animal's health. Due to rising requirements to reduce environmental pollution and costs of agricultural production it is important to use pesticides with appropriate precision.

It should be noted that spray quality is primarily determined by the degree of nozzle wear [Gajtkowski 1985]. Nozzle wear rate depends on outlet size and material a nozzle is made of [Wargocki 1995]. Moreover, higher degree of nozzle wear affects the degree of drops merging, which facilitates their following off the surface of protected plants and infiltration into subterranean water, and this, in turn, causes environmental contamination. If drops generated by a nozzle are very small, they are drifted by wind and liquid evaporates before reaching protected plants.

METHODS

The aim of this study was to determine the influence of changes of agricultural nozzles technical condition on obtaining appropriate drop tracks size.

New nozzles (LECHLER 110-03) of nominal flow rate 1,17 $l*min^{-1}$ were destroyed by 3 bar pressure. A testing stand with sprayer boom *speeds of 5 km/h (1,39 m/s), 7km/h (1,94 m/s), 9 km/h (2,50 m/s) was usede for drop placement on a model surface. The model surface consisted of film strip of the size 100 x 10 cm Measurements were recorded at the pressure of 1 bar, 3 bars, 5 bars. The nozzles were destroyed to reach 5 and 10% wear rates, which was calculated by comparing changes in liquid flow rate from each nozzle to nominal flow rate. Water solution of kaolin was used for destroying nozzles. 9.8 kg of kaolin were added into 150 l of water [Ozkan et al., 1992]. The following ranges of drop track diameter were taken for evaluation:*

- *< 150 μm,*
- *150 ÷ 250 μm,*
- *250 ÷ 350 μm,*
- *350 ÷ 450 μm,*
- *> 450 μm.*

After drying up of the drops 5 images of the size 5 x 5 cm were scanned from each film strip. The first image was scanned in the nozzle symmetry axis, and the 10 and 20 cm on the lefy and right sides of such an axis. Drop track diameter, spray coverage degree and number of drops were calculated using the computer programme Image Pro+ made by Media Cybernetics.

RESULTS

The analysys of the tests results revealed that increase in working pressure and working speed coincided with reduction of mean diameter of drop tracks sieze (Figure 1)

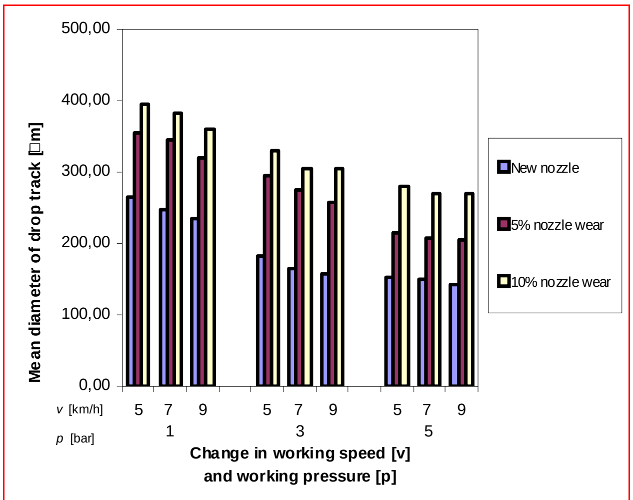

Fig. 1. Change in mean diameter of drop track as a function of working pressure (respectively for new nozzle and 5% and 10% wear rates).

Increase in working speed causes separation of individual drops falling on the spray surface, reduces their merging, but simultaneously reduces liquid dose per hectare.

The test results of coverage degree as a function of changes in working pressure and working speed were presented in Figure 2. A rise in working pressure increases coverage degree. This happens because higher working pressure makes a nozzle produce smaller drops despite its wear.

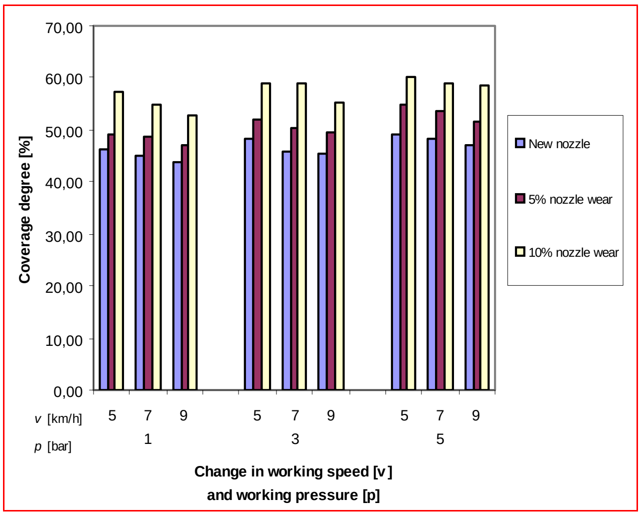

Fig. 2. Change in coverage degree as a function of changes in working pressure (respectively for new nozzles and 5% and 10% wear rates).

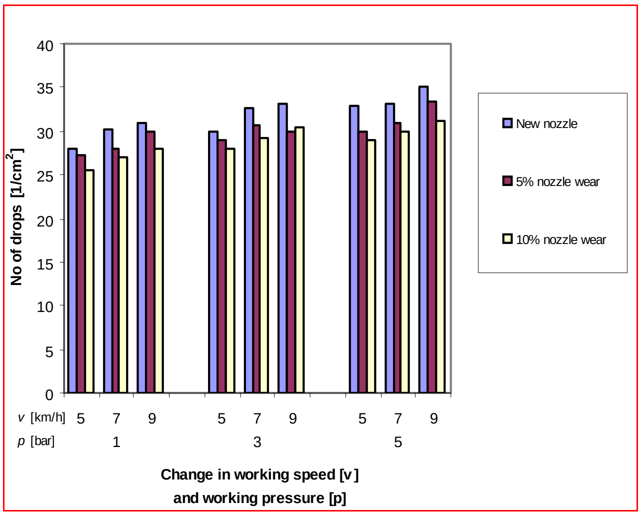

Fig. 3. Change in the number of drops per 1 cm^2 as a function of changes in working pressure (respectively for new nozzle and 5% and 10% wear rates).

A worn nozzle, in turn, doses a higher volume of liquid, and consequently coverage degree increases. A rise in working speed was found to coincide with a decrease in coverage degree.

Excessively low pressure or slow working speed cause the merging drops. This process is especially dangerous while performing the plant protection spray with nozzles with a higher wear rate. Figure 3 shows graphic interpretation of the results concerning the number of drops per 1 cm² as a function of changes in working pressure and working speed.

CONCLUSION

Increase in nozzle wear degree causes changes in drop tracks size left on spray surface. Excessively low pressure or slow working speed cause merging of drops. This process is especially dangerous while performing plant protection spray with nozzles with high wear rate. High working pressure in nozzles with low flow rate as well as using of worn-out nozzles cause deterioration of working parameters of agricultural spray as respectively these increase the number of drops of smaller diameter or make liquid flow off plants surface.

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ACTA TECHNICA CORVINIENSIS
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[1] SORINA SERBAN

VIEWING PERIODICAL SYSTEM WITH THE HELP OF MICROSOFT ACCESS DATA BASE

Abstract:
As an expression of periodic law, the structure of periodical system created by Mendeleev embodied many forms in time. For the present form of the periodic table, knowing the electronic configuration of each element and of outermost electrons in particular is of great importance.
The periodic table contains 110 elements organized in groups and periods, and recently elements with atomic numbers 111, 112, 114, 116, 118 have been discovered.
The most important properties are presented for each element (discovery, natural state, source, use and biological role), physical properties (atomic number, atomic weight, melting and boiling point, density, electron configuration, electron affinity), information on isotopes (nuclei, atomic mass, range, life duration), ionization energy.
The aim of this paper is to use a Microsoft Access study program for teaching purposes. This application is intended for high school pupils and for 1st and 2nd year college students as well, thus they will enlarge the perspective upon physical and chemical properties and electronic configuration of elements in periodical system.

Keywords:
periodical system, nonperiodic properties, atomic numbers, data base

THEORETICAL CONSIDERATIONS

As an expression of periodic law, the structure of periodical system created by Mendeleev embodied many forms in time. For the present form of the periodic table, knowing the electronic configuration of each element and of outermost electrons in particular is of great importance.
This explains the periodicity of specific properties in terms of atomic number Z (atomic and ionic radius, ionization energy, electron affinity, melting and boiling points). There are also certain properties, called nonperiodic properties that vary constantly (atomic mass, for example). Nonperiodic properties of elements are given by atomic nuclei, as the periodic properties are given by their electron shells.
The periodic table contains 110 elements organized in groups and periods, and recently elements with atomic numbers 111, 112, 114, 116, 118 have been discovered.
The most important properties are presented for each element (discovery, natural state, source, use and biological role), physical properties (atomic number, atomic weight, melting and

boiling point, density, electron configuration, electron affinity), information on isotopes (nuclei, atomic mass, range, life duration), ionization energy.

APPLICATION PRESENTATION

To study the periodic table, a data base called Periodical System was created. The data base is designed to align all the elements with all their physical and chemical properties. Autoexec will open the form Introduction which is active for 8 seconds and then the main menu opens automatically. This form appears as:

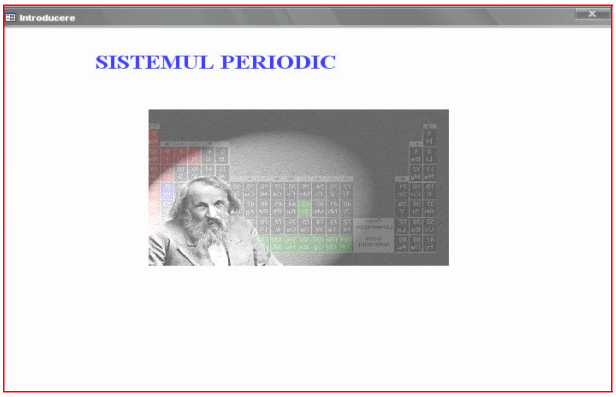

Fig. 1. Data Base Called Periodical System

For the form to work properly, the event Timer was programmed (with an 8000 millisecond interspace)

```
Private Sub Form_Timer()
        DoCmd.Close
        DoCmd.OpenForm "meniu"
End Sub
```

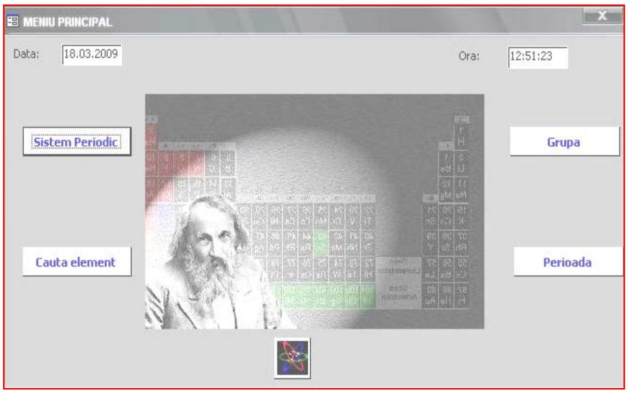

Fig. 2. The Main Menu

Thus, after 8 seconds this window will close automatically and it will open MAIN MENU; which is for us the main form. The main menu contains two text boxes that inform us on date and time, events programmed with Timer property at a 1000 mseconds interspace. The code is:

```
Private Sub Form_Timer()
        Me!Data_txt.Value = Date
        Me!Ora_txt.Value = Time
End Sub
```

As for the rest, when pressing the buttons, the work forms will open, except for the button "close application". The code for the 4 open buttons is similar, so we will present only one:

```
Private Sub sisp_btn_Click()
On Error GoTo Err_sisp_btn_Click
  Dim stDocName As String
  Dim stLinkCriteria As String
  stDocName = "SIS_P"
  DoCmd.OpenForm stDocName, , , stLinkCriteria
Exit_sisp_btn_Click:
  Exit Sub

Err_sisp_btn_Click:
  MsgBox Err.Description
  Resume Exit_sisp_btn_Click
  End Sub
```

The code for closing application:

```
Private Sub STOP_Click()
On Error GoTo Err_STOP_Click
  DoCmd.Quit

Exit_STOP_Click:
  Exit Sub

Err_STOP_Click:
  MsgBox Err.Description
  Resume Exit_STOP_Click

End Sub
```

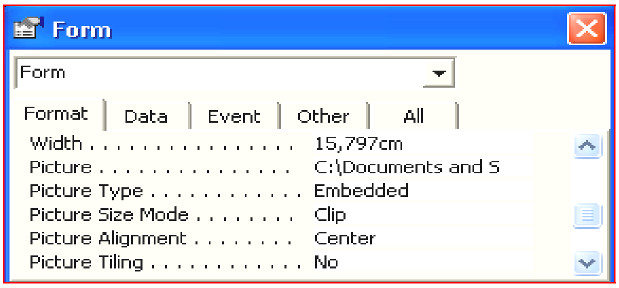

Fig.3. The Form

For most of the forms we used background images which can be added by opening the ***Properties*** *window.*
Thus, for ***Pictures*** *property we choose the background file,* ***Embeded*** *type, in order to differentiate it from the image on the hard disk of the computer, and to embed it in our data base. For the forms that are bigger than the image we choose Strech option instead of Clip for the image to cover the entire form.*

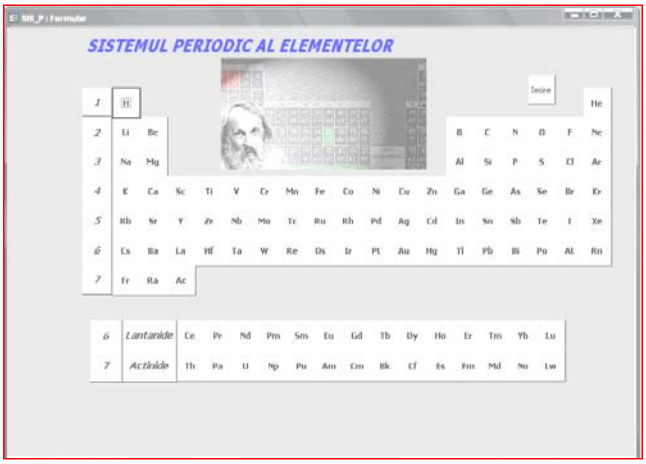

Fig. 4. The Periodical System

When pressing the Periodical System button, the form with the same name will open. The form contains numerous buttons with the name of each element in periodic table. By pressing one button a form will open, the same for all buttons, Element form, which will post all elements' properties.

We realized the capture of this form in DESIGN mode to highlight the text box, Text0, which is a hidden box, and in this box the symbol of each element will appear when pressing the drawn buttons. We realized this to open the form Element, for the element which corresponds to each button. The form Element is generated when querying Element, and it will make a selection based on the content in the text box hidden in our form.

```
Private Sub H_Click()
On Error GoTo Err_H_Click

    Me!Text0.Value = "O"

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "ELEMENT"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

                          Exit_H_Click:
Exit Sub

Err_H_Click:
    MsgBox Err.Description
    Resume Exit_H_Click

End Sub
```

The Element form appears as presented in the figure 5.

Fig. 5. The Periodical System. Example

We can observe The Structure image, which is an OLE type object in our data base. A second button, Search element in main menu, opens a form where we can search a chemical element using three criteria: name, symbol, atomic number.

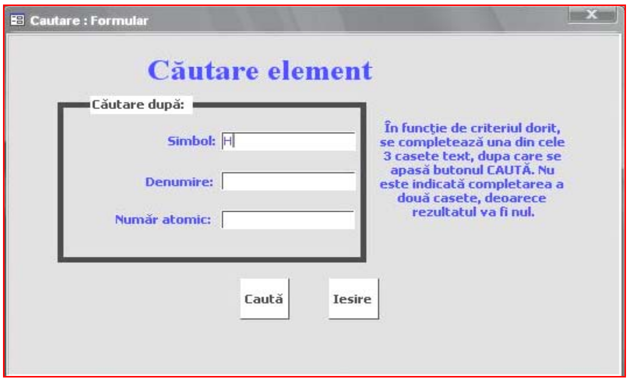

Fig. 6. The Periodical System. Search Meniu

Apart from the filled in text box, when pressing the Search button a new form will open and it will contain the element we searched for with all its properties. Behind this form there is a query which will have as a selection criterion all the 3 text boxes, and only one of them needs to be filled in.

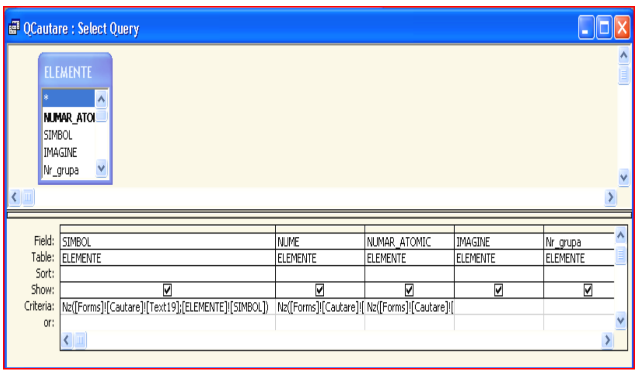

Fig. 7 The Periodical System. Select Query

Thus, as a selection criterion, we will use a function:

Nz([Forms]![Cautare]![Text19];[ELEMENTE]![SIMBOL])

This will search in the text box corresponding to our Seach form for any text, and if there is a text inside, the value in the text box will be the criterion, and if there is no text, it will select all values in Elements table, then it will pass to the next column to continue the criterion. The generated form will have a structure that differs from Element form shown above.

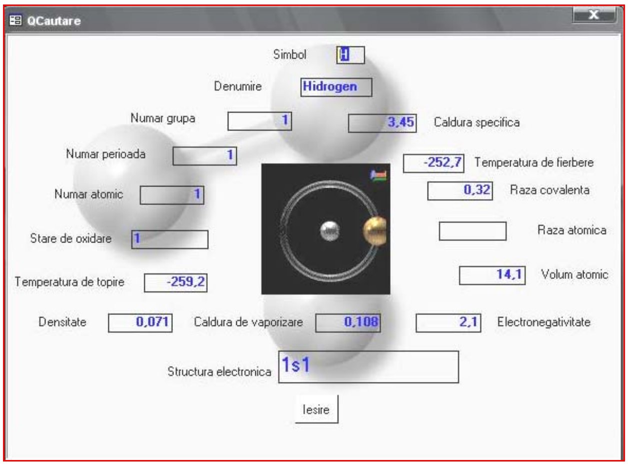

Fig.8. Generated form of Search

On the main interface there are two more buttons; when pressing them we can see the position of chemical elements in group and period.

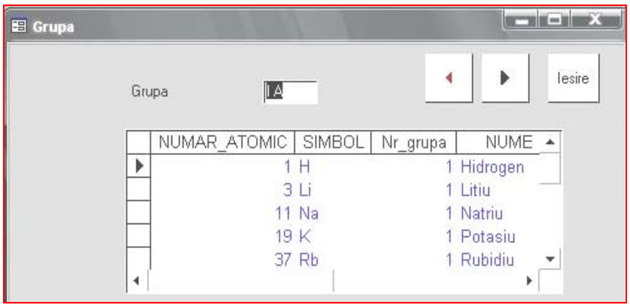

Fig. 9. Position of chemical elements in group

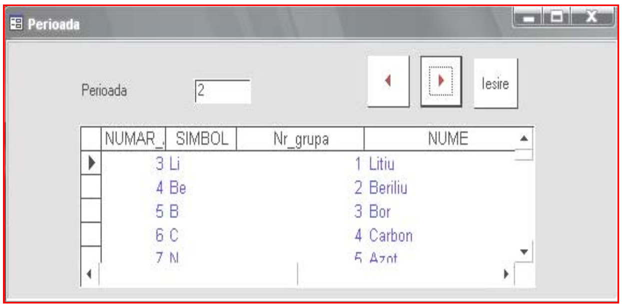

Fig. 9. Position of chemical elements in period

Groups are considered the most common way to classify the items. In some groups, the elements have properties similar or identical property whole group - these groups are given names that are used quite often, eg. alkali metals, alkaline-earth metals, transitional metals, etc.

A period is a horizontal row of the periodic table. Although groups are the most common way to group elements are regions of the periodic system where the similarities are more significant horizontal than vertical. The number shows the number of layers occupied by electrons.

The problems encountered when using the periodic table for teaching purposes are: the complexity of properties that characterize each and every element and the multitude of elements.

CONCLUSION

The usage of educational soft will increase the students' proficiency and creativity, the level of medium and superior training, the amount of knowledge and it will lead subsequently to a better usage of Informatics in various fields of activity.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] ROMANA HRICOVÁ

APPLICATION OF SIMULATION MEANS IN COMPUTER AID OF MANUFACTURING SYSTEMS CONTROL

Abstract:
The paper deals with the options of simulation means exploitation in the applications usable for the aid of the manufacturing systems controlling. There are shown the aspects recommended for building, validation and verification of the simulation model as also the procedures of exploitation of simulation outputs in practice. The paper deals with advantages and disadvantages of described software technology with respect to the concrete environment and conditions of simulated model.

Keywords:
operation, simulation, validation, implementation

INTRODUCTION

Modeling and simulation play increasingly important roles in modern society. They contribute to our understanding of how things function and are essential to the effective and efficient design, evaluation, and operation of new products and systems. Modeling and simulation results provide vital information for decisions and actions in many areas of business. There are some formal approaches to be kept to ensure both model and simulation correctness and credibility; and the simulation has some limitations, especially to validity and credibility issues.

BUILDING SIMULATION MODEL

The primary reason for modelling and simulation is to reduce costs on new projected system and/or finding the critical aspect of real system and their optimization. Approach to data acquisition related to solve problem entity is shown in Figure 1.

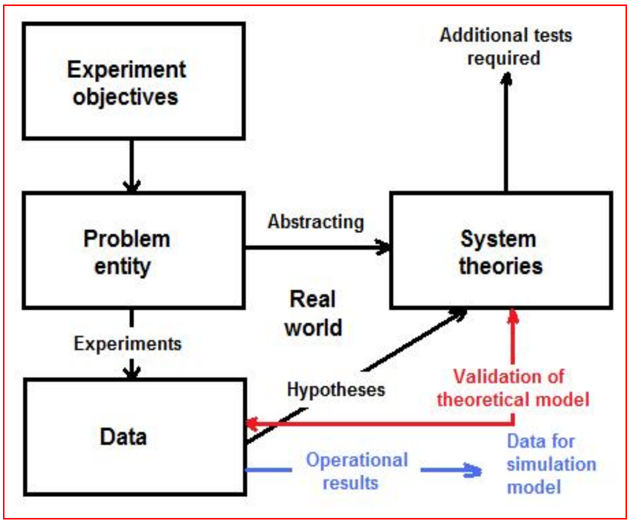

Figure 1 Problem entity analysis in real world

System theories are the interface, which are connecting the real and simulation worlds. For successful realization of simulation model, it is necessary to make data acquisition, verification and validation as precise as possible. The primary motivation for modelling, simulation, verification and validation is risk reduction; and the relation between costs spent on model development and benefits from it, is the core issue in the question of how much the simulation is needed. Limitations in items required for effective simulation (required data and detailed characterization of associated uncertainties and errors, simulation/software details, etc.) must be addressed, with many of the management processes in many areas of simulation application. After making these procedures, the initial data for simulation model can be abstracted and derived from real world. After that, the preparation phase is finished and development of simulation model can be initiated. Approach to building simulation model is shown in Figure 2.

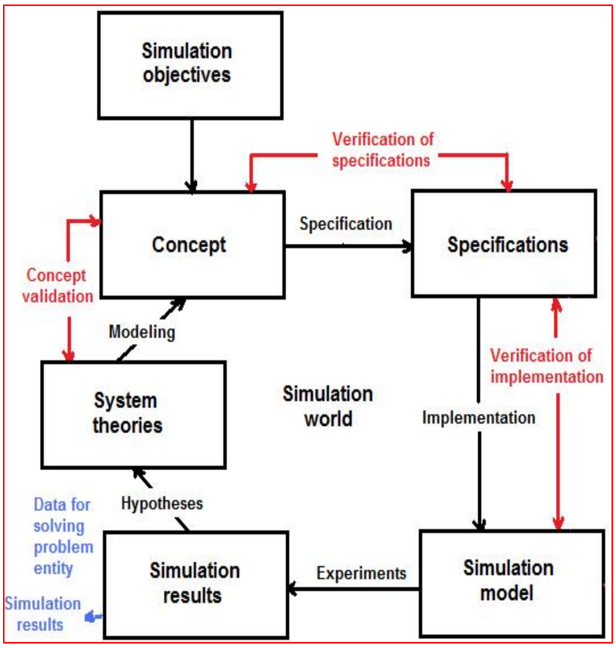

Figure 2 Simulation world

Under concept of simulation model, we can understand computer simulation model imitating behavior of some real system created on the base of mathematical computer model under the frame of system theories. Simulation model enables to create predictive scenarios of possible occurs in modeled system under some conditions. Simulation project usually includes several steps, which can be summarized, as follows:

- *conception formulation and analysis of the problem;*
- *data and information collection;*
- *building model;*
- *verification and validation;*
- *design of experiments;*
- *performance of experiments and analysis of results;*
- *improvement of designed experiments;*
- *final analysis of results;*
- *documentation of process.*

Time most demanding of all steps are data and information collection and then validation. Dynamic processes are regularly to much complex to totally precise analytical description, since they include wide spectrum and low volume of items, too much aims of planning, flexibility of scheduling, etc. In these cases, the simulation is ideal candidate for performing analyses and optimization. [1], [4]

SOME ASPECTS OF SIMULATION USE

The following recommendations should be considered before building correct and useful simulation model:

- ***Qualitative Assessment of Problem Entity:*** *In many operation areas, such as medical and technical diagnoses, knowledge engineering, the problem entity mainly depends on qualitative assessment. In various disciplines, the qualitative assessments are generally credible and repeatable. Qualitative assessment in modeling and simulation commonly provides unstructured, vague, and incomplete evaluations, therefore the feedback debugging of the model and its calibration is required.*
- ***Costs of simulation:*** *Before using simulation, it is necessary to estimate the benefits of modeling and simulation for concrete intended solution. Costs of simulation can increase by lack of information about modeling and simulation and improper ways of data acquisition and implementation. Despite the increasing reliance on models and simulations as well as more effective and creative ways to use existing systems, sometimes provided simulation results do not meet the*

requirements of end user, and the costs of simulation are then increasing with its validation and verification.

- ***Inference:*** Description and quantification of uncertainty in the model or simulation and in the experimental data is very important.
- ***Adaptation:*** Models and simulations using adaptive programming are changing during operation. Changes can be relatively minor or major, affecting the structure of the program as well as individual processes within the program, which need to be a subject of validation and verification.
- ***Aggregation:*** Models and simulations normally aggregate some representational aspects to make the mode easier to use or to allow the simulation to execute in a reasonable time. Such aggregation is not primary interest. But some models and simulations can aggregate aspects that are of primary interest and could significantly influence the simulation effectiveness. [1], [6]

Tab. 1 Application areas of computer simulation systems.

Application area	%
Transportations systems	7
Supply chain management	10
Manufacturing systems	14
Military	4
Health care	4
Financial modelling	4
Education and training	4
Risk analysis	3
Computer and communication networks	8
Business process workflow	11
Aerospace	3
Other	28

APPLICATION AREAS

Typical goals set for simulation experiments are [5]:

- reduction of costs;
- increase of performance;
- testing of newly designed processes before their implementation in practice;
- reaching optimal exploitation of resources (machines, production lines, equipment, personnel, etc.);
- reaching better logistic performance inside the system;
- exploitation of model for forecasting of future behavior;
- studies of capacity exploitation, level of stocks, logistic control, integrating studies, bottlenecks, better scheduling of processes.

Most frequent application areas of computer simulation systems are shown in Table 1.

SIMULATION OF MANUFACTURING SYSTEMS

One of the largest application areas for simulation modeling is simulation of manufacturing systems. Specific issues addressed in manufacturing systems control are as follows:

The need for and the quantity of resources:

- number and type of machines for a particular objective,
- number, type, and physical arrangement of transporters, conveyors, and other support equipment such as pallets and fixtures,
- location and size of inventory buffers,
- evaluation of a change in product volume or mix,
- evaluation of the effect of a new piece of equipment on an existing manufacturing system,
- evaluation of capital investments,
- labor-requirements planning.

Performance evaluation:

- Throughput analysis,
- Time-in-system analysis,
- Bottleneck analysis.

Evaluation of operational procedures:

- production scheduling,
- inventory policies,
- control strategies [for example for an automated guided vehicle system (AGVS)],
- reliability analysis (for example such as studying effects of preventive maintenance),
- quality control policies.

Following are some of the performance measures commonly estimated by simulation:

- throughput studies,
- time in system for parts,
- bottlenecks identification and solution,
- times parts spend in queues,
- frequency of orders and demands
- probability studies,
- work in process time studies,
- queue sizes,
- timeliness of deliveries,
- gantt studies,
- storage utilization,
- material handling studies,

- *utilization of equipment or personnel.*

Randomness of manufacturing systems:

The following issues are sources of randomness in manufacturing systems:

- *arrivals of orders, parts, or raw materials*
- *processing, assembly, or inspection times*
- *machine times to failure*
- *machine repair times*
- *loading/unloading times*
- *setup times*

Generally, each source of system randomness needs to be modeled by an appropriate probability distribution; sources of randomness in practice are very rarely normally distributed. Before modeling, there is necessity to specify the probability distribution for each of randomness sources.

SIMULATION EXPERIMENTS

The simulation input has usually random nature, which means that the results of simulation runs can be considered as a statistical estimate of reality. It means that every simulation measure is not the true performance, but its statistical calculation. To avoid high variances, a thus to ensure the correlation of simulation runs with reality, it is necessary to design appropriate choices for the following:

- *length of each simulation run,*
- *number of independent simulation runs.*

Their correct specifications provide statistically precise bias free results.

The proper selection of type of study is also very important, general division of the simulation experiments can be as follows:

- *static or dynamic simulation,*
- *deterministic or stochastic simulation,*
- *continuous or discrete event simulation.*

It is recommended to perform from three to five independent runs for each system design. The average of the estimated performance measures from the individual runs is then used as the overall estimate of the performance measure.

Every independent run should use different random numbers and probability distributions settings. Each of the run should start in the same initial time, with reset of simulator statistical counters before each run [2], [7].

The overall estimate should be more statistically precise than the estimated performance measure from one run. For most of the simulation studies of manufacturing systems, the long-run of behavior of the system is more reliable as a short runs. It means, the behavior of system is simulated in "normal" production manner. Simulation output data from the analysis should be correctly treated and interpreted.

SIMULATION ADVANTAGES

Simulation is often used as a research methodology for problem solving, and provides especially low costs on experiments in the comparison with real tests and measurements. Some of the simulation advantages are as follows:

- *low costs on experiments in comparison with the real measurements,*
- *saving time necessary on experiments,*
- *high flexibility of simulation tests,*
- *options to do variant solutions and specification in batch mode, which is much faster than optional real experiments,*
- *discrete event simulation enabling to perform simulation runs in real time,*
- *option of adaptive models and optimization,*
- *exploitation of simulation in design of new manufacturing systems,*
- *options of calibration of the models during implementation of results into practice and continuous improvement.*

SIMULATION DISADVANTAGES

A lot of pitfalls can be identified and these can cause simulation studies fail and result in projects missing their deadlines or overspending the costs. Some of pitfalls can be identified as follows:

- *not sufficient definition of the problem by problem owner, which often does not understand what the simulation expert wants or is trying to do,*
- *not sufficient definition of results that are expected by problem owner,*
- *low skills of the simulation expert regarding specific domain of problem topic issues and knowledge,*
- *weak statistical background of data and information needed as a simulation input,*
- *lack of time to complete the study,*
- *the implemented simulation model does not correspond to the conceptual model,*

- *the simulation environment leads to unclear structure of the model,*
- *the simulation model is too inflexible and has a limited set of options for experimentation,*
- *output data are not correctly implemented or are not usable for the reality.*

CONCLUSIONS

Useful approach to spread use of simulation in manufacturing systems depends on size and complexity of solved system. For small and medium enterprises is efficient to share expertise in simulation developed by many research centers. For large and complex manufacturing systems, it is more efficient to build concrete specific solutions on own base. Solving industrial problems by simulation reduces times and costs, and makes it affordable for many enterprises. Simulation studies are a part of the planning process in manufacturing systems. Simulation tools are rarely applied as single tools; they usually serve as a testbed for production planning and control (PPC) systems. The simulation also allows performing cost simulation studies in the first steps of the planning and thus calibrating business plan.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] JOSEF BRADÁČ

NUMERICAL ANALYSES USING IN PRODUCTION OF WELDED PARTS

Abstract:
By help of numerical analyses it is nowadays possible to simulate the whole technological welding process and to better understand, on the basis of the acquired results, how the individual input parameters affect the whole technological process, mainly the quality of the resulting material structure and the level of the final deformations and distortion. The submission presents the so called local-global approach method, which enables to solve even complicated constructions with more welds. By applying this method we can obtain final deformations or distortions, including the overall effect of individual welds. Thanks to the characteristics described above, this method is often successfully applied to predict distortions and deformations before the welding itself.

Keywords:
welding simulations, Local-Global approach, projection methods, Sysweld programme

INTRODUCTION

Due to high demands on the quality of welds there is a need for a bigger number experimental check welds, which are carried out before the proper welding of real elements. These experiments are used, for example, to confirm the suitability of the chosen welding technology, material properties, preheat temperature, filler material, etc. To sum it up, they are used to validate the welding process. Further comes the measurement of the material properties in the weld zone. These experiments make production more expensive and at the same time they are highly time-consuming (especially in heavy constructions). Consequently, numerical welding simulations find wider application not only in the development studios, but also during the production preparation phase. In the last few years there was a big expansion of such analyses, which in some cases already replace experimental tests. We may expect that in near future the numerical analyses will reflect the reality much better than experimental measurement of the individual parameters of the process.

The France ESI Group company Sysweld programme is one of the most complex programmes for welding process simulations.

SYSWELD PROGRAMME

Sysweld programme is based on the finite elements method and the solution is founded on a phase transformation. The computation itself is devided into two stages: thermal-metallurgic analysis and mechanical analysis. The thermal-metallurgical analysis solves the computation of

nonstacionary temperature fields, phase transformation, hardness of the structure, and of the austenitic grain size, as appropriate. This is quadrated with the material input data, which should be entered in a temperature dependent form.
On the figure 1 we can see an example of output from thermal-matelurgical analysis. There is temperature field on the fillet weld shape model. Red elipse marked molten zone. [4,5]

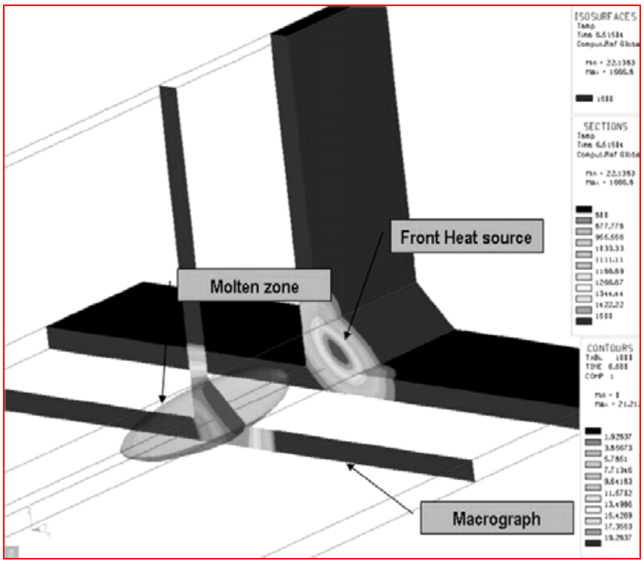


Fig. 1 Temperature field on the fillet weld shape model

The mechanical analysis follows the thermal-metallurgical analysis and it is not possible to carry it out without a previous thermal load of the scale. It enables to compute a time curve of the individual stress tensor factors, main stress values, spatial stress-strain state according to the HMH theory, as well as the shear stress Tresc analysis. The elastic and plastic deformation computation. Elastic and plastic deformation computation of the individual components as well as of the resulting stress tensor. It is, inter alia, able to compute e.g. the strees energy density. Input values for viscoplastic material behavior. Due to high demands on the quality of welds there is a need for a bigger number experimental check welds, which are carried out before the proper welding of real elements. Consequently, numerical welding simulations find wider application not only in the development studios, but also during the production preparation phase. [1,6] On the figure 2 we can see an example of output from mechanical analysis. There are computed distorsions after welding, which are display on the initial shape. [2,6]

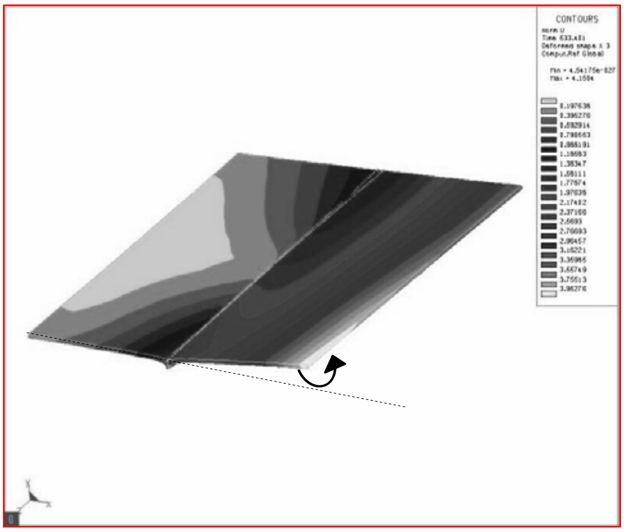


Fig. 2 Computed distorsions after welding

LOCAL-GLOBAL APPROACH

In case standard SYSWELD methodology is used for solving the simulation computation, the required mesh (i.e. fine meshing) leads to an excessive model size and consequently to unbearable prolongation of computation time. A simplified method called the local-global approach is proposed to overcome this limitation and to provide a solution to simulate complicated constructions. The size of the model is therefore not limited. Another advantage is that the individual welding sequences and clamping conditions can be further adjusted to minimize distortions. The main idea is to create a local model that represents only a part of the weld with its results (constraints and strains). This model is then projected on the global model depending on the trajectories (paths) of the various welds. The input data is then completed by the order in which the welds are carried out and by the clamping conditions of the structure.
The Local-Global Approach is based on local as well as global phenomenon:

- *Local phenomenon - High temperature and material non-linearity appear in very small areas around the welding joint. Plastic strains are concentrated around this small zone.*
- *Global phenomenon - Global distortion of the assembly is due to local plastic strains induced by the welds. The behaviour of the global structure can be considered to be elastic.*

The simulation of the welding joints (residual plastic strains and stresses) can therefore be separated from the global computation (distortion). [1,6]

PROJECTION METHODS

They are methods for extraction and projection from local to global model. In practice there are two types of projection from local to global model, independent of the type of a weld joint, whereas the effects of the welding joints are applied to the global model through the tensor field of plastic strains computed during the welding simulation for the local model. A projection method called extrusion can be used in case of steady state welds, where the results of the mechanical analysis are identical for the whole weld. The principle of this method is demonstrated on Figure 3. Results of the mechanical analysis for the local model are extracted and projected to the global model. The condition is that the local and global mesh must be identical.

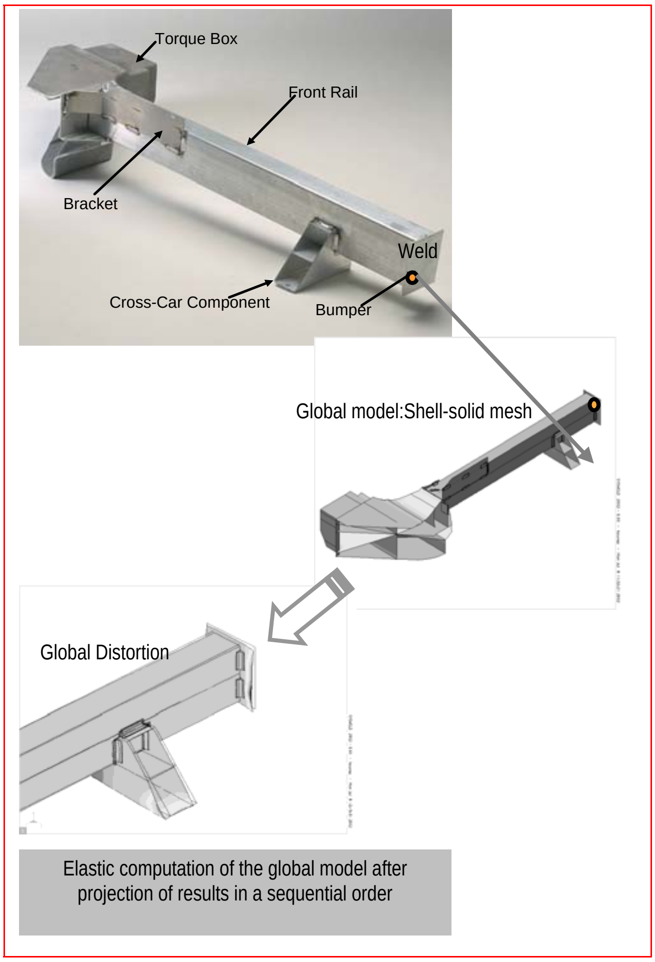


Fig. 3 Principle of extrusion method

For geometrical reasons, a block method can by used in case of short joints or in case intersections appear between welds. This method is mainly suitable for short joints in non steady state and all other configurations. In this case the plastic strain distribution is not continuous along the welding path. The principle is that the whole local model together with the respective results is projected to the rough mesh of the global model as shown on Figure 4. [5,7].

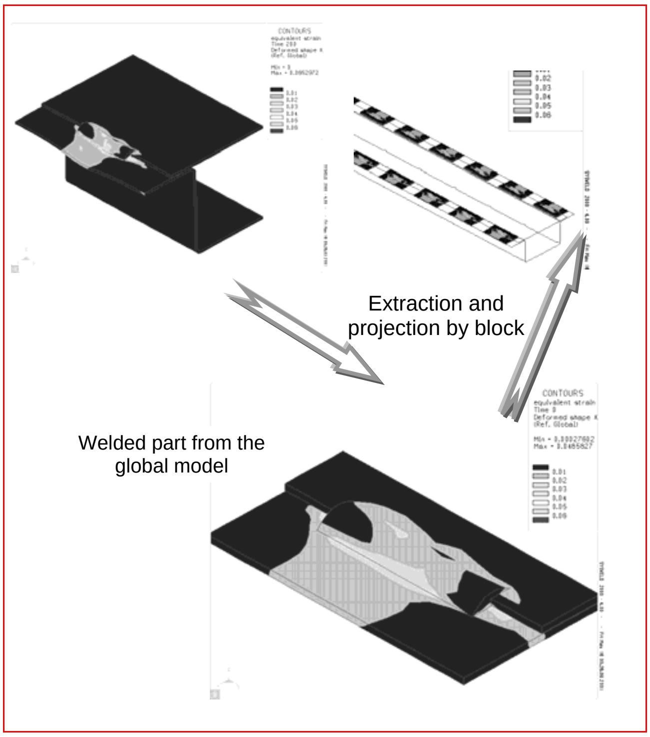
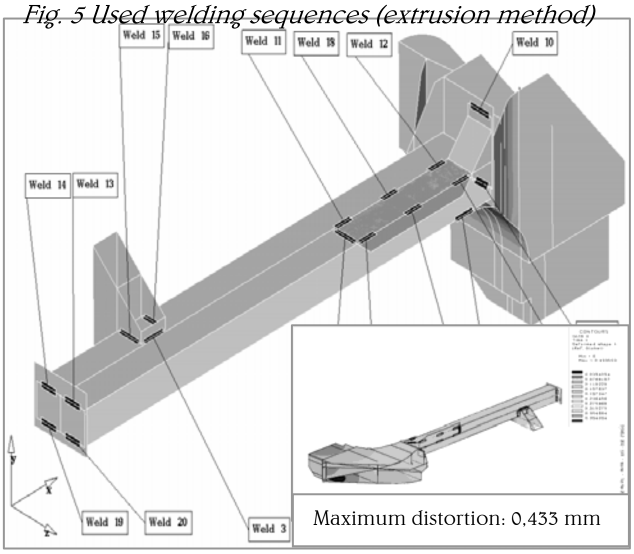


Fig. 4 Principle of block method

Fig. 5 Used welding sequences (extrusion method)



and final distortions

EXAMPLES OF APPLICATION OF INDIVIDUAL PROJECTION METHODS

As an example of the application of extrusion method, the contribution mentions welding of a front rail (automotive industry), which is welded of five parts by 22 weld joints. Figure 5 shows welding sequence, which gives the lowest distortions. On the small figure we can see final distortions after welding, maximal distortion reaches 0,433mm value.

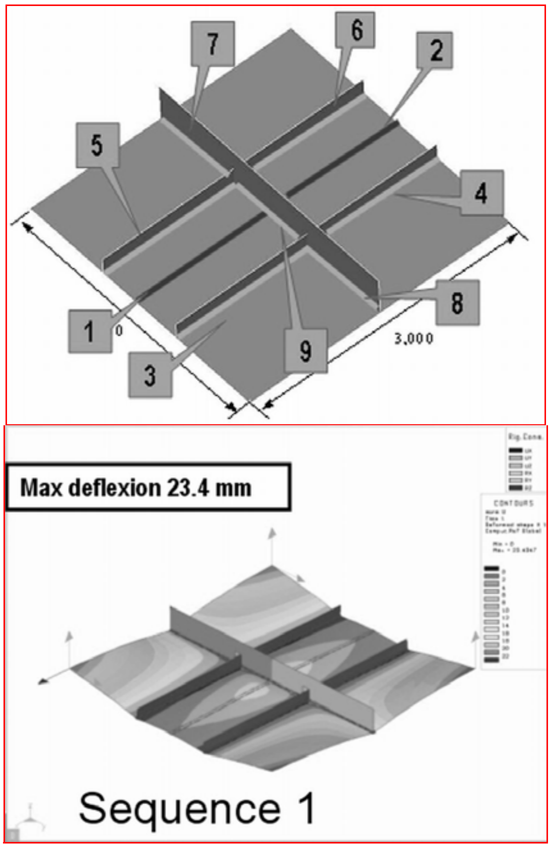


Fig. 6 Welding sequence No. 1 (extrusion method)

As an example of the block method, the contribution mentions welding of a profile demonstrated by figure 4. This profile is welded by means of twenty welds and similarly as in the previous case, there are different welding sequences. Once optimizing those sequences we can minimize the distortions resulting from welding. Figures 8 and 9 again shows a comparison of two sequences. We can see that both sequences are not suitable from the point of view of the final distortions. It is necessary to keep on searching for a better sequence, or to adjust the structural design, parameters, or the welding method itself. [3,7]

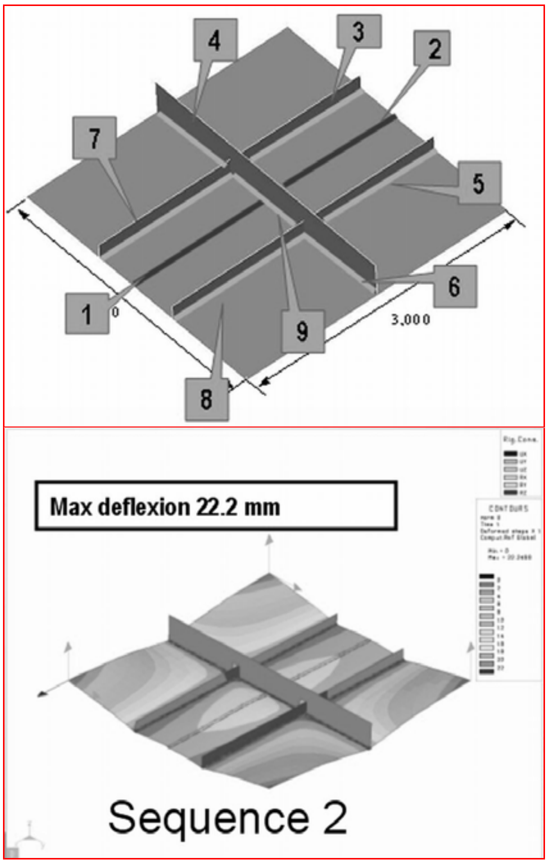


Fig. 7 Welding sequence No. 1 (extrusion method)

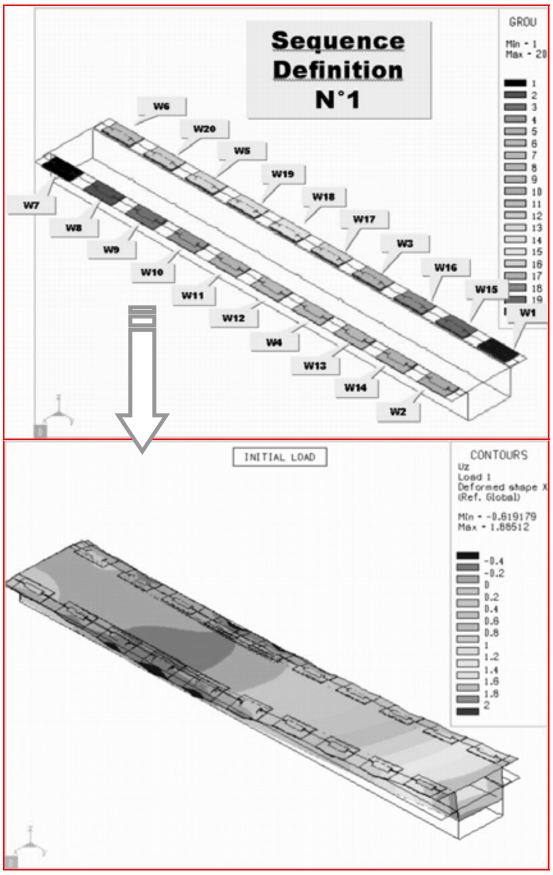


Fig. 8 Welding sequence No. 1 (block method)

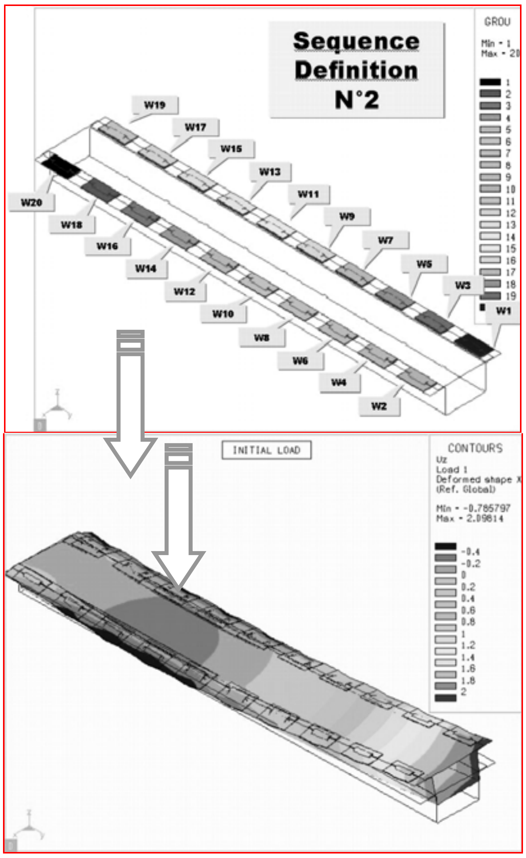


Fig. 9 Welding sequence No. 2 (block method)

CONCLUSION

As shown above, application of the local-global approach method enables us to solve rater complicated structures and subsequently predict final distortions without having to conduct expensive experimental tests. However, we must keep on mind that the quality of the simulation results highly depends on the quality of the local model simulation, and that the residual stresses and plastic strains in the welding joint are highly dependent on the global stiffness of the assembly structure, including the effects of the clamping tools. That is why it is necessary to pay a special attention to the choice of the local model simulations and especially to the boundary conditions applied to the limits. This is the key point for the success of the method as well as for obtaining the relevant results.

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I want to acknowledge ESI Group Company for Sysweld programme and other support materials.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] MONIKA ERIKA POPA, [2.] GABRIELA MIHUT, [3.] VASILE ALEXA

SIMULATION TENDENCIES IN THE CONTINUOUSLY CAST HALF-PRODUCTS AREA

Abstract:

Primordial method for the decrease of the superheat of the steel of the in of the crystallizer, consist in the introduction of consumable micro-coolers, which can be exterior or internal.

The mathematical molding of the solidification and cooling phenomenon of continuously cast half-products, presented the in afterwards, is based on the mathematical description of phenomenon. This solution problem is, practically, the heat solving equation in of non-steady regime. For defined the heat conduction between half-product and crystallizer is necessary the cognition of initial conditions, the variation law of the heat flux between half-product – crystallizer and the heat flux between crystallizer – cooling water.

In this paper is presented simulation solidification model of steel continuous casting, using finite element model. For this is considered a section in mould-continuous casting system. This section is divided with discreet element structure. Using these experiments is made graphical dependents of temperature in some different point from surface crust to center of half-product, and also solidification speed for S235 (OL37) steel.

Keywords:

continuous casting, steel, solidification

INTRODUCTION

The metallurgical industry from Romania is structured in way echeloned assured necessary of iron metallurgical products of the economic branches, and in order to participate at the international changes of products from steels in the sight compensation of the import of prime materials.

The management in metallurgy must be find answers in current stage, to another two questions, which operates more criteria in the practice of the exploitation method.

- *What technical-organizational solutions to adopted the in the classic technology in order to growth of the cast productivity, accomplished the quality metallurgical products (the maximal productivity criteria)*
- *What sizes of continuously cast half-products to adopted the in manufacturing process, in order to appropriate the final form, accomplished this quality (the dimensional criteria)*

Obviously, all these criteria's are subordinate by-path of primordial interest of the metallurgy's *managers, namely the good qualities manufactured products at the minimal costs.*

The main task of the continuous cast is improved of continuous cast steel quality. In order to assured the solidification conditions imposed by the steel chemical composition must be synchronize a numerous technological factors, the most important be the steel chemical composition, the casting temperature and speed of drawing.

Primordial method for the decrease of the superheat of the steel of the in of the crystallizer, consist in the introduction of consumable micro-coolers, which can be exterior or internal. The exterior micro-coolers can be prepared out of the system and entered the crystallizer, and the internal micro-coolers are constituted from steels crusts, immediate format in the core of the half-products, on the water cooled surfaces. The outside micro-coolers can be entered in the liquid steel below different forms: small shots, granules or particles, draw-bars, wire, tube, etc. The addition of micro-coolers in crystallizer drives to the growth of the zone of the echi-axial crystals, diminish the degree of superheat and reduce the axial porosity.

The mathematical molding of the solidification and cooling phenomenon of continuously cast half-products, presented the in afterwards, is based on the mathematical description of phenomenon. This solution problem is, practically, the heat solving equation in of non-steady regime. For defined the heat conduction between half-product and crystallizer is necessary the cognition of initial conditions, the variation law of the heat flux between half-product – crystallizer and the heat flux between crystallizer – cooling water. Some conditions are can easy schematized, other only that drive to systems of which equations can be solved on analytic path.

THE PROGRAMM

The computer program is written in C++ and works under Win32 (i.e. Windows 95, 98, Me, NT4, 2000, XP – with Intel processor). For the graphic interface, the program uses MFC (Microsoft Foundation Classes), a class library that encloses the functional character of the standard programming interface Windows API – Application Program Interface. The source program has a modular, object-oriented architecture. One C++ module consists in general in a pair of files: one with the extension.H (form header) that contains function and/or class declarations, used as interface with the other modules, and one with the extension .CPP (from C++) that contains definitions (implementations of the functions and classes declared in the header). The other ones are auxiliaries of these or are meant to implement graphs, windows, dialogue cases, etc. The C standard functions (open (), or exit ()), which are not a Windows API components, uses other biblioteq, respectively MSVCRT (Microsoft Visual C Runtime). The 3D graphs are realized with the Windows implementation of OpenGL specification (Open Graphics Library). The dynamical biblioteq (MFC42.DLL, MSVCRT.DLL, OPENGL32.DLL and GLU32.DLL) are installed with the operating system.

For implementation of an algorithm of the above described model we need the fallowing initial data: ambient temperature, casting temperature, initial temperature of the crystallizer, number of nodes from half-finished product and from crystallizer with respect to both axes, values of thermal conductibility for steel and cupper function of temperature, values of enthalpy for steel and copper function of temperature. In case of steel this functional dependence need to include fusion latent heat; tapping condition of half-finished product from equipment; stopping condition of the algorithm. This could be: manual stopping, after a given time period, at a specified minimum, average, or maximum temperature of the half-finished product, maximum variation of enthalpy at an iteration.

The simulation is realized for a half-finished product (bloom), having the cross-section 240x270 mm, made of steel OL37-2K, according to the SR EN 10025 standard. The data are: the ambient temperature 20°C, the casting temperature 1550°C, the convection constant K = 15.

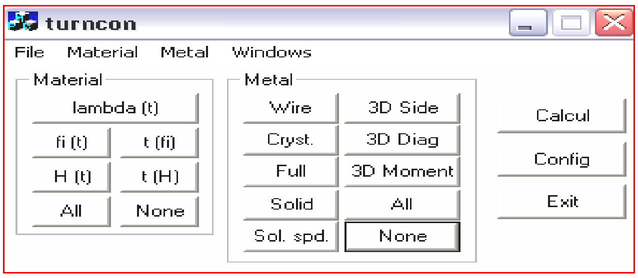

Fig. 1. The main window of the program

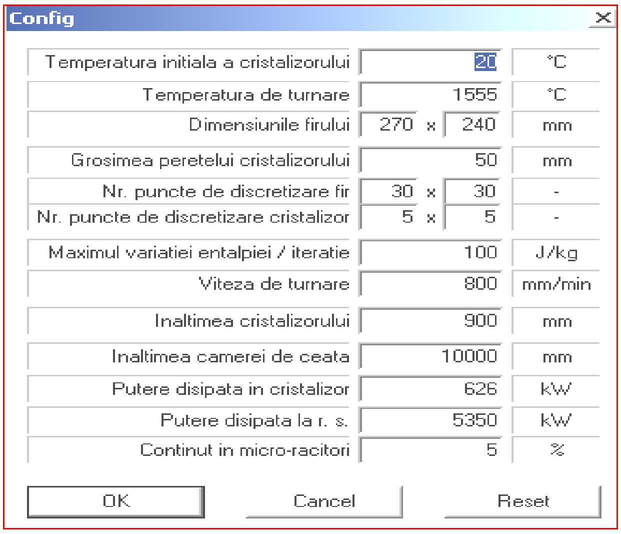

Fig. 2. The data input window

For configuration of specific dates for every steel grade, using the main interface (fig. 1.) the program opens the dialog box presented in fig. 2.

The simulation of the continuously cast half-products is effectuated in the case of 5% consumable micro-coolers introduced in crystallizer. The simulation is effectuated just for the primary and secondary cooling and not for the entire line of cast installation. Thus is explained the great values of the temperature of steel in the interior of the half-products (the middle layers) but which we diminish the feather below the value of the temperature solidus up to the moment which in the half-product is uttered.

With the number of knots of digitization is major (both the crystallizer and the half-product) and the maximum the variation of in an enthalpy in single iteration is less, the real time of simulation is major. In this case, the real time is 9h 8 min 44 s corresponding to the 13 min 21 s, in simulated time. The run of the program can be interrupted all moments, but with the mention as be start from same moment of time but must run the program from beginning. For illustrate the operation of the program, we accomplished captures of the screen to different moments of times, from which can obtain some information concerning the temperatures in the cast equipment, the real and simulated times.

The temperatures are indicated by the mean of a colored gradient, having the values: red for casting temperature, blue for ambient temperature and green for their average. Any intermediary temperature is a combination of these.

A first obtained dependence is represented by temperature variation of the half-finished product function of time (fig.6.). The distribution of the discredited points is also presented.

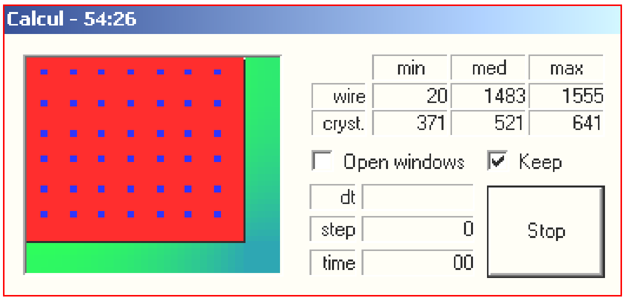

Fig. 3. The dialog window at 54min 26s (real time), respectivelly 0s (simulated time)
(at the moment of the micro-coolers introduces)

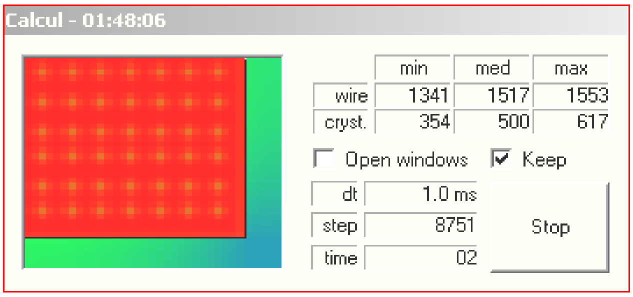

Fig. 4. The dialog window at 1h 48min 06s (real time), respectivelly 2s (simulated time)

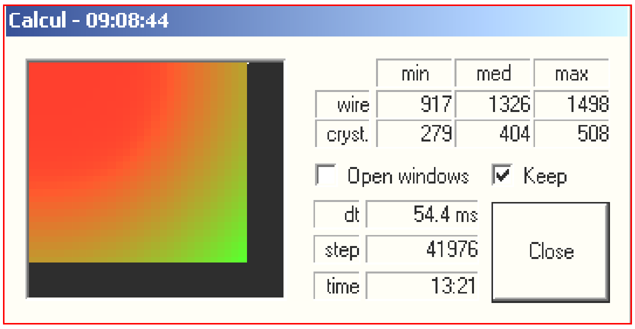

Fig. 5. The dialog window at 9h 8min 25s (real time), respectivelly 13min 21s (simulated time)
(at the end of program simulation)

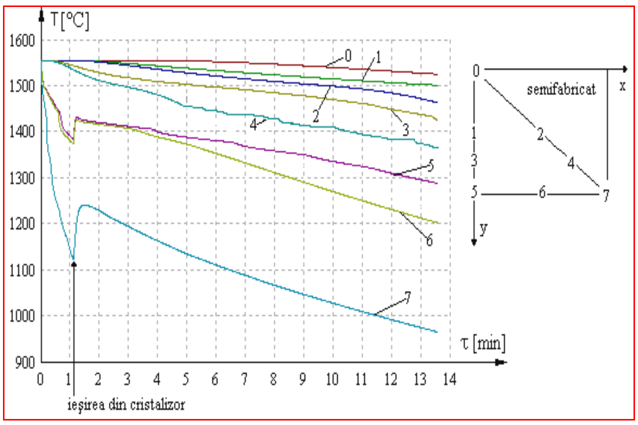

Fig.6. Temperature variation function of time

At a time moment (in the presented case equal with 1 min 7s), when it took place the driving out of considered surface from crystallizer, it took place an increasing of temperature in the superior layers of the half-finished product (with approximately 100°C in the corner and with 35…50°C in points 5 and 6 of the surface).

This increasing of the temperature is due to the lack of cooling of the wire immediately after the driving out from crystallizer to the firs ring of secondary cooling. After this moment the cooling and the solidification of the wire took place normally, the recorded temperatures corresponding to the measured ones.

It needs to be specified that the simulation was realized just for primary and secondary cooling, not for the entire running of the wire in the equipment. This explains steel's high temperature values in the interior of the half-finished product (middle layers), but they are decreasing under the solidus temperature value until the cutting of the half-finished product.

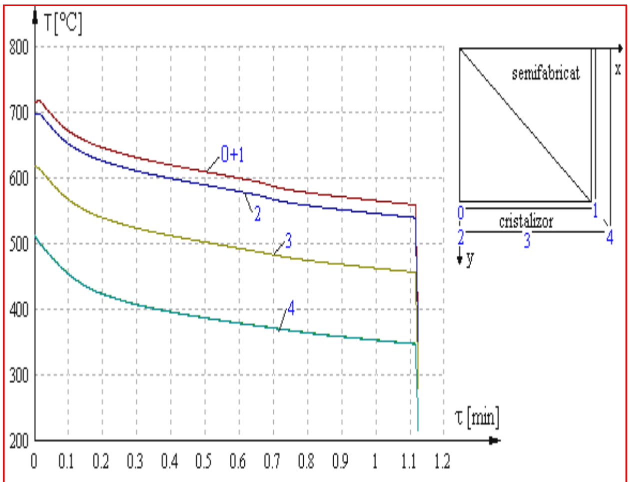

Fig.7. The temperature variation in the crystallizer, function of time

As regards the temperatures distribution in the crystallizer (which take over the heat transferred by the half-finished product and transfer it to the cooling water), it is presented in fig.7. In this case to it is presented also the position of the discredited points.

In the moment of the cast process beginning, in crystalizer (in discretized points), the temperatures are relative high. At 10s (simulated time) the temperature is between 350-600°C, and it is observed a slowly decreasing of the temperature of points placed near the center of the half-finished product, but also the variation mode of the temperature from layers closer to wire surface (320…550°C at 30s, 275…520°C at 1 min 7s, in final moment of simulation).

In fig. 8 the cumulate diagramme of the temperature are presented. It is observed the two cooling zone, respectivelly the primary cooling (when variated both the temperature in crystallizer and the cast line), and the secondary cooling (when only the cast line temperature is present). It was obtained variation type for the solidification speed, function of time. It refers to a solidification speed calculated between two consecutive iterations, fact that partially explain the oscillating aspect of the curves.

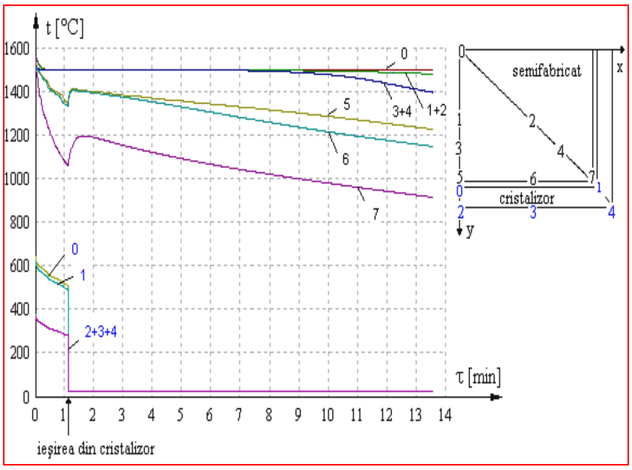

Fig. 8. The temperature variation in crystallizer and the cast line

Another type of temperature distribution, when the half-finished product is droved out from secondary cooling zone, it is presented in fig. 9…fig.13, at 3s, 9s, 24s, 30s and 60s, after introduced the micro-coolers.

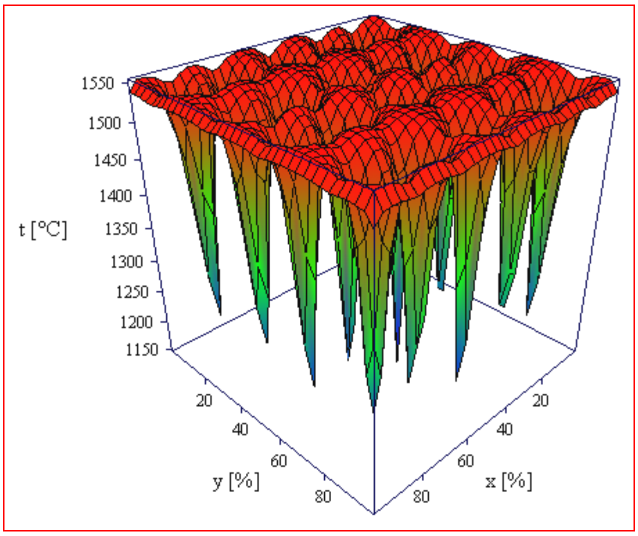

Fig. 9. The thermal field at 3s after the micro-coolers addition

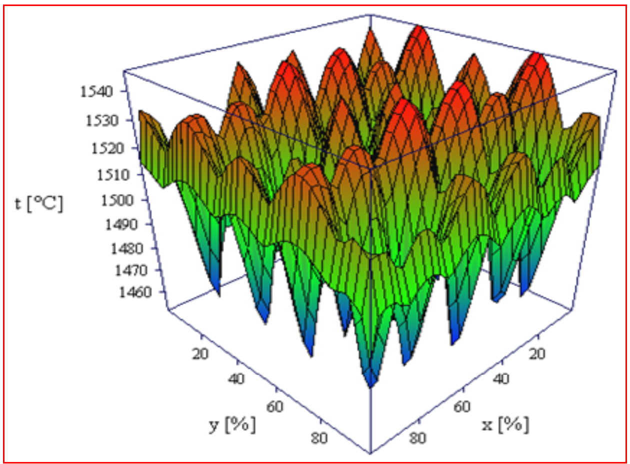

Fig. 10. Thermal field at 9s after the micro-coolers addition

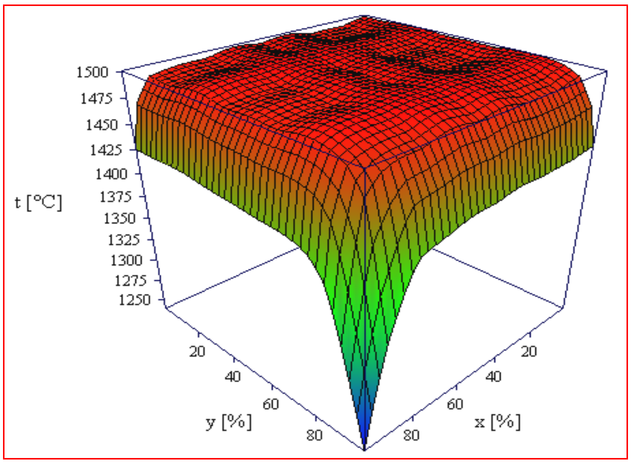

Fig. 13. The thermal field at 60s after the micro coolers addition

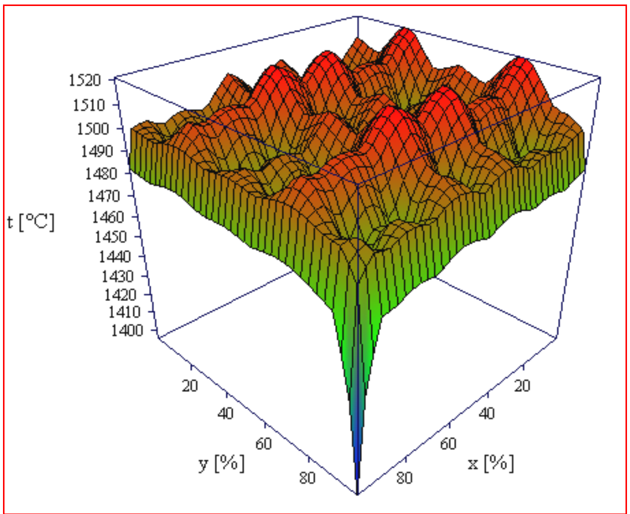

Fig. 11. Thermal field at 24s after the micro-coolers addition

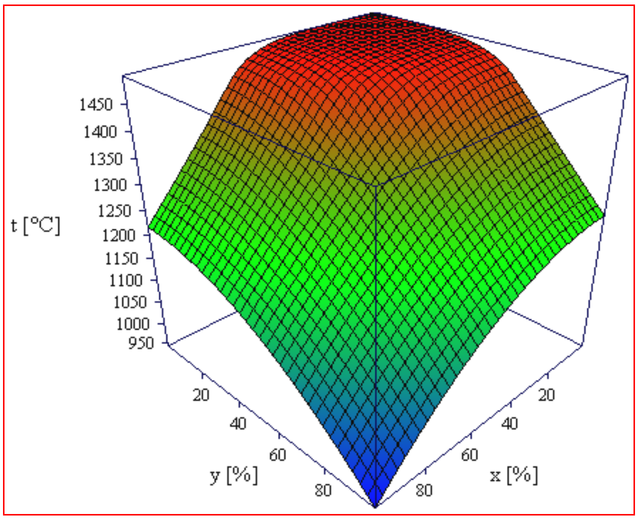

Fig. 14. The thermal field in half-product (with section 240x270mm) at 13 min 21s (simulated time)

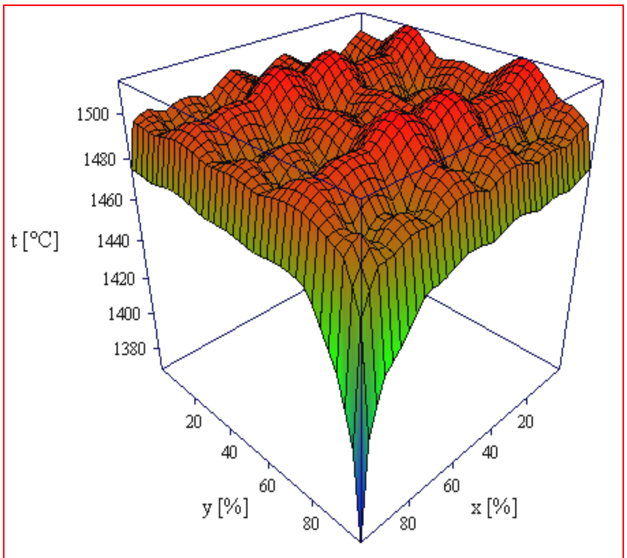

Fig. 12. The thermal field at 30s after the micro-coolers addition

The fig. 14 presents the thermal field in the half-product in the moment of the 13 min 21s (simulated time). The obtained regression surfaces corresponded from a quarter from the half-product section is like similarly of the other parts of the section. From the point of view of the temperature values, the half-product corner is the first cooled section, and the core is the most slowly cooled part.

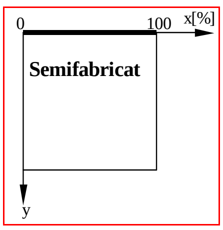

Fig. 15. The axe x for y = 0

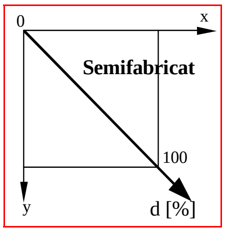

Fig.16. The diagonal

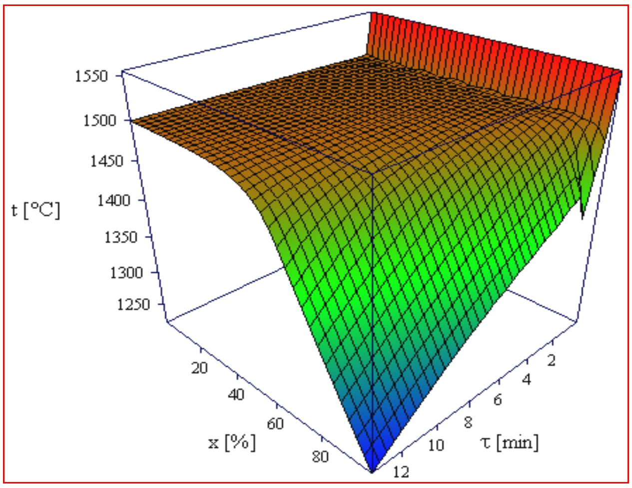

Fig. 17. The thermal field in half-product (240x270mm) across the axe x for y = 0, in time

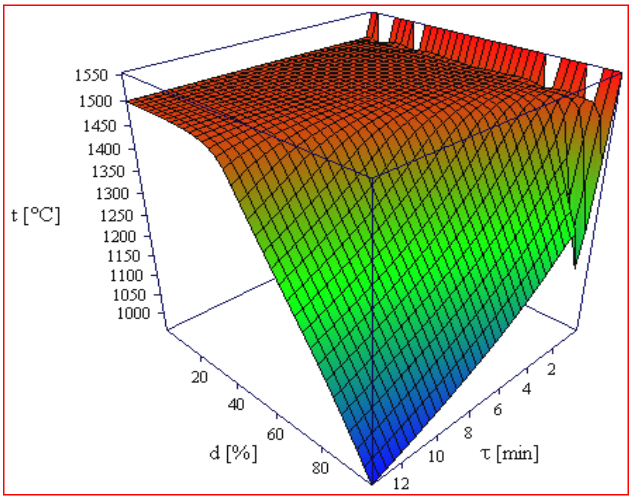

Fig. 18. The thermal field in half-product (section 240x270mm) across the diagonal, in time

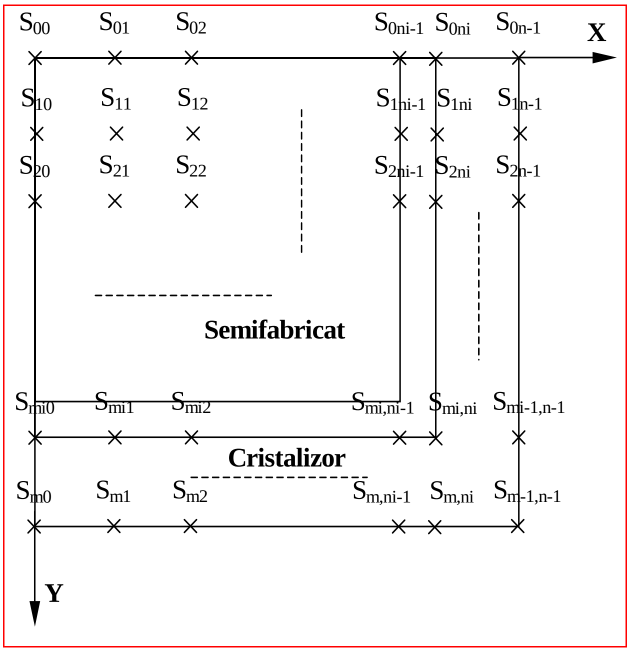

Fig. 19. The discretisation network

In order to realize a bi-dimensional mathematical modeling of a half-finished product it is considered a section of half-finished product-crystallizer assembly, which is divided using a discretisation network (fig.19). As results of the considered hypothesis, the half-finished product-crystallizer assembly is symmetric with respect to longitudinal axis of the half-finished product. The origin of the system of coordinates will be in the center of the half-finished product and the calculus will be made just for positive x and y.

The temperature of every node represents the mean temperature of node adjacent surface. In these nodes are written the finite differential equations presented above.

The model is realized based on the fallowing simplifying assumptions:

- *the heat transfer on longitudinal axis is neglected, considering that heat transfer take place just in horizontal section of the half-finished product*
- *the density variation is neglected*
- *the crystallizer section is consider to be a equivalent rectangular section*
- *it is consider that the crystallizer loose heat uniformly on each surface*
- *it is consider that at zero moment the temperature of steel mass is uniform. For the surface nodes it is correct to assume that at the casting moment it took place the formation of a thin solidified steel layer, and the loosed heat by this layer is transmitted instantaneously to the nodes from the interior surface of the crystallizer.*
- *the evolving of fusion latent heat it is produced in liquidus-solidus interval, direct proportional with the temperature*

CONCLUSION

Analyzing the graphical dependences from the performed researches, based on literature review data and from own experimental work it results the fallowing conclusions:

- *The results obtained by simulation with presented program being similar with practical data;*
- *In every diagram there are observed a temperature leap or a solidification speed leap after approximately 1min 7s min from the beginning of the casting, respectively immediately after the driving out from the*

crystallizer of the considered section, leap caused by the impossibility of elimination of a heat flux from the half-finished product interior;

- *It is observed a numerous crystallizing centers, uniform distributed;*
- *Also, it is observed an appreciate difference between the liquid steel temperature and the steel temperature from immediate proximity of micro-coolers;*
- *The indurations advances consisted standardized it a temperatures of first in of the minute after the administration of micro-coolers;*
- *After precinct a minute from the administration micro-coolers don't else notices significant differences what in looks the variation of the temperature of the in mass of steel;*
- *Through the addition of micro-coolers is obtained adjustment of the a temperature of the in of the crystallizer depending on the quality and the quantity of micro-coolers;*
- *Modifying a series of parameters (number of discretized points, dissipated heat in crystallizer and in secondary cooling, data of steel grade) it could be obtained more correct values, applicable to other steel grades.*

The number of nodes is established starting with the necessity of finding a solution for the following contradiction: the use of a high number of nodes increases the precision of the model (the error introduced by the hypothesis that the adjacent surface of every node has the same temperature as the node is decreases with the decrease of node area); on the other hand a high number of nodes lead to an increasing of processing time due to the increasing of nodes number and due to decreasing of time intervals between iterations imposed by stability conditions of the solutions.

The chosen time interval represent the time in which the unsteady heat transfer process is approximate with a steady process. From this reasons as well as the characteristics of the real process are far from that of a steady one, the iteration period should be smaller.

In order to realize a bi-dimensional mathematical modeling of a half-finished product it is considered a section of half-finished product-crystallizer assembly, which is divided using a discretisation network. The temperature of every node represents the mean temperature of node adjacent surface.

Continuous casting is used to solidify most of the 750 million tons of steel, 20 million tons of aluminum, and many tons of other alloys produced in the world every year. Most previous advances have been based on empirical knowledge gained from experimentation with the process.

As computer power increases, mathematical models are becoming increasingly powerful tools to gain additional quantitative insight.

Model applications include basic machine design calculations, identifying and quantifying the mechanisms of various types of defects, troubleshooting the origin of particular defects, and optimizing the various process conditions to increase productivity or minimize defects.

Continuous casting transforms molten metal into solid on a continuous basis and includes a variety of important commercial processes. These processes are the most efficient way to solidify large volumes of metal into simple shapes for subsequent processing. Continuous casting is one of the prominent methods of production of casts. Effective design and operation of continuous casting machines needs complete analysis of the continuous casting process.

The proposed algorithm can be used for the analysis of both stationary and moving solidification problems in which phase change occurs at a specific temperature.

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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MODIFIED INDUCTION GENERATOR

Abstract:
Wind energy occupies an important part in producing electrical energy all over the world, we are habituated to use Synchronous Generator -winded rotor or permanent magnetic-, induction Generator –squirrel cage or double fed[1]. In this paper on propose to use two machines running by one shaft, with different numbers of poles. The induction machine as main generator (high power) and a small synchronous generator as pilot one by this system we can generate electrical power from wind at all wind speeds.

Keywords:
Wind energy, induction machine, main generator

INTRODUCTION

In wind turbine we can use Induction Generator as main source and Synchronous Generator as exciter (small power). If the two machines have the same number of poles, we can find away to turn the I-G faster than the S-G, so in the beginning of operation, at low wind speed, the S-G- will give us certain voltage depending on rotating speed and excitation current.

This voltage will be applied on the terminals of I-G fig (1) so the squirrel cage I-G can work as a generator since it turn faster than S-G then by increasing the wind speed all parameters (voltage, frequency) will increase and the I-G will feed our external loads and we can inject the generated power in the grid[2].

In our laboratories by using a proto type model, small machines (Ind. &Syn.) which have the same number of poles. We did the test and prove that the I.G. can work as generators at all speed far from synchronous speed; the efficiency for our models is low. But we hope to modify it by using machines winded specially for this purpose.

THE PRINCIPLE OF MODIFIED GENERATOR

The modified induction Generator is consist of connecting the terminals of I-G to the output terminal of small pilot Synchronous Generator (permanent or winded rotor), and to run the two machines by one motor (wind power).

The number of pair poles of the two machines is equal we can use gearbox to create variable speed differences between the two machines. And if the Generators have different number of poles, then we can turn them on by the same shaft, at the same speed, but the differences in poles number must be determined for the best differences speed which gives the maximum power.

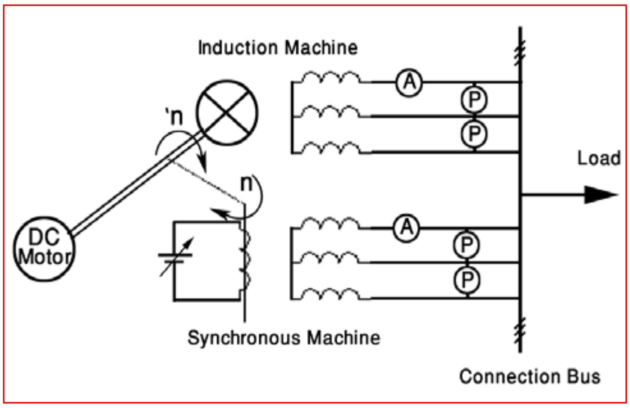


Figure1: Symbolic diagram for Modified Induction Generator

To do that in the laboratory, we connect four poles induction motor with four poles synchronous generator on the same shaft of DC machine (as wind turbine). By using mechanical speed converter, we were able to run synchronous generator in a speed, which is relatively less than the speed of the induction motor, and we start running this group by a specified speed. Whatever it was, less than the synchronous speed which is related to 50 Hz. The synchronous generator will generate alternating voltage but at low frequency.

For this reason, we have connected the induction machine to this output (low frequency). In this case, the synchronous speed of the induction motor is the same speed of low frequency. So the induction motor works as a generator and begin to gives power to the net. When the speed comes faster, the frequency and the power come higher.

Synchronous generator in this modified machine is a virtual net. It distracts induction generator.

The Modified Induction Generator Tests

A- Laboratory machines parameters:

Machine 1: *DC machine (substitute of wind turbine)*

Pn = 1.25 [Kw]; Ra = 2.9[Ω]; Rf =157 [Ω];

La = 0.13 [H]; J = 0.063 [kg.m2]

Machine 2: *Squirrel cage induction motor (suggested induction generator)*

P = 2.2 [Kw]; N = 1425 [r.p.m];

Un = 220/380 [V]; In = 9.6 / 5.5 [A]

Fn = 50 [Hz]; Cosφn = 0.77; Rst = 2.7 [Ω];

Lst = 63 [mH]; J=0.02[kg.m2]

Machine 3: *Synchronous machine (suggested virtual source):*

N = 155 [r.p.m]; Star Un = 220 [V]
In = 3.2 [A]
Delta Un= 127 [V]
In = 5.5 [A]

Uex = 220 [V]; Iex = 1.2 [A];

Sn = 1.2 [KVA]; P.F = 0.8;

Rst = 1.35 [Ω]; Rf = 127 [Ω];

Lst = 0.0102 [H]

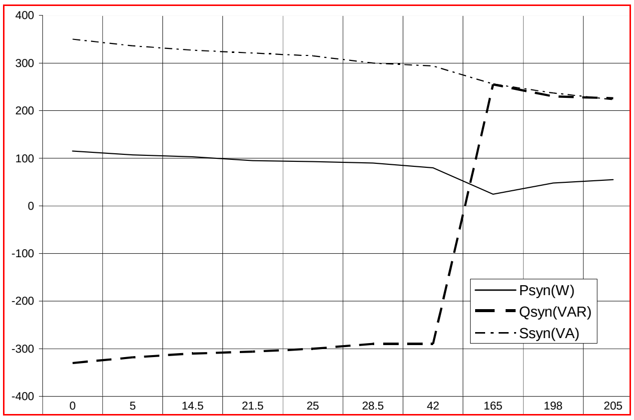
B-Laboratory tests on modified induction generator:

Using laboratory machines, and tiring to keep a constant speed differences between the I-G S-G and regulating the output voltage by changing the excitation current of Sy-G- and load we have obtain the result mentioned in table (1)

Where:

Nsyn: Synchronous Machine Speed
If: Synchronous Machine Exciting Current
Unet: Connection Bus Voltage
Isyn: Synchronous Machine output Current
Psyn: Synchronous Machine output Active Power
Qsyn: Synchronous Machine output Reactive Power
Ssyn: Synchronous Machine output Power
F: Connection Bus frequency
Iind Induction Machine output Current
Pind: Induction Machine output Active Power
Qind: Induction Machine output Reactive Power
Sind: Induction Machine output Power
Nind: Induction Machine Speed
Iload: Load current

From the laboratory results, we draw the active and reactive power for the synchronous generator as a function of load power changing (Pload) (Figure2).



	0	5	14,5	21,5	25	28,5	42	165	198	205
Psyn (W)	115	107	103	95	93	90	80	24,5	48	55,2
Qsyn (VAR)	-330	-318	-310	-306	-300	-290	-290	255	230	226
Ssyn (VA)	350	336	327	321	315	300	294	256	237	223

Figure2: Psyn, Qsyn and Ssyn as function to Pload

Table1: Laboratory test results

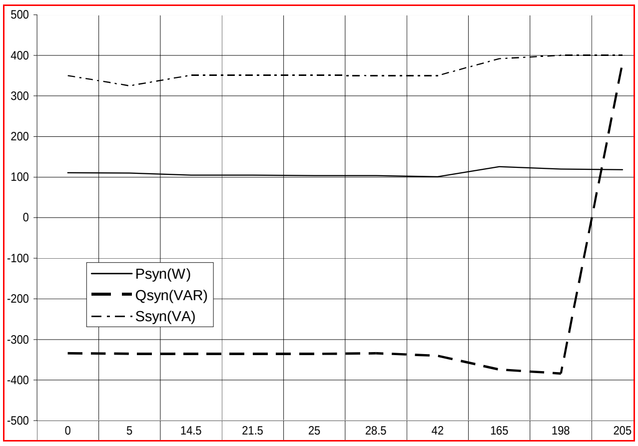
Nsyn (r.p.m)	670	670	670	670	670	670	670	670	670	670
If (A)	1.2	1.2	1.18	1.18	1.2	1.2	1.2	1.2	1.2	1.2
U net (V)	50	50	50	50	50	50	50	50	50	50
I syn (A)	6.9	6.72	6.57	6.4	6.3	6.2	6	5.1	4.7	4.6
P syn (W)	115	107	103	95	93	90	80	24.5	48	55.2
Q syn (VAR)	-330	-318	-310	-306	-300	-290	-290	255	230	226
S syn (VA)	350	336	327	321	315	300	294	256	237	223
F (Hz)	23	23	23	23	23	23	23	23	23	23
Iind (A)	7	7.03	7	7	7	7	7	7.63	7.9	7.9
Pind (w)	111	110	105	105	104	104	101	126	120	118
Qind (VAR)	-334	-335	-355	-335	-336	-334	-340	-374	-384	382
Sind (VA)	350	325	351	351	351	350	350	392	400	400
Nind (r.p.m)	750	750	750	750	750	750	750	750	750	750
I load (A)	0	0.1	0.29	0.43	0.5	0.57	0.84	3.3	3.95	4.1
P load (W)	0	5	14.5	21.5	25	28.5	42	165	197.5	205
I dcm (A)	3.2	3.2	3.7	3.8	3.8	3.8	4	5.4	5.8	5.9
U dcm (V)	170	170	170	170	170	170	170	172	175	175
P dcm (w)	544	544	629	646	646	646	680	928.8	1015	1032

Pload: load Active Power
Idcm: Prime mover machine Current (Dc Machine Current)
Ucm: Prime mover machine Voltage (Dc Machine Voltage)
Pdcm: Prime mover machine Power (Dc Machine Power)

As we see, the synchronous generator active power decrease at the end of chart when the active load get on, we also see, DC motor has consumed extra power from the net at these values.

In addition, the reactive power for synchronous generator changed also the synchronous generator current decrease in this stage, with constant output voltage.

In the entire situation, on notice that the applied frequency was 23 Hz and the voltage of the virtual net was 50V. That is mean, induction motor changed to work as induction generator at different frequency from nominal frequency (50Hz).



	0	5	14,5	21,5	25	28,5	42	165	198	205
Psyn (W)	111	110	105	105	104	104	101	126	120	118
Qsyn (VAR)	-334	-335	-335	-335	-336	-334	-340	-374	-384	382
Ssyn (VA)	350	325	351	351	351	350	350	392	400	400

Figure3: Pind, Qind and Sind as function to Pload

This test and other tests, which were repeated, assure that induction motor works as induction generator at any voltage and frequency.

But we should mention her, that the working conditions to run two machines are not easy, because the stator of induction motor supplied from low frequency /23Hz/and 50 voltage. And this is not convenient with the machine's impedance and features (it works at 220 voltage and 50H frequency). For this reason, the current consumed was very high (7A).

We did many tests on modified induction generator and we will mention some of it:

- Changing the speed of the synchronous generator with constant induction generator speed: and we have found at 100 r.p.m

Differential speed between the I.G. and S.G. and at many speeds (different working frequency) the output power of synchronous machine was maximum.

- changing differential speed between the two machines and constant voltage with same load:

We have noticed, the generated power increased with speed increasing.

SIMULATION OF MODIFIED INDUCTION GENERATOR WHICH IS CONNECTED TO THE NET

We simulate the modified induction generator by matlab program using real parameters for our laboratory machines:

We rely on libraries and the object of matlab program during the simulation [3].

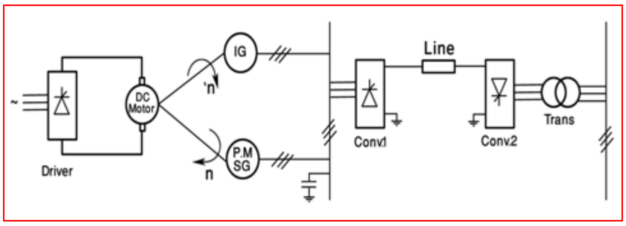


Figure4: symbolic diagram for simulated system

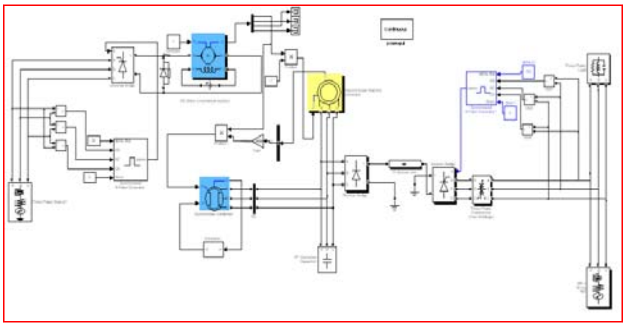


Figure5: General diagram for matlab simulated system

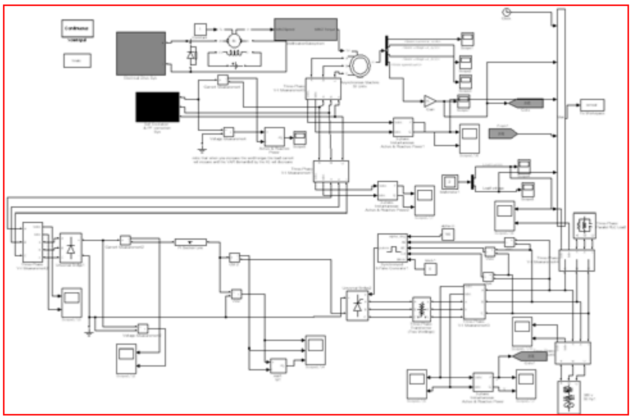


Figure6: Specification diagram for matlab simulated system

The system has made from these components:
1- Squirrel cage induction machine.
2- Permanent magnetic synchronous machine.
3-Direct current machine: the prime mover (Wind turbine)
4-Converter Bridge to drive the DC machine (Wind turbine)
5- Transition line by DC current (over head line) with (Converter_ Inverter_ Duel converter)
6- Transformer.

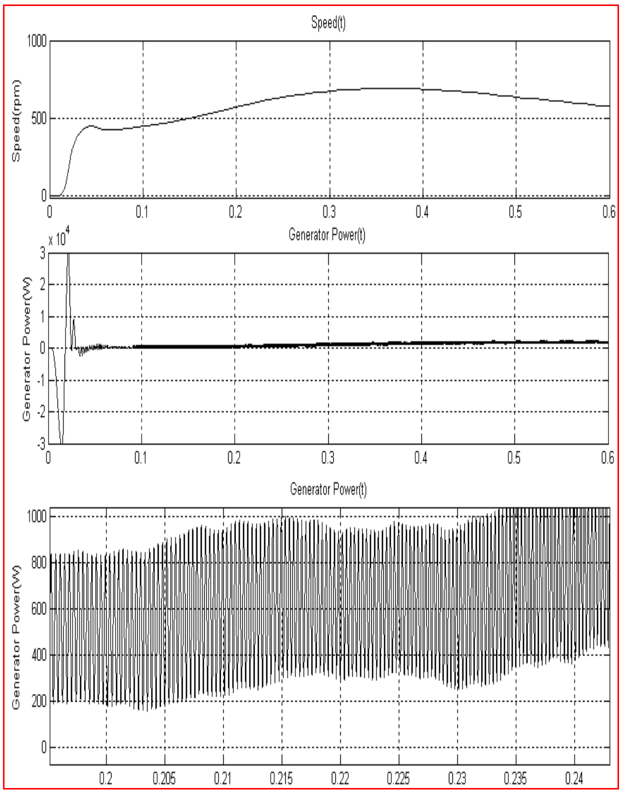


Figure7: Simulation result for modified induction generator at n=750 [r.p.m]
[speed (t); Generator power (t)]

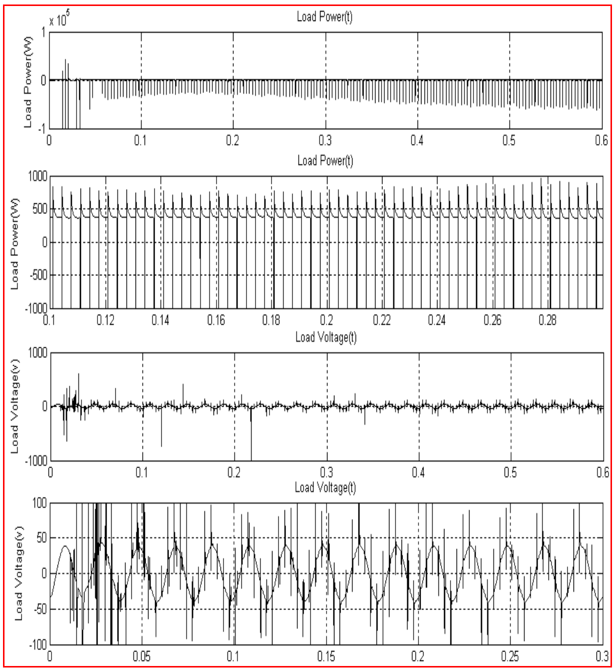


Figure8: Simulation result for modified induction generator at n=750 [r.p.m]
[Load Power (t); Load Voltage (t)]

GENERAL RESULTS

The idea of induction generator comes from the need for induction generator speed over than the synchronous speed to start work as induction generator.
And by adding capacities to the stator of the induction generator, have a big effect to decrease the speed to start generating.
But generators need high capacities, with mechanical regulator to increase the speed of rotating the cost of gear box in wind turbine reach for 1/3 from the general costs.
So we have an idea to create a virtual network from the output of synchronous generator which illusion the induction motor which is connected with it.
And as long as synchronous generator could generate on alternative voltage in any rotating speed so by using any generator kind on the axis might help to create virtual network.
And as a result we connected a group of DC machines synchronous and induction to the same axis.
The system was started from zero, and the stator wind of induction machine connected on parallel with synchronous generator.
We have noticed that, the induction motor has started to inject power and generate it as long as we increase the speed as long as we could generate a bigger power. Finally, to reach the regular frequency for the network, we can use converter inverter system or dual converter in future as an output for the whole system [4]. It allows having any voltage or frequency in any speed, whatever was speed of wind, it can give the right frequency and voltage to the network

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] ISTVÁN POMIZS

VALUES CREATED TROUGH EDUCATION FROM THE EMPLOYERS POINT OF VIEW

Abstract:

It is necessary to reinterpret the basic principles which are generally accepted as underpinning the stability and effectiveness of the market economy.

In order to recover from a crisis all strategies should include the development of education and research in addition to other effective government policies, rational fiscal discipline and the acquisition of new markets. It is very relevant to examine whether Hungary has done enough to develop the education system in parallel with its economic reforms.

The present study emphasizes the importance of more effective cooperation between the economy and education.

Keywords:

education expansion, labour market, economic processes, universities strategic changes, market- conform education

INTRODUCTION

Hungary is falling more and more behind its competitors when it comes to learning. In spite of the numerous reforms of the past years the gap in knowlwdge that separates us from the most developed parts of the world has not narrowed, but rather widened. National and international studies prove without doubt that not only the average Hungarian citizen but also young adults and students have serious shortages of knowledge.' (Fazekas Károly, Köllő János, Varga Júlia (2008) Green paper Ecostat Bp.)

These were the conclusions of the authors of a national study which shocked the Hungarian public. Given that in the present difficult situation many theories (hitherto treated as taboo) have to be rethought, this short study analyses the interaction between the economy and education. With respect to the collection of data the latest research and statistical analyses have been used. The study shows the general situation of education and employers, the opinions of students in higher education and the main indicators of our economy.

THE CURRENT SITUATION OF EDUCATION

The 'perfect' school remains a vision because state norms provide such control that quality cannot be supported. Owing to the lack of long-term development concepts institutes of education are at the mercy of political changes.

The two-level secondary school final exam has failed to deliver on its promise because higher education does not require the higher level exam; therefore, it does not require that system either. The special vocational schools cater mostly for disadvantaged youngsters and thus they try to give marketable competences to those who have never wanted nor been able to accept the teaching methods used by schools. Furthermore, larger numbers of people are *pushed out of the mainstream of education and no tangible, effective measures have been taken to deal with this situation (unless it considered to be 'effective' to put into normal schools disadvantaged students earlier taught with special methods and separated from normal students). Teaching based on skills and abilities that was promised as part of the reform of secondary education has not spread in practice.*

The continuous deterioration of the knowledge levels of disadvantaged (especially gipsy) students can hardly be compensated by the issuing of National Qualification Register diplomas; the latter often have no real vocational knowledge as their basis. It is a fact that our education system is not good at handling students with above-average or below-average abilities. Teacher training in Hungary does not have any programme that could effectively support and help the teaching and reintegration of disadvantaged youth. The number of drop-outs is frightening, and because of the high level of unemployment, integrated teaching (as a possible solution) has only resulted in a race for students and has not become a real solution.

One-third of students finishing secondary education are illiterate. Evidence shows that students are getting worse at general knowledge and the logical thinking necessary for success on the labour market in the modern world. However, this is happening while the numbers of National Qualification Register certificates and high school diplomas are rising.

HIGHER EDUCATION

The reform package of higher education has had a greater negative influence on our economic and social problems. The massive increase in the number of graduates can be dated back to the eighties. Since the eighties the number of university and colleges students has quadrupled and today there are far more students in higher education that the economy requires; this has led to the sidelining of people with lower qualifications. It is forecasted that after 2010 almost one-quarter of Hungarian citizens will have a degree. Unemployment leads to social unrest, and the money spent on training is lost due to emigration or because graduates often work in jobs that are not related to their training. It is a false hope to expect the inreased number of university graduates (too many in proportion to the population and compared to the needs of the economy) to lead us out of the economic crisis.

The initial rush appeared to be justified because Hungary had lower numbers of well-trained professionals compared to developed countries. However, the creation of new jobs did not keep up with the production of graduates. As a result of the excessive expansion of higher education the quality of that education has deteriorated. In ten years' time today's 25-35-year-olds will constitute the backbone of a highly-educated workforce; they will be responsible for advising politicians and Hungary's future may depend on them.

EMPLOYERS

In our economy companies in foreign ownership (whether partly or fully) are of great importance. They have introduced a culture that sooner or later all Hungarian companies have to master if they want to operate effectively in the global economy. It is therefore important to pay greater attention to their expectations even if their conduct leaves a lot to be desired in many areas (for example, often in the way they treat their employees).

The financial crisis has accelerated the process in which big companies try to maintain their effectiveness by searching for cheaper and cheaper labour.

Among companies employing more than 250 people (e.g. big Hungarian joint ventures or foreign companies) multinational companies employ most freshly-graduated people (27%). Positive returns include the task-supply path resulting from the matrix structure of organisation; the latter, in addition to cost rationalisation, provides an opportunity to learn about foreign cultures and organizational structures, as well as multicultural integration, and networking.

What multinational companies require from our vocational and higher education and training are independence, loyalty, effective communication, problem-solving abilities, the willingness to learn new things, emotional stability, creativity, responsibility, openness, teamwork and imaginative thinking. This means students should be taught and trained according to such criteria and this requires a change in today's methods. Conscious preparation should be carried out to fill the limited amount of posts available. Needs should be assessed. Career advisors, employment statistics, job markets, job portals and alumni systems can also help with this.

ECONOMY, UNEMPLOYMENT

Hungary's GDP was 2.3 per cent less in the first quarter of 2009 than in the first quarter of 2008. In order to guard against the crisis, only 5.5 per cent of companies plan to hire new workers. This is the tendency with the biggest companies and with companies employing 100-249 people. Companies employing 50 to 99 employees reported lower growth while companies with less than 50 employees reported higher growth. 3.4 per cent of companies producing mainly for export plan to hire workers and this is practically the same as in the last quarter. Companies producing for the Hungarian market have reported worse expectations: 5 per cent plan to hire workers (9 per cent in January) while 19.5 per cent plant to lay off workers (18.7 per cent January). The percentage of companies in full foreign ownership that plan to hire people is 3 per cent (8 per cent in the previous quarter); the proportion of those planning to lay off workers has decreased to 16 per cent from 17 per cent in January. 7 per cent of fully Hungarian companies predict expansion but none of the partly foreign-owned companies are expecting growth. This represents a 1 per cent point increase and a 3 per cent point decrease compared to the last quarter of 2008.

At the end of June 2009 the number of people employed in Hungary was 2.66 million. Private companies employed approximately 1.85 million, while state companies employed 731 thousand personnel. Considering the same period from the previous year these figures indicate a 4.1 per cent decrease: private companies laid off 6.2 per cent while the state sector hired 1.1 per cent.

Production had been increasing continuously since 2007 but this stopped in the third quarter of 2008 when the growth indicator decreased considerably. In the fourth quarter the decrease became more rapid and continued into the beginning of 2009.

59 per cent of companies reported a decrease in production while 10 per cent reported an increase. Fully foreign-owned companies are still in a better position than partly foreign-owned or fully Hungarian companies; nevertheless, all three categories have experienced decreasing results. The situation of companies with 20 to 49 employees and that of companies employing more than a hundred employees worsened slightly, while companies employing 50 to 99 employees took an even harder hit. 22 per cent of companies with more than a hundred employees have deemed their situation to be good while 12 per cent of companies employing fewer than fifty employees have given such a positive forecast.

The recession has affected employment, too.

There were 5524 freshly-graduated people registered as unemployed in August 2009; this is twice as many as five years ago. (In China there were one million students in higher education in 1998 and six million in 2008. As a result of this, 32 per cent (nearly one-third) of freshly-graduated students do not have a job.)

PROSPECTS, SURVEYS

Looking at surveys conducted among university and college students it is possible to get a picture of how they see their situation and their future.

Half of the students think they are in a worse position on the labour market in 2009 than students who graduated before the economic crisis. (Fig 1.). However, many students think that the crisis does not affect their chances of finding a job.

The students strongest expectations in connection with their degree are financial stability and social mobility (Fig 2.) On a national level the average net income was 121,700 HUF; the average salary of physical workers was 89,600 HUF, while that of those in intellectual occupations was 154,700 HUF. Net income was on average 1 per cent higher than the previous year; in the private sector there was a 3.7 per cent increase, while in the public sector there was a 5.4 per cent decrease.

The third most important point is that the respondents believe their degree will enable them to have a freer, more relaxed lifestyle. The students asked considered certain other values as being less important, such as the prestige associated with a degree and the possibility of acquiring a managerial position. The least important expectation was that with a degree a *foreign study trip or working abroad would be easier.*

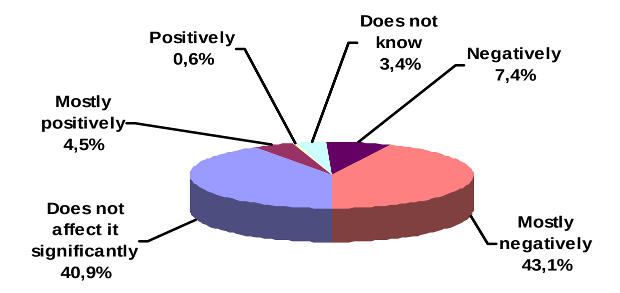

Fig 1: *How does the world economic crisis affect your chances of finding a job in your field? (%) N= 7 825 Source: Educatio-OFIK, Diplomás pályakövetés 2009-Hallgatói vizsgálat (Career paths of graduates 2009 – Student survey)*

Fig 2: *What advantages do you expect from having a degree? Source: Educatio-OFIK, Diplomás pályakövetés 2009-Hallgatói vizsgálat (Career paths of graduates 2009 – Student survey)*

The majority of students (83.9%) think they have a good chance of finding a job that they like in their professional field within one to two years of graduation, and only 13.7 per cent are pessimistic in this area. The cause of the difference in views is related to how students see the crisis and not so much to the actual influence of the crisis on the judgment of chances of employment

CONCLUSIONS

A study of the development of the career paths of graduates can greatly contribute to the up-to-date analysis of employment possibilities and the labour market. Due to state and company measures implemented to guard against the effects of the economic crisis our economy is slowly recovering. OECD data suggest that by the end of 2009 the global economy will stabilize. In Eastern European countries the recovery will take longer. Due to the foreign currency debt of households, the high rate of unemployment (around 10 per cent) and the high budget deficit, Hungary will need a much longer period to catch up with other countries. However, the message is important: Hungary will only have a chance to compete successfully if investments and other economic developments are rational and serve the needs of the market and the global society. This applies to educational reforms, too. In order to help freshly-graduated people in this fierce competition, education and companies should cooperate effectively to create higher education programmes that lay the foundation for long-term employment. Besides the state and the education system, the responsibility of students is also growing in that they have to set their sights on usable, improvable knowledge, and be hardworking and persistent.

In an ideal situation our education system should react fast to the needs of the economy and be able to transfer usable skills. It is also necessary to think of the relationship between education and the economy in the context of the lessons that can be learnt from the present crisis

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

[1.] TONI UZUNOV

EXPERIMENTAL DETERMINATION OF DYNAMIC CHARACTERISTICS OF ELECTRIC WIRE ROPE HOIST

Abstract:
Experiments are performed using realized testing facilities. The empiric equation of the hardness factor of the "rope – electrical hoist – metal structure" system depending on the rope length with rated load capacity of the hook, is received. A value of logarithmic decrement of fading of oscillations in rope and a dependency of the damper factor depending on the rope length for lifting device of electrical hoist are received experimentally.

Keywords:
Lifting device, dynamic characteristics, dynamic processes

INTRODUCTION

The electric hoist is a compact machine that features simple construction and simple service. In order to investigate the dynamic processes and increasing the reliability of operation of the electric hoist, a thorough analysis of the transition processes is required, not only for the motor but also for the system of driving and driven elements as a whole. In order to investigate the influence of the vertical oscillations of the load on the dynamic load of lifting devices the mechanical mathematical models are established [4]. Dependencies are received for the influence of the ratio of the acceleration time and the duration of the fading oscillations of the load after the completion of the acceleration process, on the minimum and maximum values of the acceleration amplitudes and dynamic force [4]. The using of mechanical mathematical models for investigation of dynamic load of electric hoist is possible with some dynamic characteristics of the lifting device. Most of these characteristics are given in the technical data for the actual electric hoist but the hardness factor c and damper factor d of elastic system of the lifting devise may be received only experimentally.

The kinematical schemes of the lifting devices contain elastic elements and the flexible element of these has the highest elasticity value. The hardness of the flexible element is not a constant value and depends on its length that varies with lifting and lowering of the load [2]. The variable hardness influences on the characteristic oscillations of the load which results in change of the ratio of the start time and the half-cycle of the fading oscillations of the load that is decisive for the dynamic load of the elements of the lifting device [1].

The subject of the investigation is to determine experimentally the hardness factor in vertical moving direction and the damper factor for elastic system of lifting device of electric wire rope hoist.

EXPOSITION

Experimental determination of the hardness factor c and damper factor d is performed for lifting device of electrical wire rope hoist of TT II

10226 type with rated load capacity Q = 500 kg, lifting height 9 m, lifting speed 8 m/min and gear ratio of the tackle u_p=2. A experimental facility shown on Fig. 1 is realized with a possibility to create static load of the hook with force F and measuring of the caused vertical movement of the roller block and longitudinal deformations of the rope.

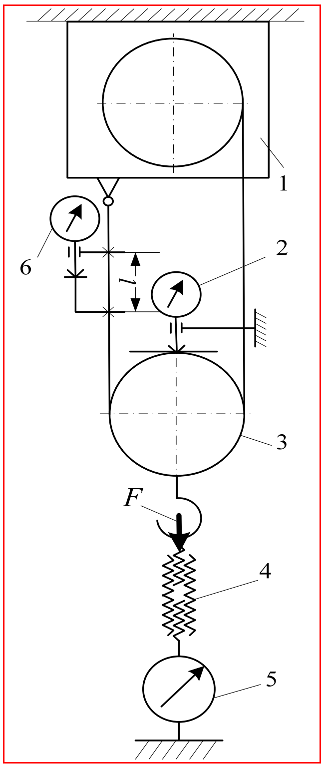

Figure 1. *Scheme of the facility for measurement of the movements of the roller block and the elongations of the rope with various loads of the hook*

The determination of the c factor for hardness of the rope – electrical hoist – metal structure system is made using the measurement of vertical movement of the movable roller block with various load of the hook.

The movement of the roller block 3 (Fig. 1) of the electrical hoist 1 is measured by indicator gauge 2 with a value per division of 0.01 mm with stand fixed to the fixed support. The hardness c_r of the rope is determined by reading its longitudinal deformation with various loading and the elongation Δl of a section with a length of l (Fig. 1) is measured through indicator gauge 6 with a division value of 0.001 mm.

The hook load is made through screw device 4 and the force value is measured by spring loaded dynamometer 5 with a sensitivity 100 N per division and range of 10000 N. 10 tests are made with seven repetitions with loading of the hood with force F up to 5000 N with a step of 500 N and following unloading.

After statistical processing of the experimental data, dependences for the deformation δ_r of the rope and the deformation δ of the whole system "rope – electrical hoist – metal structure" by the loading force F.

The rope deformation is calculated according to the following dependency:

$$\delta_r = \frac{\Delta l}{l} L \,, \qquad (1)$$

where L is the rope length, m.

The graphical interpretation of the dependencies received $\delta = \delta(F)$ and $\delta_r = \delta_r(F)$, with length L = 4,535 m are shown on Figure 2 a) and Fig. 2 b), respectively. Position 1 represents the changes in the loading deformation, and position 2 represents the unloading deformation, and position 3 represents average values of these.

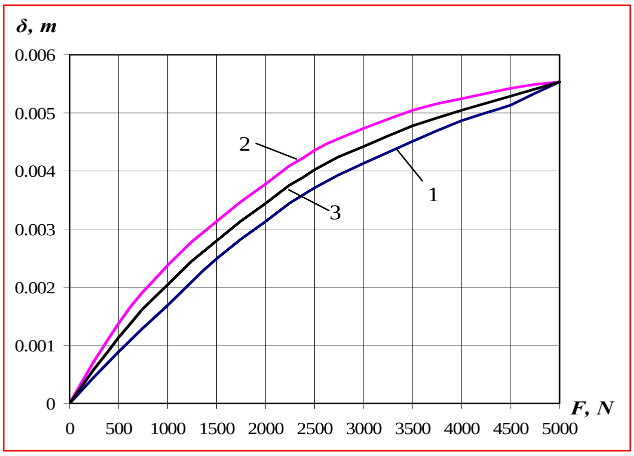

Figure 2.a Graphical relationships: $\delta = \delta(F)$

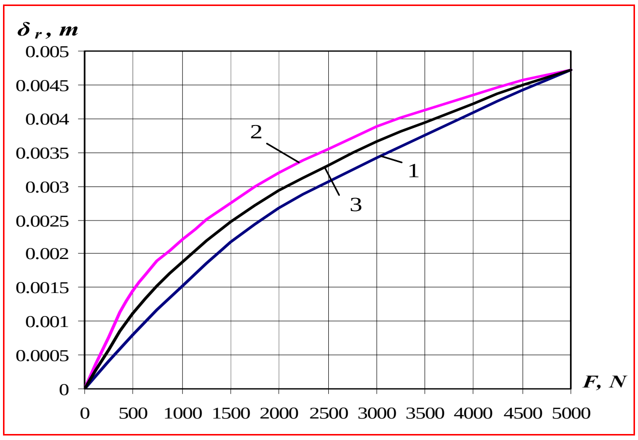

Figure 2.b. Graphical relationships: $\delta_r = \delta_r(F)$

From the graphs drawn is clear that the decreasing of the force F causes the deformation values of the system to be close to these for the rope. When compare the force F with the load capacity O of the electrical hoist, a conclusion may be made that in case of loads below 0.2 Q, the deformation of the rope is decisive for the hardness of the whole system.

Because the dynamic loads will be investigated with rated load with the experimental date with maximum load for the hardness factor of the rope c_r, a value of c_r=5,296 . 10^5 N/m, and for the hardness factor of the system c, c=9,042.10^5 N/m, respectively, are received from the following equations:

$$c_r = \frac{F_{\max}}{\delta_r}; \qquad (2)$$

$$c = \frac{F_{\max}}{\delta}, \qquad (3)$$

where

F_{max} = 5000 N is the maximum loading force;

δ_r and δ – the deformation of the rope, respectively the system, with maximum load, m.

Considering the gear ratio of the tackle and using the dependency

$$\frac{1}{c} = \frac{1}{c_s} + \frac{1}{2c_r}, \qquad (4)$$

for the c_s factor of hardness of the "electrical hoist – metal structure" system is received a value of c_s = 6,179 . 10^6 N/m.

Because of the fact that the deformation of the rope depends on its total length, using the equations (1), (2) and (4), values of the hardness factor c of the system in relation with the rope length L with rated load. Using the values received and MS Excel software the empirical equation is calculated $c = f(L)$

$$c = 3243797{,}403\,L^{-0{,}832} \qquad (5)$$

with a precision factor $R^2 = 0{,}995$.

On Fig. 3 is shown the graphical interpretation of the function (5) with the continuous line (pos. 1) and dotted line (pos. 2) represents the regression function c = f(L). From the graph received is clear that the decreasing of the rope length L from 18 to 7 m causes the hardness factor c to be slowly increasing function and in case of L lower than 7 m, the system hardness increases considerably.

In order to determine the damper factor d, the following function shall be used [2]:

$$d = 2\sqrt{\frac{cm}{1+\left(\frac{2\pi}{\nu}\right)^2}}, \text{ kg/s}, \qquad (6)$$

where m is the weight of lifted load, kg;

ν – logarithmic decrement of damping of the rope oscillations.

The logarithmic decrement of the damping of the rope oscillations is determined experimentally using the designated test facility on a base of the investigated electrical hoist shown on Fig. 4.

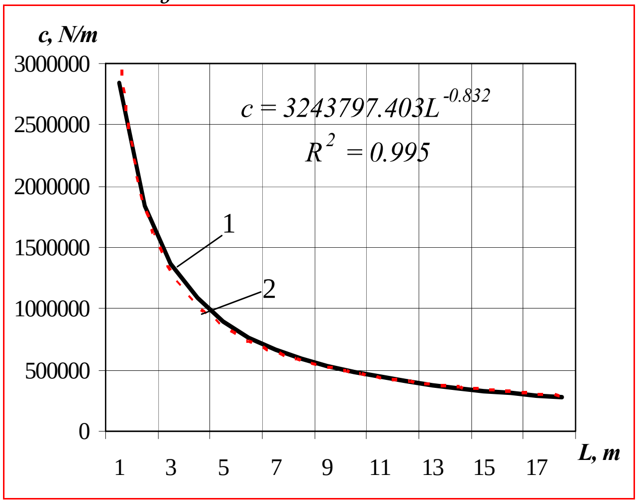

Figure 3. Function $c = f(L)$

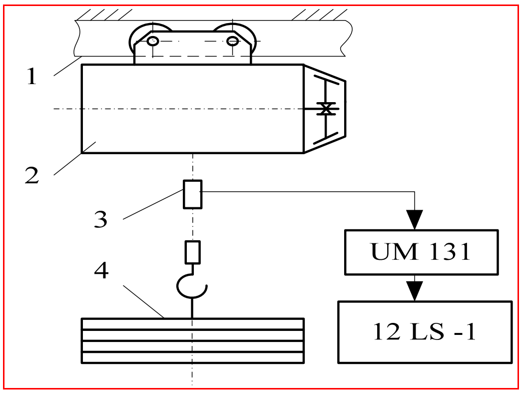

Figure 4. Experimental facility for determination of the logarithmic decrement of damping of the system oscillations

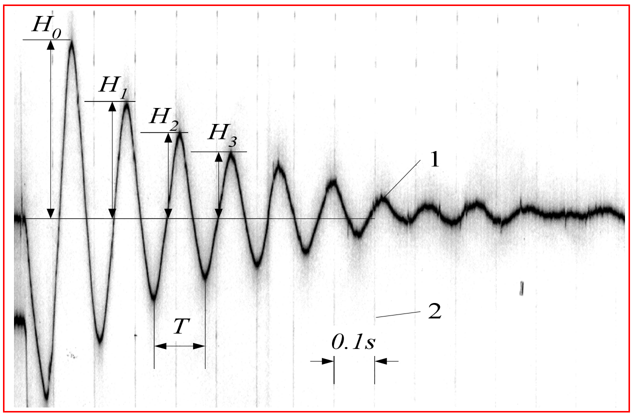

Figure 5. Oscillogram of the rope oscillations in the acceleration process during lowering the load

The electrical wire rope hoist 2 (Fig. 4) is fixed to a monorail track 1 through travel device. A strain-gauge weighting device 3 registers the *rope oscillations fixed on the top of the fixed section of the tackle developed by the authors' team [3]. The electrical signal received by the weighting device proportional to the rope force is amplified by the strain-gauge amplifier UM 131 and is recorded by light-beam oscilloscope 12LS-1 using galvanometer with characteristic frequency 1000 Hz.*

The experiments are performed with a load with a weight of 500 kg and total rope length 4 to 5 m and the oscillations in the flexible element in transitional processes are recorded. The records for each of the processes of acceleration and decelerating in the directions of lifting and lowering are repeated 4 times.

On Fig. 5 is shown an oscillograph of the rope oscillations during the acceleration in the direction of lowering the load. There are registered the signal 1 from strain-gauge weighting device and vertical marks for time 2 per 0,01 s that are generated by the light-beam oscilloscope. From the record is clear that the rope oscillations are fading with a period T with average value T = 0,1364 s is calculated after processing of the results of 16 oscillograms and using time marks.

The decrement of the damping of the oscillations is determined according to the following equation

$$\nu = \frac{1}{n}\ln\frac{H_0}{H_n}, \qquad (7)$$

where

H_0 is the maximum amplitude for the first deviation from the balanced position, mm;

H_n is the maximum amplitude of n-th successive deviation from the balanced position in the same direction, mm.

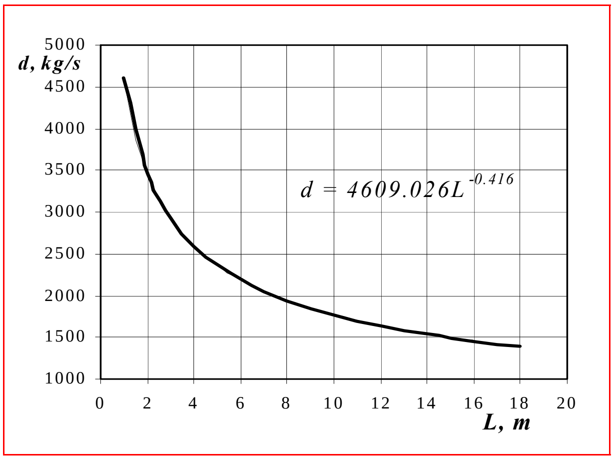

***Figure 6.** Function $d = f(L)$*

Following the statistical processing of the results of the 16 oscillographs, the average values are received for the first four successive amplitudes using which an average value of the damping decrement is received $\nu = 0{,}3593$.

Using equations (5) and (6) with load weight m = 500 kg for the damping factor d and rope length L the following empiric equation is drawn

$$d = 4609{,}026\,L^{-0{,}416} \qquad (8)$$

On Fig. 6 is shown the received function d = f(L) where is clear that in the range of the rope length the value of the damping factor is changed 3 times.

CONCLUSIONS

- *Graphical functions for the deformation δ_r of the rope and the deformation δ of the whole system "rope – electrical hoist – metal structure" where it is clear that with hook load with a force up to 0.2 Q the deformation δ_r is decisive for the whole system hardness.*
- *Empirical functions c = f(L) and d = f(L) are determined that may be used for investigations of the influence of the lifting height on the dynamic loading of the elements of the lifting device with rated loads.*

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[4.] UZUNOV T, S. STOYKOV, G. KENAROV Methods for investigation of the influence of the times of transitional processes on the dynamic loads of lifting device. under print

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ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

THE 3RD KUWAIT WASTE MANAGEMENT CONFERENCE & EXHIBITION

6TH – 8TH APRIL 2010 KUWAIT

OVERVIEW

The 3rd Kuwait Waste Management Conference & Exhibition will be held on 6 – 8 April 2010 at the Radisson SAS Hotel under the patronage of H.E. Dr. Fadel Safer, Minister of Public Works and State Minister of Municipal Affairs and with the support of Kuwait Municipality, Environment Public Authority and Public Authority of Industry.
The 3rd Kuwait Waste Management Conference & Exhibition is the region's definitive event dedicated to the waste industry. Now in its third year, the event is the leading industry forum for the latest waste technologies, solutions and products.
This 3-day event will feature valuable insights and practical experiences. Several hundred participants are expected to attend from Kuwait and nearby regions and countries, along with other international experts. With multiple technical sessions focused on municipal, industrial and medical waste management challenges, the event promises a unique opportunity for delegates to gain insights into waste management solutions, listen to regional and international case studies and network with their peers.

PROGRAM:

Kuwait Waste Management Conference & Exhibition will address all areas of waste management, including:
- *Solid waste management*
- *Construction and demolition waste management*
- *Industrial waste management*
- *Waste management for oil, gas and petrochemical industries*

- *Hazardous waste management*
- *Medical waste management*
- *Wastewater management*
- *Recycling Systems*
- *Material Recycling*
- *Landfill technologies*
- *Composting*
- *Waste-to-Energy*
- *Waste management policy, financing, planning and regulation*

If you wish to participate at the event as a speaker and have suggestions for the program, email us here info@kuwaitwaste.com

EXHIBITION:

An exhibition will be held in conjunction with the technical sessions within the conference venue. The exhibition is intended to provide an opportunity for companies, consulting and research organizations to display and demonstrate their products and services related to the subject of Recycling & Waste Management and other associated services. Interested organizations are encouraged to participate either by sponsoring the event or by taking part in the exhibition.

WORKSHOP: HEALTHCARE WASTE WORKSHOP - ADVANCED LEVEL

The effective management of healthcare waste is of vital importance to the health care sector and the people in all countries, who need to be assured that such wastes are managed and disposed of properly.

The different categories of waste normally generated from a health care setting are non-risk/non-hazardous, solid waste (household waste) as well as risk/hazardous waste such as infectious waste, sharps, pharmaceutics, chemicals and other potential dangerous waste streams. Included in the domestic waste is also 'green waste' from maintenance of grounds, and construction and demolition wastes from building activities.

Transmission of disease occurs mainly through injuries from contaminated sharps and through inhalation of bio-aerosols. Besides tuberculosis (TB), blood borne diseases - like hepatitis B (HBV), hepatitis C (HCV), and the human immunodeficiency virus (HIV) - are infections of particular concern. Toxic risks arise among others from reagents (particularly laboratory reagents), drugs, and mercury thermometers (CEC, 1993).

The personnel responsible for health care waste management, i.e. for waste minimisation, collection, transport, storage, treatment and disposal, will require access to relevant professional advice and the implementation of a sound management system adequate for the purpose. Risk assessment is required in the contexts of the protection of staff and the protection of the environment.

Due to the changes in health care processes, the quantity and quality of healthcare waste is changing. The volume of waste generated is steadily raising and materials are getting more toxic. Those responsible for health care waste are increasingly challenged to investigate further the management of health care wastes. The aim, where possible, should be to substantially reduce the volume of waste. Special consideration should be given to hazardous waste, because of its higher risks and the cost intensive specialist treatment and disposal. In particular, sound and practical systems of segregation are required.

This advanced level course is not intended for trainees without previous knowledge in healthcare waste management. The advanced training course will especially deal with the following subjects and waste streams:

- *Pharmaceutical waste*
- *Photochemical waste*
- *Cytotoxic waste*
- *Other chemical waste*

- *Contracting & pricing of waste services*
- *Occupational health & safety*
- *External transportation of waste*

TRAINING COURSE:

The overall goal of this training course is to train healthcare and paramedical staff in the principles of advanced healthcare waste management and to introduce better management processes.

Objectives of the training course

The main objective of the training is to increase the know-how of responsible persons for healthcare waste management in for waste management in their hospital. The participants will learn how to plan, set up and independently run advanced healthcare waste management systems of a health institution. After the course, the employees will know how to deal with more complex waste streams and how to reduce occupational health impacts by hazardous waste. They will know how to react in case of emergencies and injuries and how to use more advanced waste management tools.

Target Audience

The training is targeting employees of the middle or higher management level of a healthcare institution who are responsible for the monitoring and management of the safe handling of healthcare waste. It is expected that the participants have a basic knowledge in healthcare waste management.

Tutorial Design and teaching method

The course is a mix of informative theoretical lessons and interactive workshops (lectures/ presentations). The lessons are based on simulations, questions, exercises, and practical demonstrations undertaken by qualified trainers to make learning enjoyable and to encourage a high level of knowledge retention. Following the training, participants' performance will be evaluated.

Topics covered

The tutorials are practical orientated and covers a wide range of topics, including:

- *Tasks and responsibilities of an healthcare waste officer*
- *Job description, SOP, MSDS, etc. for healthcare waste management*
- *Advanced planning of modern healthcare waste systems*
- *Recycling of hazardous and non-hazardous waste*
- *Management of complex waste streams including*
  - *Pharmaceutical waste*
  - *Chemical waste*
  - *Cytotoxic waste*
- *Photochemical waste*
- *Contracting of waste treatment & disposal*
- *External logistic aspects*
- *Management methods for different types of waste*
- *Development and implementation of waste management plans*
- *Alternative treatment methods for bio-hazardous waste*

CALL FOR PAPERS:

Authors are invited to submit an abstract of the proposed paper in English or Arabic. It should state clearly the objectives, subject matter and conclusions to be presented in the full paper. Selection of papers will take account of originality, relevance, and likely interest to delegates.

Papers should be of technical nature and we recommend that authors take an exhibition stand should they wish to support their presentations with commercial material.

ABSTRACT SUBMISSION:

Send abstracts via email to: program@kuwaitwaste.com

Abstracts should be submitted in a Word Document file or PDF, maximum one A4-page in length. The abstract should contain a full title, the names and addresses of the authors, and contact person details.
Please include full name, address, email address and phone number for the contact person and lead author.

DEADLINES:

- *Abstracts Due: December 31, 2009*
- *Abstract Acceptance Due: January 15, 2010*
- *Final Version Due: February 15, 2010*
- *Conference and Exhibition: April 6th - 8th, 2010*

It may be possible to accept a small number of late submissions.

CONFERENCE LANGUAGES:

The official conference languages are English and Arabic. Papers, visual materials, and other documents will be presented in the English or Arabic languages.
Correspondence regarding all aspects of the abstracts or technical papers should be sent preferably by e-mail to the Technical Committee at program@kuwaitwaste.com .

SHORT COURSES:

Short courses will be offered for an additional cost in conjunction with the Conference. The short course topics will be announced in our next mailing. Any company specialized in a subject matter and wishes to propose a course should contact the Technical Committee Chairman.

FOR MORE DETAILS:

Please Contact The Technical Committee Kuwait waste Management Conference & Exhibition

- *P.O. Box 1242 Dasman, 15463 Kuwait*
- *Tel: +965 24342828*
- *Fax: +965 24330809*
- *E-mail: program@kuwaitwaste.com*

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

3RD INTERNATIONAL CONFERENCE FOR ENTREPRENEURSHIP, INNOVATION AND REGIONAL DEVELOPMENT - ICEIRD 2010

THEME:

ENTREPRENEURSHIP BEYOND CRISIS - CHANNELLING CHANGES TO ADVANTAGE

NOVI SAD, SERBIA

27 - 29 MAY 2010

ORGANISED BY

UNIVERSITY OD NOVI SAD,
FACULTY OF TECHNICAL SCIENCES,
DEPARTMENT FOR INDUSTRIAL ENGINEERING AND MANAGEMENT
UNIVERSITY OD NOVI SAD, UNESCO CHAIR IN ENTREPRENEURIAL STUDIES
CISCO ENTREPRENEUR INSTITUTE, TRAINING CENTER SERBIA

TARGET AUDIENCE

The conference is addressed at national and regional government representatives in all countries of South-East Europe, who are involved in the process of policy making in the area of Innovation, Entrepreneurship and Regional Development. Special target group are enterprises, as well as non-governmental organizations active in conference topics.
The conference brings together policy makers, experts, practitioners, professors, business people and scientists in this subject area. ICEIRD 2010 will make a contribution to policy making and new ideas

on competitiveness in the region. Special target audience are students, young researchers, scientists, and their supervisors from academia and industry to present actual research projects and results.

OBJECTIVES AND SCOPE OF THE CONFERENCE

We live in a time of change, in a fast evolving, increasingly global and competitive economy. Sustaining a competitive advantage requires that individuals, companies, and nations anticipate, stimulate and manage change rather than simply react to it. This is what entrepreneurship is about: channeling change to your advantage. New ideas generate new realities and this requires knowledge from different disciplines and the ability to combine such insight with the daily practical realities of business life.

We hope that ICEIRD 2010 will give small contribution how to achieve this delicate balance by itself combining both theory and practice, gathering in the same place decision makers (government, ministries- and state agencies), scientists (universities, research and development centres, start-up. centres and incubators) and practitioners (SME's) in order to discuss topic that are of crucial importance for national competitiveness and increased regional development in the South East Europe. The key areas of the conference are:

- *Entrepreneurship as a process of identifying opportunities and putting useful ideas into practice; Innovation as the driver of national, regional and global economy;*
- *Regional development and the possibilities and barriers for closer cooperation between South East European economies.*

MISSION:

Mission of the International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD) is to strengthen the entrepreneurial spirit and help develop and sustain economic growth by fostering innovation, through the academic knowledge and expertise. ICEIRD Consortium has been established to provide a multi-disciplinary and cross-sectoral forum for researchers, practitioners, and policy makers in the field of innovation and regional development, and a means for sharing findings that promote innovation and therefore enhance economic, technological and regional socio-economic development through new economic activities that stimulate generation of wealth through entrepreneurial and sustainable employment and growth and thus increase competitiveness as well as civil society development and enhancement via the inter-networking of disciplines, researchers, policy makers and practitioners in diverse countries in the region.

The ICEIRD Consortium drives research agenda in the field of technology, innovation and entrepreneurship and regional economic development. It is one of the premium and pioneering consortia that successfully and effectively link theory and practice through well-established research outputs and annual meetings.

TOPICS OF INTEREST

Creativity, Complexity and Competitiveness Issues for Small and Medium Enterprises (EU and other)

- *Leveraging e-skills for Innovation in the Knowledge Society*
- *Managing and Leveraging Complexity, Creativity and Innovation in SMEs*
- *Trust, Respect, Culture and Collaboration Issues for SMEs in SEE vs. other regions (EU)*
- *Leadership and Management practices that can be applied to SMEs*
- *SME Business process modeling, SME Knowledge management and technology transfer*
- *New Technology Ventures Financing*
- *Business incubation management and leadership*
- *Human Resources Practices for promoting innovation for SMEs*

South East European Entrepreneurial and Innovation Clusters

- *SMEs' Entrepreneurship as an Innovation Driver*

- *Opportunities and barriers for closer cooperation between South East European SMEs*
- *Strategic Integration vs. Flexibility and SME Competitiveness*
- *Innovation Clusters, Technology Transfer and Social Entrepreneurship*
- *Social Networking as Driver of EICs formation*
- *Science & Technology Parks and EICs*
- *Young and Women Entrepreneurs development via EICs*
- *Benchmarking of Entrepreneurship and Innovation Best Practices in the region*
- *Innovation policy in SMEs*

Technology Innovation, Transfer and Commercialization across Governement, University,

- *The role of the State and Public Policy with regards to SME Innovation and Entrepreneurship*
- *Governmental and regional policies on entrepreneurship and innovation*
- *Entrepreneurial Universities and Entrepreneurial Innovation Clusters*
- *Entrepreneurship education, University – Industry collaboration*
- *Innovative supply chains, Innovative Supply Chain Management practices in SEE*
- *SMEs and the role of the Innovation Zone (business centers and incubators)*
- *Intangibles Valuation and Intellectual Property Rights*

IMPORTANT DATES

Submission of abstracts: 22nd January 2010
Notification of acceptance: 26th February 2010
Submission of papers: 26th March 2010
Submission of camera ready full papers: 23rd April 2010
Early egistration and author registration: 23rd April 2010

SCIENTIFIC COMMITTEE – Conference Chair

Dr. Zoran Anisic, University of Novi Sad, Novi Sad, Serbia

SCIENTIFIC COMMITTEE – Conference Executives

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Professor Vojin Senk, University of Novi Sad, Novi Sad, Serbia
Dr. Jaka Vadnjal, GEA College for Entrepreneurship, Piran, Slovenia
Professor Colin Williams, University of Sheffield, Sheffield, United Kingdom

SCIENTIFIC COMMITTEE – Committee Members

Mr. Adi Kovacevic, WUS Austria, Graz, Austria
Mr. Anthony Gribben, European Training Foundation, Turin, Italy

GOALS

The objective of ICEIRD Consortium is to establish an effective channel of communication between policy makers, government agendas, academic and research institutions and persons concerned with *the latest research, scientific development and practice on innovation and regional development, with the following goals:*

- *To bridge the gap between academic and industry through applied research on technology, innovation and entrepreneurship and regional economic development*
- *To foster knowledge transfer and collaboration between the academic and industry sectors in emergent technology, system and model contexts*
- *To organize annual conferences/workshops to meet with members and participants and disseminate latest research and practice*
- *To publish results of projects in quality academic and professional journals, books, handbooks, proceedings, and reports.*
- *To generate funding from sources such as local government and research councils for furthering and developing new projects that could benefit the regional and country economy and industry by sharing of experiences and know-how between regions and countries*
- *To work in partnership with industry on specific entrepreneurial challenges, or innovative ideas*
- *To drive international research collaboration on projects related to innovation and regional development.*
- *To serve as the resources and expertise's hub on entrepreneurship and innovation by providing an ICEIRD consortium platform and a knowledge bank.*
- *To infuse and pump knowledge and expertise into improving the competitiveness of enterprises in developing countries.*
- *To be the first successful international network that enables exchange and transfer of knowledge, expertise and resources between developed and developing countries (the real global innovative chain)*

BACKGROUND

The International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD) Consortium was formally established in 2008. It is a multi - disciplinary and cross-sectoral network crossing several streams of theory and practice, namely entrepreneurship, innovation, regional economic development and information systems. The ICEIRD Consortium was set-up with members from institutions jointly researching and collaborating in strategising/organising the annual ICEIRD conference and managing joint projects focused on the theory, policy and practice of entrepreneurship and innovation in particular as it pertains to information technologies. One of the higher concern features of the so-called European Innovation Paradox is the divide between academic research and policy-making, between thinkers and doers. The ICEIRD can become an authoritative reference in bridging this gap by developing analysis in the field of innovation and regional policy, based on high-level academic research, but without neglecting the lessons learnt by policy makers and professionals in the field. Thus establishing experiential feedback learning loops and cross fertilization among two communities which have lived too far away from each other for far too long, and in the European Union in particular.

SUBMISSIONS

Paper Submission - Academic papers accepted and presented at the conference will be published in the Conference Proceedings. Selected papers will be also published in a special issue of the International Journal for Innovation and Regional Development (IJIRD), Interscience Publisher Ltd. As well as full academic papers, the following submissions are welcomed and will be published in the Booklet of Abstracts:

- ***Case Study Submissions** - Presentations from individuals or companies working in the field*
- ***Practitioner Contribution** - Contributions, either presentations or demonstrations, from individuals or companies working in the field.*

- ***Institutional Contribution*** *- Contributions, either presentations or demonstrations, from institutions working in the field (agencies, chambers, tehnoparks, incubators, municipal offices, etc.)*

Abstract details: *All submission types require an abstract up to 300 words in the first instance, to be received b 22 January 2010.*

Full paper: *Only required for academic paper submissions once the abstract has been selected, no more than 6-8 pages to be received 26 March 2010. Papers should be submitted as DOC. and PDF. files through Easy Chair conference system.*

LOCATION

Novi Sad is located in the southern part of Europe, in Serbia and lies on the left bank of the river Danube. It is the second largest city in Serbia.. In contrast to many other European destinations, has the reputation, by full right, of a multinational, multicultural and multi-confessional metropolis in which all differences are seen as advantages. The witnesses to that are Novi Sad Theatre/Újvidéki Színház and University of Novi Sad with 19 faculties and specialized departments at which the lectures are held in languages of national minorities or were founded with that purpose. Still, there are so many other things that represent a daily, lively routine of Novi Sad. Novi Sad is quite sensitive to its bridges. 134 pontoon bridges have been constructed from 1720s until 1920s. The history of these bridges is another story, a story so special that sometimes Novi Sad was called "the town where river runs above the bridges". Novi Sad is a simple city, hospitable and open-hearted to all of its visitors, built by measure of a man. It is a city one gets to know and love easily, but also a place hard to forget and leave forever.

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ACTA TECHNICA CORVINIENSIS
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VIIth INTERNATIONAL CONGRESS "MACHINERY, TECHNOLOGY, MATERIALS" – INNOVATIONS FOR THE INDUSTRY

26. – 28.05.2010
SOFIA, BULGARIA

INVITATION

The SEVENTH INTERNATIONAL CONGRESS "MACHINERY, TECHNOLOGY, MATERIALS'10" will be carried out together with the EXHIBITION OF MECHANICAL ENGINEERING MECHTECH'10 in Inter Expo Center Sofia.
Together and collaborating these two events will form the industrial forum "MACHINERY, TECHNOLGY, MATERIALS – INNOVATIONS FOR THE INDUSTRY". We hope that in this way the Congress will become a bigger innovation mediator between scientific research and industry.
The program of the Congress offers you different ways to present the results of your research in front of you colleagues and the representatives of the industry. We invite you to take advantage of these opportunities.
*Beside the international congress **MTM'10** and MECHTECH'10 the INDUSTRIAL FORUM includes: EXHIBITION MECHTECH in the halls of INTER EXPO & CONGRESS CENTER OF SOFIA and Innovations exchange and consulting services for the Industry.*
*We invite you to take part (personally or by correspondence) in the VII INTERNATIONAL CONGRESS **MTM'10** with publishing of your papers or messages on innovative technical solutions for the industry. You are welcome to participate either in the common stand "SCIENTIFIC INNOVATIONS FOR THE INDUSTRY" which is organized by us.*

TOPICS:

01. MACHINES
02. TECHNOLOGIES
03. MATERIALS

SCIENTIFIC PROGRAM:

- *PLENARY SESSION with ordered papers*
- *SECTIONAL SESSIONS in the congress halls of Inter Expo & Congress center*
- *POSTER PRESENTATIONS OF PAPERS at the congress stand in the exposition of the Forum*
- *Participation with models, prospects, samples and/or multimedia presentations at the "SCIENTIFIC INNOVATIONS FOR THE INDUSTRY stand in the Forum's exposition.*

OFFICIAL LANGUAGES AT MTM'10: BULGARIAN, RUSSIAN, ENGLISH

PUBLICATIONS:

- *In separate volume ISSN 1310-3946 of the proceedings for each topic session, which will be lodged in St.St. Cyril and Methodius National Library and Central Scientific-technical Library in Bulgaria*
- *In CD, containing all papers.*
- *Detached issue of the International virtual scientific-technical journal "MACHINERY, TECHNOLOGY MATERIALS" (ISSN 1313-0226). This publishing is at will and requires additional payment.*
- *Author's scroll, containing the title page, the content of the volume and printed copy of the author's paper with the page numbers from the Proceedings.*

IMPORTANT DATES:

- *Sending the full text of the paper and Application Form "A":15.02.2010*
- *Confirmation of the paper receiving: 01.03.2010*
- *Payments and Application Form "B": 15.03.2010*
- *Announcement of the plenary and sectional sessions program on our web page: 15.04.2010*
- *The Organizing Committee will receive posters up to: 15.04.2010*
- *Receiving of the application for transfer: 14.05.2010*
- *Registration of the participants: 25 and 26.05.2010*
- *Opening of the congress: 26.05.201*

TIME AND SPACE:

26 - 28. 05. 2010,
Inter Expo Centre,
bul. „Tzarigradsko shose" №147,
SOFIA – BULGARIA

SECRETARIAT:

SCIENTIFIC-TECHNICAL UNION OF MECHANICAL ENGINEERING
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2ND INTERNATIONAL CONFERENCE MANAGEMENT OF TECHNOLOGY - STEP TO SUSTAINABLE PRODUCTION MOTSP 2010

2 – 4 JUNE 2010
ROVINJ, CROATIA

AIMS AND SCOPE

International Conference "Management of Technology - Step to Sustainable Production" (MOTSP 2010), *will take place from 02-04 June 2010 as a joint project organized by the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Faculty of Graphical Arts, Croatia, Faculty of Management, University of Primorska, Koper and University of Maribor, Faculty of Mechanical Engineering, Slovenia.*

The main objective of this International Conference (MOTSP 2010) is to gather international experts from academic entities, research laboratories and industries related to the field of Management of Technology and Sustainable Production. The Conference will also provide a platform for sharing knowledge, ideas and results between science and industry.

The management of technology, the stimulation of innovation and invention and the transfer of technology are considered important challenges of the developed countries and countries in transition.

MAIN TOPICS:

- *Management of Technology*
- *Production, Operation Management*
- *Strategic, Engineering Management,*
- *Industrial Engineering*
    - *Operational Research*
    - *Logistics*

- *Production Economics*
- *Decision and Risk Analysis*
- *Manufacturing Costs*
- *Supply Chain Management, Total Quality Management*
- *Forecasting, Technology Foresight*
- *Business Intelligence*
- *Maintenance, etc*

- *Rapid Prototyping and Manufacturing*
- *Computer Integrated Manufacturing CAD, CAM, CAPP, CAQ,.*
- *Artificial Intelligence*
- *Total Cost Assessment*
- *Sustainable Production*
    - *Product Lifecycle Management (PLM)*
    - *Green Production (BAT)*
    - *Clean Production*
    - *Eco Design*
    - *LCM (Life Cycle Management) & Decision Supports*
    - *LCA (Life Cycle Assessment)*
    - *LCI (Life Cycle Inventory)*
    - *LCIA (Life Cycle Impact Assessment)*
    - *Extended Products*
    - *SLCA (Social Life Cycle Assessment)*
    - *Renewable Sources of EnergyEnergy Efficiency and Audit*
    - *Energy Efficiency and Audit*
    - *Eco Labeling*
    - *Recycling*
    - *Reverse Logistics*
- *Social Responsibility*

GENERAL INFORMATIONS:

Deadline for abstract submission: ***January 15th, 2009***
Submission of paper titles and abstracts (up to 100 words) using abstract submission form at motsp2010.info
Notification of acceptance of abstracts: ***January 20th, 2009***
Final submission of full papers: ***March 15th, 2010***
Notification of the acceptance of full papers: ***April 15th, 2010***

CORESPONDENCE ADDRESS:

Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Ivana Lučića 5, 10 000 Zagreb, Croatia
Assoc. Prof. Predrag Ćosić, Ph.D., Head of Department of Industrial Engineering
Secretary: Nataša Tošanović, B.Sc. Mech. Eng.
Phone 385 1 61 68 355 Fax: 385 1 6157 123
E-mail: motsp2010@fsb.hr
URL: motsp2010.info

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

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:

Abstract submission deadline: ***1st March 2010***
Notification to Authors: ***1st April 2010***
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,
UNIVERSITY OF NOVI SAD, SERBIA
FACULTY OF TECHNICAL SCIENCES
Trg Dositeja Obradovića 6,
21000 Novi Sad, Serbia
azoran@vts.su.ac.rs
http://www.ftn.ns.ac.yu/MCP-CE2010/info.php

10th INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC GEOCONFERENCE & EXPO SGEM 2010

MODERN MANAGEMENT OF MINE PRODUCING, GEOLOGY AND ENVIRONMENTAL PROTECTION

20-25 JUNE 2010

ALBENA SPA & RESORT COMPLEX, BULGARIA

INVITATION

We are pleased to inform you that the 10th Anniversary International Multidisciplinary Scientific GeoConference SGEM 2010 will be held in the period of 20-25 of June, ***2010 at FLAMINGO GRAND congress centre of ALBENA SPA & Resort Complex, Bulgaria.***

Continuing the tradition of previous SGEM conferences, SGEM2010 *will bring together again researchers, educators, and experts representing research and educational institutions, companies, government agencies and consulting organizations from all over the world to discuss on the questions concerning the contemporary geosciences, to exchange ideas and to propose potential solutions of problems related to the global changes.*

The new aspects of the 10th Anniversary International Multidisciplinary Scientific GeoConference are:

- ***Parallel scientific sessions.*** *Besides conference Hall FLAMINGO GRAND (capacity of 250 seats) another three new conference halls will be available (capacity of 80, 120 and 170 seats);*
- ***Separated MD/PhD sessions;***
- ***Special workshops*** *will be conducted as a parallel to the conference events;*
- *Paper abstracts will be accepted for publishing and presentation after* ***double-blind peer review process;***
- *Presenting* ***new special exhibits of rocks and mineral specimens and fossils;***
- ***Enlarging SGEM EXPO*** *popularity and increasing its participants;*
- *SGEM participants will recieve* ***a special reduction in the price of many entertainment services*** *in Albena Complex as - riding, paintball, tennis, carting, fitness, spa-procedure and many more...*

The OnLine registration in the 10th Anniversary International Multidisciplinary Scientific GeoConference SGEM 2010 & EXPO HAS JUST OPENED.
You are welcome to join this event. *For more information, please visit our website: www.sgem.org*
Looking forward to welcoming you at the ***10th GeoConference & EXPO - SGEM 2010!***

MAIN TOPICS:

1. *Section "Geology"*
2. *Section „Hydrogeology, Engineering Geology and Geotechnics"*
3. *Section "Exploration and Mining"*
4. *Section „Mineral Processing"*
5. *Section "Oil and Gas Exploration"*
6. *Section „Applied and Environmental Geophysics"*
7. *Section „Geodesy and Mine Surveying"*
8. *Section „Photogrammetry and Remote Sensing"*
9. *Section „Cartography and GIS"*
10. *Section „Informatics"*
11. *Section „Geoinformatics"*
12. *Section „Micro and Nano Technologies"*
13. *Section „Hydrology and Water Resources"*
14. *Section „Marine and Ocean Ecosystems"*
15. *Section „Forest Ecosystems"*
16. *Section „Soils"*
17. *Section „Air Pollution and Climate Change"*
18. *Section „Renewable Energy Sources and Clean Technologies"*
19. *Section "Nuclear Technologies"*
20. *Section "Ecology and Environmental Protection"*
21. *Section „Recycling"*
22. *Section „Environmental Economics"*
23. *Section „Education and Accreditation"*
24. *Section "Environmental Legislation, Multilateral Relations and Funding Opportunities"*

IMPORTANT DATES:

Abstract Submission: ***10 March 2010***
Full paper Submission: ***10 May 2010***
Poster Submission: ***20 May 2010***
Registration and payment for participants WITH papers: ***10 May 2010***
LATE Registration and payment for participants WITH papers /you should pay registration fee +15% in addition, if NOT your paper/s will be excluded from the proceedings and the programme: ***11 - 20 May 2010***
Registration and payment for other participants /after that date you should pay registration fee +15% in addition: ***30 May 2010***
Booking Hotel by Name: ***1 May 2010***

CORESPONDENCE ADDRESS:

URL: http://www.sgem.org
E-mail: sgem@sgem.org
Fax: +359 2 817 24 77

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

THE 1ST CONFERENCE "MAINTENANCE 2010"

ODRŽAVANJE 2010 MAINTENANCE 2010

JUNE 10-13 2010,
ZENICA, B&H

INVITATION

Faculty of Mechanical Engineering in Zenica organizes the 1st Conference "MAINTENANCE 2010".
Conference objectives are:

- Gathering of people engaged in maintenance funds for the operation of various aspects and their structural organization,
- Communication of the research results in the field of maintenance, as theoretical and practical,
- Exchange of experiences from practical maintenance activities,
- Transfer of knowledge in the field of maintenance.

Organizing Committee would like to invite all potential authors and participants to submmit abstracts (up to 100 words), not later than Januar 31st 2010.
The official Conference languages are English, Bosnian, Serbian and Croatian.

MAIN TOPICS:

The Conference will be performed as follows: plenary session (Key papers concerned global topics), symposium (papers according to the conference topics) and workshops, when needed.
We would like to inform all the potential authors to prepare papers in the following topics:

- TECHNOLOGY MAINTENANCE
- RELIABILITY AND MAINTENANCE
- LOGISTICS IN THE MAINTENANCE
- QUALITY AND MAINTENANCE
- MONITORING AND DIAGNOSTICS
- MENADŽEMENT AND MAINTENANCE
- INFORMATION SYSTEMS MAINTENANCE
- NEW TECHNOLOGIES IN THE MAINTENANCE
- EDUCATION MAINTENANCE
- ECOLOGY AND MAINTENANCE

ORGANIZING COMMITTEE:

- Dr. SAFET BRDAREVIĆ - president,
- Dr. SABAHUDIN JAŠAREVIĆ - secretary
- Dr. MUSTAFA IMAMOVIĆ,
- AMIR ABAZOVIĆ, B.Sc.
- NUSRET IMAMOVIĆ, B.Sc.
- MERIM ALIĆ, student

PROGRAM REVIEW COMMITTEE:

- DR. SAFET BRDAREVIĆ, (B&H) - PRESIDENT
- DR. BOJAN AČKO (SLOVENIA)
- DR. ŽIVOSLAV ADAMOVIĆ (SERBIA)
- DR. RANKO ANTUNOVIĆ (B&H)

IMPORTANT DATES:

Submission of abstracts: January 31st 2010
Notification of acceptance of the abstracts and instructions for preparing papers: February 15th 2010
Submission of the full paper: April 15th 2010
Registration fee payment: May 15th 2010
Final programme: May 15th 2010
"Maintenance 2010": June 10th-13th 2010

TIME AND VENUE:

The conference will be held from 10th to 13th June 2010 in Zenica, Bosnia and Herzegovina.
Zenica is a town in the Zenica-Doboj Canton, in the central part of Bosnia and Herzegovina. Area of the city is 500 km2, population is about 130 thousand.Economic center of the geographic region of central Bosnia and near Travnik and Jajce, the most important city in that part of the state.

CORESPONDENCE ADDRESS:

FACULTY OF MECHANICAL ENGINEERING IN ZENICA Fakultetska 1
- For Conference Maintenance 2010 -
72000 ZENICA
BOSNIA & HERCEGOVINA
You can get all the information regarding the Conference at:
Phone: +387 32 449-143; +387 32 449-145
Fax: +387 32 246-612
You can also contact:

- Prof.dr. Safet Brdarević
- Doc.dr. Sabahudin Jašarević

E-mail:

- sjasarevic@mf.unze.ba;
- sjasar@yahoo.com;
- sbrdarevic@mf.unze.ba

Conference Maintenance 2010: http://www.unze.ba/odrzavanje/index.htm

ACTA TECHNICA CORVINIENSIS
BULLETIN OF ENGINEERING

SCIENTIFIC EVENT

XXIV. MICROCAD
INTERNATIONAL SCIENTIFIC CONFERENCE

18-20 MARCH 2010, MISKOLC, HUNGARY

INVITATION

The primary aim of the conference is to give an opportunity to the Hungarian and foreign experts, researchers and PhD students to present their latest results in the accredited scientific fields of the University of Miskolc, as well as to meet, establish and cultivate personal and professional relations.

MAIN TOPICS:

Sections	Code
Energy Management	A
Waste Processing and Recycling	B
Geographical Information Systems and Their Applications	C
Metal Extraction, Processing and Energy Utilization	D
Materials Science and Technology	E
Fluid and Heat Engineering	F
Applied Mechanics	G
Mathematics and Computer Science	H
Physics and Physics Education	I
Automation and Telecommunication	J
Electrotechnics and Electronics	K
Machine and Construction Design	L
Material Processing Technologies	M
Production Engineering and Manufacturing Systems	N
Applied Information Engineering	O
Material Flow Systems. Logistical Information Technology	P
Economic Challenges in the 21st Century	Q
Humanities	R
Health Science	S

GENERAL INFORMATIONS:

*Papers of the conference will be published in section proceedings. The format of the **ready-for-print paper**, as an example, can be downloaded from the website of the conference. The maximum length of the ready-for-print paper is 6 (A4) pages. One copy of the **ready-for-print paper** of the presentation shall be posted **in printed form** and shall also be sent **electronically by uploading it** at www.tuko.hu/microcad_upload.php **in PDF format exclusively.** No other formats are possible.*

IMPORTANT DATES:

Registration on-line, sending ready-for-print typescripts of papers:	***10 January 2010***
Participants shall be informed about the acceptance of papers by:	***20 January 2010***
Transferring the registration fee:	***15 February 2010***
Programme booklet is available at the INTERNET:	***26 February 2010***
The registration desk of the conference will be open on:	***17-18-19 March 2010***

REGISTRATION:

Applicants will be included in the programme booklet if the following conditions are fulfilled:

1. ***On-line registration** at **http://www.uni-miskolc.hu/~microcad** till 10 January 2010;*
2. ***The printed** and the **electronically uploaded versions** of the ready-for-print paper reach the organisers till 10 January 2010.*
3. *The Scientific Committee of the Conference accepts the paper(s).*
4. *The registration fee is transferred.*

CORESPONDENCE ADDRESS:

UNIVERSITY OF MISKOLC
DEPARTMENT OF RESEARCHES MANAGEMENT AND INTERNATIONAL RELATIONS
H-3515 MISKOLC EGYETEMVÁROS
e-mail: rekveres@uni-miskolc.hu

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]

REFERENCES

[1] AUTHORS. YEAR. TITLE OF REFERENCE, JOURNALS NAME, VOLUME, PAGES
[2] AUTHORS. YEAR. TITLE OF BOOK, EDITING HOUSE
[3] AUTHORS. YEAR. TITLE OF REFERENCE, CONFERENCE NAME, VOLUME OR PROCEEDING, PAGES

AUTHORS & AFFILIATION

[1.] NAME SURNAME
[2.] NAME SURNAME

[1.] DEPARTMENT, FACULTY, UNIVERSITY, COUNTRY
[2.] INSTITUTION OR COMPANY, COUNTRY

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