TEHNOLOGIA INOVATIVĂ

REVISTA CONSTRUCȚIA DE MAŞINI - SERIE NOUĂ

Anul 64, Nr. 1 / 2012

- "Tehnologia Inovativa"
printed form: ISSN 2248 - 0420; ISSN-L 2248 - 0420
- "Tehnologia Inovativa"
online form: ISSN 2248 - 0420; ISSN-L 2248 - 0439

EDITOR: ICTCM – CITAf

041303 Bucuresti
Şos. Olteniţei nr. 103, sector 4, O.P. 8
Tel: **021 332.37.70/234**
Fax: **021 332.07.75 / 021 332.31.95**
E-mail: ictcm@ictcm.ro

Responsabil editor: Irina Rădulescu

Responsabil difuzare: Ionuţ Dimache

INFORMAŢII, ABONAMENTE:

Revista este evaluată CNCSIS la categoria B+,
apare trimestrial.
Abonamentele se fac direct, prin dispoziţie de plată sau mandat poştal, trimis pe adresa revistei.

CONT – ICTCM:
nr. RO58 RNCB 0075 0352 1240 0001;
BCR sector 4
TIPAR: ICTCM – CITAf

COPYRIGHT 2003
Toate drepturile asupra acestei ediţii sunt rezervate ICTCM – CITAf. Nu este permisă reproducerea integrală sau parţială a articolelor din revista „Tehnologia Inovativă" fără consimţământul scris al editorului.
Opiniile exprimate în revistă aparţin semnatarilor articolelor, fără să reflecte obligatoriu şi punctul de vedere al editorului.

Din sumar

MECANICĂ / MECHANICS

HIDRAULICĂ / HYDRAULICS

ORGANE DE MAŞINI ŞI REZISTENȚA MATERIALELOR / MACHINE ELEMENTS AND MATERIALS STRENGTH

TEHNOLOGIE INOVATIVĂ / INNOVATIVE TECHNOLOGY

ECONOMIE INDUSTRIALĂ / INDUSTRIAL ECONOMY

ANUL 64 / 2012 – NR. 1

TEHNOLOGIA INOVATIVĂ

REVISTA CONSTRUCȚIA DE MAŞINI

COLEGIUL DE REDACȚIE

Octavian BOLOGA - Universitatea „Lucian Blaga” din Sibiu

Olivier BONNEAU – Universitatea din Poitiers, Franța

Ion BOSTAN – Universitatea Tehnică a Moldovei

K.D. BOUZAKIS – Aristoteles University of Thessaloniki, Grecia

Doug BRANHAM - Lubrication Systems Company, Houston, Texas, USA

Dan BRÎNDAŞU - Universitatea „Lucian Blaga” din Sibiu

Mircea CIOBANU - Universitatea „Ştefan cel Mare” din Suceava

Valeriu DULGHERU – Universitatea Tehnică a Moldovei

Dan FILIPOIU - Universitatea POLITEHNICA din Bucureşti

Michel FILLON – Universitatea din Poitiers, Franța

Mohamed HAJJAM – Universitatea din Poitiers, Franța

Tudor ICLĂNZAN - Universitatea „Politehnica” din Timişoara

Nicolae Valentin IVAN - Universitatea „TRANSILVANIA” din Braşov

Gheorghe MOGAN – Universitatea „TRANSILVANIA” din Braşov

Ilie MUSCĂ - Universitatea „Ştefan cel Mare” din Suceava

Nicolae OANCEA - Universitatea „Dunărea de Jos” din Galați

Dumitru OLARU - Universitatea Tehnică „Gheorghe Asachi” din Iaşi

Juozas PADGURSKAS – Lithuanian University of Agriculture, Lithuania

Radu POPESCU – Academia Română - INCE – CEIS, Bucureşti

Tudor PRISĂCARU - Universitatea POLITEHNICA din Bucureşti

Vasile PUIU - Universitatea din Bacău

Stanisław PYTKO - University of Science and Technology, Kraków, Poland

Alexandru RĂDULESCU - Universitatea POLITEHNICA din Bucureşti

Minodora RÎPĂ - Universitatea „Dunărea de Jos” din Galați

Lucian TUDOSE - Universitatea din Cluj

Thami ZEGHLOUL – Universitatea din Poitiers, Franța

COMITET ONORIFIC

Gheorghe AMZA - Universitatea POLITEHNICA din Bucureşti

Niculae Napoleon ANTONESCU – Universitatea „Petrol şi Gaze” din Ploieşti

Traian AURITE - Universitatea POLITEHNICA din Bucureşti

Gavrilă CALEFARIU - Universitatea „TRANSILVANIA” din Braşov

Mircea COZMÎNCĂ - Universitatea Tehnică „Gheorghe Asachi” din Iaşi

Emanuel DIACONESCU – Universitatea „Ştefan cel Mare” din Suceava

Marian GHEORGHE - Universitatea POLITEHNICA din Bucureşti

Constantin ISPAS - Universitatea POLITEHNICA din Bucureşti

Valeriu JINESCU - Universitatea POLITEHNICA din Bucureşti

Aurel JULA - Universitatea „TRANSILVANIA” din Braşov

Constantin MINCIU - Universitatea POLITEHNICA din Bucureşti

Eugen PAY - Universitatea de Nord din Baia Mare

Iulian POPESCU - Universitatea din Craiova

Aurelian VLASE - Universitatea POLITEHNICA din Bucureşti

Ioan VOICA - Universitatea POLITEHNICA din Bucureşti

EDITOR
Oficiul de Informare Documentară pentru Industrie, Cercetare, Management
din cadrul
Centrului Incubator Tehnologic de Afaceri
S.C. ICTCM S.A. BUCUREŞTI

RESPONSABIL EDITOR
Irina Rădulescu

REDACTOR
Irina Rădulescu

WEBMASTER
Ramona Ioanid

CUPRINS

MECANICĂ / MECHANICS

1. **INFLUENCE OF ORAL ENVIRONMENT ON RESTORATION ALLOYS**
   Adina Oana Armencia
   Faculty of Dental Medicine, „Gr.T.Popa"University of Medicine and Pharmacy, Iasi, ROMANIA pag. 5

HIDRAULICĂ / HYDRAULICS

2. **INFLUENȚA CONTAMINĂRII ULEIURILOR HIDRAULICE ASUPRA PERFORMANȚELOR SERVOVALVELOR / INFLUENCE OF HYDRAULIC OIL CONTAMINATION ON THE SERVOVALVES PERFORMANCE**
   Popovici Aristia-Ioana
   Technical University of Civil Engineering Bucharest, Bucharest, ROMANIA pag. 11

ORGANE DE MAŞINI ŞI REZISTENȚA MATERIALELOR / MACHINE ELEMENTS AND MATERIALS STRENGTH

3. **ASPECTE PRIVIND RUPEREA MATERIALELOR METALICE SUB INFLUENȚA TEMPERATURII/ SOME ASPECTS REGARDING METALLIC MATERIALS FRACTURE DUE TO TEMPERATURE INFLUENCE**
   Savaniu Ioan Mihail, Vlase Monica
   Technical University of Civil Engineering of Bucharest, Bucharest, ROMANIA pag. 17

4. **REALIZAREA MODELULUI CU ELEMENTE FINITE A ASAMBLĂRILOR NITUITE DIN STRUCTURILE DE AVIAȚIE / FINITE ELEMENT MODEL OF RIVETING ASSEMBLIES FROM AVIATION STRUCTURES**
   D. Bartiş, A. Lupaş, R. Nedelcu
   Academia Tehnică Militară, Bucureşti, ROMÂNIA pag. 23

5. **SCULE MINIERE DE PERFORAT/ MINING EXPERIMENTAL TOOLS FOR DRILLING OPERATION**
   Vlad Alexandru Florea
   University of Petroşani, Petroşani, ROMANIA pag. 31

TEHNOLOGIE INOVATIVĂ / INNOVATIVE TECHNOLOGY

6. **EXPERIMENTAL PLANS METHOD WITH APPLICATION TO THE MODELING OF AN ELECTROSTATIC SEPARATION PROCESS**
   Alexandru Rădulescu [*], Alina Covrig [*], Lucian Dascalescu [**]
   * University "POLITEHNICA" Bucharest, ROMANIA, ** University of Poitiers, FRANCE pag. 35

ECONOMIE INDUSTRIALĂ / INDUSTRIAL ECONOMY

7. **THE "PERSPECTIVES 360" INSTRUMENT – A MANAGEMENT SKILLS ASSESSMENT TOOL**
   Michelle Moore, John Moore
   Exponential Training & Assessment Limited , Earl Shilton, ENGLAND pag. 39

8. **ROLES AND ACTIVITIES OF HIGH GROWTH COACH**
   Michelle Moore, John Moore
   Exponential Training & Assessment Limited **,** Earl Shilton, ENGLAND pag. 47

Promovare:
PROIECTE ÎN IMPLEMENTARE LA INSTITUTUL NAȚIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII/ IMPLEMENTING PROJECTS OF NATIONAL INSTITUTE FOR SMALL AND MEDIUM ENTERPRISES
Ana Maria Onu, Lidia Constantin, Gabriela Sincă, Andreea Tudose, Ioan Pițurescu
INIMM Bucureşti, ROMANIA pag. 51

ABSTRACTS "INNOVATIVE TECHNOLOGY" 1 / 2012

INFLUENCE OF ORAL ENVIRONMENT ON RESTORATION ALLOYS

Adina Oana Armencia
Faculty of Dental Medicine,
„Gr.T.Popa"University of Medicine and Pharmacy,
Iaşi, ROMANIA

Corrosion and dissolving of thin films laid on the surface of restorative materials represents two phenomena which take place in salivary environment (natural or artificial). Degradation of metallic and non-metallic materials is, usually, a combination of electrochemical and mechanical effects. In a watery environment, like the salivary environment, electrochemical corrosion prevails, associated in lower proportions with the occurrence of chemical corrosion cells (uniform dissolving of the restorative dental material). Above these two phenomena, a third form of corrosion takes place in the oral environment, biologic corrosion, held under the direct influence of the bacterial microflora.

INFLUENȚA CONTAMINĂRII ULEIURILOR HIDRAULICE ASUPRA PERFORMANȚELOR SERVOVALVELOR / INFLUENCE OF HYDRAULIC OIL CONTAMINATION ON THE SERVOVALVES PERFORMANCE

Popovici Aristia-Ioana
Technical University of Civil Engineering
Bucharest, Bucharest, ROMANIA

This paper presents findings regarding the influence of hydraulic oil contamination upon the quality indicators of servovalves. In this paper hydraulic oil contamination is considered a result of abrasion and erosion wear. Lubricant degradation lead to viscosity decreasing; this conclusion is affirmed by many researchers. Using Czarny's relation was determined H46 hydraulic oil viscosity in various stages of degradation (working hours). By simulating with MATLAB-SIMULINK program was examined how the viscosity variation causes changes of servovalves performance, measured with quality parameters, especially overadjustment and the period of transitory regim, for two servovalves with different characteristics.

ASPECTE PRIVIND RUPEREA MATERIALELOR METALICE SUB INFLUENTA TEMPERATURI / SOME ASPECTS REGARDING METALLIC MATERIALS FRACTURE DUE TO TEMPERATURE INFLUENCE

Savaniu Ioan Mihail, Vlase Monica
Technical University of Civil Engineering of
Bucharest, Bucharest, ROMANIA

The paper presents the results of a comparative study regarding metallic material fracture due to temperature variation. It was analyzed, for a simple metallic sample, the corelation between the results obtained using the experimental method and than the finite element modeling. The analysis offers informations that helps the results validation obtained by finite element modeling of a metallic structure, considering the structure temperature.

REALIZAREA MODELULUI CU ELEMENTE FINITE A ASAMBLĂRILOR NITUITE DIN STRUCTURILE DE AVIAȚIE / FINITE ELEMENT MODEL OF RIVETING ASSEMBLIES FROM AVIATION STRUCTURES

D. Bartiş, A. Lupaş, R. Nedelcu
Academia Tehnică Militară, Bucureşti,
ROMÂNIA

The fatigue phenomenon appears especially during the exploitation of certain marks of the bodies subjected to variable requests in time or repeated. Usually the cracks start in no visible places, with the limit of the opening of a rivet or on the surface of assembly of the plates.
Generally the riveted joints problem it is a problem of non-linear fracture mechanic. Calculus effort is considerable enlarged by the numerical approach of the non-linear problem of fracture mechanics by comparison with that one of linear mechanics without a considerable intake on solution precision. For that reason fatigue durability prediction methodologies and fatigue damage risk prevention, generally take account on the linear elastic materials bearing. In this paper it is formulated a model which allows numerical problems solving in reasonable time.

SCULE MINIERE DE PERFORAT/ MINING EXPERIMENTAL TOOLS FOR DRILLING OPERATION

Vlad Alexandru Florea
University of Petroşani, ROMANIA

The excavation of mine workings in hard rocks is made through drilling-blasting technology; in the frame of this method, the holes drilling is one of the basics operations of this technology and is realised by percussive procedure.
Single edge chisel bits, D.C.P., with Φ 40mm diameter, are the most usual mining tools for holes drilling, both for coal and ores mining; its consumption has a significant "weight" for the cost of drilled rock ton, depending on rocks physical-mechanical properties.
With a view to reducing the costs for simple edge chisel bits, was investigate the possibility to use hard alloys with structural gradient for producing the tippeds which are the edges of these tools, also,the pulverization on the bit surface.

EXPERIMENTAL PLANS METHOD WITH APPLICATION TO THE MODELING OF AN ELECTROSTATIC SEPARATION PROCESS

Alexandru Rădulescu [*], Alina Covrig[*], Lucian Dascalescu[**]
* University "POLITEHNICA" Bucharest, ROMANIA
** University of Poitiers, FRANCE

Electrostatic separation process is based on the electrical forces acting on charged or polarized particles in an electric field, generated by an electrode system connected to a high-voltage supply. The aim of this paper is to obtain a mathematical model capable to reflect the effects of a large number of controllable factors. The statistical analysis of the data revealed a significant correlation between the high-voltage, the roll-speed, the angular position and the quantity of the middling product in the processed material. These findings could be helpful for the optimisation of the operating conditions of the electrostatic separation applications where the metal content in the feed materials is characterized by important fluctuations with time.

THE "PERSPECTIVES 360" INSTRUMENT – A MANAGEMENT SKILLS ASSESSMENT TOOL

Michelle Moore, John Moore
Exponential Training & Assessment Limited **,**
Earl Shilton, ENGLAND**,**

Perspectives 360 is a simple and effective skills assessment system for assessing the skills of managers. Perspectives 360 provides managers, Human Resource specialists, trainers, business coaches, management consultants and business advisors with valuable information on the perceived skills of managers.

ROLES AND ACTIVITIES OF HIGH GROWTH COACH

Michelle Moore, John Moore
Exponential Training & Assessment Limited **,** Earl Shilton, ENGLAND

The High Growth Coach project vision is to support the growth of SMEs resulting in long-term, sustainable wealth creation, job creation, increased sales revenues and profitability. The aim is to develop and deliver the High Growth Coach Programme to enable the development of effective and competent specialist High Growth Coaches for use by regional and national agencies engaged in High Growth Coaching.

Promovare:

PROIECTE ÎN IMPLEMENTARE LA INSTITUTUL NAȚIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII/ IMPLEMENTING PROJECTS OF NATIONAL INSTITUTE FOR SMALL AND MEDIUM ENTERPRISES

Ana Maria Onu, Lidia Constantin, Gabriela Sincă, Andreea Tudose, Ioan Pițurescu
INIMM Bucureşti, ROMANIA

INFLUENCE OF ORAL ENVIRONMENT ON RESTORATION ALLOYS

Adina Oana Armencia

Faculty of Dental Medicine, „Gr.T.Popa"University of Medicine and Pharmacy, Iasi, ROMANIA
email: adinaarmencia@yahoo.com

REZUMAT: *Coroziunea şi dizolvarea filmelor subţiri depuse pe suprafaţa materialelor restaurative reprezintă două fenomene ce au loc în mediul salivar (natural sau artificial). Degradarea metalelor şi a materialelor nemetalice este, în mod obişnuit, o combinaţie a efectelor electrochimice şi mecanice. Într-un mediu apos, cum este mediul salivar, predomină procesul electrochimic de coroziune, asociat, în proporţii mai mici, cu apariţia celulelor de coroziunea chimică, (dizolvarea uniformă a materialului dentar restaurativ). Peste aceste două fenomene, se suprapune în mediul oral, o a treia formă de coroziune, coroziunea biologică, desfăşurată sub directa influenţa a microflorei bacteriene.*

ABSTRACT: *Corrosion and dissolving of thin films laid on the surface of restorative materials represents two phenomena which take place in salivary environment (natural or artificial). Degradation of metallic and non-metallic materials is, usually, a combination of electrochemical and mechanical effects. In a watery environment, like the salivary environment, electrochemical corrosion prevails, associated in lower proportions with the occurrence of chemical corrosion cells (uniform dissolving of the restorative dental material). Above these two phenomena, a third form of corrosion takes place in the oral environment, biologic corrosion, held under the direct influence of the bacterial microflora.*

CUVINTE CHEIE: coroziune chimică, procese electrochimice şi mecanice, aliaje

KEYWODS: chemical corrosion, electrochemical and mechanical effects, alloys

INTRODUCTION

Maintaining the structural integrity and stability of the materials used in restorative dentistry within normal limits represents a constant concern.

Restorative dental materials do not contain only the pure metal, but also a varying quantity of "alloy elements", which influence both the mechanical properties of the material as well as its behavior in the oral environment.

The consequences are variable, ranging from simple color modifications to alterations in the binding force of the material to the tooth, the initiation and maintenance of gashes or modifications due to corrosion (pitting).

All these effects are caused by the corrosion process, a phenomenon which is accompanied by dimensional variations, initiation of pitting with the invasion of microorganisms and appearance of different pH and airing conditions [2, 8].

AIM OF STUDY

Our purpose was to determine the way in which artificial saliva influences the occurrence of corrosion on some alloys used in restoring hard dental structures.

MATERIALS AND METHOD

We selected specimens from different materials used frequently in dental practice: Cr-Co alloy, Cr-Ni alloy, titanium (figure 1).

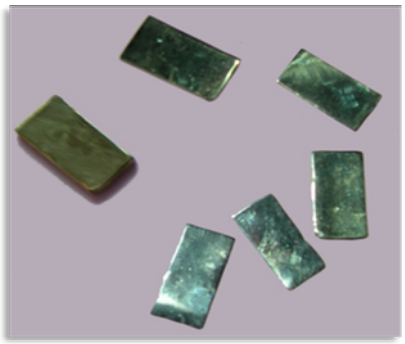


Figure 1. *Specimens from metallic materials studied*

Different granulations were used for polishing the examined surfaces (10 μ, 120 μ, 320 μ, 400 μ, 600 μ, 800 μ, 1000 μ, and 1200 μ). Final polishing of the surface was conducted in two stages: prepolishing with diamond paste with granulations of 1μ, and final polishing with granulations of 0,25 μ.

It is very important at this point to apply very low pressure whilst polishing, thus avoiding overheating and cracking of the specimen.

The processing and respectively the casting and finishing of the specimens was conducted sequentially, according to the armamentarium and instructions of the manufacturing companies.

We used Duffo-Quezada artificial saliva as the watery environment in order to determine the influence of saliva in the occurence of alloy corrosion, the composition of this saliva being presented in table 1.

We chose this composition because some previous studies indicated the fact that it has corrosive properties similar to the natural saliva. pH value of this solution was determined with a pH-meter/milivoltmeter OP-208 RADELKIS (Budapest, Hungary): pH=7,08.

Because the corrosion that occurs at the mere immersion of the alloy in the corrosive environment is very slow (natural corrosion), the potentiodynamic method was used to study the electrochemical processes.

The experimental assessments were carried out with a Potentistat/galvanostat PGP201 (VoltaLab 21) (figure 2) and the gathering and processing of the experimental data was made using the VoltaMaster 4 software.

Table I. *Composition of the artificial saliva proposed by Duffo and Quezada*

Compoziția (g/L)	
NaCl	0.600
KCl	0.720
$CaCl_2 \cdot 2H_2O$	0.220
KH_2PO_4	0.680
$Na_2HPO_4 \cdot 12H_2O$	0.856
KSCN	0.060
$KHCO_3$	1.500
acid citric	0.030

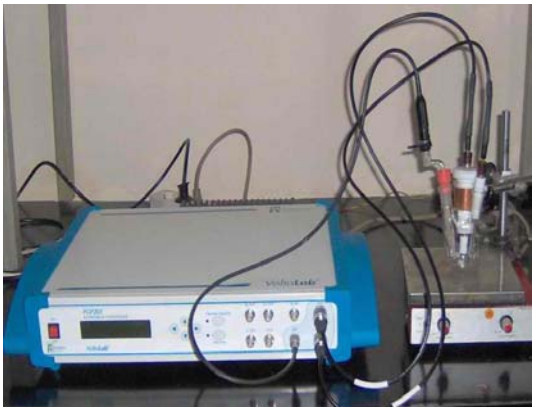


Figure 2. *PGP 201 device used for potentidynamic measurements*

The device and the processing program have special facilities that include precise determination of the polarization resistance, registration of the corrosion potential over long periods and testing of the corrosion in concerning points.

It was especially used for the evaluation of the instant speed of corrosion. For the measurements conducted with the VoltaLab 21 potentiometer we used the cell in figure 3, made from Pyrex glass.

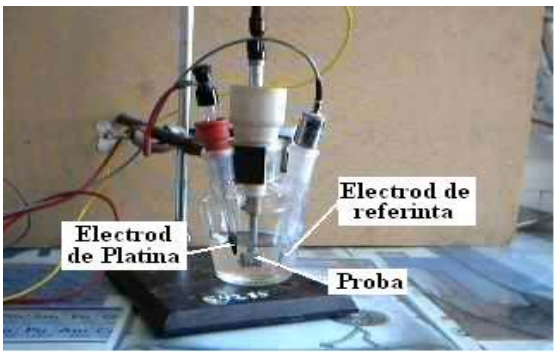


***Figure 3**. Electrolitic cell with three electrodes*

It has an usable volume of 50-150 ml. As reference we used a miniature saturated Hg/Hg_2Cl_2 electrode (saturated calolomel), provided with Luggin capillary, and as auxiliary electrode (measurement electrode) we used a platinum electrode with the surface of 0,19 cm^2. For the study of „forced corrosion" (or stimulated) we used cyclic polarization curves (cyclic voltamograms).

In acquiring these, the potential of the electrode formed with the studied alloy is increased with a constant velocity up to a default value and afterwards it is varied in reverse (towards negative values until it reaches the initial value or another value).

During the entire variation period, the electric current passing through the solution between the work electrode and auxiliary platinum electrode is measured.

In this study, cyclic polarization curves (cyclic voltamograms) have been recorded on a potential area ranging between (-500) mV and (+2000) mV with a speed of variation of the potential of 10 mV/s.

We started from a negative potential of sufficient value, with the purpose of reducing all ionic species or molecules in the solution and possibly from the surface of the alloy, for the electrochemical process to be carried out on a „clean" surface (maximum anodic limit).

Variation speed of the working electrode potential was relatively high, in order to obtain high enough intensities of the current to cover accidental system fluctuations, but low enough to see all processes that take place in the solution or on the surface of the electrode.

RESULTS AND DISCUSSIONS

The values for corrosion parameters of the studied materials in Duffo-Quezada saliva are presented in table 2.

***Table 2.** Parameters of the instant corrosion process for the corrosion of alloys in saliva*

ALIAJ	E_0 (mV)	R_p (kohm.cm^2)	J_{cor} (μA/cm^2)	v_p (μm/an)
Verasoft I	-365	4,95	4,53	53,0
Verasoft II	-316	5,73	5,77	67,5
Ni-Cr-Co	-187	10,80	4,08	47,8
Titan	-323	85,1	0,097	0,858

The shape of the cyclic polarization curve for Ni-Cr-Co alloy (figure 4) indicates corrosion in points (pitting corrosion): the breakdown potential, E_{BD} =840 mV and the repassing potential, E_{BD}=840 mV.

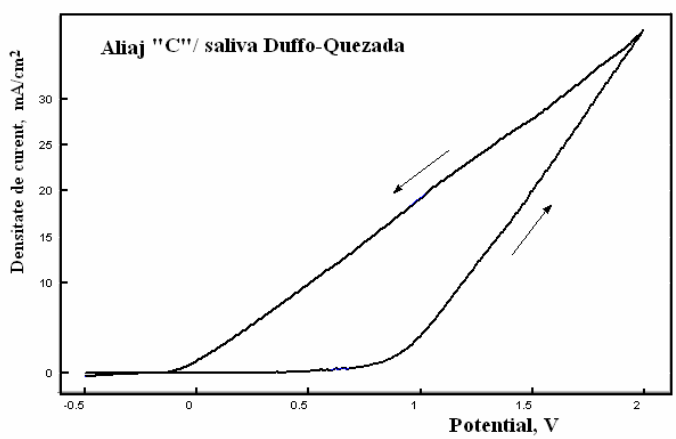


***Figure 4.** Cyclic voltamogram for Ni-Cr-Co alloy in Duffo-Quezada saliva (v= dE/dt = 10 mV/s)*

In the 1000-2000 mV suprapotential interval, the current-potential curve (anodic curve) is linear; the corrosion current rises linear with the potential applied to the electrode, thus at the overpotential of 2000 mV, the corrosion flow is $j_{cor}(2V)$ = 37,74 mA/cm^2 (almost 1000 times greater than the instant corrosion flow).

The cathode branch is also linear, but on a higher potential interval (+2000 … -150 mV), being placed behind the cathode branch, representing a process of defective passivation.

The two Verasoft specimens (figure 5, figure 6) were obtained from different sources. Still, conduct in artificial saliva is similar; both curves indicate a generalized corrosion.

In the interval of potential 1000...20000 mV, the anodic curve is linear (current density rises lineal with the potential applied to the alloy).

The return curve (the cathode branch of the polarization curve) is also lineal and it practically overlaps the anodic branch.

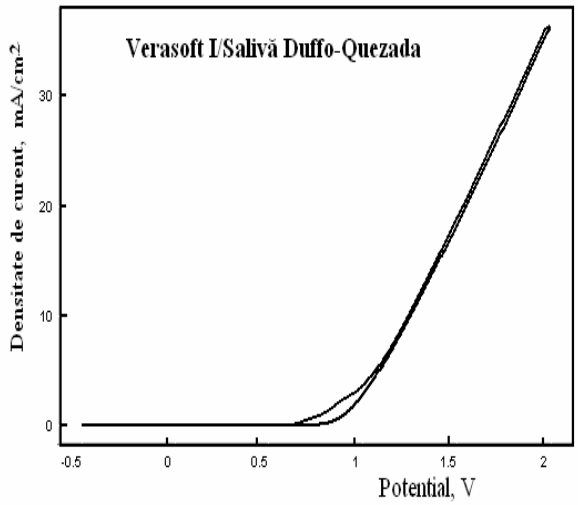


Figure 5. *Cyclic voltamogram for the Verasoft I alloy in Duffo-Quezada saliva (v= dE/dt = 10 mV/s)*

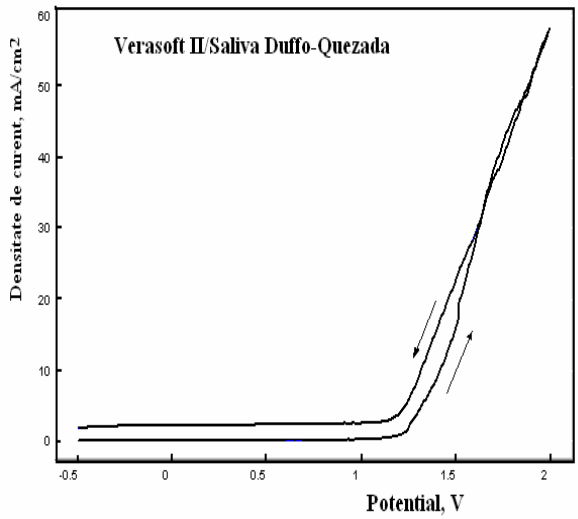


Figure 6. *Cyclic voltamogram for the Verasoft II alloy in Duffo-Quezada saliva (v= dE/dt = 10 mV/s)*

Verasoft II also presented generalized corrosion with a tendency towards pitting. The difference between the two samples is related to the breakdown potential values: 785 mV for the first sample and 840 mV for the second sample, still within the limits of experimental errors. Current density values for 2V overpotential are high enough compared to those of the Ni-Cr-Co alloy: $j_{cor}(2V)$ = 36,2 mA/cm^2 for sample I respectively $j_{cor}(2V)$ = 58,2 mA/cm^2 for sample II.

The cyclic voltamogram for titanium indicates that this material was passived before even introduced in the solution, because it oxidizes easily when exposed to air during manipulation (figure 7).

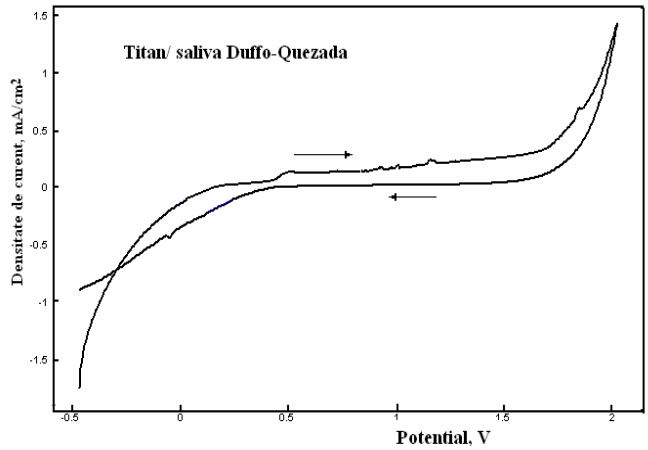


Figure 7*. Cyclic voltamogram for titanium in Duffo-Quezada saliva (v= dE/dt = 10 mV/s)*

For this reason, in the 0...1600 mV potential interval, current density was very low between 0,05 and 0,3 mA/cm^2. Increasing of current for potentials higher than 1600 mV do not represent a corrosion process, but are due to the oxidizing of water with oxygen release at the electrode. Thus, titanium has the higher resistance to corrosion of all the studied metals.

The corrosion pattern is closely related to the composition of the material, pH of the environment, surface roughness and microstructural elements [2, 10]. Therefore, alloys with high concentration of chrome and molybdenum have a low susceptibility to corrosion. Chrome is introduced in nickel-based alloys in order to increase its ability to form that oxide-protective film on its surface.

The medical literature admits the fact that a content of 16-27 % Cr can increase the resistance to corrosion of alloys [3, 4]. Ni-Cr based alloys have comparable corrosion speed. Titanium is by far the most resistant biomaterial of those studied here, having the lowest corrosion speed under 1 μm/an.

It is well known that the oxide layer, which covers the material, makes a bivalent molecular link, which offers this material the quality of osteointegration of the titanium implant [1, 9].

Moreover, titanium acts like a cathode and tends to attract Calcium ions around it. This property is useful because in the oral environment, it allows the appearance of a hidroxiapatite core around the material. Titanium molecules adhere inevitably to the bone walls, without any toxic effects, due to the attracted calcium ions that prevent corrosion.

Moreover, we must add that corrosion resistance depends on the structural homogenity of the alloy. Thus, Cr-Ni-based alloys do not have only one structural phase, therefore, that important homogeneity for resistance to corrosion is not present. This proves that this layered pattern, with different chemical compositions, represents the starting point of the electrochemical cells [10].

The global polarization curve for passivable alloys like Cr-Ni, Fe-Cr-Ni or Cr-Co is quite interesting. Even in the same alloy, heterogeneity represents the anodic area susceptible to corrosion. We want to mention that the heterogeneity of the salivary electrolyte can be a source of corrosion, heterogeneity that comes from difference of ventilation or that of the local pH, mechanism that is probably responsible for passivation of the surfaces. [8, 10].

In order to be corrosion-resistant, prosthetic alloys must be either noble or passivable. Common alloys (Cr, Ni, Cr-Co-Ni) are prone to corrosion due to their lack of corrosion-protective agents; when processing deficiencies are added, it is clear why corrosion cannot can be avoided [6, 7, 11].

CONCLUSIONS

The instant speed of corrosion has relatively low values for alloys studied in the artificial Duffo-Quezada saliva, but varies from one material to another.

The Chromium-nickel alloys studied had higher resistance to corrosion than chromium-cobalt alloys. Both Verasoft alloys, although not of the same batch, had a very similar composition and similar corrosion behavior. Nickel, manganese and copper dissolve from the alloy and pass into the solution (about 9% of existing quantity). Some of the copper is oxidized on the alloy surface and transformed in CuO (insoluble and adherent to the surface), justifying the presence of oxygen for the electrochemical-treated specimen.

Biomolecules influence corrosion of metals or metal alloys, their presence inhibiting or accelerating the corrosion rate.

Cyclic Voltamograms offer information on the type of corrosion (general corrosion, localized corrosion, passivation, etc.), the potential at which corrosion begins to run with considerable speed (breakdown potential) and the potential of repassivation.

However, it is hard to simulate oral conditions and the influence of environment on the stability of dental alloys. The oral ambience is difficult to be created artificially due to the synergism between the bacterial flora, pH and material composition.

REFERENCES

[1]. **Al-Mayouf A., MAl-Swayih A.A. and Al-Mobarak N. A**., *Effect of potential on the corrosion behavior of a new titanium alloy for dental implant applications in fluoride media*. Materials and corrosion, Vol.55, 88, (2004).

[2]. **Manaranche C, Hornberger H.** *A proposal for the classification of dental allozs according to their resistance to corrosion.* Dental Materials 2007, 23, 1428-1437.

[3]. **Benatti O.F.M., Miranda W.G., Muench A.** *In vitro and in vivo corrosion evaluation of nickel-chromium- and copper-aluminum-based alloys.* Journal of Prosthetic Dentistry. 2000; 84(3): 360–363.

[4]. Hanks C.T, Wataha J.C, Sun Z. *In vitro models of biocompatibility: a review*. Dent Mater, 1996; 12: 186-93.

[5]. Bhaskar V, Subba Reddy V.V. *Biodegradation of nickel and chromium from space maintainers: An in vitro study.* J Indian Soc Pedod Prev Dent, 2010; 28:6-12

[6]. **Chen C.C, Chen R.G.S, Huang S.T**. *Effect of chemical composition on the corrosion behavior of Ni-Cr-Mo dental casting alloys*. Journal of Biomedical Materials Research. 2002; 60(3):458–465.

[7]. Mareci D., Nemtoi Gheorhe, Aelenei N, Bocanu C. *Electrochemical behaviour of various non-precious Ni and Co based alloys in artificial saliva.* European Cells and Materials, Vol.10, 2005 :1-7

[8]. **Bayramoğlu G, Alemdaroğlu T, Kedici S, Aksüt AA**. *The effect of pH on the corrosion of dental metal alloys.* J Oral Rehabil. 2000 Jul; 27(7):563-75.

[9]. **Her-Hsiung Huang.** *Surface characterizations and corrosion resistance of nickel-titanium dental orthodontic wires in artificial saliva of various degrees of acidity*. Journal of Biomedical Materials Research: Part A Vol. 74A, 2005: 629-639

[10]. **Holland R.I**. *Corrosion testing by potentiodynamic polarization in various electrolytes.* Dental Materials. 1992; 8(4):241–245.

[11]. **Kuphasuk C, Oshida Y, Andres C.J, Hovijitra T, Barco M.T, Brown D.T.** *Electrochemical corrosion of titanium and titanium-based alloys.* Journal of Prosthetic Dentistry. 2001; 85(2):195–202.

Quick Info

DESIGNING A BETTER CERVICAL COLLAR FOR ACCIDENT VICTIMS

Cervical collars were first developed during the Vietnam War to stabilize the heads and necks of accident victims, but research has shown that this device may be overdue for an update. Students at Rice University tested a currently used cervical collar and found that when a patient's neck is injured, the collar can push the head away from the body — potentially doing more harm than good. They recently built a prototype of a new type of cervical collar, called the HeadCase, that immobilizes the head without putting pressure on the neck.

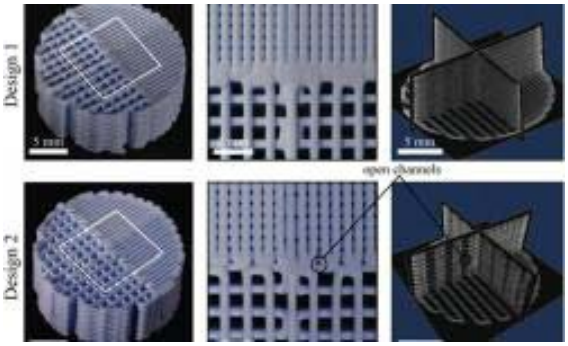
"Problems with the current collar are being discovered," said Kelsey Horter, a bioengineering student and a certified emergency medical technician. "We went back to basic emergency-care ideas. As EMTs, we're taught that if the knee is hurt, you stabilize above and below it. You never just stabilize the part that's injured — which is exactly what we think the current cervical collar does. We jumped on the premise that if we could stabilize the head and torso right beneath the neck, then we could stabilize the neck. That's what our device does."

The newly developed device places support on the side of the cheeks and the chest, and at the top of the back. The HeadCase is disposable and is expected to cost less than the $15 price tag on current disposable collars, of which 15 million are used in the United States each year. It stores flat for easy transport and can be placed on a patient in 60 seconds, team members said. The team has filed a provisional patent through Rice.

A team of Rice University seniors developed the HeadCase, a cervical collar that properly immobilizes the head without putting pressure on the neck. (Credit: Rice University)

(source: http://www.medicaldesignbriefs.com)

FABRICATION METHOD MAY IMPROVE ARTIFICIAL BONE SCAFFOLDS



Researchers focused on pore design factors in developing a new method for the fabrication of artificial bone scaffolds.
Manufacturing result for designs 1 and 2.
Design 1 has a completely walled off quadrant interface preventing fluid transport, while design 2 has open channels between quadrants.

Researchers at the University of Illinois have developed a new method for the fabrication of artificial bone scaffolds that can assess important pore design factors such as porosity and their role in new bone formation. Their method's capablities for *in vivo*control of different scale porosities could lead to more flexible, efficient design of bone scaffolds used for regeneration of bone tissue lost to disease or injury.

Using a fabrication method of robotic deposition, the researchers modified it to precisely control ink flow, enabling the fabrication of scaffolds with multiple materials in a single scaffold and with multiple length scales of porosity. This method could play an important role in the drive to create artificial bone replacements that can serve to seed new tissue growth and obviate the need for bone harvesting. In order to create the scaffolds, the researchers used a nozzle-based solid freeform fabrication (SFF) system as the manufacturing platform because the method enables strict control of the macrostructure, while at the same time integrating multiple materials with different microstructures or chemistries.

(source: http://www.medicaldesignbriefs.com)

INFLUENȚA CONTAMINĂRII ULEIURILOR HIDRAULICE ASUPRA PERFORMANȚELOR SERVOVALVELOR / INFLUENCE OF HYDRAULIC OIL CONTAMINATION ON THE SERVOVALVES PERFORMANCE

Popovici Aristia-Ioana

Technical University of Civil Engineering Bucharest, Bucharest, ROMANIA, e-mail: arys_jo@yahoo.com

REZUMAT

Articolul prezintă rezultatele studiului influenței contaminării uleiurilor hidraulice asupra indicatorilor de calitate ai servovalvelor. Contaminarea uleiurilor hidraulice este privită în această lucrare drept consecință a uzării abrazive şi erozive. Degradarea uleiurilor provoacă micşorarea vîscozității; această concluzie este susținută de mai mulți cercetători. Folosind relația lui Czarny s-a cuantificat vîscozitatea uleiului hidraulic H46 în diverse stadii de degradare, respectiv ore de funcționare. Prin simularea cu ajutorul programului MATLAB-SIMULINK s-a analizat modul în care variația vîscozității provoacă modificări ale performanțelor servovalvelor, modificări măsurate prin indicatori de calitate, cu precădere suprareglajul şi durata regimului tranzitoriu, pentru două servovalve cu caracteristici diferite.

ABSTRACT

This paper presents findings regarding the influence of hydraulic oil contamination upon the quality indicators of servovalves. In this paper hydraulic oil contamination is considered a result of abrasion and erosion wear. Lubricant degradation lead to viscosity decreasing; this conclusion is affirmed by many researchers. Using Czarny's relation was determined H46 hydraulic oil viscosity in various stages of degradation (working hours). By simulating with MATLAB-SIMULINK program was examined how the viscosity variation causes changes of servovalves performance, measured with quality parameters, especially overadjustment and the period of transitory regim, for two servovalves with different characteristics.

KEYWORDS: servovalve, modeling-simualtion, quality parameters, hydraulic oil, contamination, viscosity

CUVINTE CHEIE: servovalvă, modelare-simulare, indicatori de calitate, ulei hidraulic, contaminare, vîscozitate

1. INTRODUCTION

Design and manufacture of automatic hydraulic systems must give an answer to the problems of providing high performance. Working capacity of servovalves with contaminated oils is one of the problems.

In [3] it is stated that the servovalves must ensure a high purity degree of hydraulic oil, through proper measures; therefor the direct conversion servovalves are less sensitive to the effects of contamination.

Tribological processes characteristic for servovales (erosion and abrasion) generate hard wear particles, with strong microcutting effects or fatigue of the superficial layer caused by friction of particles with the coupling surfaces (spool-sleeve).

Some measures to control the wear process of servovales coupling are:

- using of materials with high hardness;
- ensuring an efficient filtering;
- choosing the pair of materials (spool-sleeve) with low tendency of jamming (welded microjunction);
- choosing materials with different hardness for surfaces in contact an relative motion, as a result the

abrazive effects are diminished by „fixing” the hard particles in the material with lower hardness (for example: spool end is plated with soft materials such as bronze - 45÷100 HB hardness, the sleeve body is made of very hard materials - 55÷62 HRC).
Despite the measures adopted in the servovalves design and manufacturing stage, hard particles of contamination are always present in hydraulic oil [3].
This paper analyzed two aspects of contamination: contaminant material mass particularity and the contamination influence on the viscosity of hydraulic oil.

2. ABOUT CONTAMINATION AND FILTRATION OF HYDRAULIC OILS

Purity of hydraulic oils is reviewed periodically. Contamination analysis should be performed after every 500 working hours of hydraulic systems. The results for this analysis are presented in tables 1 and 2.

Tabel 1: *Mass of contaminated particles for hydraulic oils*

Hydraulic oil	Viscosity [mm^2/s]		Wear - contamination [mg/kg]			
	40ºC	100ºC	Fe	Cr	Sn	Al
HLP 46	45.31	6.94	1	0	0	1
HVI sample 1	65.59	8.05	5	0	0	1
HVI sample 2	65.43	8.69	8	0	0	1

Hydraulic oil	Wear - contamination [mg/kg]						
	Ni	Cu	Pb	Mo	Si	K	Na
HLP 46	0	2	0	0	10	1	3
HVI sample 1	0	9	0	0	2	3	4
HVI sample 2	0	9	1	1	2	2	4

Tabel 2: *Size groups for the number of contaminating particles*

Number of particles / 100ml [μm]	Hydraulic oil		
	HLP 46 sample 1	HLP 46 sample 2	HLP 46 sample 3
< 4	10.223.615	5.120.000	0
4-5	446.463	1.024.000	3.242.080
6-13	0	0	592.920
14-20	17.407	182.400	8.860
21-37	3.791	0	4.170
38-70	0	0	10

A major concern for servovalves is the filtrasion of hydraulic oil; the purity classes prescribded are restrictive and mandatory. According to NAS 1638 standard the recommended purity classes of servovalves are 4, 5 and 6. The maximum number of allowed particles of impurities is specified in Table 3.

Tabel 3: *Class structure according to NAS 1638*

The maximum number of particles in 100 [ml] of hydraulic oil / particle size			
Particle size [μm]	Class		
	4	5	6
5÷15	4.000	8.000	16.000
15÷25	712	1425	2850
25÷50	126	253	506
50÷100	22	45	90
>100	4	8	16

ISO 4406 defines 19 classes of purity; the particles distribution is graphically represented in figure 1. For servovales ISO recommends the use of classes 10-13 [9].

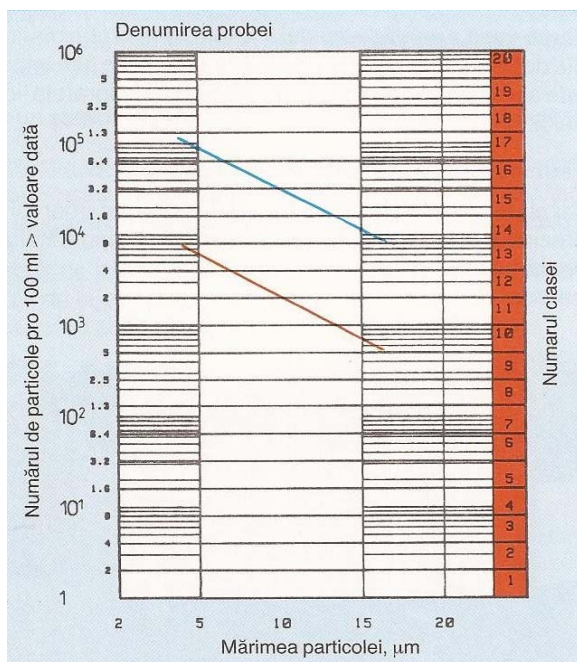


Figure 1: *ISO 4406 – classes of purity*

Technical solution for filtration specific for servovalves meets the requirements of presented rules. It is found that there are contamination particle smaller then 5 [μm] which are not retained by hydraulic oil filter, even for a fine filter of x = 3 (reccommended for servovalves working with pressures > 160 bar).
By using transmission electron microscopy were analyzed different stages contamination of H46 oil

samples; wear particles of different sizes, shapes and materials are presented in Table 4 [2].

Tabel 4: *Contamination size and material for H46*

No. crt.	Average size of particle	Solid phase material
1	1-2 µm	γ FeOOH orthorhombic
2	0.2-0.4 µm	C cubic + SiC
3	82 nm	C cubic + $FeCO_3$
4	80 nm	Al_4Si cubic

3. CONTAMINATION – VISCOSITY RELATIONSHIP

Contamination with abrasive particles generated by tribological processes of wear changes the reference parameters of lubricants (viscosity, wear spot diameter, squeeze-film curve).

This paper examines how the viscosity variation caused by contamination affects servovalves precision and stability.

Data identified in the literature shows that „used lubricant viscosity decreases more or less than that of fresh lubricant, the differences are most evident for temperatures close to ambient temperature (20ºC÷25ºC)" [2]. This statement is confirmed by experimental measurements performed on H46 hydraulic oil considering different degrees of contamination (Figure 2) [2].

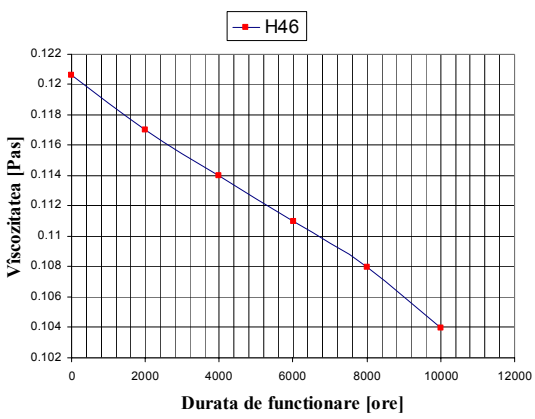


Figure 2: *Viscosity variation with contamination degree for H46*

In [8] is also highlighted the decrease of dynamic viscosity with the size of contamination particle.

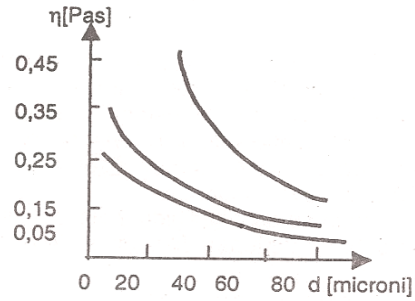


Figure 3: *Viscosity variation with particle size*

To quantify the effect of viscosity change depending on the lubricant degree of wear in paper [2] was used Czarny relation:

$$\eta = \eta_0 e^{-Kt} \qquad (1)$$

where: η_0 - initial viscosity of the lubricant; d - lubricant life; K - wear intensity coefficient.

The author of paper [2], PhD Eng. Irina Rădulescu, proposed the value $1,4073 \cdot 10^{-5}$ for the coefficient ***K***, value which was determinated based on statistical analysis of experimental data obtained; these data were used in this paper to analyze the performance of servovalves ($\eta_1 = 0.1206$ [Pa·s] – for fresh oil; $\eta_2 = 0.112$ [Pa·s] - after ~ 4000 hours and $\eta_3 = 0.104$ [Pa·s] - after ~ 6000 hours).

4. RESULTS

Considering the effect of viscosity decreasing of hydraulic oil by contamination with solid particles, were analyzed servovalves performances in transitory regime by simulation servovalves working and they were quantified using the quality parameters of indicial response [1][5][7].

Simulation scheme used is shown in Figure 4.

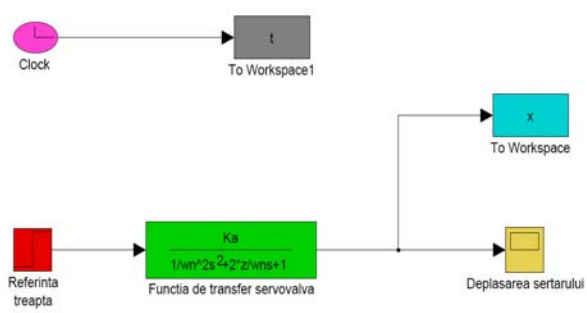


Figure 4: *Simulation scheme – fig. 4.7/71 – R3*

The simulation program was applied for two servovalves presented in Table 5.

Tabel 5: *Servovalves technical data*

No crt.	Name	Q_n [l/min]	D_N [mm]	p_N [N/m^2]	Δp_N [N/m^2]
1	Servovalve 1 4WSE2EM10	45	10	$300 \cdot 10^5$	$70 \cdot 10^5$
2	Servovalve 2 4WSE2EM16	100	16	$300 \cdot 10^5$	$70 \cdot 10^5$

where: $\boldsymbol{Q_n}$ – nominal flow; $\boldsymbol{D_N}$ – nominal diameter; $\boldsymbol{p_N}$ – supply pressure; $\boldsymbol{\Delta p_N}$ – nominal pressure drop.

Simulation was performed under the following condition: variable viscosity ($\eta_1 = 0.1206$ [Pas]; $\eta_2 = 0.112$ [Pas]; $\eta_3 = 0.104$ [Pas]), constant positive allowance (4 [μm]) and different values of the input voltage ($U_1 = 1.85$ [V]; $U_2 = 4$ [V]; $U_3 = 7$ [V]) [6].
In Figure 5 are shown the results obtained for the first servovalve (for positive allowance j = 4 [μm] and the input voltage $U_1 = 1.85$ [V]) and in Figure 6 for the second servovalve.

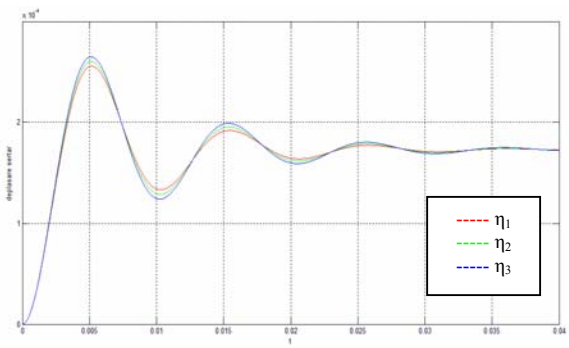


Figure 5: Servovalve 1 - U=1.85*[V], j=4 [μm],*
η – variable [Pa·s]

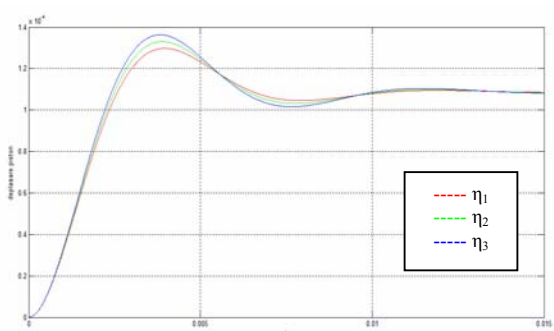


Figure 6: Servovalve 2 - U=1.85*[V], j=4 [μm],*
η – variable [Pa·s]

Quality parameters of step response (pointed in Figure 11) are shown in Table 6 (for servovalve 1), Table 7 (for servovalve 2) and graphs in Figure 12 (for servovalve 1) and 13 (for servovalve 2). Were analyzed only overadjustment (σ) and the period of transitory regime (t_t) which have the most important meaning in relation with the involved issue.

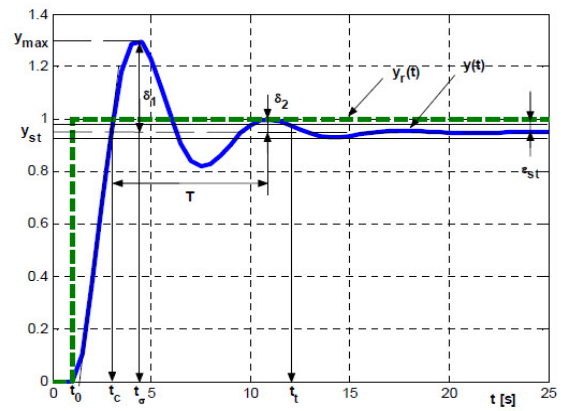


Figure 7: *Quality parameters of step response*

Tabel 6: *Quality parameters for varying viscozity – SERVOVALVE 1*

No crt	Quality parameters	j = 4 [μm]; U = 1.85 [V]		
		η_1=0.1206	η_2=0.112	η_3=0.104
1	Value of stationary regime **(y_{st}) [mm]**	0.17297	0.17297	0.17298
2	Overadjustment **(σ) [%]**	0.4790	0.5060	0.5322
3	Period of transitory regime **(t_t) [ms]**	21	22.7	24.4
4	Increasing time **(t_c) [ms]**	2.725	2.695	2.665
5	Attenuation degree **(δ)**	0.77	0.744	0.717

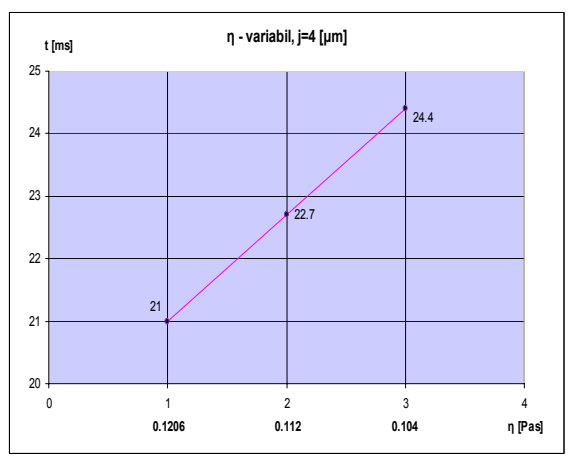


Figure 8: *Variation of transitory regime period depending to the viscosity variation – Servovalve 1*

Tabel 7: *Quality parameters for varying viscozity – SERVOVALVE 2*

No crt	Quality parameters	j = 4 [μm]; U = 1.85 [V]		
		η_1=0.1206	η_2=0.112	η_3=0.104
1	Value of stationary regime **(y_{st}) [mm]**	0.10861	0.10861	0.1086
2	Overadjustment **(σ) [%]**	0.1947	0.2248	0.2553
3	Period of transitory regime **(t_t) [ms]**	7.3	7.8	8.4
4	Increasing time **(t_c) [ms]**	2.295	2.23	2.17
5	Attenuation degree **(δ)**	0.963	0.951	0.935

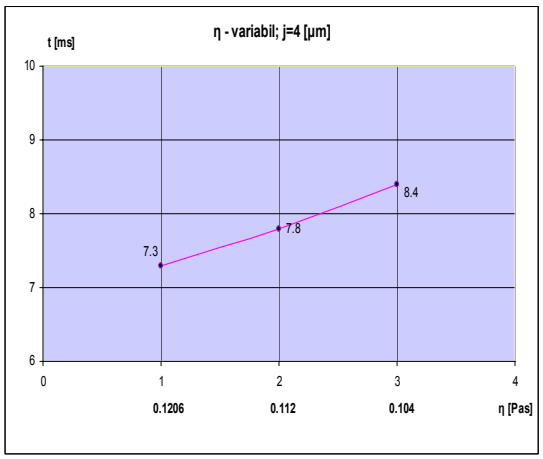


Figure 9: *Variation of transitory regime period depending to the viscosity variation – Servovalve 2*

5. CONCLUSIONS

- The values of overadjustment (σ) and the period of transitory regime (t_t) are influenced by viscosity variation as follows:
  - overadjustment (σ) and the period of transitory regime (t_t) increases with viscosity decrease for a constant value of the positive allowance and they are not influenced by the input voltage;
  - servovalves flow increasing lead to decreasing values for overadjustment and for the period of transitory regime.
- Servovalves overadjustment values increases with viscosity decrease;
- Servovalves with lower flow are more sensitive to viscosity changes caused by the effect of contamination than those with higher flow; therefore the servovalves precision is differentiated according to flow size, considering lubricant degradation in time.

REFERENCES

[1]. **Pătruţ, P., Nicolae, I.,** *"Acţionări hidraulice şi automatizări – teorie, aparate, sisteme automate şi aplicaţii industriale"* – Editura Nausicaa, Bucureşti, 1998.

[2]. **Rădulescu, I.,** *"Cercetări experimentale privind monitorizarea lubrifianţilor industriali pe durata lor de viaţă"* - Teză de doctorat, Bucureşti, 2010.

[3]. **Ionescu, I., Mareş, C.,** *"Servovalve electrohidraulice – concepţie, baze fizice, fabricaţie, încercări, tendinţe"*, Editura Lux Libris, 1996, Braşov

[4]. **Călinoiu, C., Vasiliu, N., Vasiliu, D., Catană, I.,** *"Modelarea, simularea şi identificarea experimentală a servmecanismelor hidraulice"*, Editura Tehnică, Bucureşti, 1998 .

[5]. **Catană, I., Vasiliu, D., Vasiliu, N.,** *"Servomecanisme electrohidraulice – construcţie, funcţionare, modelare, simulare şi proiectare asistată de calculator"*, Bucureşti, 1995.

[6]. **Popovici, A.I.,** *"Simularea numerică şi determinarea experimentală a efectului uzurii asupra performanţelor sistemelor hidraulice de reglare automată"*, Raport de cercetare nr. 3, Bucureşti, 2012.

[7]. **David, R.,** *"Stabilirea criteriilor optimale pentru alegerea sistemelor hidraulice de reglare automată în acţionarea utilajelor de construcţii"*, Teză de doctorat, Bucureşti, 2008.

[8]. **Robescu, D.N., şi alţii,** *"Fluide polifazice"*, Editura Tehnică, Bucureşti, 2010.

[9]. ***Catalog Rexroth** *"Hydraulik Trainer – Volume 2"*.

Quick Info

Improve Your Data Logging Productivity Using Advanced Limit Testing

A D V A N C E D L I M I T T E S T I N G
Snapshot: Product Qualification

Understanding how temperature changes can affect the performance of a product is a requirement for most designers. One electronics designer needed to qualify the performance of a vacuum pump by performing tests over a wide range of temperatures. As computer hard drives become larger and more affordable, the designer wanted to capture all the data while the tests were running, then go back and analyze the data to focus on areas of destabilization.
To make the analysis more effi cient, the designer used Agilent BenchLink Data Logger Pro and set up fl oating limits to indicate when the performance of the vacuum pump became unstable, making it easier to zero in on the problem areas. This solution improved the designer's productivity by eliminating programming, setting up and configuring the automated test more quickly, and reducing the analysis time.
Data logging hardware and software is used to collect and interpret data for design validation in a wide variety of applications. For example, environmental testing is required for many new products.
During environmental testing, you subject a product to extreme changes in temperature, pressure and humidity to prove it can safely function in various environments.
Automated data logging is ideal for these extensive and often time-consuming tests.
You can confi gure different channels of your data logger to make assorted measurements, such as temperature, voltage, resistance or pressure throughout the duration of the test so the data can be collected and analyzed. Creating a program or using software such as Agilent's BenchLink Data Logger Pro can be helpful in setting up your experiment, and adding limit testing to your experiment can help you quickly determine whether the design has performed as you expected.

Limit testing using fixed ranges

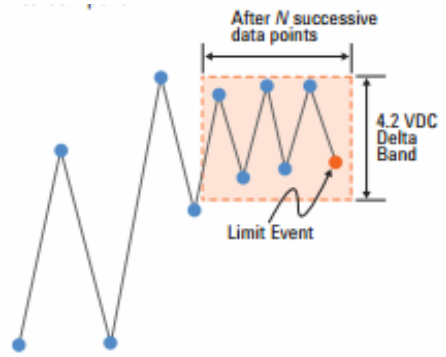
When your application calls for a fixed limit, introducing limit testing to your data logging program is very straightforward.
The measurement is compared to the limit:

- Exceeds high level:
measurement > high level
- Exceeds low level:
measurement < low level
- Out of range:
measurement > high level or
measurement < low level
- Within range:
measurement < high level and
measurement > low level

When you write a data logging program, you can apply these tests to indicate whether the measurements fall within the limits. Agilent's BenchLink Data Logger Pro software will automatically fl ag readings in red (or another color you choose) to indicate failed limits on the graph or on the limit light panel. When you export the data for analysis, BenchLink Data Logger Pro will also indicate failed limits for easy identification to aid in your investigation.

Limit testing using floating ranges

For some applications, it can be difficult to determine the absolute limits.
When you are looking for an oscillator, temperature, or reference to stabilize within a band (or to be alerted when destabilization has occurred), floating limits can be a better fi t.
When you write your own program, you can analyze the most recent values and determine if the difference between the minimum and maximum reading fits within a specified range. For example, if you use a Java array to store the last N readings, the function java.util.Arrays.sort() will order the array so the minimum and maximum (fi rst and last) values in the array can be compared.
When you use Agilent's BenchLink Data Logger Pro, the channel limit settings allow you to simply select whether you are looking for the readings to stabilize or you want to be warned when the readings destabilize. Then you can set the delta for the band and the number of data points to compare.



Example of using fl oating limits to find stabilization by looking for six successive readings within the specified delta band.

(source:
http://cp.literature.agilent.com/litweb/pdf/5989-8466EN.pdf)

ASPECTE PRIVIND RUPEREA MATERIALELOR METALICE SUB INFLUENȚA TEMPERATURII / SOME ASPECTS REGARDING METALLIC MATERIALS FRACTURE DUE TO TEMPERATURE INFLUENCE

Savaniu Ioan Mihail, Vlase Monica

Technical University of Civil Engineering of Bucharest, Bucharest, ROMANIA, mihaisavaniu@yahoo.com
Technical University of Civil Engineering of Bucharest, Bucharest, ROMANIA, monica_utcb@yahoo.com

REZUMAT
Articolul prezintă rezultatele unui studiu comparativ privind ruperea materialelor metalice avand in vedere variatia de temperatura. S-a analizat pentru o piesa metalica simpla corelatia dintre rezultatele obtinute pe cale experimentala si cele obtinute in urma unei modelari cu ajutorul elementului finit. Analiza efectuată oferă informatii care ajuta in validarea rezultatelor obtinute in urma modelarii cu element finit a unei structuri metalice la care se are in vedere temperatura structurii.

ABSTRACT
The paper presents the results of a comparative study regarding metallic material fracture due to temperature variation. It was analyzed, for a simple metallic sample, the corelation between the results obtained using the experimental method and than the finite element modeling. The analysis offers informations that helps the results validation obtained by finite element modeling of a metallic structure, considering the structure temperature.

KEYWORDS: *ductile fracture, fragile fracture, temperature variation, finit element*

CUVINTE CHEIE: *ruperea ductila, rupere fragila, variatia temperaturii, element finit*

1. INTRODUCTION

The analysis of metallic materials way of fracture is very important in engineering practice. In the case of a macroscopic analysis of a deteriorated metallic sample, we can easily detect, by the shape and the way of fracture, the type of the material that was used, or the type of the stress that deteriorated the metallic sample.

The metallic materials fracture can be classified by the following criteria:

- the crystallographic way of fracture or the fracture aspect;
- the size of the plastic deformations that precede the fracture.

The metallic materials fracture can be ductile, fragile or mixed. The behavior of the ductile or the fragile fracture is not allways an intrinsic feature of each metallic material. The fracture behavior can be essentially influenced by the factors that describe the mechanical stress conditions which determine the fracture:

- material temperature during the loading;
- the velocity of the load application;
- the way of the stress development in the tested sample, depending on the load complexity and the presence of the stress concentrators or structural defects inside the material.

We can consider that the main influence factor is the metallic material temperature during the stress period, and the characteristic threshold corresponding to this factor is the so-called ductile-fragile transition temperature. If the temperature of the mechanical tested sample is higher than the transition temperature, it's fracture behavior is ductile, and also, if the material temperature decreases under the transition temperature, it's fracture behavior is fragile. The influence of the other two factors are considered based on the changes produced by the transition

temperature values; thus, the increase of the stress velocity (the dynamic stress or impact) and/or the increase of the way of stress development (as a result of the complex mechanical loading or the presence of the stress concentrators) determines the tendency of any metallic material towards a fragile fracture behavior and produces an increase of the material transition temperature (the increase of the temperature range in which the material has a fragile fracture behavior, and as a result, the decrease of the temperature range in which the material has a ductile fracture behavior).

In order to highlight the specific features of the policristaline metallic materials behavior under mechanical stress, it is used as a reference test, the tensile/traction test using the traction equipment. After testing some samples with the traction equipment, depending on the material nature and/or the influence of the factors previously shown, we can obtain fractures as presented in fig.1

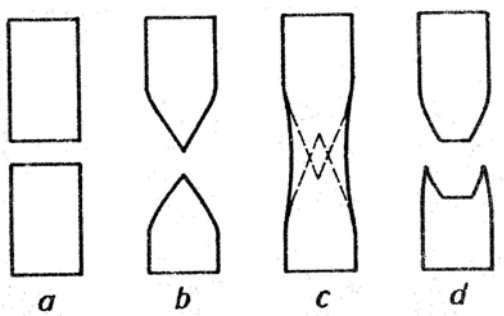


***Figure 1**. Different fractures in traction stress: a) fracture by fragile tearing; b) fracture by shearing (ductile); c) fracture by shearing of the materials with moderate ductility; d) cone-cup fracture.*

The paper presents a comparative study between the results obtained in a real experiment and the results obtained in a SOLIDWORKS simulation. The purpose of the paper is to highlight the relation between the fracture character and the temperature during the load period, in a real environment as well as in a virtual environment. In this study we try to validate the results obtained using modeling programs with finite element for metallic samples, considering also the temperature of the virtual model

2. EXPERIMENTAL RESULTS

We have considered a rectangular bar made of hipoeutectoid steel - OL 5. In fig. 2 it is presented the microscopical analysis of the tested steel and it is observed it's ferrite-pearlite structure. The rectangular bar was tested using the tensile/traction equipment in order to determine the material characteristics. The bar has a rectangular section with the 10 x 10 mm dimensions and 250 mm length. The bar was fixed in the equipment clamping disks as shown in fig.3.

The traction equipment indicates the value of the fracture force (daN) applied to the clamping disks at which the sample breaks. The value of the fracture force was 5700 daN. This value was considered, also, as the load force in the finite element simulation method. The tests were carried out on several samples which were heated or cooled. During the testing period it was observed – in the case of the heated samples – that they broked at the interface of the rectangular bar and the clamping disks of the equipment. A possible explanation is that in the clamping zone appears a thermal bridge between the heated bar and the clamping disks of the equipment that have the ambient temperature.

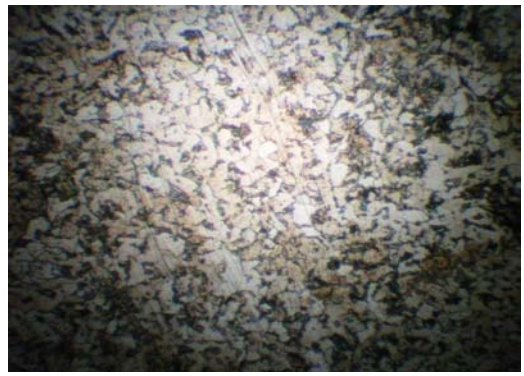


***Figure 2**.The microscopic analysis of the analised steel (200 X magnification).*

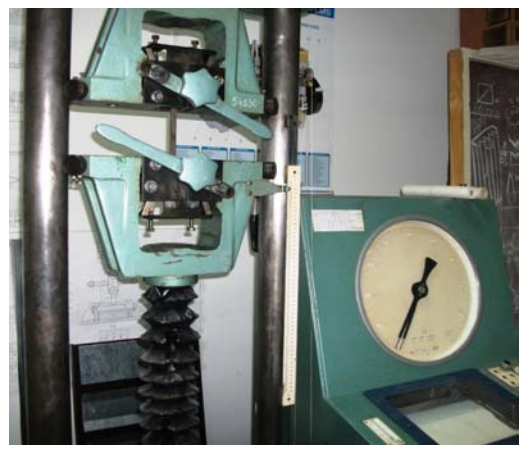


***Figure 3.** Tensile/traction test of the bar sample.*

3. THE TESTING RESULTS OF THE FINITE ELEMENT SIMULATION METHOD

Regarding the finite element simulation method we created a model, in a virtual environment; the metallic sample is made of OL 52 steel. The system strain was calculated and the point of the maximal strain was

determined. Also, the stress state of the virtual sample and the maximal stress was determinated.

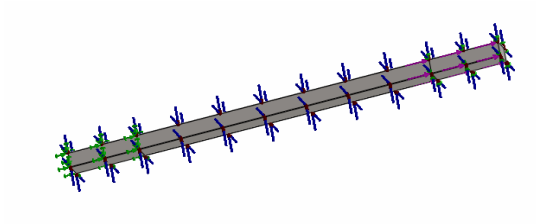


Figure 4. *The diagram of the suspension and load application.*

The finite element study was a static one and the strains in the clamping disks of the traction equipment were neglected.
Considering the temperature of the tested sample we have considered the following cases:

Case 1 – The calculus hypothesis according to an equivalent stress in the metallic sample, based on the V-th resistance theory of the potential energy of deformation – Von Mises, equal to the fracture stress of the OL52 steel, considering the metallic sample temperature fixed in the virtual clamping disks of – 200^0 C.

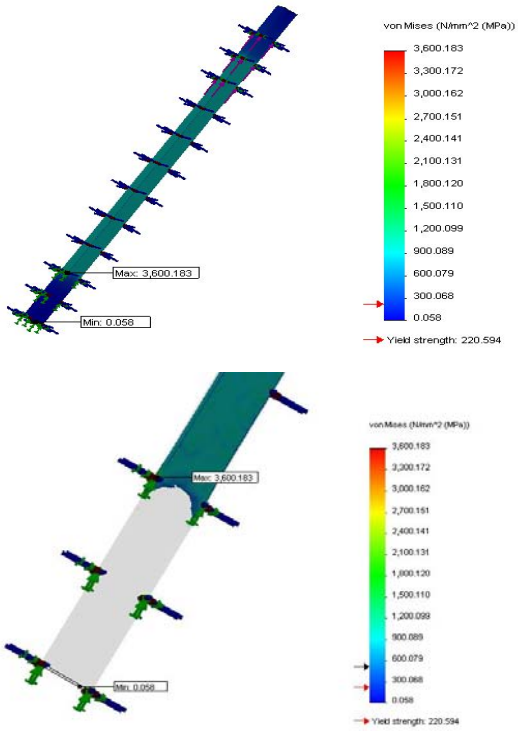


Figure 5. *Equivalent stress for the –200^0 C temperature.*

Case 2 – The calculus hypothesis according to an equivalent stress in the metallic sample, based on the V-th resistance theory of the potential energy of deformation – Von Mises, equal to the fracture stress of the OL52 steel, considering the metallic sample temperature fixed in the virtual clamping disks of – 100^0 C.

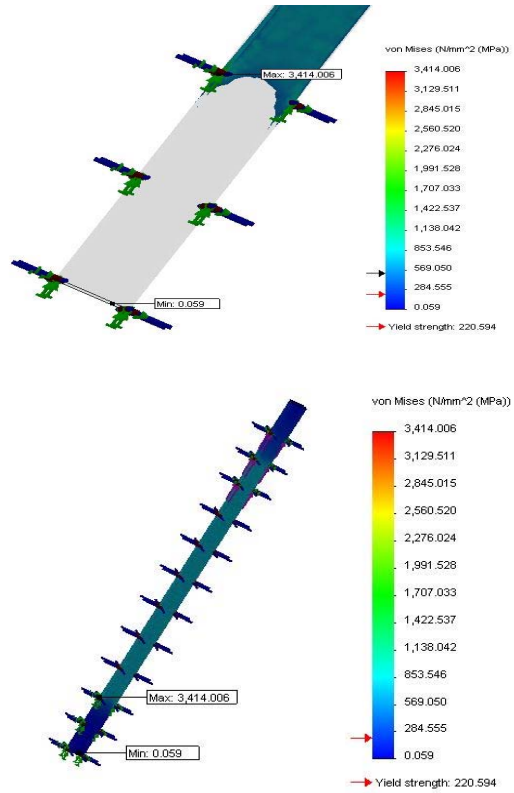


Figure 6. *Equivalent stress for the –100^0 C temperature.*

Case 3 – The calculus hypothesis according to an equivalent stress in the metallic sample, based on the V-th resistance theory of the potential energy of deformation – Von Mises, equal to the fracture stress of the OL52 steel, considering the metallic sample temperature fixed in the virtual clamping disks of 0^0 C.

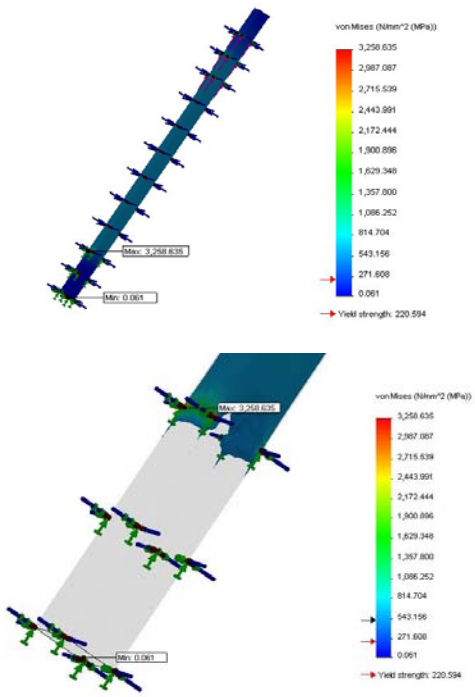


***Figure 7**. Equivalent stress for the 0^0 C temperature.*

Case 4 – The calculus hypothesis according to an equivalent stress in the metallic sample, based on the V-th resistance theory of the potential energy of deformation – Von Mises, equal to the fracture stress of the OL52 steel, considering the metallic sample temperature fixed in the virtual clamping disks of 100^0 C.

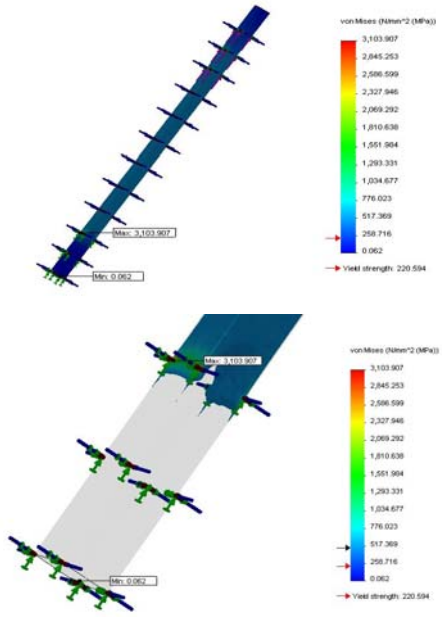


***Figure 8**. Equivalent stress for the 100^0 C temperature.*

Case 5 – The calculus hypothesis according to an equivalent stress in the metallic sample, based on the V-th resistance theory of the potential energy of deformation – Von Mises, equal to the fracture stress of the OL52 steel, considering the metallic sample temperature fixed in the virtual clamping disks of 200^0 C.

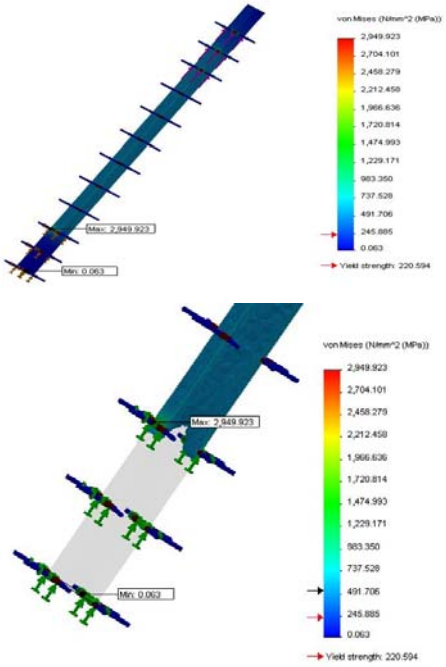


***Figure 9.** Equivalent stress for the 200^0 C temperature.*

The simulations were repeated for another five situations, corresponding to 400^0 C; 600^0 C; 800^0 C; 1000^0 C and 1200^0 C temperatures. The results are presented in the next chapter.

4. RESULTS INTEPRETATION

Based on the test results, regarding the stress that developes in a real metallic structure tested in the conditions of a certain load and temperature and regarding the equivalent stress obtained in the finite element simulation method of a virtual model of the metallic construction, we have obtained the results presented in the following table:

Nr.	Sample temperature in SW simulation [^{0}C]	Maximal stress in the tested metallic construction [MPa]	The metallic sample strain [mm]
1	-200	3600.18	0.476
2	-100	3414.00	0.493
3	0	3258.63	0.510
4	100	3103.90	0.527
5	200	2949.92	0.544
6	400	2764.43	0.578
7	600	2661.3	0.612
8	800	2967.75	0.646
9	1000	3768.84	0.680
10	1200	4573.42	0.714

In the case of finite element simulation method, the diagrams of the results show a stress and strain variation with the temperature.

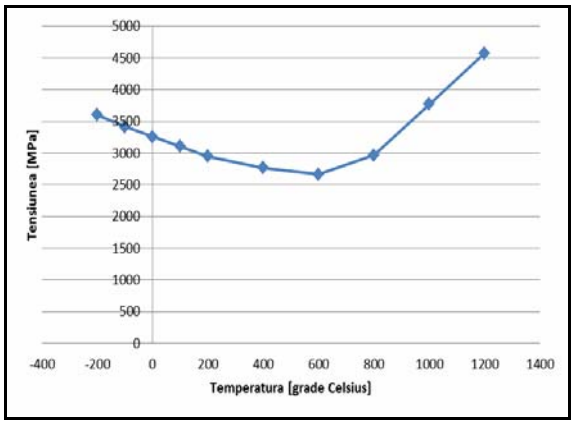


***Figure 10.**: The stress variation in the metallic sample with the temperature variation.*

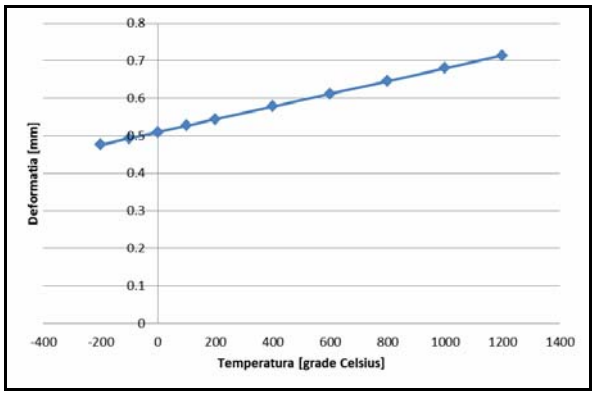


***Figure 11.** The strain variation in the metallic sample with the temperature variation.*

5. CONCLUSIONS

The experimental conclusions are:

- in the case of finite element modeling we observed that the stress in the tested sample has high values both at low and high temperatures. The increase of the stress in the tested sample, in the same conditions of suspension and loading, suggests that the mechanical strength of the metallic sample increases with the temperature decrease. This increase of the stress with the temperature decrease is validated by the tests carried out on the real model and also presented in the scientific papers [4]. Analyzing the stress variation in the metallic sample, it can be observed the same phenomenon that appears with the temperature increase, phenomenon which is difficult to explain;
- also, analyzing the strain variation with the temperature, it can be observed it's decrease with the decrease temperature of the metallic tested sample, which suggests a ductility decrease and thus, the appearance of fragility. At lower temperatures the strain is smaller than the strain in the case of normal temperatures, as the tensile/traction tests confirme.

REFERENCES

[1]. **Buzdugan Gh** – *Rezistenta Materialelor , Editura Academiei, Bucharest, 1986*;
[2]. **Zlateanu Tudor** – *Tehnologia Materialelor, U.T.C.B.,* Bucharest, *1982*;
[3]. **Herman Schuman** – *Metalurgie Fizica,Editura Tehnica, Bucharest, 1957;*
[4]. **George Dieter** – *Metalurgie Mecanica, Editura Tehnica., Bucharest, 1970;*
[5]. **M.Blumenfeld** - *Introducere in metoda elementelor finite, Editura Tehnică, Bucharest, 1995.*

Quick Info

Hints for Selecting the Correct Temperature Sensor for Your Application

If you want to make reliable temperature measurements, you need to carefully select the right temperature sensor for your application. Understanding the advantages and disadvantages of temperature sensors will help you take the proper precautions when you set up a test.
Thermocouples, thermistors, resistance temperature detectors (RTDs), and temperature ICs are the most common temperature sensors used in electronic test.
This measurement brief compares operating ranges, accuracy, cost, stability, sensitivity and ease of use for these popular temperature sensors.

USING THE APPROPRIATE SENSORS

Snapshot: Temperature Profiling in Consumer White Goods

A manufacturer of high-end home refrigerators wanted to create a 3-D profi le of the temperature variations inside its refrigerators. The temperature profi le would allow the company to verify the accuracy and consistency of its refrigerators' internal temperature and also allow them to market temperature consistency as a valuable consumer benefit. The manufacturer chose to use Agilent 34970A data acquisition units to conduct the tests. Company test engineers then needed to select the best temperature sensors for the sensor array they needed to insert into the refrigerated cavity. The temperature range was fairy narrow, but they needed high accuracy over that range. Thermocouples were not accurate enough and thermistors were found unsuitable. Ultimately, using the four-wire resistance measurement technique, they used an array of RTDs because they gave the best accuracy in this application.

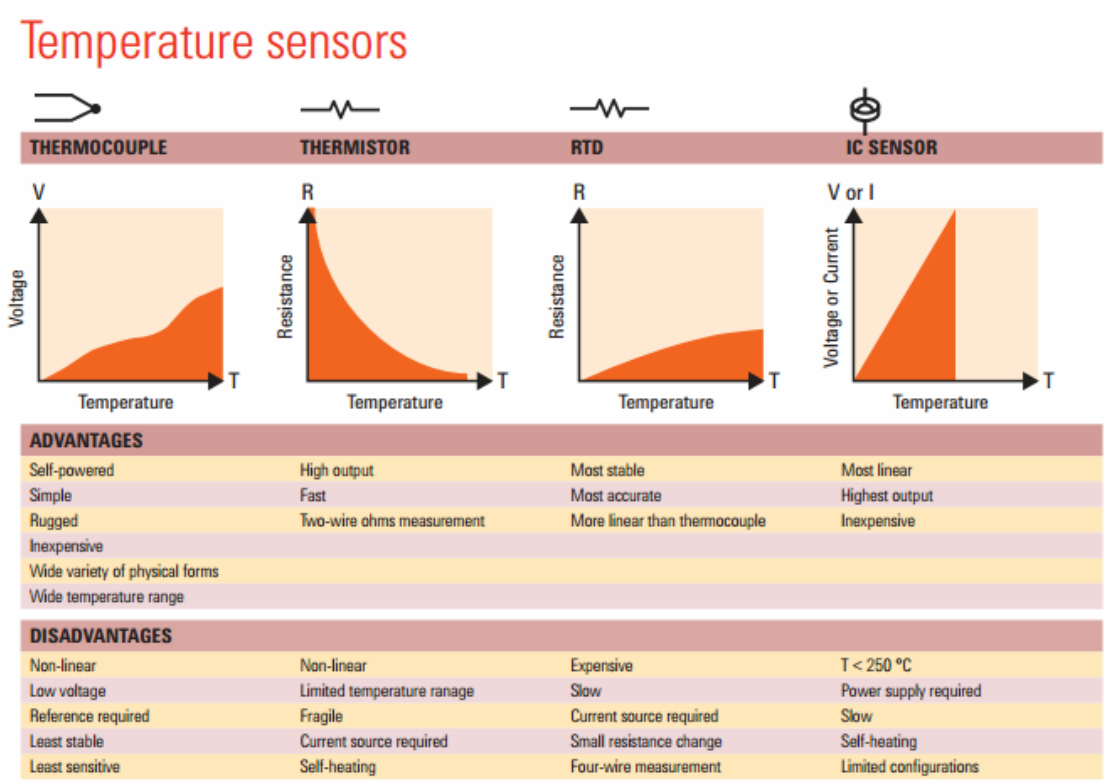


Figure 1: Advantages and disadvantages of popular temperature sensors

(source: http://cp.literature.agilent.com/litweb/pdf/5989-7800EN.pdf)

REALIZAREA MODELULUI CU ELEMENTE FINITE A ASAMBLĂRILOR NITUITE DIN STRUCTURILE DE AVIAȚIE
FINITE ELEMENT MODEL OF RIVETING ASSEMBLIES FROM AVIATION STRUCTURES

D. Bartiş[1], A. Lupaş[2], R. Nedelcu[3]

[1]Academia Tehnică Militară, Bucureşti, ROMÂNIA, danabartis@yahoo.com
[2] Academia Tehnică Militară, Bucureşti, ROMÂNIA, , lupas_a@yahoo.com
[3]Academia Tehnică Militară, Bucureşti, ROMÂNIA, roxananedelcu@yahoo.com

ABSTRACT:
The fatigue phenomenon appears especially during the exploitation of certain marks of the bodies subjected to variable requests in time or repeated. Usually the cracks start in no visible places, with the limit of the opening of a rivet or on the surface of assembly of the plates.
Generally the riveted joints problem it is a problem of non-linear fracture mechanic. Calculus effort is considerable enlarged by the numerical approach of the non-linear problem of fracture mechanics by comparison with that one of linear mechanics without a considerable intake on solution precision. For that reason fatigue durability prediction methodologies and fatigue damage risk prevention, generally take account on the linear elastic materials bearing. In this paper it is formulated a model which allows numerical problems solving in reasonable time.

REZUMAT:
Fenomenul de oboseală, apare în special în timpul exploatării unor repere de organe de maşini supuse unor solicitări variabile în timp sau repetate. În general, problema asamblărilor nituite este o problemă de mecanica nelianră a ruperii. Abordarea numerică a problemei neliniare de mecanica ruperii măreşte considerabil efortul de calcul, comparat cu cel din mecanica liniară, fără un aport pe măsură asupra preciziei soluțiilor. În această lucrare este formulat un model general al asamblărilor nituite pentru stabilirea metodolgiei de predicție a durabilității şi de prevenire a avariilor prin fisuri multiple.

KEYWORDS: durability, fatigue, damage, tension, cell, model, finit element

CUVINTE CHEIE: durabilitate, oboseală, avariere, tensiune, celulă, model, element finit.

1. INTRODUCERE

Avarierea componentelor structurale ale unui avion poate avea consecințe catastrofale, având drept rezultat pierderea avionului sau a chiar de vieți. Dintre factorii care influențează durata de viață a unui avion, ***oboseala*** reprezintă cel mai frecvent şi periculos fenomen.

Avioanele sunt proiectate cu o resursă inițială şi cu o rezervă de resursă sub care practic, fisurile datorate oboselii nu ar trebui să fie un motiv de îngrijorare. Cu toate acestea, faptul că avarierea prin oboseală este frecventă reprezintă dovada naturii complexe a acestui fenomen.

În literatura de specialitate sunt descrise trei tipuri de avarii care caracterizează prezența fisurilor prin oboseală MSD MED şi WFD [2], [3]:

- **MSD** (multiple-site damage) – *deteriorare prin fisuri multiple;*
- **MED** (multiple element damage**)** – *deteriorare în elemente multiple*;
- **WFD** (widespread fatigue damage) **-** *extinderea deteriorării cauzată de oboseală.* Apariția avarierii în locații multiple, MSD [4], [5], mai ales în primul rând de nituri ale îmbinărilor nituite din structurile fuzelajului, reprezintă un motiv foarte serios de îngrijorare.

2. FACTORI CARE LIMITEAZĂ DURATA DE VIAȚĂ A UNUI AVION

În cele mai multe dintre cazurile de cedare ale structurilor de aviație, cauzele avariilor au fost localizate la nivelul asamblărilor nituite unde, ca urmare a regimului de funcționare cu solicitări variabile se inițiază şi se dezvoltă fisuri, care în timp, prin propagare şi joncționare, diminuează rezerva de rezistență a structurii până la valoarea critică.

Pentru predicția durabilității la oboseală şi prevenirea riscului de avarie prin fisuri multiple în structurile de aviație cu asamblări nituite sunt necesare următoarele tipuri de analize:

- ✓ analiza tensiunilor globale şi locale în asamblările nituite;
- ✓ analiza locală, liniar elastică a găurilor de nit;
- ✓ analiza factorilor de intensitate a tensiunilor pentru fisurile inițiale şi dezvoltate de la găurile de nit;
- ✓ analiza la oboseală a fisurilor bazată pe mecanica ruperii.

3. FORMULAREA MODELULUI GENERAL AL ASAMBLĂRILOR NITUITE PENTRU METODOLOGIA DE PREDICȚIE A DURABILITĂȚII ŞI DE PREVENIRE A AVARIILOR PRIN FISURI MULTIPLE ÎN STRUCTURILE AERONAVELOR

Asamblările nituite sunt elemente structurale generatoare de risc, în special, datorită distorsionării puternice a câmpului tensiunilor în vecinătatea găurilor de nit.

Particularitatea importantă a avarierii prin fisuri multiple constă în joncțiunea unora dintre fisurile plasate pe găuri de nit adiacente, fapt ce contribuie, prin salt, la mărirea vitezei de degradare a asamblării.

Se alege pentru implementare în metodologia de predicție a durabilității la oboseală şi pentru prevenirea avariilor legea lui Paris pentru simplitatea ei şi pentru faptul că are cea mai largă utilizare în aplicațiile inginereşti [7] [8] .

Mărimea ΔK reprezintă variația factorului de intensitate a tensiunilor pe un ciclu. Dacă R este coeficientul de asimetrie a ciclului de solicitare variabilă, relația (1) se poate pune sub forma (2):

$$\frac{da}{dN} = C\Delta K^{n} \qquad (1)$$

$$\frac{da}{dN} = C[(1-R)K]^{n} \qquad (2)$$

Pentru a prinde efectele primelor două moduri de fisurare – modurile plane – factorul de intensitate a tensiunilor din relația (2) se înlocuieşte cu factorul efectiv al intensității tensiunilor definit de Tanaka [16] (3):

$$K_{ef} = \sqrt{K^{2}{}_{I} + K^{2}{}_{II}} \qquad (3)$$

În relația (3) K_I si K_{II} reprezintă factorii de intensitate a tensiunilor pentru cele două moduri de fisurare plană, respectiv modul I şi modul II .

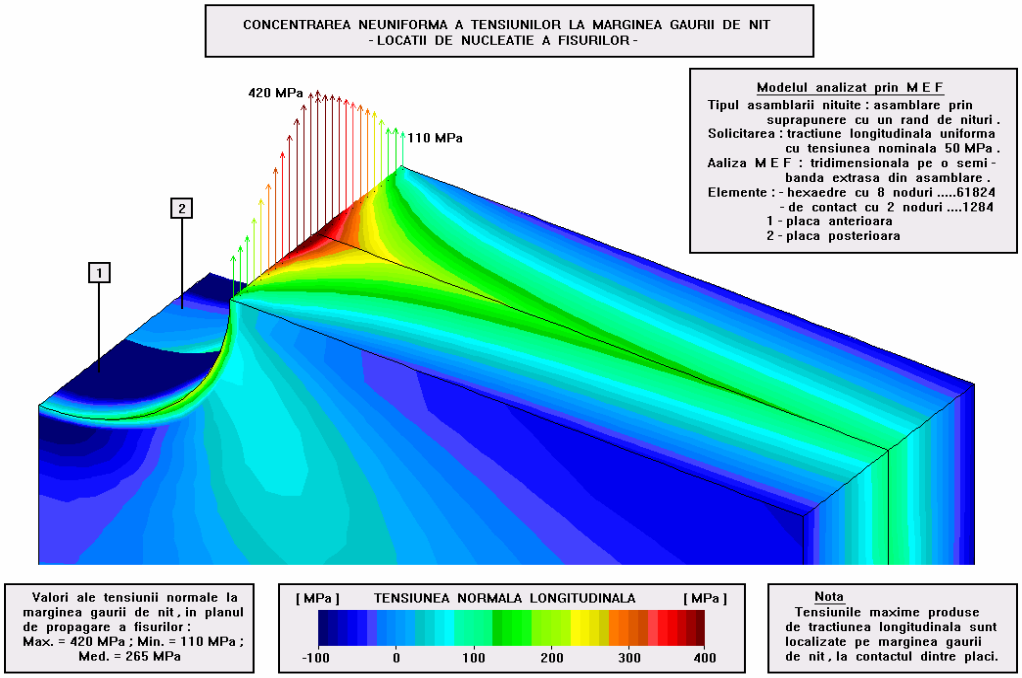


Figura 1. *Concentrarea tensiunilor la marginea găurii de nit*

În regim de solicitare variabilă concentrările de tensiune sunt surse de nucleaţie şi iniţiere a fisurilor.

Distribuţia tensiunilor în asamblările nituite prin suprapunere – asamblări simple – se stabileşte în funcţie de sarcinile variabile în timp, aplicate elementelor structurale.

Starea de tensiune la nivelul asamblării poate fi analizată ca o combinaţie a unei stări de tracţiune – starea principală – şi a unei stări de încovoiere excentrică.

În figura 1 este reprezentată o semibandă extrasă din asamblare corespunzătoare unei jumătăţi de nit [1].

Se observă câmpul de tensiune obţinut prin simularea numerică tridimensională cu elemente finite pe o asamblare cu un rând de nituri, solicitată la tracţiune longitudinală care localizează, fără echivoc, zona de iniţiere a fisurii, pe marginile găurilor, la contactul dintre plăci.

Câmpul de tensiune neuniform din vecinătatea nucleului de iniţiere a fisurii, consecinţă a suprapunerii tensiunii secundare de încovoiere peste tensiunea primară de tracţiune, imprimă viteze radiale neuniforme de propagare a fisurii.

4. INIŢIEREA ŞI PROPAGAREA FISURILOR ÎN ASAMBLĂRILE NITUITE MODELATE BIDIMENSIONAL

S-a observat că pot fi simulate cu succes în spaţiul tridimensional asamblări cu un număr limitat de nituri [3] [4] .

Comparând aceste date cu posibilităţile programelor de analiză MEF existente (până la 1024000 noduri) se constată că asamblările ce pot fi analizate cu aceste programe nu pot depăşi mai mult de 8 nituri.

Dar o asemenea aplicaţie ar dura, pe cel mai performant calculator personal actual, mai multe zeci de ore, uneori fiind necesară mărirea memoriei prin conectarea în paralel a mai multor calculatoare.

Pentru satisfacerea nevoilor actuale de calcul în domeniul structurilor de aeronave, cu asamblări nituite, realizarea modelului bidimensional [1] al iniţierii şi propagării fisurii este o necesitate (Figura 2).

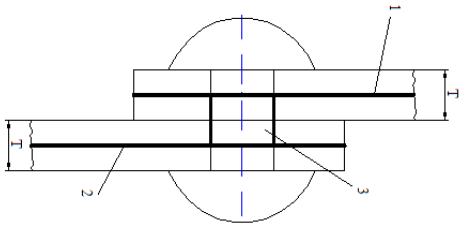


Figura 2. *Modelul bidimensional al asamblării nituite (pentru un singur nit)*

Linie groasa (1,2) - cele două plăci prin suprafeţele lor mediane; (3) - porţiunea din tija nitului ; linie subţire - asamblarea reală.

Avantajul principal al modelului bidimensional constă în reducerea cu o unitate a dimensiunii problemei evaluării câmpurilor de tensiune din asamblare, cu efecte favorabile asupra efortului de calcul.

În privinţa deformaţiilor, modelul bidimensional nu ţine seama de deformaţiile de încovoiere, în starea deformată suprafeţele mediane ale plăcilor asamblate, care iniţial erau plane, rămân plane.

În modelul bidimensional contactul dintre plăci şi tijele de nit se realizează pe curbe de contact, localizate în planul median al plăcilor, diferind astfel de situaţia reală când contactul se realizează pe suprafeţele de contact.

Substituirea contactului de suprafaţă cu contactul pe curbe are avantajul reducerii numărului de elemente de contact, fapt ce diminuează efortul de calcul.

Modelarea asamblărilor, include numai asamblări simple, deoarece ele reprezintă cvasitotalitatea asamblărilor de plăci, table, elemente de înveliş, prezente în structurile aerospaţiale.

Existenţa unei regularităţi în repartiţia niturilor în asamblare permite definirea unei celule unitare care include un nit şi domeniul vecin din asamblare. Cu ajutorul celulei unitare, prin multiplicare pe două direcţii, se poate construi partea principală a oricărei asamblări nituite.

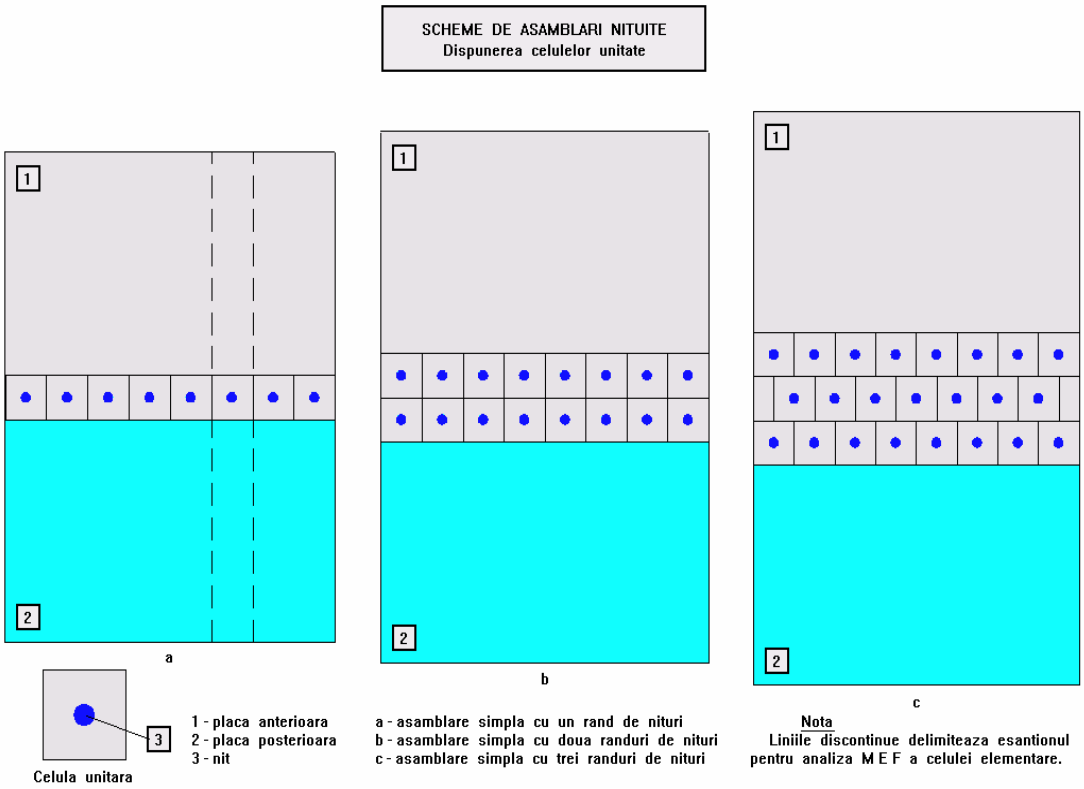


Figura 3. *Scheme de asamblări nituite, caracterizate fiecare prin numărul de nituri*

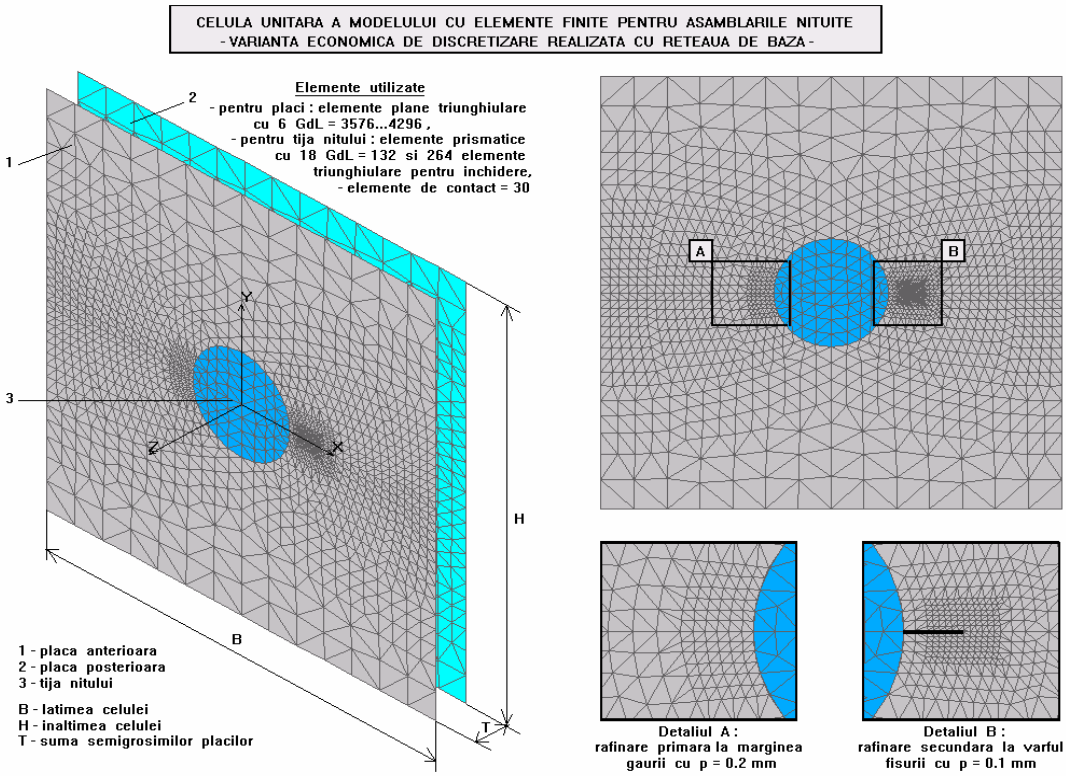


Figura 4. *Celula unitară*

5. CELULA UNITARĂ A MODELULUI GENERAL AL ASAMBLĂRILOR NITUITE

În abordarea problemelor mari prin metoda elementelor finite, discretizarea [6] este o operațiune importantă de care depinde, în foarte mare măsură, precizia soluțiilor.

În Fig. 4. este reprezentată celula unitară, a modelului general al asamblărilor nituite, modelată cu elemente triunghiulare cu 6 grade de libertate [1]. Cele două plăci, anterioară şi posterioară sunt discretizate cu rețeaua de bază de elemente finite. Rețeaua de bază este o rețea de elemente finite cu densitate variabilă. Pe direcția pe care urmează să se dezvolte fisurile, rețeaua de bază are pasul inițial constant, cu o valoare dată (p = 0,4 mm). Pornind de la direcția preconizată de propagare a fisurilor, densitatea rețelei se micşorează, pe măsura îndepărtării de linia niturilor.

Deoarece în asamblările nituite [7,8] se produce concentrarea tensiunilor pe marginea găurilor de nit şi la vârful fisurilor, acestor locuri li se acordă o atenție deosebită la modelarea cu elemente finite. Înainte de apariția fisurilor, în zonele de pe marginea găurilor de nit, se realizează o rafinare primară a elementelor prin reducerea la jumătate a pasului de discretizare (detaliul A din figura 4). După inițierea unei fisuri, zona în care aceasta a apărut se supune unei rafinări secundare, care reduce pasul de discretizare încă o dată la jumătate. În timpul propagării fisurii, zona de rafinare primară şi cea de rafinare secundară se centrează pe vârful fisurii şi se deplasează împreună cu acesta (detaliul B).

Starea de solicitare fiind starea plană, fiecărui nod îi sunt asociate numai două variabile nodale – deplasările pe axele OX şi OY (figura 4).

Pentru modelarea cu elemente finite a tijei nitului (figurile 4–3), sunt folosite elemente prismatice cu baza triunghiulară, în concordanță cu tipul de elemente alese pentru modelarea plăcilor. Închiderea tijei nitului între plăci, pentru simularea efectului capetelor de nit presupuse rigide, se face, de asemenea, cu elemente triunghiulare cu 3 noduri.

Contactul între tija nitului şi plăci, reprezentate prin planul lor median, este modelat cu elemente de contact de tipul NOD – NOD. Numărul de elemente cu care se modelează plăcile nu este un număr constant, existența fisurilor face ca acesta să varieze datorită inițierii şi propagării lor.

6. VALIDAREA REȚELEI DE BAZĂ

Verificarea rețelei de bază [1] se face prin compararea cu o rețea fină. Rețeaua fină se obține din rafinarea rețelei de bază, rafinare ce constă în divizarea fiecărui element triunghiular din rețeaua de bază, în patru elemente triunghiulare.

În figura 5 sunt prezentate câmpurile tensiunilor echivalente von Mises în celula unitară prevăzută cu două fisuri simetrice. Datorită simetriei, în figură au fost reținute jumătăți ale celulei unitare, dispuse simetric față de axa de simetrie. În partea stângă este dispusă jumătatea de celulă unitară discretizată cu rețeaua de bază iar în partea dreaptă jumătatea celulei unitare discretizate cu rețeaua fină.

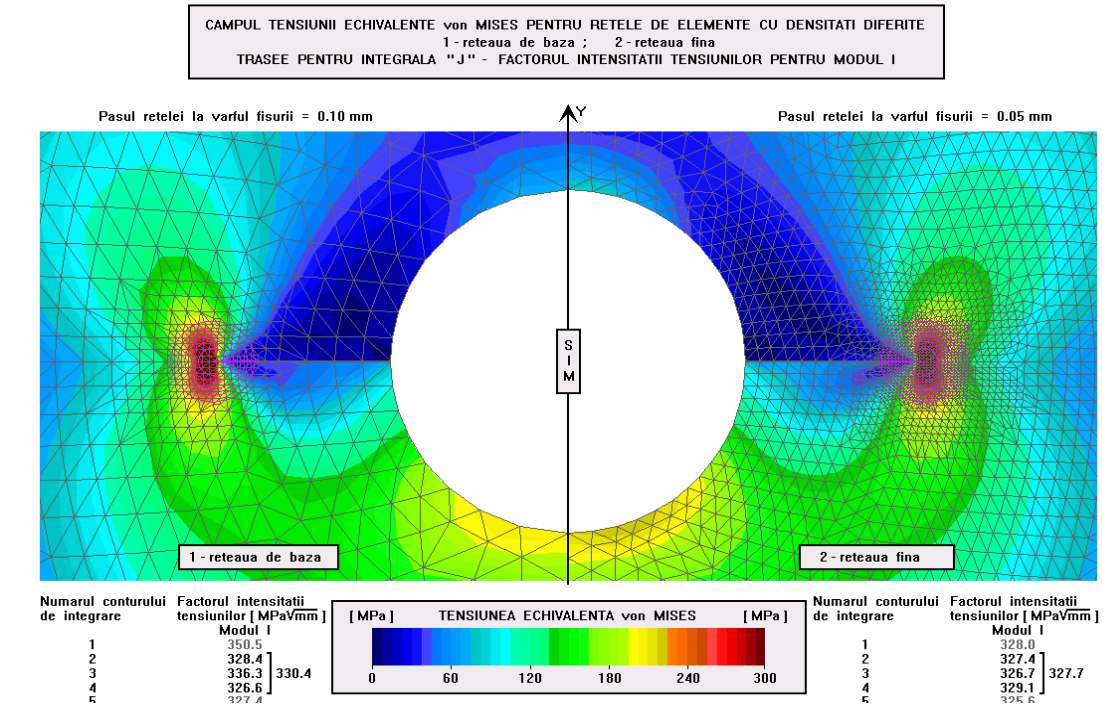


Figura 5. *Câmpul tensiunii echivalente Von Mises pentru rețele de elemente cu densități diferite*

Simetria relativă a câmpurilor de tensiune reprezentate în figura 5 conduce la concluzia că soluțiile obținute pe cele două rețele de discretizare sunt foarte apropiate. Se remarcă că modelul cu elemente finite, aplicat fisurilor în materiale cu proprietăţi liniar – elastice nelimitate, conduce la câmpuri cu puternice concentrări de tensiune la vârful fisurilor.

7. ANALIZA CÂMPURILOR DE TENSIUNE LA VÂRFUL FISURII

Deoarece materialele utilizate în construcția structurilor de rezistență ale aeronavelor, au comportări elasto – plastice, care determină o distribuție diferită a tensiunilor în vecinătatea vârfului fisurii în comparație cu modelul lui Irwin sau cu soluțiile obținute prin metoda elementelor finite pe medii liniar – elastice, se impune o analiză comparativă a comportării fisurilor în medii modelate ca elasto – plastice şi liniar elastice.

S-au considerat la fiecare model câte două fisuri simetrice, pornind de la marginea găurii de nit şi având lungimea a = 2,5 mm.

Pentru discretizarea celor două modele s-au utilizat [1] elemente plane patrulatere care reprezintă mai fidel câmpul tensiunilor în stare elasto – plastică. Ambele modele sunt supuse solicitării de tracțiune longitudinală cu aceeaşi valoare a tensiunii nominale de 50 MPa.

În figura 6 sunt reprezentate câmpurile tensiunilor echivalente von Mises în cele două modele comparate, cu detalii centrate pe vârful fisurilor în fig.ura 7, se constată diferențe mai accentuate ale câmpurilor de tensiune în zonele adiacente vârfurilor, acolo unde stările de tensiune sunt diferite pe cele două modele.

Pe măsura îndepărtării de vârful fisurilor cele două câmpuri de tensiune tind să se egalizeze, simetria reprezentărilor demonstrând acest fapt.

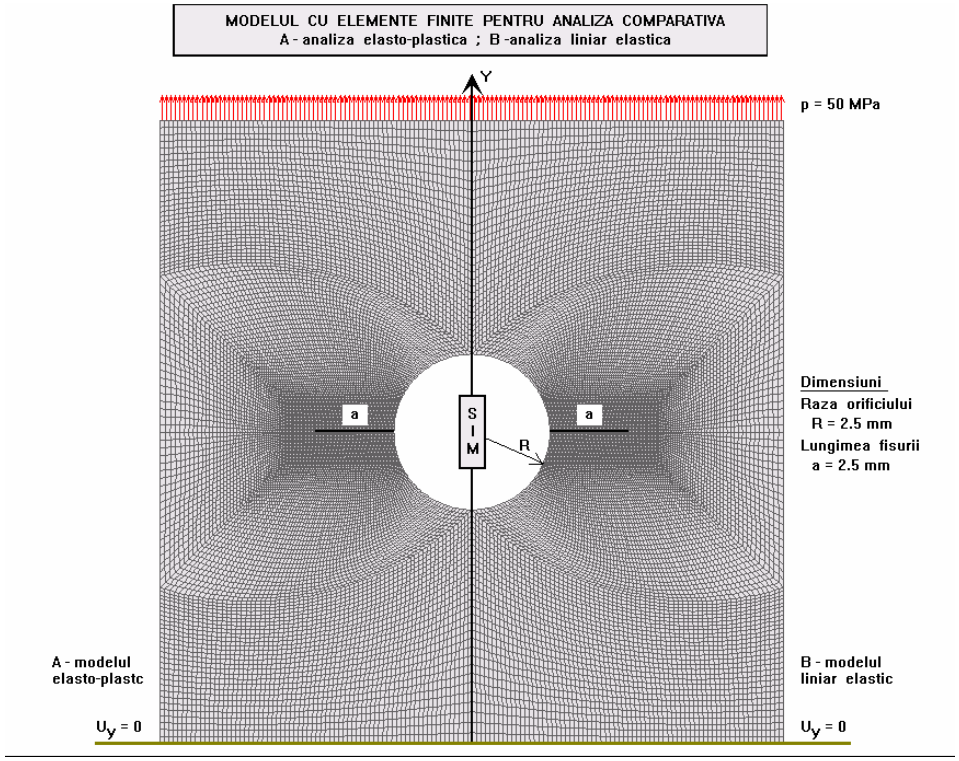


Figura 6. *Modelul cu elemente finite pentru analiza comparativă*

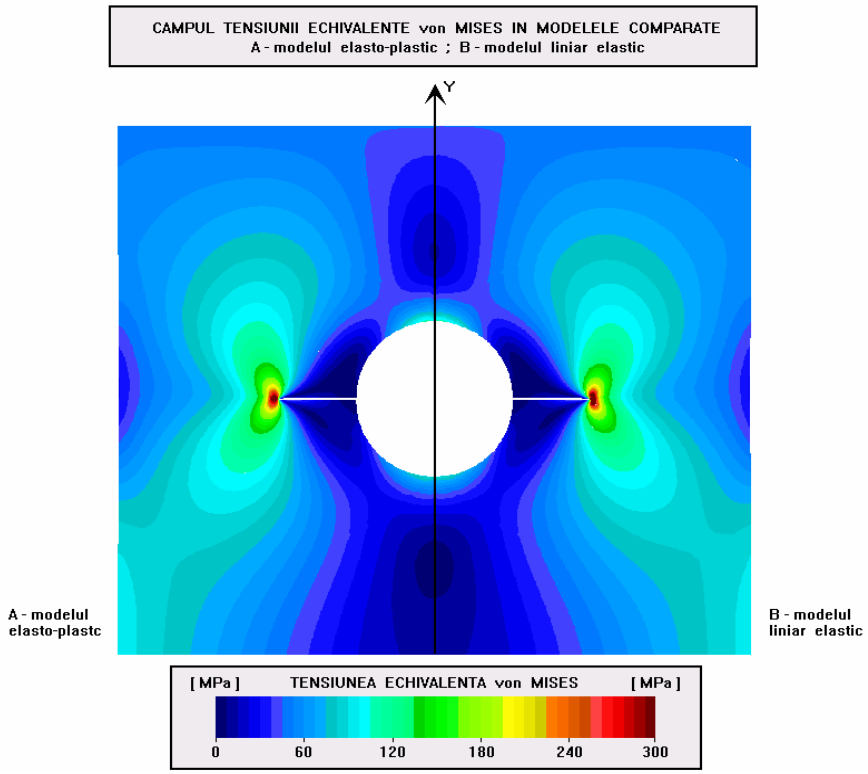


Figura 7. *Câmpul tensiunilor echivalente von Mises în modelele comparate*

Analiza comparativă a câmpurilor de tensiune stabilită pe cele două modele şi a erorii permite simplificarea modelării cu elemente finite a asamblărilor nituite prin adoptarea proprietăţilor liniar elastice pentru material.

Pentru decizia finală asupra fineţii reţelei la vârful fisurii, se mai face o analiză comparativă în care sunt implicate trei reţele cu densităţi diferite: de bază, fină şi foarte fină. Compararea soluţiilor obţinute pentru cele trei variante se face pe baza valorilor integralei totale J.

Utilizarea reţelei de bază la modelarea cu elemente finite a asamblărilor nituite se poate considera ca o soluţie acceptabilă din ambele puncte de vedere, precizie satisfăcătoare şi efort de calcul rezonabil.

Contactul se modelează cu elemente de contact de tipul NOD–NOD cu orientarea normală pe suprafaţa de contact. Elementul de contact NOD–NOD este definit de două noduri, câte unul pe fiecare corp ce intră în contact.

În figura 8 sunt reprezentate, în detaliu modelele cu elemente finite ale părţilor centrale din cele două tipuri de asamblări nituite, ocupate de celulele unitare.

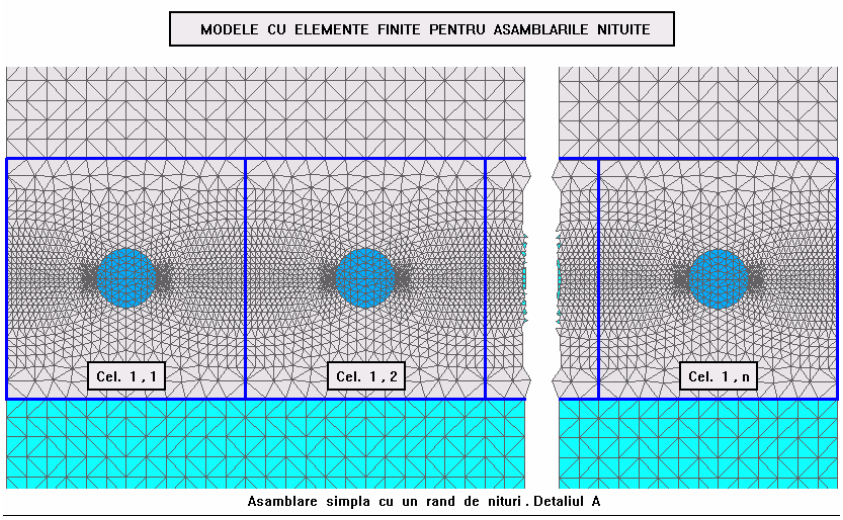


Figura 8. *Modele cu elemente finite pentru asamblări nituite*

Discretizarea cu elemente finite a celulelor unitare [1] se face folosind rețeaua de bază, definită mai sus, analizată şi validată. Detaliile din fig 8 evidențiază densitatea variabilă a rețelei de elemente finite pe celulele unitare. Densitatea maximă de elemente finite se atinge în zonele predictibile de concentrare a tensiunilor, care în situația inițială se găsesc la marginea găurilor de nit, iar după inițierea şi propagarea fisurilor se centrează pe vârful acestora.

8. CONCLUZII

Cercetările experimentale (prezentate în altă lucrare) [1] şi simulările numerice efectuate au arătat că datorită faptului că niturile sunt intens solicitate în timpul serviciului, atât datorită ciclurilor de presurizare a interiorului fuzelajului cât şi a solicitărilor la încovoiere, se pot iniția şi propaga fisuri mici, care se pot uni determinând distrugerea instantanee, aşa cum a demonstrat accidentul Aloha.

În modelul cu elemente finite al asamblărilor nituite fisurate se poate formula ipoteza propagării fisurilor în linie dreaptă, pe linia niturilor, în secțiunea de minimă rezistență.

Indiferent de situație, discretizarea cu elemente finite a celor două domenii ale fiecărei celule unitare se realizează folosind rețeaua de bază.

Această ipoteză permite adaptarea cu uşurință a modelului cu elemente finite al asamblărilor nituite afectate de fisuri la configurația geometrică în schimbare continuă.

Admițând ca certă linia niturilor ca linie posibilă de propagare a fisurilor, modelul cu elemente finite al celulei unitare se împarte în două subdomenii printr-un plan de separare, la nivelul axelor niturilor. Acest plan defineşte liniile niturilor pe cele două plăci ale asamblării.

Analiza câmpului de tensiune, pune în evidență câteva constatări deosebite [1]:

- vârful fisurii este un punct singular al domeniului, unde tensiunile iau valori infinite;
- după inițierea unei fisuri aceasta tinde să se propage, marginile fisurii tinzând să se depărteze una de alta, rămânând tot timpul libere.

Viteza de propagare a fisurilor depinde, în plus față de factorul de intensitate a tensiunilor, ΔK_{ef} , de tratamentul termic la care este supus aliajul de aluminiu şi de forma ciclului de solicitare.

9. BIBLIOGRAFIE

[1]: **Bartiş D**. ” *Contribution regarding joints influence in the estimation of technical resource in aviation structures”,* A thesis in Aviation Engineering*, Technical Military Academy, Bucharest, 2008.*

[2]: **Cali C., Citarela R., Perrela M.,** *Multiple site damage (MSD) crack growth: numerical evaluations and experimental tests,* Department of Mechanical Engineering, University of Salerno via Ponte don Melillo 1, 84084 Fisciano (SA), Italy, 1998.

[3]: **Bakuckas John,** Jr., *Structural Integrity of transport Airplanes,*Airworthiness Assurance Branch, AAR – 480, Atlantic City International Airport.

[4]: **Keller Eric, *Real-Time Sensing of Fatigue Crack Damage for Information-Based Decision and Control,*** ”A thesis in Mechanical Engineering, The Pennsylvania State University”, The Graduate School College of Engineering, May 2001.

[5]: **Ko L. William,** *Prediction of Service Life of Aircraft Structural Components Using the Half-Cycle Method,* NASA Technical Memorandum 86812.

[6]: **Muller R. P. G**., *An Experimental and Analytical Investigation on the Fatigue Behavior of Fuselage Riveted Lap Joints,* NLR TR 69116 U, 1969.

[7]: **Pastramă S. D., De Castro P. M. S. T.,** *Stress Intensity Factors for Crack Starting from rivet holes,* 9th Portuguese Conference on fracture – 2000.

[8]: **Pastramă S. D., De Castro P. M. S. T**., *Approximate Stress Intensity Factors for Multiple Elliptical and Through Cracks Developing from Holes,* 9th Portuguese Conference on fracture – 2004.

SCULE MINIERE DE PERFORAT/ MINING EXPERIMENTAL TOOLS FOR DRILLING OPERATION

Vlad Alexandru Florea

University of Petrosani, ROMANIA, e-mail: floreavladalexandru@yahoo.com

REZUMAT:
Excavarea lucrărilor miniere în roci tari este realizata prin tehnologia de perforare-puşcare; în cadrul acestei metode, perforarea găurilor este una din operațiile de bază ale acestei tehnologii si este realizată prin procedeul percutant.
Capetele detasabile, cu o singură muchie daltă, D.C.P., cu diametrul Φ 40mm. sunt cele mai uzuale scule miniere pentru perforarea găurilor, atât pentru cărbune, cât şi pentru minereuri; consumul lor are o „greutate" semnificativă pentru costul tonei de rocă perforată, depinzând de proprietățile fizico-mecanice ale rocilor.
În vederea reducerii costului sculelor cu o muchie daltă simplă a fost investigată posibilitatea utilizării aliajelor dure cu gradient structural, pentru producerea plăcuțelor care sunt muchii ale acestor scule, precum si aceea de pulverizare a taisurilor.

ABSTRACT:
The excavation of mine workings in hard rocks is made through drilling-blasting technology; in the frame of this method, the holes drilling is one of the basics operations of this technology and is realised by percussive procedure.
Single edge chisel bits, D.C.P., with Φ 40mm diameter, are the most usual mining tools for holes drilling, both for coal and ores mining; its consumption has a significant "weight" for the cost of drilled rock ton, depending on rocks physical-mechanical properties.
With a view to reducing the costs for simple edge chisel bits, was investigate the possibility to use hard alloys with structural gradient for producing the tippeds which are the edges of these tools, also,the pulverization on the bit surface.

CUVINTE CHEIE: scule, operatie de perforare, aliaje dure sinterizate, pulverizare

KEYWORD: tools, drilling operation, hard sintered alloys, pulverization

1. INTRODUCTION

Powder metallurgy is the best method of discovering and developing new materials, especially of the "structural gradient" type.

A new generation of structural gradient materials can be obtained by phase change, so that the resulting structure should meet certain operation conditions.

Until 1975, world-famous firms such as WIDIA VALENITE, TIZIT PLANSEE, SANDVIK COROMANT etc., have made hard sintered alloys based on WC-Co, after their own formula.

Hard sintered alloys are characterised by physical and mechanical features that enable them to be used in various fields of modern technology, [1].

It is important to point out that these features can be changed, according to the subsequent destination, by structural control, as well as by a controlled blend of the WC-Co system.

The advantages of this new technology are both economic and of the unlimited possibilities of utilisation of the processes specific for powder metallurgy for the realisation of different functional combinations.

2. EXPERIMENTAL DRILLING TOOLS

Hard sintered alloys, of WC-Co system, are used, on a wide scale, as material for mining tools edges: materials with structural gradient, from the same system, can offer a succession of spectacular solutions, for different practical imposed demands, [1].

The encouraging results, obtained until now, allowed the estimation of specific consumptions of drilling tools, with about 15% less than currently obtained ones.

Fine grain structures result in higher hardness, to the detriment of the bending and compression resistance. At the same time, the cobalt content leads to an increase of the bending resistance and, implicitly, of the tenacity but it diminishes hardness.

Of the standard use groups, the one named "G" comprises materials sintered from the WC-Co system with cobalt content of up to 30%. These materials are also used to produce the hard plates used to reinforce mining tools.

The mining tools for percussive drilling used in mine workings (figure 1) have high specific consumptions, which have a significant impact on the costs involved by the mining of useful minerals.

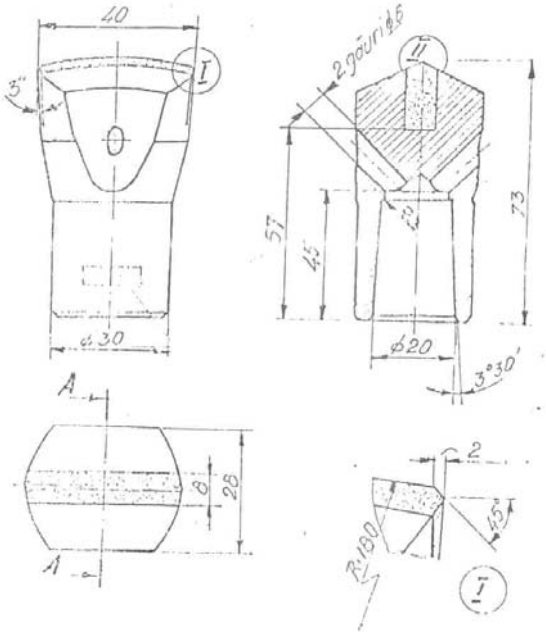


Figure 1. *Tools for percussive drilling*

Figure 2. *Worn detachable bits*

Figure 2 shows worn detachable bits, in most cases, the hard plates would be broken. It should be pointed out that these cases are specific to the drilling of hard and abrasive rocks.

Nowadays, the producers of such tools are concerned with the development of hard plates that last longer. One of these methods consists of the mechanical laying of the hard component in powder form over a sintered or presintered layer.

On grounds of this technique, the University of Petrosani-ROMANIA, in collaboration with specialised factories, has achieved sample sets of percussive drilling mining tools (figure 3). The hard alloys systems selected for these sets were, [2]:

- the WC-Co system (sorts G10, G20, G30);
- the WC-(Ta,Nb)C-Co (sorts K20 and K30);
- the WC-TiC-(Ta,Nb)C-Co (sorts P30).

Figure 3. *Experimental percussive drilling mining tools*

The set of tools was tested in siliceous sandstones with the following mechanical characteristics:

1. compressive strength [MPa] 46,0-52,0;
2. tensile strength [MPa] 38-46.

The concordance between the practical performance and the characteristics of the rocks in which the newly created structural gradient materials are tested is difficult to achieve; in the underground, drilling is performed in various rock structures, even within a one-meter length. Thus, it is necessary to permanently collect rock samples from the site of the experiment in order to establish the physical and mechanical characteristics of the respective rocks.

The results of the underground experiments using the detachable bits plated with hard alloys have proved about 15% lower specific consumptions, before the complete wear of the tools from the sample set.

Figure 4. *Drilling tools with hardening cutting edge by pulverization*

The cutting edge of the rotary boring bits are reinforced with tipped by brazing in order to obtain the mentioned properties and small wears.

The drilling tools with hardening cutting edge by pulverization were realized experimental for the purpose of eliminate the cemented carbide tip with the object of obviate their detach in the operating time, especially owing to inadequate quality of brazing.

The hardening by pulverization of mining tools (figure 4) with tungsten carbide powder, it is the positive results of practical experience in underground mine, in potential explosive medium.

The pulverization coating consist in pulverization of additional fusible metal under the form of fines particles on the bit surface, [3].

In the event of cemented carbide coating, the heat source (oxyacetylene flame) it is dissolved the additional metal and also one superficial layer from the base material, building up one melting bath in which the tungsten carbide are distributed

The work with pulverization bit attest that it not determined to inflame of the underground explosive mixture.

CONCLUSIONS

The tests of the drilling tools had confirm that:

- in case of percussive drilling, the tools used hard alloys with structural gradient for. producing the tipped which are the edges of these tools had a good abrasion wear behaviour in explosion hazard medium;
- the solution of hardening to the mining tools for rotary drilling by pulverization permit theirs utilization with good results, especially in coal but not also in hard rock.

REFERENCES

[1]. **Cojocaru M. -** Compozite materials, Ed. Matrix Rom, 1997.

[2]. **Colin C.** – Processing of composition gradient WC-Co Cermet, Vol. I, Reutte, 1993.

[3]. ***** SR EN 657:2005** „Thermical pulverization”.

Quick Info

Advanced Physics-Based Analysis for Aerodynamics Applications

(Live Presentation – Wednesday, May 16, 2012, 1:00 pm ET)

Simulation has been demonstrated to be a powerful tool for the modeling of complex fluid system behavior. Moving beyond single point analysis involves the introduction of new advanced approaches such as adjoint methods. Sensitivity analysis tools based on adjoint methods can be the foundation for a new view into the physics of the system and its behavior that allows not only optimization to be performed, but also the robustness of the design to be understood and managed. In this presentation the basic ideas behind adjoint methods will be described and an overview given of the implementation of the ANSYS Fluent adjoint solver. An explanation of the role of these methods in robust design and optimization will be presented. A discussion on related technologies such as mesh morphing will also be given. A number of examples will be shown to illustrate the workflow and the enabling effect that this extended set of tools can have on the engineering design process. Some of the challenges that remain will also be highlighted.

Speaker:
Dr. D.C. Hill, Principal Engineer, ANSYS, Inc.

(source: NASA Tech Briefs
ntb@ceryx.techbriefs.com)

The Next Step in Nondestructive Material Analysis – Damage and Contamination Analysis, Coating Evaluation and Material Identification Using Handheld FTIR Spectroscopy

(Live Presentation – Wednesday, June 6, 2012, 2:00 pm ET)

Handheld FTIR spectroscopy provides a range of new capabilities for non-destructive testing of composites, coatings and polymers. As the range of high performance materials increases, so do the needs for non-destructive testing. FTIR can be used for identification, performance testing and damage assessment of composites, polymers and coatings. In effect, FTIR spectroscopy allows chemist and engineers to non-destructively test the chemistry of a sample, similar to the way which ultrasound can non-destructively test the physical properties of a sample.

Recent technological advances in FTIR instrumentation have allowed miniaturization of laboratory instruments into compact, robust handheld instrumentation. By moving the measurement out of the laboratory and into the field, the spectroscopic measurements have truly become non-destructive, increasing their effectiveness for real world use.

This webinar will chronicle the advancements in handheld FTIR spectrometers and focus on their use for industrial applications. Examples will be given covering the deployment of these systems for applications in composites, coating and polymer analysis, showing how the measurements are done as well as the software advancements which allow the analysis to be done quickly in the field. The webinar will provide a new appreciation for what can be accomplished with non-destructive testing using handheld FTIR spectrometers.

Speaker:
Dr. John Seelenbinder
Applications Manager, Mobile Spectroscopy Products
Agilent Technology

(source: NASA Tech Briefs
ntb@ceryx.techbriefs.com)

EXPERIMENTAL PLANS METHOD WITH APPLICATION TO THE MODELING OF AN ELECTROSTATIC SEPARATION PROCESS

Alexandru Rădulescu [*], Alina Covrig[*], Lucian Dascalescu[**]

* University "POLITEHNICA" Bucharest, ROMANIA, e-mail: varrav2000@yahoo.com
** University of Poitiers, FRANCE

ABSTRACT
Electrostatic separation process is based on the electrical forces acting on charged or polarized particles in an electric field, generated by an electrode system connected to a high-voltage supply. The aim of this paper is to obtain a mathematical model capable to reflect the effects of a large number of controllable factors. The statistical analysis of the data revealed a significant correlation between the high-voltage, the roll-speed, the angular position and the quantity of the middling product in the processed material. These findings could be helpful for the optimisation of the operating conditions of the electrostatic separation applications where the metal content in the feed materials is characterized by important fluctuations with time.

KEYWORDS: Electrostatic separation, Experimental design, Experimental Plans Method.

1. INTRODUCTION

Electrostatic separation is based on the electrical forces acting on charged or polarized particles in an electric field [1], generated by an electrode system connected to a high-voltage supply. Applied high voltage should be adjusted close to the threshold beyond which spark discharges could occur between the electrodes, in the presence of the processed material [2, 3]. In this way, one ensures the highest possible intensity of the electric field, which implies best particle charging conditions, and most effective electric separation forces.

Indeed, electrostatic induction, which is the prevalent charging mechanism of conductive particles in roll-type separators (Fig. 1), depends directly of the electric field strength at the surface of the electrode carrier. Corona charging, which affects both conductors and insulators, is also proportional with the electric field strength, and hence with the voltage applied to the electrode system, [6].

The optimization of electrostatic separation processes requires the simultaneous control of various electrical and mechanical factors. In a roll-type corona-electrostatic separator, for instance, the granular mixture to be separated is fed with a certain speed on the surface of a rotating roll electrode, connected to the ground.

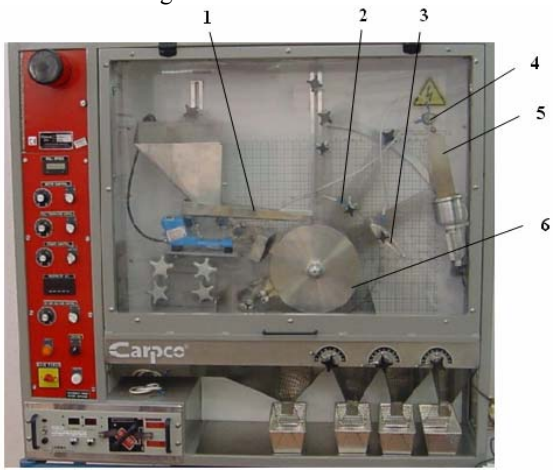


Figure 1. *Roll-type corona-electrostatic laboratory separator with high-voltage probe, [6]*

Legend: 1- feeder; 2 - corona electrode; 3 - electrostatic electrode; 4- high-voltage connector; 5- high-voltage probe; 6 - grounded roll electrode.

A high intensity electric field is generated between this roll and one or several electrodes connected to a high-voltage supply. The insulating particles are charged by ion bombardment in the corona field zone [2, 3] and are pinned to the surface of the rotating roll electrode by the electric image force.

The conducting particles are not affected by the corona field; they charge by electrostatic induction in contact with the grounded roll and are attracted to the high-voltage electrode. Consequently, the list of factors influencing the electrostatic separation process should include the high-voltage level, the electrode configuration, the feed rate, the granule size, the roll speed.

Therefore, the aim of the present paper is to analyze the possibility of using the experimental plans method for obtaining a mathematical model capable to reflect the effects of a large number of controllable factors, as well as their main interactions.

An experimental design was chosen and compared with respect to the same response function: the middling fraction obtained from the separation of a granular mixture containing 25% copper and 75% PVC, derived from a standard technological process developed for the recycling of chopped electric wire wastes.

2. EXPERIMENTAL PROCEDURE

A laboratory roll-type corona-electrostatic separator EHTP 25-36 (CARPCO Inc., Jacksonville, Florida) [6], was employed for the experimental study (Figure 1).

The separator was provided with two high voltage electrodes: a wire-type corona electrode and a tubular (non-ionizing) electrode. Both electrodes were connected to a same D.C. high voltage supply, by means of a multi-pole high voltage connector, the potential of which was measured as shown in Figure 2.

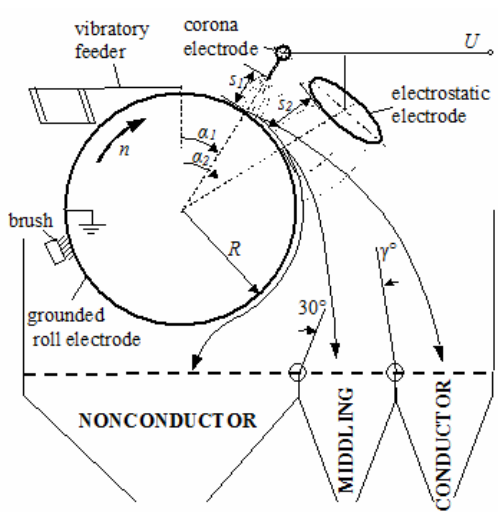


Figure 2. *Variables of an electrostatic separation process*

A thorough examination of the conditions of the industrial application lead to the following list of two-level factors to be studied by experimental design techniques:

- high-voltage level U [kV];
- roll-speed n [min^{-1}];
- angular α_1 [°] and radial s_1 [mm] position of the corona electrode, with respect to the roll electrode;
- angular α_2 [°] and radial s_2 [mm] position of the electrostatic electrode with respect to the roll electrode;
- angular position γ [°] of the splitter between the collectors for conductor and middling fractions.

The granular material employed in the experiments was obtained from genuine chopped electric wire wastes processed in the recycling industry, with 5%, 25% or 45% of stranded copper (diameter: 0.25 mm; length > 1mm and < 5 mm), Figure 3.

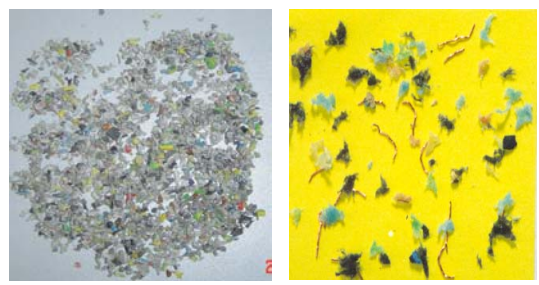


Figure 3. *Specific granular materials*

3. THEORETICAL MODEL

The conceptual framework of Taguchi's methodology is based on the idea that the control factors should be optimized for the attainment of a specified target value and the elimination of variation [4, 5]. When using this approach, distinction should be made between easy-to-control "design factors", and hard-to-control "noise factors". In most cases, the former affect essentially the mean output of the process.

The latter may or may not affect the mean response of the process and the spread of the response values around that mean. The analysis of the experimental data should enable the identification of the factors which affect only the mean, only the spread around the mean, or both properties: electrode configuration, the feed rate, the granule size, the roll speed [3].

Following Taguchi's methodology, the design factors should be arranged as inner and outer orthogonal arrays (Figure 4).

The voltage U, the roll speed n, and the splitter angle γ (Fig. 2) were used as design factors, and varied in a cubic inner array chosen in accordance with the recommendations from the literature [2].

The target of the experimental design is to maximize the recovery of high-grade conductor and non-conductor products, by minimizing the quantity of middling *M*. Thus, the optimum levels of the design factors are those for which *M* is minimum and relatively insensitive to noise factors is high. The Taguchi demonstrated that when the target is a minimum this objective is attained when the following function *Y* is maximized:

$$Y = -10\log\left(\psi^2 + \sigma^2\right) \quad (1),$$

where ψ is the average and σ^2 is the variance of the responses obtained for each given point of the inner array.

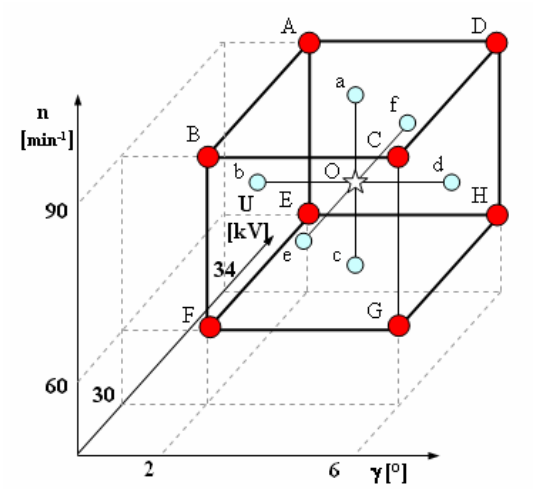


Figure 4. *The arrangement of the electrostatic separation "design"*

A regression model can be fitted which contains both types of factors (design and noise) and their interactions, by using a composite centered-face (CCF) design [4].

With a quadratic polynomial model, the response *y* of the process is expressed as a function of *e* factors u_i ($i = 1,..., e$):

$$y = f(u_i) = c_0 + \sum c_i u_i + \sum c_{i,j} u_i u_j + \sum c_{ii} u_i^2 \quad (2)$$

A normalized centered value can be defined for each factor as follows:

$$x_i = (u_i - u_{ic})/\Delta u_i = u_i^*, \quad (3),$$

where:

$$u_{ic} = (u_{imax} + u_{imin})/2;\ \Delta u_i = (u_{imax} - u_{imin})/2 \quad (4)$$

With these notations, the response function becomes:

$$y = f(x_i) = a_0 + \sum a_i x_i + \sum a_{i,j} x_i x_j + \sum a_{ii} u_i^2 \quad (5),$$

where x_i can take only the values:

–1 (for the minimum input value u_{imin}) and
+ 1 (for the maximum input value u_{imax}).

For the three factors considered in the present study (U, n and γ), one response was considered: the quantity of middling product m_M (which should be minimized, in order to recover a maximum of Cu and PVC).

Thus, *y* gives the financial result of processing a mass of waste material:

$$m = m_N + m_C + m_M \quad (6),$$

when the non-conductor product is 100% PVC.

The best possible result is y_{max}, which corresponds to the ideal case when $m_M = 0$ and the copper content of the conductor product is 97% or higher.

In the above formulas m, m_{NC}, m_C, and m_M are respectively the masses in grams of waste material, non-conductor, conductor and middling products.

4. RESULTS AND DISCUSSIONS

The results of the electrostatic separation tests carried out in accordance with Taguchi's approach are given in Table 1, which contains also the ambient humidity RH.

It can be observed that in the chosen experimental domain the increase of the voltage level *U* slightly increase the mass of middling. The diminution of the roll speed has a stronger diminishing effect on the mass of middling.

Also, it can be observed that the middling mass is slightly affected by the angleγ. Therefore, a good separation is achieved at

U = 30.52 kV, n = 60 min^{-1} and $\gamma = -6^0$; in this case, the middling mass is m_M = 0.71 g.

The computation of the function Y, makes possible a finer analysis of the situation. A simple model, characterized by good statistics (correlation coefficient 0.973) can be derived:

$$Y = 1.719 + 0.845 n^* + 0.237 U^* + 0.381 \gamma^* + 0.275 (n^*)^2 + 0.245 (U^*)^2 \quad (7)$$

(2)

The plots of the response *Y* predicted by the above model are shown in Fig. 5, for the value of the angle $\gamma = -6^0$.

They convey an unambiguous message: for the considered domain of variations of the control factors, the most robust design is obtained at lower values of the speed *n*, and lower values of the applied voltage *U*, with the angle γ having little influence on the output values.

(4)

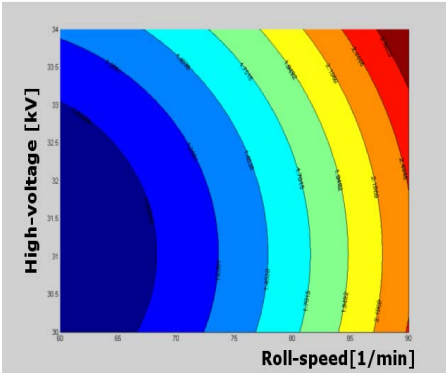


Figure 5. *Predicted curves for the middling mass*

Table 1. *Experimental results*

No.	U *[kV]*	n *[s^{-1}]*	γ *[°]*	RH *[%]*	m_{NC} *[g]*	m_M *[g]*	m_C *[g]*
1	30	1	-6	29.00	0.98	0.69	0.29
2	30	1.5	-6	28.90	2.53	2.20	0.33
3	34	1	-6	28.10	1.22	0.87	0.35
4	34	1.5	-6	28.60	2.85	2.34	0.51
5	30	1	2	29.20	1.40	0.72	0.68
6	30	1.5	2	29.40	3.09	2.50	0.59
7	34	1	2	29.40	1.92	1.92	0.00
8	34	1.5	2	29.60	3.99	2.76	1.23
9	32	1	-2	28.60	1.20	0.90	0.30
10	32	1.5	-2	28.50	2.71	2.33	0.38
11	30	1.25	-2	28.60	1.73	1.41	0.32
12	34	1.25	-2	28.50	2.12	1.75	0.37
13	32	1.25	-6	29.80	1.37	1.35	0.02
14	32	1.25	2	29.90	2.36	1.34	1.02
15	32	1.25	-2	28.70	1.67	1.25	0.42
16	32	1.25	-2	28.70	1.49	1.38	0.11
17	32	1.25	-2	28.80	1.78	1.51	0.27

Figures 6 and 7 show the prediction error for the middling mass and, consequently, the surface response for the whole process.

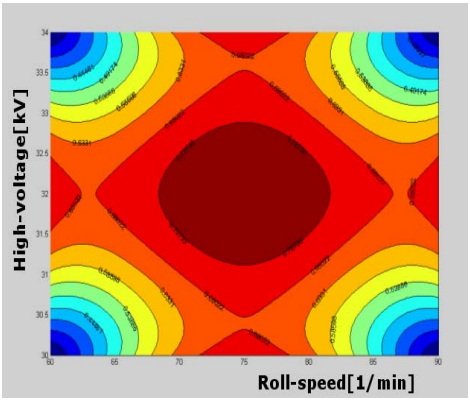


Figure 6. *Prediction error curves for the middling mass*

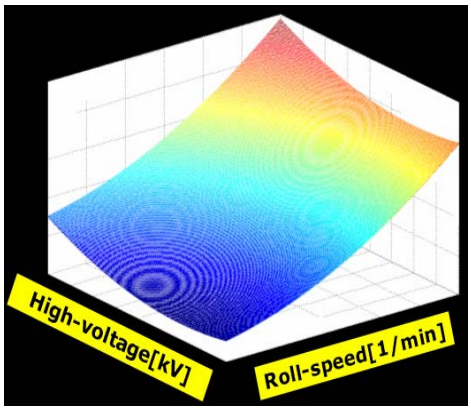


Figure 7. *Surface response for the whole process*

5. CONCLUSIONS

The impact of environmental conditions on the outcome of electrostatic separation is an issue that cannot be occulted at a time when the robust process design becomes a prerequisite of the industrial application of any new technology.

Taguchi's methodology provides an alternative to standard factorial design. Its peculiarity resides in the fact that the selection of the experimental design is made from examination of linear graphs, allowing the investigation of the desired interaction effects, based on process knowledge.

High-voltage and roll-speed are two variables that are easily controllable in any commercial electrostatic separator. From this point of view, the procedure described in this paper can be readily applied in an industrial environment.

The operator should adjust the high-voltage and the roll-speed at the levels recommended by Taguchi's methodology or by the interaction analysis approach.

However, special attention should be given to the preparation of the processed materials: the outcome of the electrostatic separation process is influenced by the metal content of the granular mixture to be sorted.

REFERENCES

1. **Tanasescu, F., Bologa, M., Cramariuc, R.** *Electrotehnologii.*, vol. 1, Electrostatica, Bucuresti, Editura Academiei Romane, 1999.
2. **Dascalescu, L., Mizuno, A., Tobazeon, R., Morar, R., Iuga , A., Mihailescu, M., Samuila, A.** *Charges and forces on conductive particles in roll-type corona-electrostatic separators*, Conf. Rec. IEEE – IAS Annual Meeting, Toronto, 1993 .
3. **Dascalescu, L., Morar, R., Iuga , A., Samuila, A., Urs, A.** *Corona discharge in electroseparators for large gaps*, The 9th International Conference on Electrostatics, Wraclow, Poland, 29 May – 2 June 2001.
4. **Goupy, J.**, *Introduction aux plans d'expériances*, Paris, Editura Dunod, 2001.
5. **Goupy, J.**, *Plans d'expériance pour sourfaces de réponse*, Paris, Editura Dunod, 1999.
6. *****CARPCO**. *Physical separation systems for mineral processing*, Bulletin no.9813, Carpco Inc., Florida USA, 1998.

THE "PERSPECTIVES 360" INSTRUMENT – A MANAGEMENT SKILLS ASSESSMENT TOOL

Michelle Moore, John Moore

Exponential Training & Assessment Limited **,** Earl Shilton, ENGLAND**,**
michelle@exponentialtraining.com, John@exponentialtraining.com

ABSTRACT:
Perspectives 360 is a simple and effective skills assessment system for assessing the skills of managers. Perspectives 360 provides managers, Human Resource specialists, trainers, business coaches, management consultants and business advisors with valuable information on the perceived skills of managers.

REZUMAT:
„Perspectives 360" este un sistem simplu şi eficient de evaluare a competenţelor managerilor. „Perspectives 360" oferă informaţii valoroase managerilor, specialiştilor în Resurse Umane, formatorilor, „antrenorilor în afaceri", consultanţilor în management şi consilierilor în afaceri, cu privire la competenţele percepute ale managerilor.

KEYWORDS: management, skills, assessment

CUVINTE CHEIE: conducere, abilităţi, evaluare

1. INTRODUCTION TO 360 ASSESSMENT AND FEEDBACK

1.1. 360 ASSESSMENT AND PERSPECTIVES 360: An Overview

Perspectives 360 is a simple and effective skills assessment system for assessing the skills of managers. Perspectives 360 provides managers, Human Resource specialists, trainers, business coaches, management consultants and business advisors with valuable information on the perceived skills of managers.

The system is based upon a series of behaviours that building into a set of Specific Skills which are grouped into six Core Skills, drawn from the UK National Occupational Standards for Management.

The on-line system simply requires managers to complete an on-line questionnaire and to nominate a number of other people who also complete a short on-line questionnaire. Although the questionnaires only take 10 – 15 minute to complete, collectively they provide a clear picture of the manager's skills across twenty-five Specific Skills.

The questionnaires are completed by the people who know them best – the people with whom they work. Typically, this will include the manager's own line manager, one or more of the manager's own team members and other people such as some colleagues or someone else with whom the manager interacts.

Perspectives 360 for Managers is ideal for first line managers, middle and senior managers, relatively new managers and experienced managers. This is because the report takes into account the different perspectives of the people invited to assess the manager and the feedback process takes into account the operating context of the manager (i.e. the job role and organizational context).

Combined with quality feedback by a trained Perspectives Facilitator, managers gain new insight into how they are perceived by others. Managers receive a clear, concise feedback report which includes a set of development suggestions on how to improve their performance in each of the Specific Skills. When combined with feedback from a Perspectives Facilitator and the completion of a simple and practical Action Plan, managers are equipped to implement new ideas to improve their performance.

1.2 360° ASSESSMENT AND FEEDBACK

The term 360° assessment refers to the practice of gathering and processing assessment feedback from multiple sources. The term 360° feedback refers to the de-briefing of and discussion with managers about the results of the 360° assessment. "*The systematic collection and feedback of performance data on an individual or group, derived from a number of the stakeholders in their performance.*"

The aim of 360° assessment and feedback is to obtain performance information about an individual from those with whom the individual interacts. In the case of Perspectives 360, the feedback is obtained from a senior manager (i.e. the manager's own line manager), junior personnel (i.e. a member of the managers' own team) and other people working at a similar level as the manager .

The use of 360° assessment and feedback models has grown in popularity in recent years. One of the reasons for this growth in popularity is the fact that the assessment involves and engages a range of stakeholders, such as line managers, peers, team members and in some cases, customers and suppliers.

Assessment and feedback systems based upon 360° models have a number of characteristics in common with other skills assessment techniques such as employee surveys, ability tests and conventional performance appraisal systems. The next table provides a brief comparison of the main uses, characteristics and similarities of each of these techniques.

Table 1. *Comparison of the main uses, characteristics and similarities of each of techniques*

	Employee Surveys	**Ability Tests**	**Personality Inventories**	**Performance Appraisal**	**360° Feedback**
Purpose	To diagnose organisational issues	Selection or promotion	Selection, development & counselling	Performance improvement, rewards, motivation, succession planning, identifying potential	Multi-purpose, excluding selection. Can be used on teams & individuals
Coverage	Almost anything, e.g. opinions, attitudes, safety, training	Specific Skill areas, e.g. verbal or numerical ability	Personality or cognitive style	Results-based, achievement of objectives.	Competencies broken down into detailed behaviours
Method	Questionnaires, sometimes augmented by interviews and focus groups.	Questionnaires or exercises which invite people to demonstrate specific skills	Questionnaires which invite people to describe their feelings, preferences or typical actions.	Discussion between manager and appraisee based on appraisal documentation.	Questionnaires on disk, paper or network.
Respondents	Answered by all or a sample of employees	Answered by participants themselves	Answered by participants themselves	Usually manager and appraisee.	Participant, boss and selected others,

	Employee Surveys	Ability Tests	Personality Inventories	Performance Appraisal	360° Feedback
Administration	Questionnaires distributed with explanatory letter. Answers from individuals kept confidential.	Administered by trained personnel in strictly controlled conditions.	Administered sometimes by self, sometimes in controlled conditions.	Usually organised by the HR function.	Questionnaires usually sent out by the participant. Collected externally or at a central point.
Answers/ Scores	Questionnaires use a rating scale for perception on opinions.	Questions have a right answer. Can also have a pass or fail element.	No right or wrong answers.	Assessment by the opinion or observation of the manager and appraisee. Performance rating scales often used.	Rating scales used to show perception of how effective the behaviour is, or how often it occurs.
Feedback	Initially to those who commissioned the survey. Sometimes to other parties.	To HR functions or line management. Not always to the participant.	Generally given to the participants face to face by a facilitator.	By the manager to the appraisee.	Individual feedback report discussed with a trained facilitator.

One of the key features and advantages of 360° assessment and feedback is that different groups or stakeholders (e.g. team members, peers or colleagues and line managers) often hold different views of the individual being assessed. The assessment therefore provides feedback from a number of different perspectives, each of which is valid and relevant.

For most people perception is reality. In other words, what your colleagues see you doing or hear you saying is real to them, describes the person you are, and forms the basis of their opinion of you. It also governs how they respond to you. No matter what your intentions are, people usually see only the tip of the iceberg and therefore understanding their perception can be a powerful development tool: mishandled, it can also be potentially harmful to an individual's self image and confidence.

2. USING PERSPECTIVES 360

Perspectives 360 is a web-based assessment system that has been designed to collect and collate feedback from several people about the frequency with which a manager demonstrates certain behaviours.

Feedback is sought from above, below and laterally, hence the term 360 degree. Perspectives 360 has been designed to include a self-assessment, as well as an assessment by the manager's own line manager, a member of the manager's team and one of their peers.

A 360 degree assessment provides a 'rounded' view of the skills of a manager to be obtained and when compared to the self assessment, provides a valuable insight into specific areas for development and improvement Perspectives 360° assessment can be completed by anyone who works with the manager closely enough to form a view.

Figure 1. *The 360 degree assessment*

Self-assessment: This is a key feature of Perspectives 360 because managers have the opportunity to measure how they perceive themselves and then compare this with the perception of others.

Line Manager: The manager's own manager provides an important source of feedback because their view of the manager may conflict with the views of others.

Team Member or Direct Report: For some managers, obtaining feedback from direct reports represents an interesting, but possibly challenging source of feedback. Direct reports often have a different perspective on the manager's style and behaviour. Perspectives 360 can expose managers who are perceived as good at managing upwards, but not so at managing downwards or visa versa.

Colleagues or Peers: This refers people who are on approximately the same level as the manager, but possibly from different parts of the organisation. It can include people who go to the same meetings or who interact with the manager at work. It might be other departmental managers or senior colleagues.

Perspectives 360 meets several needs that all busy managers and organisations have, such as:

- Providing clear and effective feedback on their management skills and performance;
- Identifying developing needs in a time efficient and systematic way;
- Prioritising of individual and organisational management development needs;
- Planning a set of practical actions design to improve performance;
- Benchmarking management teams and individuals;
- Evaluating the impact of learning and development interventions.

Perspectives 360 provides a simple, cost effective solution requiring relatively little time, minimal investment that yields results.

3. PERSPECTIVES 360 APPLICATIONS

One of the features of Perspectives that customers like is its number of applications including the supporting the following processes:

Figure 2. *The Perspectives 360 applications*

- **Individual Personal and Organisational Development**

Perspectives 360 is a great tool for supporting individual and organisation development. Often Perspectives 360 Facilitators use the individual or organisation report as the basis identifying learning and development needs. The use of the feedback de-brief meeting which can be held either on a one-to-one basis with managers or on a group basis enables managers and organisations to plan personal and organisational development.

Feedback meetings provide a context for the assessment report and to agree a personal or organisational development action plan.

- **Training Needs Analysis, Research and Benchmarking**

A common use of Perspectives 360 is as a training needs analysis tools (TNA). The group reports enable the identification of common development needs. Using the analysis reporting tools enables training needs to be sorted by division, department and team. Perspectives 360 has also been used to underpin large scale sector skills research exercises on behalf of government skills agencies.

- **Coaching Tool**

Increasingly organisations are using coaching to develop managers and management teams. Perspectives 360 provides a rich source of ideas and resources to underpin coaching programmes. Many Perspectives 360 use Perspectives 360 at the beginning of a coaching programme to provide a framework for the subsequent coaching sessions.

- **Evaluation of Learning and Development**

Perspectives 360 can be used to provide an evaluation of learning and development or personal development by providing a before and after report. Perspectives 360 can provide a concise report showing how other people perceived the managers' skills prior to and after a development programme

4. THE PERSPECTIVES 360 DESIGN

Perspectives 360 uses a hierarchical structure and comprises a set of 75 behaviour statements which link to a set of twenty five Specific Skills.

The Specific Skills are in turn grouped into six Core Skills:

- Planning,
- Managing People,
- Communication,
- Team-working,
- Leading and
- Personal Effectiveness.

Figure 3. *The Perspectives 360 hierarchical structure*

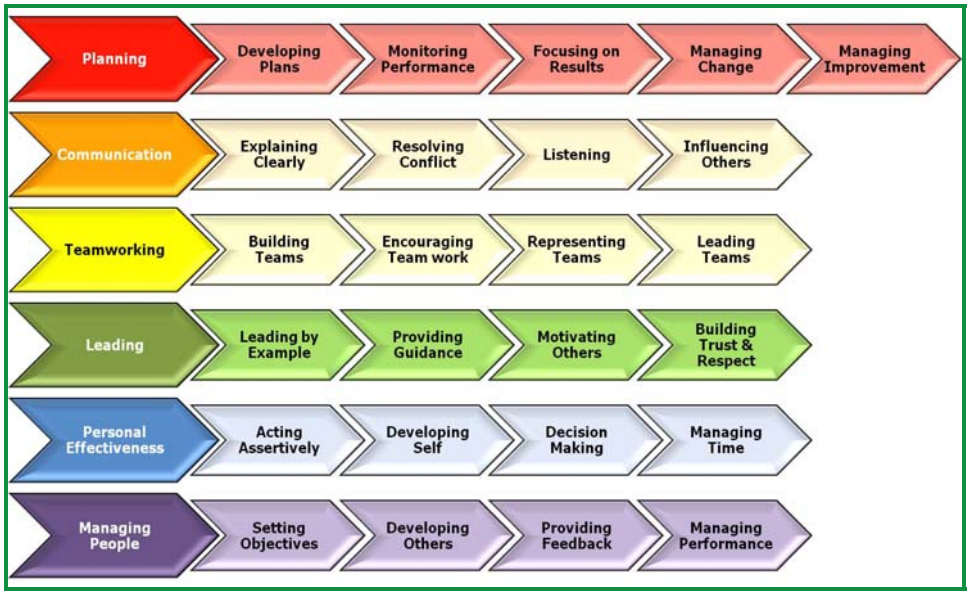


Figure 4. *Core and Specific Skills model used by Perspectives 360*

The Core Skills cover the primary functions undertaken by managers at all levels. Although the design of Perspectives 360 separates the skills into twenty five Specific Skills, in order to improve performance, managers only need to work on improving their performance in 3 – 6 Specific Skills in order to see an improvement across most the skills. This is because of the way each of the Specific Skills link to each other.

For example, a manager seeking to improve their performance in the Core Skill of Planning is likely to positively impact their performance in Explaining Clearly, Building Teams, Building Trust and Respect and Setting Objectives as effective planning involves the use of these Specific Skills.

This page contains a summary of the Core and Specific Skills model used by Perspectives 360.

5. THE PERSPECTIVES 360 REPORT

The report provides a summary of Perspectives 360 report comprises eight pages: the first page report shows a summary of the Core Skills.

The next page is a full page graph showing the self assessment score and the respondent's score in each Specific Skill.

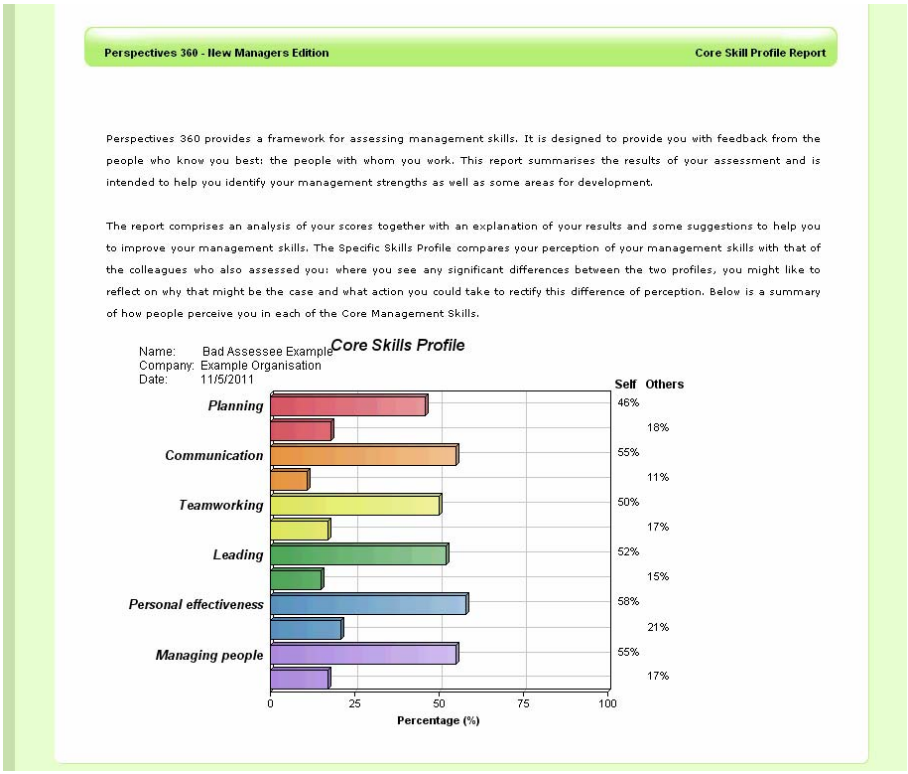


Figure 5. *A summary of the Core Skills*

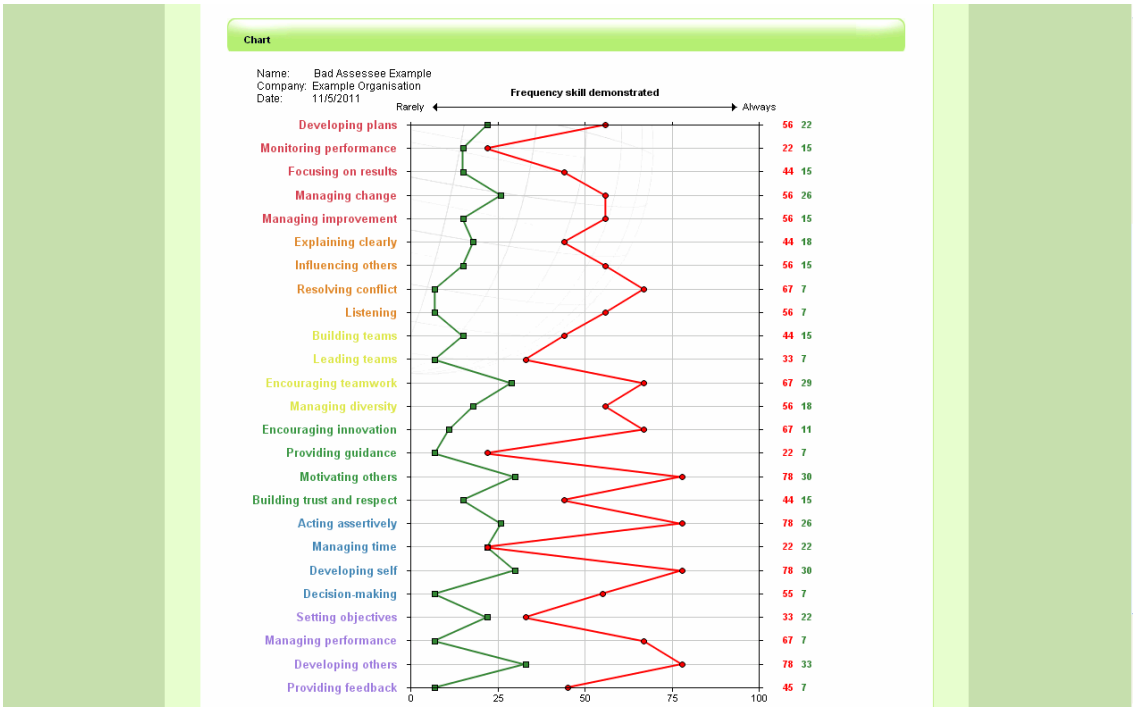


Figure 6. *The self assessment score and the respondent's score in each Specific Skill*

There is also a one page narrative for each Core Skill summarising the results of the assessment including a development suggestion for each Specific Skill.

CONCLUSIONS

The project vision is to establish an European-wide network of 360-degree assessment centres and set up the European Management Skills Benchmark Database.

The project aims to transfer the use of a 360 degree management skills assessment tool, Perspectives 360, from the United Kingdom to Greece**,** Slovenia**,** Romania**,** Ireland and Lithuania**,** resulting in the assessment of 300 SME managers and the development of the European Management Skills Benchmark Database.

This project will result in new insight, understanding and acceptance of 360 degree assessment and feedback models and their use in the recognition of skills and competence.

REFERENCIES

[1]: www.exponentialtraining.com
[2]: http://www.exponentialtraining.com/about/eu-projects/perspectives-360/

Quick Info

Exponential Training and Assessment

At Exponential we Deliver Flexible, Affordable, Professional Accreditation for Managers, Leaders, Coaches & Consultants.

Gaining a professional qualification from an internationally recognised *UK awarding bodies* such as the Chartered Management Institute (CMI) and the Institute of Consulting (IC) will set you apart from millions of others in the UK and around the World.

Gaining professional accreditation whether in management and leadership, coaching and mentoring or consulting and business support is not easy – but then again if it was everyone would have it.

That's why Exponential's professionally accredited programmes not only help to set you apart as someone who is exceptional, committed to their own development and as someone who really knows their job, but they provide you with the support, encouragement and time-efficient resources to help you to achieve your goals.

Exponential works with a number of *UK awarding bodie*s including the CMI and the IC meaning that not only do you benefit from gaining a qualification from internationally recognised *UK awarding bodie*s, but you also benefit from membership of the appropriate professional institute whilst you are studying.

Exponential's qualifications can be delivered as a supported distance learning qualification or as abespoke training programme. This means that whether you are an individual wanting to complete a qualification, or a company wanting to develop a group of individuals, Exponential can deliver a programme accredited by internationally recognised *UK awarding bodie*s that is designed to meet your specific needs.

Did you know?
Research shows that individuals with qualifications and membership stand to gain £171,000 in additional earnings, over the course of their career: £81,000 from holding professional qualifications and £71,000 from holding membership of a professional institute.

London Economics (2008)

(source: http://www.exponentialtraining.com)

ROLES AND ACTIVITIES OF HIGH GROWTH COACH

Michelle Moore, John Moore

Exponential Training & Assessment Limited , Earl Shilton, ENGLAND,
michelle@exponentialtraining.com, John@exponentialtraining.com

ABSTRACT:
The High Growth Coach project vision is to support the growth of SMEs resulting in long-term, sustainable wealth creation, job creation, increased sales revenues and profitability. The aim is to develop and deliver the High Growth Coach Programme to enable the development of effective and competent specialist High Growth Coaches for use by regional and national agencies engaged in High Growth Coaching.

REZUMAT:
Viziune proiectului "High Growth Coach"este de a sprijini dezvoltarea IMM-urilor pe termen lung, crearea unor mijloace durabile, crearea de locuri de muncă, creşterea veniturilor din vânzări şi a rentabilității. Scopul este de a dezvolta şi oferi Programul "High Growth Coach"pentru dezvoltarea unor specialişti apți şi competenți către agențiile regionale şi naționale implicate în Coaching de nivel ridicat.

KEYWORDS: coaching, SME, specialist

CUVINTE CHEIE: coaching, IMM, specialist

1. INTRODUCTION TO HIGH GROWTH COACH. The High Growth Coach Competency Framework

High Growth Coaches require a balance of behaviours, skills and knowledge enabling the delivery of generic and specialist High Growth Coaching services.

They undertake a variety of roles during the course of the delivery of a High Growth Coaching programme including those of the coach, facilitator, mentor, trainer, advisor, broker and consultant.

Whilst each role has a different focus, they each draw upon a set of core or fundamental skills. Although not impossible, it is unlikely that most High Growth Coaches will be competent in each of these roles, however they are likely to be competent in two or more of the roles.

High Growth Coaches need to possess a minimum level of business acumen and be able to support High Growth Companies through the High Growth Coaching Process.

Above all else High Growth Coaches must behave professionally and ethically.

The HGC Framework comprises three levels of hierarchy:

- Specialist Knowledge and Capability
- High Growth Coaching Competences and
- Professional Behaviours.

Each of the levels is subdivided into a series of behaviours and knowledge, skills and roles providing a comprehensive High Growth Competency Framework.

Specialist Knowledge and Capability: comprises the functional and sector specialist expertise that High Growth Coaches possess

High Growth Coaching Competences: comprise the core High Growth Coaching skills, tools, and techniques essential in delivering High Growth Coaching services

Professional Behaviours: comprise the professional and ethical behaviours High Growth Coaches need to be able to demonstrate

The Framework provides a structure within which potential and existing High Growth Coaches can assess themselves for the purpose of improving and developing their knowledge, skills and competencies.

The Framework is not about being competent or not, it is a framework of good practice and development, (Figure 1).

Figure 1. *The High Growth Coach Competency Framework*

2. THE HIGH GROWTH COACHING ROLES AND ACTIVITIES

Whilst researching the roles and activities of High Growth Coaches, it became clear that High Growth Coaches undertake a much broader range of activities than those undertaken by a traditional business coach.

High Growth Coaches sometimes take the lead and provide clients with direction; sometimes they provide support to clients who take the lead; sometimes they take action on behalf of clients to solve a problem; there are times when the client requires their High Growth Coach to take the role of a consultant to research and solve a specific problem; or they need to source a specialist supplier and use the High Growth Coach as a procurement agent or a broker; and there are times when they need to acquire some specific knowledge or skills in which case the High Growth Coach delivers some training.

In total, seven separate roles have been identified. Although each role is quite distinct, they are all closely related. Many of the High Growth Coaching Fundamental Skills such as Rapport Building, Client Dialogue, Active Listening, Critical Thinking and Action Planning are widely used across most of the High Growth Coaching Rolesm Figure 2.

Often High Growth Coaches will undertake several of these roles with a single client. As the needs of clients change through the High Growth Coaching process so too should the role of the High Growth Coach.

It is important that High Growth Coaches adopt the 'RIGHT ROLE AT THE RIGHT TIME'.

It is also important that both the coach and client understand the role that is being undertaken: coaches need to be able to manage the boundaries between the different roles to avoid misunderstandings and confusion.

Figure 2. *The High Growth Coaching Roles*

Several of the High Growth Coach Roles are almost self explanatory, whilst others need some clarification.

The roles of the High Growth Coach as Mentor, Consultant and Advisor often get confused. This is because there is overlap between the roles. There are, however, subtle, but important distinctions.

If the different roles are not understood, clients can become confused, for example, believing that the High Growth Coach has made a recommendation when in fact they were merely offering advice.

High Growth Coaches need to make it clear to clients in which capacity they are operating, Figure 3.

The Coach Role

The Coach role is not usually a 'hands-on' activity as the coaching process is more concerned with the development of the client's understanding, intellectual capabilities and business acumen, enabling them to determine the most appropriate action that they subsequently implement themselves.

The focus is more on helping clients to develop their knowledge, skills and understanding and helping them to make informed decisions and choices about the actions they will undertake.

By working "through and with" rather than "for" a client, the client comes to own both the problem and the solution and they are motivated to set objectives and take action.

The Trainer Role

Clients sometimes do not possess the required level of knowledge, skills and understanding to perform and undertake certain activities and responsibilities.

The Trainer role involves helping clients address such gaps through the delivery of training or learning programmes. This may take the form of a conventional training course, a workshop or other training intervention.

The Facilitator Role

The Facilitator role has many skills in common with the Trainer role. The Facilitator role also uses many of the same training and communication methods, but the focus is less on the direct transfer of knowledge and skills and more on helping clients to gain insight and understanding to enable them to draw their own conclusions and to make their own decisions: something which it has in common with the Coach role.

The Advisor Role

The Advisor role often involves providing clients with independent and impartial information and opinions regarding the different options or choices open to them.

There are similarities to the Coach role in that this role is about helping clients to make informed choices, but the difference is that the Advisor role involves making recommendations on the appropriate choice or decisions: the final decision and implementation of any recommendation is made by the client and not the High Growth Coach.

The Broker Role

There are occasions when clients require services and products that cannot be provided by the High Growth Coach and they are asked to help source suitable suppliers.

The Broker role involves helping clients to clarify and define product and service specifications and supplier selection criteria, but it does not extend to undertaking the procurement on behalf of the client.

The final purchase decision is that of the client and not the High Growth Coach.

The Consultant Role

The Consultant role usually involves the High Growth Coach providing advice and recommendations, which is subsequently extended to a hands-on role with the implementation of their recommendations.

Often the consultant role is about the implementation of a solution to resolve a specific problem (e.g. implementing a management information system).

The Mentor Role

The Mentor role tends to draw heavily upon the High Growth Coach's own experience and understanding of managing and growing a business and usually covers a diverse range of topics.

The focus of mentoring sessions often revolves around the longer term development of the client as an individual rather than focusing on the business.

Figure 3. *Examples of High Growth Coaching Roles and activities*

CONCLUSIONS

The High Growth Coach Programme developed e-learning modules to support actual and potential High Growth Coaches in developing themselves.

During project there have been detailed High Growth Coaching Roles: the HGC as a Coach, the HGC as a Trainer, the HGC as a Facilitator, the HGC as an Advisor, the HGC as a Mentor, the HGC as a Broker and the HGC as a Consultant.

Future papers will present details of each role characteristics, also HGC fundamental skills, High Growth Coaching Processes and HGC Professional Behaviours.

REFERENCIES

[1]. www.exponentialtraining.com

PROIECTE ÎN IMPLEMENTARE LA INSTITUTUL NAȚIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII

Autori: Ana Maria Onu, Lidia Constantin, Gabriela Sincă, Andreea Tudose, Ioan Pițurescu
INIMM Bucureşti

Introducere

Fiecare țară se inspiră din experiența trecută şi prezentă, dar îşi alege în ultima instanță căile şi mijloacele proprii.

Portofoliul de activități derulate de INIMM acopera o arie vastă de problematici, vizând în special competitivitatea şi dezvoltarea durabila a sectorului IMM. În acest sens putem aminti doar câteva: proiecte privind formarea profesională continuă şi învățarea pe tot parcursul vieții, proiecte vizând întărirea şi eficientizarea parteneriatului între sectorul IMM, instituții cu profil de cercetare-dezvoltare şi instituții de învățământ superior, în vederea creşterii competitivității şi promovării inovarii.

INSTITUTUL NAȚIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII are o ofertă diversificată de programe de formare adresate atât întreprinzătorilor, cât şi tinerilor care doresc să îşi înființeze o afacere, angajaților care doresc o calificare, femeilor interesate de dezvoltarea unei activitati antreprenoriale. Toate aceste programe de formare sunt concepute într-o manieră flexibilă, prietenoasă, respectând desigur legislația referitoare la formarea profesională a adulților.

Formarea profesională de înaltă calitate prin dobândirea de către grupul tinta a unor competențe valoroase care să le faciliteze ocuparea unui loc de muncă stabil şi durabil prin participarea la cursurile de formare profesionala în cadrul unor parteneriate dezvoltate de către următoarele proiecte:

Proiect cofinanțat din Fondul Social European prin Programul Operațional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conținutul acestui material nu reprezintă în mod obligatoriu poziția oficiala a Uniunii Europene sau a Guvernului României.

UNIUNEA EUROPEANĂ

GUVERNUL ROMÂNIEI
MINISTERUL MUNCII, FAMILIEI
ŞI PROTECŢIEI SOCIALE
AMPOSDRU

Fondul Social European
POSDRU 2007-2013

Instrumente Structurale
2007-2013

►**Titlul proiectului: „Creşterea gradului de ocupare a şomerilor din Regiunea Nord-Est printr-un program integrat de consiliere şi formare profesionala în domeniul IT”**
Contract: POSDRU/102/5.1/G/75723
Beneficiar: Fundaţia Institutul Naţional pentru Întreprinderi Mici şi Mijlocii
Partener: SC ICE COMPUTERS SRL
Valoare totală a proiectului: 1.936.557, 49 LEI
Durata proiectului: 24 luni (2010-2012)
Locaţia proiectului: Regiunea Nord-Est
Manager proiect: Ana Maria ONU

Începând cu data de 01.11.2010 INSTITUTUL NAŢIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII cu sediul în Şos.Olteniţei, nr.103, sector 4, Bucureşti, în parteneriat cu SC ICE COMPUTERS SRL Botoşani derulează proiectul regional **"Creşterea gradului de ocupare a şomerilor din Regiunea Nord-Est printr-un program integrat de consiliere şi formare profesională în domeniul IT"**, co-finanţat din Fondul Social European prin Programul Operaţional pentru Dezvoltarea Resurselor Umane 2007-2013, în baza contractului de finanţare POSDRU/99/5.1/G/75723 încheiat între INSTITUTUL NAŢIONAL PENTRU ÎNTREPRINDERI MICI ŞI MIJLOCII, în calitate de Beneficiar şi Organismul Intermediar Regional pentru Programul Operational Sectorial "Dezvoltarea Resurselor Umane" – regiunea Nord-Est în calitate de ordonator de credite. Valoarea totală a proiectului este de 1.979.337,10 RON, din care asistenţa financiară nerambursabilă este de 1.861.343,50 RON (1.693.822,59 - FSE şi 167.520,91-buget naţional).

Şomajul românesc este un şomaj structural. Odata cu restructurarile tehnologice, cu reorientarea unor sectoare şi ramuri de activititate cerute de tranziţia la economia de piaţă, trebuie găsite mijloacele necesare pentru a produce mişcări tot atât de profunde în planul structurii de muncă.

În plus, oamenii trebuie să conştientizeze faptul că pe parcursul perioadei active locul de muncă poate fi schimbat, trebuie cultivată disciplina de a economisi şi de a investi care sunt condiţii obligatorii de a căror îndeplinire va depinde echilibrul pe piaţa forţei de muncă. Aceste tendinţe exercită o puternică influenţă asupra sistemului de calificări, asupra posibilităţii de identificare a nevoilor viitoare de formare profesionala, asupra relaţiei dintre cererea de forţă de muncă şi oferta sistemului de educaţie si formare profesională.

Percepţia angajatorilor, conform căreia ar exista ofertă de muncă abundentă pare departe de realitate, deoarece din ce în ce mai multe firme se confruntă, şi se vor confrunta şi pe viitor, cu dificultăţi în recrutarea personalului mai mult sau mai puţin calificat.

Obiectivul general al proiectului îl constituie creşterea ratei de ocupare şi facilitarea integrării pe piata muncii prin îmbunătăţirea şi extinderea competenţelor profesionale ale somerilor şi şomerilor de lunga durata, tineri şi adulţi din regiunea Nord-Est, pentru a răspunde cerinţelor angajatorilor din sectorul informatic, în sprijinul dezvoltării rergionale, a creşterii competitivitătii resurselor umane şi promovării coeziunii economice şi sociale.

Grupul ţintă a fost identificat prin intermediul analizelor şi statisticilor existente la nivel regional şi local, adresandu-se personelor rezidente din regiunea Nord-Est şi cuprinde: 250 de Şomeri din care 100 de Şomeri lungă durată.

Cele 250 de persoane vor fi evaluate pentru identificarea competenţelor iniţiale, şi tot atâtea persoane vor participa la cursurile de formare profesională în domeniul IT.

Proiect cofinanţat din Fondul Social European prin Programul Operaţional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conţinutul acestui material nu reprezintă în mod obligatoriu poziţia oficiala a Uniunii Europene sau a Guvernului României.

Obiectivele specifice sunt următoarele:

- Îmbunătățirea capacității de ocupare a persoanelor inactive şi şomerilor de lunga durată din Regiunea Nord - Est, prin dezvoltarea competențelor profesionale prin participarea la cursuri de formare profesională în domeniul IT realizate în cadrul proiectului: 1.Noțiuni tehnologia informației; 2.Programe de bază pentru utilizarea computerului ; 3.Internet şi world wide web. Fundamente, resurse, instrumente; 4.Informare şi comunicare pe internet; 5. Securitatea în internet. Amenințări, atacuri, viruşi; 6.Elemente de criptografie. Semnatura electronică; 7.Comerț electronic; 8.Banca la domiciliu(e-banking) şi cardurile în exercițiul funcțiunii – totul despre finanțele electronice; 9.Sociologia internetului. Aplicații în sfera întreprinderilor; 10.Legislație în domeniul tranzacțiilor electronice(e-business).
- Formarea profesională a unui număr de 250 de şomeri din care 100 şomeri de lunga durata.
- Creşterea gradului de ocupare din sectorul informatic prin integrarea unui număr de 20 de cursanți participanți la cursurile de formare profesională organizate în cadul proiectului, la angajatori din Regiunea Nord-Est.

Obiectivele proiectului se înscriu politicii Uniunii Europene în domeniul ocupării care îşi propune să contribuie la atingerea obiectivelor privind dezvoltarea durabilă a economiei, un grad înalt de ocupare şi de protecție socială, egalitate de şanse între bărbați şi femei, un grad înalt al competitivității economice, creşterea calității vieții precum şi coeziunea economică şi socială. Prin intermediul activităților proiectului se doreşte implicarea activa a factorului uman, determinand, astfel, creşterea considerabilă a şanselor de inserție şi ocupare pe piața muncii, în conformitate cu Strategia economica a UE 2020 care îsi propune ca până în 2020 75% din forța de muncă europeană (mai exact populația cu vârsta între 20-64 de ani) să fie angajată.

Proiectul pune accent pe dobândirea de competențe necesare integrarii şi participării pe piața muncii, extinderii şi îmbunătățirii investiției în resursa umană prin creşterea accesului la formarea profesională continuă, asigurând atractivitatea, deschiderea către nevoile mediului economic, întărind directivele de ocupare promovate la nivelul Uniunii Europene.

În acelaşi context, proiectul va creşte şansele de ocupare a forței de muncă, va asigura corespondența dintre nevoile pieței muncii şi competențele de muncă, facilitând participarea la o formare profesională corespunzatoare şi creşterea competențelor grupului țintă vizat.

Pentru mai multe informații despre proiect vă rugăm să vizitați site-ul:
www.pro1.ro

Proiect cofinanțat din Fondul Social European prin Programul Operațional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conținutul acestui material nu reprezintă în mod obligatoriu poziția oficiala a Uniunii Europene sau a Guvernului României.

►**Titlul proiectului: "Pachet complex de formare antreprenoriala pentru incluziunea socială a femeilor în condiţii de egalitate de şanse pe piaţa muncii" – PROWOB"**
Contract: POSDRU/71/6.3/S/24567
Beneficiar Institutul Naţional pentru Întreprinderi Mici şi Mijlocii
Durata proiectului: 36 luni (2009-2012)
Locaţia proiectului: Bucureşti-Ilfov, Sud-Vest Oltenia, Sud Muntenia si Nord-Vest
Manager proiect: Ioan PIŢURESCU

Proiectul este implementat **de Institutul Naţional pentru Întreprinderi Mici şi Mijlocii** în parteneriat cu **Centrul de Consulatanţă şi Management al Proiectelor EUROPROJECT Slatina, Consiliul Local al Întreprinderilor Mici şi Mijlocii Oradea**, **Asociaţia Patronatul Judeţean al Întreprinderilor Mici şi Mijlocii Giurgiu**.

Proiectul promoveaza valorile europene precum egalitatea de şanse dintre femei şi bărbaţi în contextul încurajării femeilor de a acumula experienţa managerială teoretică şi practică şi de a se implica în activităţi antreprenoriale.

Grup ţintă:

- femei interesate de dezvoltarea unei activităţi antreprenoriale din Bucureşti, Giurgiu, Slatina şi Oradea care nu au clar definit traseul profesional, nu au calificarea si cunoştiinţele necesare pentru iniţierea şi gestionarea unei afaceri.

Obiectivul proiectului:

Stimularea promovării egalităţii de şanse pe piaţa muncii prin dezvoltarea de competenţe şi abilităţi antreprenoriale a femeilor din Bucureşti, Giurgiu, Slatina şi Oradea în cadrul unui curs de asistenţă şi formare antreprenorială. Se urmăreşte identificarea şi implementarea unor strategii adecvate pentru pătrunderea, menţinerea şi afirmarea pe piaţa europeana a femeilor antreprenori, în condiţiile egalităţii de şanse între bărbaţi şi femei.

Obiective specifice:

- Îmbunătăţirea abilităţilor şi competenţelor antreprenoriale cursantelor pentru integrarea şi afirmarea în antreprenoriat.
- Sprijinirea femeilor care doresc să se reorienteze profesional din Bucureşti, Giurgiu, Oradea şi Slatina pentru a (re)intra pe piaţa forţei de muncă prin programe de asistenţă şi formare profesională pentru iniţierea unei afaceri.

Proiectul prin tematicile abordate pe parcursul implementării cursului, propune subiecte atât teoretice cât şi practice cu informaţii actualizate la mediul economic actual, ţinând cont în egală măsură şi de nevoile, constrângerile participantelor.

Proiectul include desfaşurarea a 11 cursuri de formare antreprenoriala, se promoveaza un training informal şi intensiv în domeniul antreprenoriatului.Scopul cursurilor este de a dezvolta abilităţile de întrerprinzător ale femeilor.

În scopul valorificării potenţialului antreprenorial al femeilor, al sporirii numărului de locuri de muncă şi creşterii standardului de viaţă al populaţiei, cursul este divizat în 11 capitole concepute să corespundă necesităţilor, aşteptărilor, intereselor şi oportunităţilor ce vizează pe participantele doritoare să devina mici întreprinzători.

Sunt ilustrate cu claritate şi într-un mod sugestiv riscurile şi provocările unui mediu de afaceri caracterizat de o schimbare turbulentă.

Proiect cofinanţat din Fondul Social European prin Programul Operaţional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conţinutul acestui material nu reprezintă în mod obligatoriu poziţia oficiala a Uniunii Europene sau a Guvernului României.

Cele 11 capitole abordate sunt grupate în doua module:

Modulul 1 : Dezvoltarea abilităţilor antreprenoriale

- Dezvoltarea obiectivelor pentru afacerile mici şi mijlocii
- Ciclul de rezolvare a problemelor
- Metode stimulare a creativităţii (Brainstorming)
- Metode de analiza a ideilor de afaceri
- Strategia şi mixul de marketing
- Introducere în contabilitate

Modulul 2: Managementul în IMM din România, de la teorie la practică

- Comunicare verbală/nonverbală în afaceri
- Comunicare eficientă în afaceri
- Managementul riscului
- Managementul schimbării
- Structura şi dezvoltarea unui plan de afaceri.

Cele două module sunt susţinute de exercitii de echipa, inserate în mod atractiv şi stimulativ în cadrul temelor şi dezbaterilor.

Exerciţii de echipă:

- Analiza comportamentelor în echipă
- Roluri de echipă
- Luarea deciziilor în echipă
- Evaluarea şi recompensarea echipei
- Exersarea feed-back-ului
- Analiza modului de funcţionare a echipei
- Plan de acţiuni pentru îmbunătăţirea funcţionării echipei

Menţionăm că, la solictarea cursantelor, pentru satisfacerea cât mai completa a necesităţilor şi aşteptărilor exprimate a fost realizat un program flexibil suplimentar care a respectat însă cadrul agreat prin proiect. Instruirea s-a efectuat pe principiul "taylor made" pentru a menţine viu interesul cursantelor.

Cursantele au dezvoltat planuri de afaceri în mod individual sau în grup, astfel generându-se adevarate reţele de colaborarea care permit organizarea pe viitor a unor IMM-uri viabile şi de succes.

Cursul este astfel structurat încât să permită abordarea cu succes a temei numarul 11, "Structura si dezvoltarea unui plan de afaceri", susţinută şi de un exemplu clar şi sistematizat al modului în care un antreprenor poate opta pentru internalizarea, respectiv externalizarea unui produs sau serviciu (decizia de a fabrica sau nu un produs).

În timpul desfăşurării cursurilor de formare antreprenorială, cursantele au arătat un interes deosebit în obţinerea de informaţii personalizate în legatura cu activităţile comerciale pe care ar dori sa le desfăşoare. Astfel, au fost asigurate servicii de consultanţă şi asistenţă pentru femei în vederea iniţierii unei afaceri.

Participantele la cursul de formare antreprenorială cât şi femeile interesate de etapele iniţierii unei afaceri au beneficiat de sedinţe de consultanţă şi asistenţă.

Până în prezent s-au obţinut următoarele rezultate:

- au promovat şi au obţinut certificate de absolvire **306** de cursante;
- participantele la curs şi/sau la sedinţe de consultanţă şi asistenţă au realizat 102 planuri de afaceri.

Pentru mai multe informaţii despre proiect vă rugăm să vizitaţi site-ul:
www.prowob.ro

Proiect cofinanţat din Fondul Social European prin Programul Operaţional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conţinutul acestui material nu reprezintă în mod obligatoriu poziţia oficiala a Uniunii Europene sau a Guvernului României.

UNIUNEA EUROPEANĂ
GUVERNUL ROMÂNIEI MINISTERUL MUNCII, FAMILIEI ŞI PROTECŢIEI SOCIALE AMPOSDRU
Fondul Social European POSDRU 2007-2013
Instrumente Structurale 2007-2013

►**Titlul proiectului: „Dezvoltarea abilităţilor antreprenoriale şi manageriale în zona IMM-urilor inovative din România pentru formarea şi promovarea parteneriatelor naţionale şi transnaţionale"**
Contract: POS DRU/92/3.1/S/63922
Beneficiar: Fundaţia Institutul Naţional pentru Întreprinderi Mici şi Mijlocii
Parteneri: SC IPA SA, ASE Bucureşti, Universitatea Tehnică din Cluj-Napoca, CLIMM Oradea, PTIR, APJIMM Giurgiu, Asociaţia Patronatul Judeţean al Femeilor de Afaceri din IMM Suceava, Universitatea de Vest Timişoara, Universitatea Alexandru Ioan Cuza din Iaşi,
Partener transnaţional: European Business and Innovation Network - EBN
Valoare totală a proiectului: 8.223.421 LEI
Durata proiectului: 30 luni (2011-2013)
Manager proiect: Ioan PIŢURESCU

Într-un raport al Agenţiei Naţionale pentru IMM-uri se arată că există o participare extrem de scazută a IMM-urilor româneşti pe piaţa internaţională. Din aceeaşi analiză reiese că IMM-urile nu sunt antrenate, pregătite şi capabile să valorifice avantajele globalizării economice.

În acest context demarează la 01.03.2011 proiectul **"Dezvoltarea abilităţilor antreprenoriale şi manageriale în zona IMM-urilor inovative din România pentru formarea şi promovarea parteneriatelor naţionale şi transnaţionale"**. Prin obiectivele sale, proiectul propune măsuri pentru dezvoltarea culturii antreprenoriale, dezvoltarea de parteneriate transnaţionale şi naţionale oferind programe de formare şi consliere având ca suport două sisteme informatice care asigură atât formarea antreprenorială, cât şi posibilitatea de învăţare şi iniţiere în afaceri - parteneriate naţionale-transnaţionale.

Obiectivul general al proiectului este cel de promovare a culturii antreprenoriale printr-un set complex de activităţi integrate: consiliere, orientare, motivare, informare, formare antreprenorială pentru personalul operativ şi de conducere din IMM-uri, dezvoltarea capacităţii de a iniţia şi realiza parteneriate orizontale sau verticale între IMM-urile din ţară sau parteneriate transnaţionale, având ca suport un Centru Informatic de Asistenţă Online, utilizând ca platformă de învăţare un Modul interactiv, care pune faţă în faţă IMM-uri din România şi din Europa, într-un mod inovativ, în varii domenii de activitate.

Prin realizarea Centrului de Asistenţă Online, proiectul îşi propune să stimuleze inovarea prin toate mijloacele, să caute oportunităţi de afaceri pentru IMM-uri pentru a stimula incheierea de parteneriate, să ofere expertiză, criterii de referinţă, cele mai bune practici şi orientare pentru membri săi. În acest sens Centrul Informatic de Asistenţă Online (CIAO) va cuprinde Baze de Date în format standardizat, pe domenii de activitate, cu IMM-uri româneşti şi europene; Liste dinamice cu posibilităţi de investiţii; Modul interactiv de iniţiere de parteneriate între IMM-urile din România şi Europa; Modul Legislativ naţional şi european; Modul eLearning.

Acest centru va fi implementat în cele patru macroregiuni de dezvoltarea a României, realizându-se o Reţea Naţionala de Centre de promovare a parteneriatelor transnaţionale şi naţionale pentru IMM-uri, reţea care va fi conectată la reţeaua europeana Entreprise Europe Network, prin partenerul transnaţional implicat în proiect – European Business and Innovation Centre.

Proiect cofinanţat din Fondul Social European prin Programul Operaţional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conţinutul acestui material nu reprezintă în mod obligatoriu poziţia oficiala a Uniunii Europene sau a Guvernului României.

Grupul ţintă al proiectului este reprezentat de:

- angajaţii la nivel operativ din IMM-uri, care prezintă o serie de nevoi specifice; de calificare/recalificare, informare şi consiliere;
- managerii din IMM-uri, în special cele cu potenţial ridicat de inovare, întreprinzători, care nu au expertiza calificată şi cărora le lipsesc informaţiile despre pieţele externe şi potenţialii parteneri, care nu sunt antrenaţi, pregătiţi şi capabili să valorifice avantajele globalizării economice prin crearea de parteneriate transnaţionale sau naţionale.

Prin parteneriatul cu ASE Bucureşti, Universitatea Tehnică Cluj-Napoca, Universitatea de Vest Timişoara şi Universitatea " Alexandru Ioan Cuza " Iaşi se vor desfăşura cursuri de formare profesională specifică în susţinerea şi promovarea culturii antreprenoriale. Cursurile vizează domenii precum managementul parteneriatelor, managementul inovării şi transfer tehnologic, comunicare şi negociere în afaceri, managementul resurselor şi vor fi susţinute atât online cât şi offline. Se vor realiza activităţi suport de consiliere, consultanţă şi asistenţă personalizată pentru membrii grupului ţintă instruiţi în cadrul cursurilor.

Partenerii implicaţi în implementarea proiectului urmăresc să sprijine principiile Small Business Act prin valorificarea mai bună de către IMM-uri a oportunităţilor oferite de piaţa unică, ameliorarea tuturor competenţelor în interiorul IMM-urilor şi promovarea tuturor formelor de inovaţie, susţinerea IMM-urilor pentru a transforma provocările legate de mediu în oportunităţi, încurajarea şi sprijinirea IMM-urilor pentru a se internaţionaliza.

Pentru mai multe informaţii despre proiect vă rugăm să vizitaţi site-ul:
www.imm-ciao.ro

Proiect cofinanţat din Fondul Social European prin Programul Operaţional Sectorial pentru Dezvoltarea Resurselor Umane 2007 –2013.
Investeşte în oameni!
Conţinutul acestui material nu reprezintă în mod obligatoriu poziţia oficiala a Uniunii Europene sau a Guvernului României.

"TEHNOLOGIA INOVATIVĂ"

REVISTA CONSTRUC IA DE MA ÙNI
SERIE NOU

î úpropune s prezinte
cele mai valoroase realiz ri din domeniul
Cercet rii - Dezvolt rii
române úi úinterna ionale.

Revista ofer speciali ülor
posibilitatea de a publica articole ústudii,
de a- úprezenta produsele realizate
úde a face cunoscut
activitatea firmei sau institu iei
în paginile Revistei.

Instruc iunile privind redactarea útrimiterea
lucr rilor pot fi ob inute la adresa:

Irina R dulescu
S.C. ICTCM S.A. Bucure úti
ùos. Olteni ei nr. 103 Sect. 4 Bucure úti
Tel: 021 332 37 70 / 234
Fax: 021 332 07 75
E-mail: irena_sandu@yahoo.com

"TEHNOLOGIA INOVATIVĂ "

REVISTA CONSTRUC IA DE MA ÙNI
SERIE NOU

S. C. ICTCM S. A. Bucure úti
úICTCM - CITAf

v ofer posibilitatea
unui abonament pentru 4 numere revist /an
la pre ul de 60 lei/an.

Pentru detalii úinforma ii suplimentare
v rug m s lua i leg tura cu:

Irina R dulescu
S.C. ICTCM S.A. Bucure úti
ùos. Olteni ei nr. 103 Sect. 4 Bucure úti
Tel: 021 332 37 70 / 234
Fax: 021 332 07 75
E-mail: irena_sandu@yahoo.com

"TEHNOLOGIA INOVATIVĂ"

REVISTA CONSTRUC IA DE MA ÙNI
SERIE NOU

Pentru a face cunoscute realiz rile din cercetare úproductie,
Oficiul de Informare Documentar pentru Industrie, Cercetare, Management
din cadrul
Centrului Incubator Tehnologic de Afaceri
S.C. ICTCM S.A. BUCURE ÙTI

public revista "*Tehnologia Inovativă*" – seria nou a Revistei "*Construcția de mașini*",
realizeaz prospecte, cataloage, postere, la comand ,
în condi ii grafice deosebite,
cu macheta beneficiarului sau cu design úmachete proprii.