



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
*October 29<sup>th</sup>, 2020, Bucharest, Romania*

---

# **ICAMaT 2020**

**11<sup>th</sup> International Conference on  
Advanced Manufacturing Technologies**

**Book of Abstracts**

**&**

**Conference  
Programme**

**October 29<sup>th</sup>, 2020  
Bucharest, Romania**



## **Table of Contents**

<b>Conference Committees</b>	<b>2</b>
<b>Conference Programme</b>	<b>4</b>
<b>Book of abstracts</b>	<b>5</b>
Section 1. Product Development	6
Section 1. Programme	6
Section 1. Abstracts	8
Section 2. Processes, Tools and Equipment	17
Section 2. Programme	17
Section 2. Abstracts	19
Section 3. Industrial Systems	32
Section 3. Programme	32
Section 3. Abstracts	34



## Conference Committees

### *Scientific Committee*

Assoc.prof. **Bogdan ABAZA**, Univ. POLITEHNICA of Bucharest, Romania  
Assoc.prof. **Ovidiu ALUPEI**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Alexandra BANU**, Univ. POLITEHNICA of Bucharest, Romania  
Assoc.prof. **Claudiu BĂDULESCU**, Ecole Nationale Supérieure de  
Techniques Avancées Bretagne, France  
Prof. **Dorel BANABIC**, Technical Univ. of Cluj-Napoca, Romania  
Assoc.prof. **Diana Irinel BĂILĂ**, Univ. POLITEHNICA of Bucharest, Romania  
Lect. **Nadia BELU**, Univ. of Pitesti, Romania  
Prof. **Cristin BIGAN**, Ecological Univ. of Bucharest, Romania  
Assoc.prof. **Thomas BONNEMAINS**, Université de Bretagne Occidentale, France  
Assoc.prof. **Toufik BOUDOUH**, Univ. de Technologie de Belfort-  
Montbéliard, France  
Assoc.prof. **Mădălin CATANĂ**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Wichai CHATTINAWAT**, Chiang Mai University, Thailand  
Dr. **Saša ĆUKOVIĆ**, University of Kragujevac, Serbia  
Assoc.prof. **Sofiene DELLAGHI**, Université de Lorraine - Metz, France  
Lect. **Manuela-Roxana DIJMĂRESCU**, Univ. POLITEHNICA of  
Bucharest, Romania  
Lect. **Maria-Cristina DIJMĂRESCU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Cristian Vasile DOICIN**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Andrei DUMITRESCU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Cătălin FETECĂU**, Univ. "Dunărea de Jos" of Galati, Romania  
Lect. **Ana Cornelia GAVRILUȚĂ**, Univ. of Pitesti, Romani  
Prof. **Marian GHEORGHE**, Univ. POLITEHNICA of Bucharest, Romania  
Assoc.prof. **Ionuț GHIONEA**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Nicolae IONESCU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Monica IORDACHE**, Univ. of Pitesti, Romania



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
*October 29<sup>th</sup>, 2020, Bucharest, Romania*

---

Assoc.prof. **Lucian LĂZĂRESCU**, Technical Univ. of Cluj-Napoca, Romania  
Prof. **Marion MARTINY**, Université de Lorraine - Metz, France  
Prof. **Traian MAZILU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Sebastien MERCIER**, Université de Lorraine - Metz, France  
Prof. **Eduard Laurențiu NIȚU**, Univ. of Pitesti, Romania  
Prof. **Gheorghe OANCEA**, Univ. "Transilvania" of Brasov, Romania  
Assoc.prof. **Răzvan-Ioan PĂCURAR**, Technical Univ. of Cluj-Napoca, Romania  
Assoc.prof. **Gabriela Adriana PLĂIAȘU**, Univ. of Pitesti, Romania  
Prof. **Hanan SALEET**, Applied Science Private University, Amman, Jordan  
Prof. **Tom SAVU**, Univ. POLITEHNICA of Bucharest, Romania  
Assoc.prof. **Jeremie SCHUTZ**, Université de Lorraine - Metz, France  
Prof. **Elena SCUTELNICU**, Univ. "Dunarea de Jos" of Galati, Romania  
Prof. **Hongwu SONG**, Institute of Metal Research, Chinese Academy of Science, Shenyang, China  
Assoc.prof. **Paulina SPÂNU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Nicolae-Doru STĂNESCU**, Univ. of Pitesti, Romania  
Lect. **Ioan - Cristian TARBĂ**, Univ. POLITEHNICA of Bucharest, Romania  
Lect. **Petre Gheorghe TIRIPLICĂ**, Univ. POLITEHNICA of Bucharest, Romania

### ***Organizing Committee***

Lect. **Manuela-Roxana DIJMĂRESCU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Andrei DUMITRESCU**, Univ. POLITEHNICA of Bucharest, Romania  
Assoc.prof. **Ionuț GHIONEĂ**, Univ. POLITEHNICA of Bucharest, Romania  
Ing. **Alexandru Bogdan JUGRAVU**, Univ. POLITEHNICA of Bucharest, Romania  
Prof. **Tom SAVU**, Univ. POLITEHNICA of Bucharest, Romania  
Tehn. **Lenuța ȘTEFAN**, Univ. POLITEHNICA of Bucharest, Romania  
Lect. **Ioan-Cristian TARBĂ**, Univ. POLITEHNICA of Bucharest, Romania  
Eng. **Cristin ZAHARIA**, Univ. POLITEHNICA of Bucharest, Romania



## Conference Programme

Thursday, 29<sup>th</sup> of October 2020

**Time:** 10.00 – 10.15

**Online:** MS Teams - [ICAMaT 2020](#)

*Welcome speech:*

- **Prof. Cristian DOICIN**, Dean of the Faculty of Industrial Engineering and Robotics (IIR), POLITEHNICA University of Bucharest, Romania
- **Prof. Tom SAVU**, Head of Manufacturing Engineering Department (TCM), Faculty of Industrial Engineering and Robotics (IIR), POLITEHNICA University of Bucharest, Romania
- **Lect. Manuela-Roxana DIJMĂRESCU**, Manufacturing Engineering Department (TCM), Faculty of Industrial Engineering and Robotics (IIR), POLITEHNICA University of Bucharest, Romania

**Time:** 10.15 – 14.30

**Activities:** Paper presentations on sections

**Location:** according to the sections programme (see below)



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
*October 29<sup>th</sup>, 2020, Bucharest, Romania*

---

# **Book of abstracts**



## Section 1. Product Development

### Section 1. Programme

Online on MS Teams platform – [ICAMaT 2020 – S1.PD](#)

Time: 10.15 -12.15 / 12.30 -14.30 (RO)

Section Chairs: Cristian Vasile DOCIN, Ivan SHATSKYI

No. & Start time	Authors <i>Paper title</i>
1. 10.15	Mădălina Dumitriu, Dorina Fologea and Ioan Cristian Cruceanu <i>Effects analysis of vertical track irregularities on bogie vibration - method based on bogie modelling and wheelsets accelerations measurement</i>
2. 10.35	Dragoș Ionuț Stănică, Mădălina Dumitriu and Mihai Leu <i>The geometric filtering effect on ride comfort at railway vehicles</i>
3. 10.55	Călin Rusu, Sorin Besoiu and Mihai Olimpiu Tătar <i>Design and closed-loop control of a piezoelectric actuator</i>
4. 11.15	Ivan Shatskyi, Andrii Velychkovych, Ivan Vytvytskyi and Mykola Seniushkovych <i>Modeling of nonlinear properties of casing centralizers equipped with axial thrust</i>
5. 11.35	Flavia-Petruța-Georgiana Artimon, Constantin Stochioiu, Horia Miron Gheorghiu and Iuliana Sima <i>Experimental characterisation of a flax fibre - epoxy resin composite</i>



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
October 29<sup>th</sup>, 2020, Bucharest, Romania

<b>No. &amp; Start time</b>	<b>Authors <i>Paper title</i></b>
6. 11.55	Ruslan Puzyr, Volodymyr Kukhar, Tetiana Haikova, Roman Haikov and Olha Dolhikh <i>Mathematical modeling in the study of complex technical objects by the example of manufacturing vehicles wheel rims</i>
12.15 - 12.30	Break
7. 12.30	Elhocine Chiba, Mourad Abdelkrim, Abderrahim Belloufi and Imane Rezgui <i>Intelligent control of wheel rail contact noise phenomenon in rail transportation</i>
8. 12.50	Mihaela Cristina Tudorache, Vlăduț Marian Dinu and Răzvan Andrei Oprea <i>Aspects of the wheel-switch contact studied with the CONTACT software</i>
9. 13.10	Roman Murzac, Cristian Vasile Doicin, Mihaela Elena Ulmeanu and Teodor Țurcanu <i>Mathematical, detailed and parametric modelling for smart spinal orthoses</i>





## Section 1. Abstracts

### **S1 - 1. Effects analysis of vertical track irregularities on bogie vibration - method based on bogie modelling and wheelsets accelerations measurement**

*Mădălina Dumitriu<sup>1</sup>, Dorina Fologea<sup>2</sup> and Ioan Cristian Cruceanu<sup>2</sup>*

*<sup>1</sup>University POLITEHNICA of Bucharest, Department of Railway Vehicles, 313 Splaiul Independentei, District 6, Bucharest, Romania*

*<sup>2</sup>University POLITEHNICA of Bucharest, Doctoral School of Transports, 313 Splaiul Independentei, District 6, Bucharest, Romania*

**Abstract.** The paper analyzes the effect of the vertical track irregularities upon the vibrations in a two-axle bogie. The method in use implies the bogie modelling and the measurement of the vibrations in wheelsets generated by the track vertical irregularities. The behaviour of vibrations in the bogie is evaluated via the results derived from applications of numerical simulation developed on the basis of the bogie model, where the inputs are the accelerations measured in the two wheelsets. The vibration features in the bogie are pointed out according to the spectra of accelerations in the bogie frame, to the standard deviation values of accelerations and to the maximum values of the accelerations calculated against the two wheelsets.



## **S1 - 2. The geometric filtering effect on ride comfort at railway vehicles**

*Dragoş Ionuţ Stănică<sup>1</sup>, Mădălina Dumitriu<sup>2</sup> and Mihai Leu<sup>1</sup>*

*<sup>1</sup>University POLITEHNICA of Bucharest, Doctoral School of  
Transports, 313 Splaiul Independentei, District 6, Bucharest, Romania*

*<sup>2</sup>University POLITEHNICA of Bucharest, Department of Railway  
Vehicles, 313 Splaiul Independentei, District 6, Bucharest, Romania*

**Abstract.** The geometric filtering effect of the excitations derived from the vertical track irregularities is an important feature of the behaviour of vibrations of the railway vehicle. The paper herein examines the influence of this effect upon the ride comfort, by using results from numerical simulations. The numerical simulation applications are developed on the basis of a rigid-flexible coupled vehicle model type, where the bogies and wheelsets are represented by rigid bodies and a ‘flexible carbody’ model is used for the carbody. The efficiency of the geometric filtering effect is determined on the basis of the velocity range covered by the geometric filtering velocities, at the resonant frequencies of the carbody vibration modes, relevant for the ride comfort. The results show that the ride comfort does not continually deteriorate due to the geometric filtering effect; this effect is efficient on a larger velocity range in the case of rigid carbodies.



### **S1 - 3. Design and closed-loop control of a piezoelectric actuator**

*Călin Rusu, Sorin Besoiu and Mihai Olimpiu Tătar*

*Technical University of Cluj-Napoca, Department of Mechatronics and Machine Dynamics, 28, Memorandumului Ave, 400114, Cluj-Napoca, Romania*

**Abstract.** Piezoelectric elements can produce a high displacement resolution with high force outputs but exhibits large hysteresis nonlinearities. An efficient way to compensate for nonlinearities is using a closed loop control technique. Another limitation for many applications is their relatively short displacement ranges. One method to avoid the above-mentioned shortcoming is to integrate a piezoelectric element with a mechanical displacement amplifier based on a compliant mechanism. This paper presents the design and closed-loop control of such a piezoelectric actuator. Using the integrated strain gauge sensors, a PI controller was designed and tested.



## **S1 - 4. Modeling of nonlinear properties of casing centralizers equipped with axial thrust**

*Ivan Shatskyi<sup>1</sup>, Andrii Velychkovych<sup>2</sup>, Ivan Vytvytskyi<sup>3</sup> and Mykola Seniushkovych<sup>3</sup>*

*<sup>1</sup> Ivano-Frankivsk Branch of Pidstryhach-Institute for Applied Problems in Mechanics and Mathematics, NAS of Ukraine, Department of modelling of damping systems, Mykytynetska 3, Ivano-Frankivsk, Ukraine*

*<sup>2</sup> Ivano-Frankivsk National Technical University of Oil and Gas, Department of Construction and Civil Engineering, Karpatska 15; Ivano-Frankivsk, Ukraine*

*<sup>3</sup> Ivano-Frankivsk National Technical University of Oil and Gas, Department of Drilling, Karpatska 15; Ivano-Frankivsk, Ukraine*

**Abstract.** The issue of qualitative centering of the casing in wells with complex trajectory is considered. When choosing an effective centralizer, two competing requirements are simultaneously assigned to its mechanical properties. The centralizer must have sufficiently low stiffness in order to provide the descent of the casing into wellbore. At the same time, the centralizer must have high stiffness in order to provide proper clearance gap for high-quality cementing of the annular space. Several new designs of rod centralizers are proposed in the paper. Their main feature is that they are equipped with an additional thrust ring, which allows one to change the mechanical characteristics of the centralizer at high contact loadings. The boundary-value problems for the differential equations of mechanics of the arc rods with boundary conditions in the form of inequalities are formulated and solved. Analytical relations between the clamping force and mutual approach of the casing and the well wall, which characterize the radial stiffness of the centralizer equipped with axial thrust, are determined. It is established that the described designs of the centralizers have essentially nonlinear characteristics that contribute to the efficient centering of the casing. At vertical and slightly deviated from the vertical intervals of the wellbore, the centralizer behaves as soft and does not interfere with the descent of the string; at intervals with large curvature of the wellbore the stiffness of the centralizer increases due to the axial thrusts.



## **S1 - 5. Experimental characterisation of a flax fibre - epoxy resin composite**

*Flavia-Petruța-Georgiana Artimon<sup>1,2</sup>, Constantin Stochioiu<sup>2</sup>, Horia Miron Gheorghiu<sup>2</sup> and Iuliana Sima<sup>3</sup>*

<sup>1</sup>*University POLITEHNICA of Bucharest, Romania*

<sup>2</sup>*The National Institute of Research and Development in Mechatronics and Measurement Technique, Bucharest, Romania*

<sup>3</sup>*Bucharest National University of Arts*

**Abstract.** In the recent years, the scientific community's attention has gradually started to focus in finding solutions for pollution control and replacement of non-biodegradable products with natural products. In this matter, composite materials with natural fibres are increasingly interesting for different research studies. The present work regards a flax fibre-epoxy resin composite material, which the response is studied under tensile tests until break and repeated loading/unloading cycles. An independent variable under study has been material fibre direction of 0°, 90° and ± 45°, for both types of tests. Samples were extracted from thermo-compression fabricated plates with dimensions following the ASTM D 3039 standard. The experimental setup included an MTS C45 105 Universal Testing Machine, with variable load cells, an extensometer, as well as digital image correlation equipment. The devices allowed the determination of stress-strain curves as well as material constants and Poisson ratio. Results show, for the 90° and ± 45° typical responses for composites with these fibre directions, but a particular evolution, bilinear for the 0°.



## **S1 - 6. Mathematical modeling in the study of complex technical objects by the example of manufacturing vehicles wheel rims**

*Ruslan Puzyr<sup>1</sup>, Volodymyr Kukhar<sup>2</sup>, Tetiana Haikova<sup>3</sup>, Roman Haikov<sup>1</sup> and Olha Dolhikh<sup>3</sup>*

*<sup>1</sup>Kremenchuk Mykhailo Ostrohradskyi National University College, 7, Chumatskyi Shliakh st., Kremenchuk, 39621 Ukraine*

*<sup>2</sup>Pryazovskiy State Technical University, 7, Universytets'ka st., Mariupol, 87555 Ukraine*

*<sup>3</sup>Kremenchuk Mykhailo Ostrohradskyi National University, 20, Pershotravneva st., Kremenchuk, 39600 Ukraine*

**Abstract.** The purpose of the work is a visual application of mathematical modeling to study the manufacturing of steel wheel rims. It is shown that for training of engineering and technical personnel of enterprises, graduate students, researchers to analyze complex technical systems, it is necessary to schematize a complex approach with the involvement of most means of perception of information. An example of engineering design of the method for the calculation of the required force of shaping of on a horizontal shape-forming machine used in the preproduction workflow is given. The design of a machine for horizontal shape-forming of wheel steel rims enables quick readjusting and transfer to another rim shape, which is significant under the conditions of frequent alteration of the product nomenclature. We developed the calculation method based on the study and analysis of assumptions: on the assumptions the deformations continuity, the constancy of the volume at plastic deformation and axisymmetric stressed state as well as the local application of the load. The research resulted in obtaining visualization of the formation of recommendations for manufacturing based on mathematical modeling of the process which allows the analytical dependences for the calculation of the force of shaping of a wheel rim, taking into account the degree of deformation, the mechanical characteristics of the metal, hardening as well as the design and technological factors of the process. The topicality of the development consists in the necessity for the high-quality and the least expensive choice of the equipment of the required rated power when designing a new workflow. The experimental data, carried out both under the production and laboratory conditions, confirmed the adequacy of the theoretical formulas. It is determined by the assumptions and solutions obtained based on the mathematical apparatus of the technical theory of the shells of revolution. Modelling method will make it possible to algorithmize the calculation process quite easily and to use it as a subprogram in an applied complex of technical preproduction. It will also allow determining the shaping process most significant factors influencing the value of the force without the direct use of the calculation.



## **S1 - 7. Intelligent control of wheel rail contact noise phenomenon in rail transportation**

*Elhocine Chiba, Mourad Abdelkrim, Abderrahim Belloufi and Imane Rezgui*

*University Kasdi Merbah Ouargla, Faculty of Applied Sciences,  
Mechanical Engineering Department, Ouargla 30000, Algeria*

**Abstract.** Railway transport systems play a very important role in the future of transport. They offer sustainable solutions that reduce carbon emissions (environmental requirements) and allow more mobility with better energy efficiency, and they generate advantageous economic benefits in the long term. But the interaction between the wheel and the rail is always very difficult to approach. There are a large number of studies in the literature on this problem. However, there is still no comprehensive approach. On this work we propose to study numerical modelling of contact between wheel-rail systems by using fuzzy logic. For this purpose, the experimental collection data reported in literature are used to predict the resonance noise during wheel-rail contact in rail transport. We found a good agreement between the elaborated model and the results of the literature.



## **S1 - 8. Aspects of the wheel-switch contact studied with the CONTACT software**

*Mihaela Cristina Tudorache<sup>1</sup>, Vlăduț Marian Dinu<sup>2</sup> and Răzvan Andrei Oprea<sup>1</sup>*

*<sup>1</sup>University POLITEHNICA of Bucharest, Department of Railway Vehicles, 313 Splaiul Independentei, District 6, Bucharest, Romania*

*<sup>2</sup>University POLITEHNICA of Bucharest, Doctoral School of Transports, 313 Splaiul Independentei, District 6, Bucharest, Romania*

**Abstract.** The rapid variation of the wheel and rail profile influences, on one hand, the grip-pseudo-slip - wear characteristics, and on the other hand, the dynamic behavior of the vehicle, because the pseudo-slip forces are significantly influenced by the contact area and pressures from within this area. It must be borne in mind that, in most cases, the rail-road has deviations from the geometric dimensions, which must not affect traffic safety and the demands of the running gear and the track must be within the permissible limits. Railway switches ensure discontinuities on the railway causing high dynamic loads. In operation, the rail-way devices must ensure three basic requirements: safety against derailment, stability while on the move and passenger comfort. In this context the paper presents aspects of the multipoint wheel - rail-way switch contact using the Contact software. Considering the influence of sliding speeds on the contact phenomena at the intersection of the wheel with the running path, the paper presents an analysis of the kinematic behavior of the axle while passing over a point rail.





## **S1 - 9. Mathematical, detailed and parametric modelling for smart spinal orthoses**

*Roman Murzac, Cristian Vasile Doicin, Mihaela Elena Ulmeanu and Teodor Țurcanu*

*University POLITEHNICA of Bucharest, Splaiul Independentei, No. 313, District 6, Bucharest, Romania*

**Abstract.** The paper presents a mathematical model and the design details to manufacture a prototype of a smart orthosis for posture correction while sitting on a chair at your office or at home. The global geometry for developing the mathematical model was obtained by direct measuring a human 3D model, developed by scanning one of the authors' body and 3D printing it. Based on the mathematical model, the detailed design for the entire product was performed in accordance with the product architecture. The stages of detailed design for the critical systems within the final assembly are also presented in the paper. The posture correction orthosis must be customized for each user, thus, once the design for the critical components has been validated, a parametric design has been generated to facilitate the manufacturing process. The technical solutions are generated and analysed for a vertebral element of the orthosis, representing the critical component of the product. The vertebral element is subject to mechanical stresses, so that a finite element analysis was performed. The geometry of the component and its material were validated by using FEA on the CAD model of the vertebral element. The further work will include research regarding the changes needed for transforming the orthosis into a medical device for spinal column illnesses.



## Section 2. Processes, Tools and Equipment

### Section 2. Programme

Online on MS Teams platform – [ICAMaT 2020 – S2.PTE](#)

Time: 10.15 -12.15 / 12.30 -14.30 (RO)

Section Chairs: Abderrahim BELLOUFI, Manuela-Roxana DIJMĂRESCU

No. & Start time	Authors <i>Paper title</i>
1. 10.15	Ana-Maria Mocioiu, Diana-Irinel Băilă and Oana-Cătălina Mocioiu <i>Chemical and mechanical tests on the SiO<sub>2</sub>-ZnO materials for protective coatings of industrial use</i>
2. 10.35	Oana-Cătălina Mocioiu, Diana-Irinel Băilă, Irina Atkinson, Veronica Brătan and Ana-Maria Mocioiu <i>Manufacturing of SiO<sub>2</sub>-ZnO materials with optical properties</i>
3. 10.55	Sergiu Mazuru and Serghei Scaticailov <i>The role of the friction process in abrasive grain micro cutting technology</i>
4. 11.15	Sergiu Mazuru, Nicolaie Trifan and Alexandru Mazuru <i>Some aspects of the nitriding process of parts in machine construction</i>
5. 11.35	Volodymyr Kukhar, Elena Balalayeva, Maryna Korenko, Andrii Prysiazhnyi and Oleksandr Anishchenko <i>FEM simulation of C45 steel and Cu-ETP billet shaping at hot upsetting between convex conical dies</i>
6. 11.55	Ruslan Puzyr, Viktor Shchetynin, Roman Arhat, Yuliia Sira, Volodymyr Muravlov and Sergey Kravchenko <i>Numerical modeling of pipe parts of agricultural machinery expansion by stepped punches</i>



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
October 29<sup>th</sup>, 2020, Bucharest, Romania

No. & Start time	Authors <i>Paper title</i>
12.15 - 12.30	Break
7. 12.30	Liubomyr Ropyak, Vasyl Vytvytsyi, Andrii Velychkovych, Tetiana Pryhorovska and Maksim Shovkoplias <i>Study on grinding mode effect on external conical thread quality</i>
8. 12.50	Tom Savu, Sergiu Nanu and Ionuț Cosmin Ene <i>Automatic positioning methodology and algorithm for modular jigs and fixtures components</i>
9. 13.10	Abderrahim Belloufi, Mourad Abdelkrim, Imane Rezgui, Rebai Saci, Mourad Mezoudj, Mohammed Toufik Amira <i>Optimal selection of milling cutting tools for machining of triangular pockets</i>
10. 13.30	Mohammed Toufik Amira, Abderrahim Belloufi, Mourad Abdelkrim, Farid Abdelkrim and Mourad Mezoudj <i>Smart prediction of surface micro-hardness after milling based on fuzzy inference model</i>
11. 13.50	Florina Ionescu, Gheorghe Solomon, Ionelia Voiculescu, Delia Gârleanu and Gabriel Gârleanu <i>Experimental study towards WIG welded joint. Case study: repair by welding of X2CrNiMo17-12-2 pipes</i>
12. 14.10	Laurențiu Slătineanu, Margareta Coteață, Oana Dodun, Gheorghe Nagîț, Adelina Hrițuc, Irina Beșliu-Băncescu <i>Ways for determining the intermediate dimensions when designing the machining technology</i>
13. 14.30	Daniel-Petru Ghencea, Florea-Dorel Anania, Miron Zapciu <i>Research of fuzzy logic application on surfaces roughness prediction under finishing milling process</i>



## Section 2. Abstracts

### **S2 - 1. Chemical and mechanical tests on the SiO<sub>2</sub>-ZnO materials for protective coatings of industrial use**

*Ana-Maria Mocioiu<sup>1</sup>, Diana-Irinel Băilă<sup>2</sup> and Oana-Cătălina Mocioiu<sup>3</sup>*

*<sup>1</sup>National R&D Institute for Non-ferrous and Rare Metals, 102 Biruinței Blvd, Pantelimon, Ilfov 077145, Romania*

*<sup>2</sup>University POLITEHNICA of Bucharest, Blv. Splaiul Independentei, no. 313, sector 6, cod 060042, Bucharest, Romania*

*<sup>3</sup>Ilie Murgulescu Institute of Physical Chemistry of Romanian Academy, 202 Splaiul Independenței, Bucharest, Romania*

**Abstract.** Many industrial processes, such as chemical process and pharmaceuticals, use aggressive acidic and caustic solution which may result in an early failure of the components of plant. The various corrosion processes in harsh environments could be uniform corrosion, localized corrosion, galvanic corrosion, etc. In order to extend the life of components, a proper material selection is necessary. This direction is intended to address the behaviour of materials due to exposure in harsh environments. The main objective is to develop new vitreous coatings for different kind of materials as metals or glasses in order to protect them against acid attack. SiO<sub>2</sub>-ZnO materials were prepared by chemical route in order to be used as protective coatings. The SiO<sub>2</sub>-ZnO materials were investigated by infrared spectroscopy and differential thermal analysis in order to determine their structure and thermal characteristics. SEM and EDS measurements were performed to investigate their structure and morphology. The chemical resistance tests in acid media (HCl and HF) were followed based on STAS and ISO standards and the extraction solutions were tested by ICP-MS in order to identify elements lost during tests. Mechanical tests were performed.



## **S2 - 2. Manufacturing of SiO<sub>2</sub>-ZnO materials with optical properties**

*Oana-Cătălina Mocioiu<sup>1</sup>, Diana-Irinel Băilă<sup>2</sup>, Irina Atkinson<sup>1</sup>,  
Veronica Brătan<sup>1</sup> and Ana-Maria Mocioiu<sup>3</sup>*

*<sup>1</sup>Ilie Murgulescu Institute of Physical Chemistry of Romanian Academy,  
202 Splaiul Independenței, Bucharest 060021, Romania*

*<sup>2</sup>University POLITEHNICA of Bucharest, 303 Splaiul Independentei,  
Bucharest 060042, Romania*

*<sup>3</sup>National R&D Institute for Non-ferrous and Rare Metals, 102 Biruinței  
Blvd, Pantelimon, Ilfov 077145, Romania*

**Abstract.** Antireflection coatings have been widely used to increase the absorption of solar collectors and to reduce surface reflection. Many techniques have been explored to prepare thin coatings, such as sputtering, chemical etching, chemical vapour deposition, and the sol-gel method. SiO<sub>2</sub>-ZnO coatings were prepared on the surface of glass substrates via the sol-geldip-coating process. The structural, morphological and optical properties of the coatings were characterized. The vitreous structure was identified by infrared spectroscopy (FTIR) and X-ray diffraction (XRD). Morphology of materials was observed by scanning electron microscopy (SEM). The transmittance and reflectance spectra were investigated and the optical performance of the structure was determined.



### **S2 - 3. The role of the friction process in abrasive grain micro cutting technology**

*Sergiu Mazuru and Serghei Scaticailov*

*Department of Machines Construction Technology, Faculty of Mechanical Engineering and Transport, Technical University of Moldova, 9/8, Studentilor str., block of study nr. 6, Chisinau, Moldova*

**Abstract.** The process of micro-cutting with abrasive grain - complicated tribological phenomenon. The removal of the chip-shaped material from the surface of the semi-finished product is accompanied by elastic and plastic deformations of the surface, with heat releases and phase changes. One of the features of the grinding process and other types of abrasive processing, is that the removal of the chip especially takes place with negative front angles. According to [1] the average value of the front cutting angle values is within the limits - (46.6... 56.9). To the geometric parameters of the distant layer that characterizes the cutting process can be attributed: the thickness and width of the cut and the shrinkage of the chip. A series of scientific and manual works on cutting materials can be objected to the fact that in the process of deformation at cutting which is characterized by the coefficient of shrinkage of the chip a physical-mechanical influence has the characteristic of the processed material, the value of advance, depth of cutting and other parameters.



## **S2 - 4. Some aspects of the nitriding process of parts in machine construction**

*Sergiu Mazuru, Nicolae Trifan and Alexandru Mazuru*

*Department of Machines Construction Technology, Faculty of Mechanical Engineering and Transport, Technical University of Moldova, 9/8, Studentilor str., block of study nr. 6, Chisinau, Moldova*

**Abstract.** Nitriding is the most common and effective surface hardening method. Such chemical-thermal treatment is capable of increasing surface hardness, contact endurance, wear and seizure resistance, as well as heat resistance and corrosion resistance of a wide range of machine parts. This process of surface hardening has found its application in many branches of modern mechanical engineering. The operational requirements for the parts led to the need to replace high-temperature methods of chemical-thermal treatment (carburizing, high-temperature nitrocarburizing, etc.) for hardening processes at lower temperatures (500-650° C), namely nitriding. This replacement was facilitated by the latest technological developments in the field of various nitriding methods. The scientific developments obtained to date make it possible to gradually eliminate such disadvantages of nitriding as a significant duration of the process, increased fragility of the surface layer, insufficient values of contact endurance, and labor intensity of the process.



## **S2 - 5. FEM simulation of C45 steel and Cu-ETP billet shaping at hot upsetting between convex conical dies**

*Volodymyr Kukhar<sup>1</sup>, Elena Balalayeva<sup>1</sup>, Maryna Korenko<sup>2</sup>, Andrii Prysiazhnyi<sup>1</sup> and Oleksandr Anishchenko<sup>1</sup>*

*<sup>1</sup>Pryazovskiy State Technical University, Universytetska str., 7, Mariupol, 87555, Ukraine*

*<sup>2</sup>Kryvyi Rih State University of Economics and Technology, Technological Institute, Stephana Tilhy str., 5, Kryvyi Rih, 50006, Ukraine*

**Abstract.** On the basis of finite element analysis (FEA), geometric differences in the shaping during hot upsetting of cylindrical billets with a height-to-diameter ratio of 1.0 and 2.0 made of C45 (1.0503) steel and copper (Cu-ETP) between pointed convex conical dies with a cone slant angle of 12.5°, 15.0° and 17.5° are considered. The stroke velocity of the upper die is 0.5 m/s; process temperature ( $t$ ) and accepted surface friction coefficient ( $\mu$ ): for steel –  $t = 1100$  °C,  $\mu = 0.32$ , for copper –  $t = 850$  °C,  $\mu = 0.34$ . An equation is obtained for the relation between values of reduction in height ratio and engineering strain on height of workpiece during upsetting between conical dies, taking into account the initial billet dimensions and unevenness of forming due to the geometry of tool. The presence of qualitative and quantitative differences in shaping along the height of upset steel and copper billets was revealed, i.e. influence on unevenness of forming the rheological properties of materials under process conditions. It is advisable to use the results obtained to design and improve of technological processes of open die and closed die forging with preforming of billets.





## **S2 - 6. Numerical modeling of pipe parts of agricultural machinery expansion by stepped punches**

*Ruslan Puzyr<sup>1</sup>, Viktor Shchetynin<sup>2</sup>, Roman Arhat<sup>2</sup>, Yuliia Sira<sup>1</sup>,  
Volodymyr Muravlov<sup>3</sup> and Sergey Kravchenko<sup>3</sup>*

*<sup>1</sup>Kremenchuk Mykhailo Ostrohradskyi National University College,  
Chumatskyi Shliakh str. 7, Kremenchuk 39621, Ukraine*

*<sup>2</sup>Kremenchuk Mykhailo Ostrohradskyi National University,  
Pershotravneva str. 20, Kremenchuk 39600, Ukraine*

*<sup>3</sup>Poltava State Agrarian Academy, Skovorody str. 1/3, Poltava, 36003,  
Ukraine*

**Abstract.** The paper presents the research of plastic expansion of a pipe workpiece by punches of various configurations. It is shown that interest in this process is caused by the development of oil production, where there is a need to increase the diameter of well pipes, the automobile industry, where the protection of the driver and passengers in case of accidents comes first. Here, stable plastic deformation plays an important role as a good absorber of kinetic energy, etc. Data on the problems of expanding pipe ends are given, where special attention is paid to the destruction of the end in the form of localization of deformations and appearance of a longitudinal crack. To eliminate this phenomenon on various technological methods are used. Several spatial outlines of the tool are proposed to create an effective reloading of the pipe workpiece in the deformation zone. Based on numerical modeling, the distribution of stresses according to Mises, the displacement of the end of the semi-finished product and logarithmic deformations in the radial direction is shown for each standard size of the punch. Comparative results reveal an increase in the thickness of the workpiece in the dangerous section for all presented punches.



## **S2 - 7. Study on grinding mode effect on external conical thread quality**

*Liubomyr Ropyak, Vasyl Vytvytsyi, Andrii Velychkovych, Tetiana Pryhorovska and Maksim Shovkopljas*

*Ivano-Frankivsk National Technical University of Oil and Gas,  
Department of Mechanical Engineering, 15 Karpatska Str., Ivano-Frankivsk, Ukraine, 76019*

**Abstract.** The article has grounded the necessity to develop an empirical power dependence of cutting modes influence on part surface roughness obtained during thread grinding. The calculations were carried out for grinding of parts made of steel and hard alloy. There have been developed a relation of part material properties, grinding wheel options, lubricating and cooling liquid (constant for concrete conditions of thread grinding), depth of cutting (thickness of a grinded layer per path), revolutions of a part and a wheel, longitudinal feed refer to obtained roughness. It has been stated that components of the grinding mode contribute in roughness values in different way, in particular they are arranged in the ascending order as follows: grinding depth, rotation speed, and detail's diameter.



## **S2 - 8. Automatic positioning methodology and algorithm for modular jigs and fixtures components**

*Tom Savu, Alexandru Sergiu Nanu and Ionuț Cosmin Ene*

*University POLITEHNICA of Bucharest, Manufacturing Engineering (TCM) Dept., 313 Spl. Independentei, 060042 sector 6, Bucharest, Romania*

**Abstract.** One of the steps in designing a modular jig or fixture assembly is that of selecting the appropriate components. Among these components, those forming the jig's body must be chosen for closing the dimensional chains between the other locating, clamping, or indexing components. The methodology starts by defining the components' virtual connectors, specifying the rules for establishing their coordinates systems, and then is defining the rules to be followed for aligning and assembling two adjacent components. Different cases are described and only some of them are detailed, for clarity reasons. The algorithm is looking to determine a series of components from which the first is in a fixed position, related to other locating or clamping jig's component. A hierarchical tree is generated, using available components, having in each node a component which is assembled with a previous one using the above-mentioned connectors. Interference criteria is checked for selecting possible solutions only. A stop criterion related to the number of components in a branch is used, Solutions from the different branches are compared using the distances to an end component.



## **S2 - 9. Optimal selection of milling cutting tools for machining of triangular pockets**

*Abderrahim Belloufi, Mourad Abdelkrim, Imane Rezgui, Rebai Saci, Mourad Mezoudj, Mohammed Toufik Amira*

*University Kasdi Merbah Ouargla, Faculty of Applied Sciences, Mechanical Engineering Department, Ouargla 30000, Algeria*

**Abstract.** Minimizing machining time is an objective that must be taken into account when choosing the cutting tool. The diameter of the cutting tool is one of the parameters which greatly influences the machining time of different geometric shapes, especially pockets. In this study, a methodology for optimizing the choice of milling cutting tools for machining triangular pockets was proposed. An analytical model expressing the length of cutting tool paths has been optimized using sequential quadratic programming. The study carried out in this work leads to the conclusion that the spiral contour strategy makes it possible to have a minimum length for the machining of triangular shaped pockets.



## **S2 - 10. Smart prediction of surface micro-hardness after milling based on fuzzy inference model**

*Mohammed Toufik Amira, Abderrahim Belloufi, Mourad Abdelkrim, Farid Abdelkrim and Mourad Mezoudj*

*University Kasdi Merbah Ouargla, Faculty of Applied Sciences, Mechanical Engineering Department, Ouargla 30000, Algeria.*

**Abstract.** The lack of comprehending and control of the micro-hardness of the machined surface is an important obstacle to the use of the milling process. In order to optimize the machining process by milling, this work has focused on the problem of micro-hardness changing of machined surfaces by milling, which has been the subject of several scientific works. A fuzzy inference model was developed to study the influence of cutting conditions (cutting speed, feed per tooth and depth of cut) on the micro-hardness of machined surfaces by milling. The predicted values, obtained by fuzzy model, are compatible with the experimental values, with an average error percentage of 0.63%.



## **S2 - 11. Experimental study towards WIG welded joint. Case study: repair by welding of X2CrNiMo17-12-2 pipes**

*Florina Ionescu, Gheorghe Solomon, Ionelia Voiculescu, Delia Gârleanu and Gabriel Gârleanu*

*University POLITEHNICA of Bucharest, Faculty of Industrial Engineering and Robotics, Quality Engineering and Industrial Technologies Department, 313 Splaiul Independentei, 060042 Bucharest, Romania*

**Abstract.** Nowadays, several technological problems were raised by industrial beneficiaries regarding spiral and pipe heat exchangers repairs and thus studies were done in this regard. X2CrNiMo17-12-2, austenitic stainless-steel pipes were considered for the experiments on which artificial defects, simulating functioning defects, were done. In order to perform the repair activities on the designed defects, WIG welding process was used and an experimental stand was created. This paper presents some of the difficulties that can occur during the repair by welding of pipes and the defects identified using destructive and non-destructive testing on the probes and samples created for the experimental study scope. Significant conclusions can be drawn; up to a distance of about 100 - 150 mm from the access end, the repair has a good appearance with no serious imperfections.



## **S2 - 12. Ways for determining the intermediate dimensions when designing the machining technology**

*Laurențiu Slătineanu<sup>1</sup>, Margareta Coteață<sup>1</sup>, Oana Dodun<sup>1</sup>, Gheorghe Nagiț<sup>1</sup>, Adelina Hrițuc<sup>1</sup>, Irina Beșliu-Băncescu<sup>2</sup>*

*<sup>1</sup>“Gheorghe Asachi” Technical University of Iași, Romania*

*<sup>2</sup>“Ștefan cel Mare” University of Suceava, Romania*

**Abstract.** Among other problems to be solved, the design of a technological process of machining by cutting a part involves establishing the dimensions that can be achieved in the pre-final machining of the same surface of the part. There are distinct ways to calculate the so-called intermediate dimensions and, in particular, to define the dimensions for adjusting the position of the cutting tool tip before starting the actual machining process. The paper analyzes some such ways of establishing the intermediate dimensions, highlighting the conditions under which they can be applied, their advantages and limitations of use. Subsequently, the double-entry matrix method was applied to identify one or more methods with wider possibilities of use. It was concluded that the method of tolerance chart and respectively a method that takes into account a statistical processing of the results accumulated over time are methods likely to lead to an efficient solving the problem of determining the intermediate dimensions.



## **S2 - 13. Research of fuzzy logic application on surfaces roughness prediction under finishing milling process**

*Daniel-Petru Ghencea, Florea-Dorel Anania and Miron Zapciu*

*University POLITEHNICA of Bucharest, Department of Robots and Manufacturing Systems, Splaiul Independenței 313, Bucharest, Romania*

**Abstract.** Artificial intelligence systems are usefully tools for estimation of different parameters for industrial and non-industrial applications. In this paper is presented a fuzzy logic application for surface roughness prediction for two material type for a CAM milling process. A minimum number of measurements have been made on a specific material (al 6061) and were used for prediction of a roughness of another material (al 7075). The link parameters between these materials, used in Fuzzy logic system, is the Rockwell hardness. In this way many correction parameters of cutting regime can be calculated in a short time with minimum resource (less experiments and tests needed).





## Section 3. Industrial Systems

### Section 3. Programme

Online on MS Teams platform – [ICAMaT 2020 – S3.IS](#)

Time: 10.15 -12.15 / 12.30 -14.30 (RO)

Section Chairs: Andrei DUMITRESCU, Predrag JANKOVIĆ

No. & Start time	Authors <i>Paper title</i>
1. 10.15	Alexandra Elena Crăciun <i>Correlation between market segmentation, industrial product features and context in design assessment</i>
2. 10.35	Andrei Dumitrescu and Mihail Purcărea <i>Product domestication from consumers perspective</i>
3. 10.55	Georgiana Cătălina Neacșu, Iuliana Georgiana Pascu, Eduard Laurențiu Nițu and Ana Cornelia Gavriliuță <i>Brief review of methods and techniques used in Learning Factories in the context of Industry 4.0</i>
4. 11.15	Iuliana-Georgiana Pascu, Georgiana Cătălina Neacșu, Eduard Laurențiu Nițu and Cornelia Ana Gavriliuță <i>A brief review of the methods and techniques used in the innovative internal logistics processes and systems</i>
5. 11.35	Victor Bujakas and Maksim Glotov <i>New design of precise deployable reflector. Technologies for manufacturing of physical model</i>
6. 11.55	Miloš Madić, Predrag Janković, Milan Trifunović and Marko Kovačević <i>Application of software solution for solving engineering design optimization problems</i>



11<sup>th</sup> International Conference on Advanced  
Manufacturing Technologies (ICAMaT 2020)  
October 29<sup>th</sup>, 2020, Bucharest, Romania

---

<b>No. &amp; Start time</b>	<b>Authors <i>Paper title</i></b>
12.00 - 12.15	Break
7. 11.45	Elizaveta Gromova <i>Model of «short cycles» as an integrated product development implementation in industry</i>
8. 12.15	Alfred Tieber, Daniel-Silviu Manolache and Marian Gheorghe <i>Analysis and development of a key performance indicators model for the paper industry</i>



## **Section 3. Abstracts**

### **S3 - 1. Correlation between market segmentation, industrial product features and context in design assessment**

*Alexandra Elena Crăciun*

*Faculty of Industrial Engineering and Robotics, University Politehnica of Bucharest, 060042, Bucharest, Romania*

**Abstract.** When referring to product design assessment, even with a standard evaluation format, the perspective from which the criteria are approached differs strongly from one market category to another, this having a direct impact on the accuracy of the method. In order to achieve an objective assessment, the product must relate to a frame of reference in accordance with the product's destination, taking into account the user specifications and the actual experience of use. This paper represents the study of correlations between the market segment, product features and context and their degree of interdependence. Thus, analysing the relations between sections, the representative influence formulas for each considered feature were deduced, highlighting the extent to which the user's typology and context relate to the product features.



### **S3 - 2. Product domestication from consumers perspective**

*Andrei Dumitrescu and Mihail Purcărea*

*Manufacturing Engineering Department, POLITEHNICA University of  
Bucharest, 313 Splaiul Independentei, Bucharest 060042, Romania*

**Abstract.** Product domestication is the process by which the product purchased from the retailer is integrated into the household. This complex process has been analysed in detail from a theoretical point of view, but has not been approached from the practical perspective of consumers. This paper presents the results of a survey on a sample of students from a technical university regarding various aspects of the product domestication process (recall of the moment of product acquisition; concern for the aesthetic integration of the product into the household; investment of resources - time and money - in developing a household; difference of significance between the product in store and the product in home, etc.). After the statistical processing of the results, it was found that the process of product domestication is active and acknowledged by consumers, but at a moderate level in the case of the considered population segment.



### **S3 - 3. Brief review of methods and techniques used in Learning Factories in the context of Industry 4.0**

*Georgiana Cătălina Neacșu, Iuliana Georgiana Pascu, Eduard Laurențiu Nițu and Ana Cornelia Gavriluță*

*University of Pitesti, Faculty of Mechanics and Technology, Manufacturing and Industrial Management Department, Targul din Vale Street No.1, Romania*

**Abstract.** The rapid evolution of science and technology has forced the processes and systems of production, training and learning to adapt to innovation and the digital era of industrial technology. In the case of production processes and systems, innovation and digitalization refer to the transformation of production units into smart factories. In the case of training and learning processes and systems, innovation and digitalization lead to the creation of learning factories. Thus, this process involves the use of modern methods and techniques to develop innovative training, learning and production processes and systems. This paper is an analysis of recent studies and seeks to briefly present the evolution of industrial production processes and systems and Industry 4.0 but also the concept of learning factory. The paper also presents a review of the main methods and techniques used in innovative industrial training, learning and production processes and systems. Finally, some conclusions related to the use of these methods and techniques are summarized.



### **S3 - 4. A brief review of the methods and techniques used in the innovative internal logistics processes and systems**

*Iuliana-Georgiana Pascu, Georgiana Cătălina Neacșu, Eduard Laurențiu Nițu and Cornelia Ana Gavriliuță*

*University of Pitesti, Faculty of Mechanics and Technology,  
Manufacturing and Industrial Management Department, Targul din  
Vale Street No.1, Romania*

**Abstract.** In the last period, logistics knew a strong technological evolution that has changed the way it operates and determined its transformation into innovative logistics, especially in the case of internal logistics. Innovation in internal logistics processes and systems consists in the use of different Industry 4.0 and digitization technologies. So, it is necessary to use modern methods and techniques to support the transformation of internal logistics processes and systems into innovative ones. This paper presents an analysis of recent studies, briefly presenting the evolution of the concept of logistics, the concepts of process and logistics system and Industry 4.0. Also, the most common methods and techniques used in the realization of innovative internal logistics systems are presented and some conclusions are presented regarding their use.



### **S3 - 5. New design of precise deployable reflector. Technologies for manufacturing of physical model**

*Victor Bujakas and Maksim Glotov*

*P. N. Lebedev Physical Institute of Russian Academy of Science,  
119991, Leninsky pr. 53, Moscow, Russia*

**Abstract.** The new design of petal space antenna is considered in the paper. Various versions of solid petal-type mirrors have been considered and investigated in a number of articles and space projects. The classical scheme of petal type deployable space reflector was proposed and developed by Dornier Corporation within FIRST space project and was used in the Radioastron project to create a 10-meter antenna of space radio telescope. However, the classical petal mirror design has two significant drawbacks. Firstly, in the open state, the petals are cantilevered on the central mirror, what leads to low rigidity of the structure in open state. Secondly, in the classical design, the accuracy of the reflecting surface of the open mirror strongly depends on small errors in the operation of the deployment system. To overcome these drawbacks a new design of petal type mirror and a new system for precise opening of the mirror were proposed and studied. To test a new technical solution, a physical model of a deployable reflector was developed. The model contains a central mirror, a set of petals, hinges, locks and actuators for opening the mirror. 3D printing technology, CNC (computer numerical control) milling, plastic injection molding and carbon fiber technologies have been tested for central mirror and petals of the model fabrication. The results of computer and physical simulation are presented in the paper.



### **S3 - 6. Application of software solution for solving engineering design optimization problems**

*Miloš Madić<sup>1</sup>, Predrag Janković<sup>1</sup>, Milan Trifunović<sup>1</sup> and Marko Kovačević<sup>2</sup>*

*<sup>1</sup>Faculty of Mechanical Engineering in Niš, University of Niš, Aleksandra Medvedeva 14, 18000 Niš, Serbia*

*<sup>2</sup>Independent researcher*

**Abstract.** Engineering design problems involving a set of continuous, discrete and integer design variables and complex, non-convex objective functions and linear and non-linear constraints represent optimization problems with considerable complexity which are not trivial to solve. In recent years a number of optimization methods, particularly meta-heuristic optimization algorithms, were highlighted as effective optimization tools to deal with this type of engineering design problems. Despite certain advantages, their stochastic nature may be insufficient in dealing with various kinds of variables, constraints and objective functions. This paper discusses the application of developed software solution for solving engineering design optimization problems which is based on deterministic approach, i.e. the use of exhaustive iterative search algorithm. The use of the developed software solution is validated using four standard engineering design problems reported in the referential literature. In all case studies, the determined optimization solutions are equally good or better than those reported from other researchers using algorithms representative of the state-of-the-art in the area.





### **S3 - 7. Model of «short cycles» as an integrated product development implementation in industry**

*Elizaveta Gromova*

*Peter the Great St. Petersburg Polytechnic University,  
Politechnicheskaya st., 29, St. Petersburg, 195251, Russia*

**Abstract.** Industry 4.0 is already a common term. The modern development of the world community, characterized by the highest speed with which changes occur, the globalization of markets, the transition from centralized business models to open ones, from forms of competition to cooperation, commitment to network structures, the increasing importance of satisfying individual consumers, and the development of information and communication technologies, dictates new conditions for organizing successful production activities. Organization of production in current reality has an important characteristic, reflecting the concentration at the stage of product development. The purpose of this study is to analyze model of «short cycles» in the context of integrated product development implementation and to relate it to the current state of the Russian industrial development. Theoretical and practical aspects of this concept are given. The example of model of «short cycles» implementation in the Russian industrial sector is presented. PJSC Severstal is one of the brightest competitive examples on the world stage of following effective modern concepts of production organization in Russia. Today, reducing time to market is a key success factor. Summarizing, this model can be considered promising for enterprises of the industrial sector of the Russian economy.



### **S3 - 8. Analysis and development of a key performance indicators model for the paper industry**

*Alfred Tieber<sup>1</sup>, Daniel-Silviu Manolache<sup>2</sup> and Marian Gheorghe<sup>2</sup>*

*<sup>1</sup>PhD Student, University POLITEHNICA of Bucharest*

*<sup>2</sup>University POLITEHNICA of Bucharest, Manufacturing Engineering Department, 313 Splaiul Independentei, 060042 Bucharest, Romania*

**Abstract.** It is advisable to implement the use of key indicators by each company as a support for its continuous performant activity. Massive potential for optimisation can be found in the whole production industry. A scientific survey study has been designed and addressed to a number of companies from production industry in Europe. In the framework of this survey, the paper industry, as part of production industry, has been more profoundly analysed, in order to find the level of understanding and use of the key performance indicators and KPI systems, as an example. Based on the elements revealed by this analysis, a KPIs - Model for processes, production, financials, quality, supply chain, human resources and innovation is developed. This KPIs - Model can be a basis for the development of further KPIs – Models by any interested company, based on its specific conditions.

