Transilvania University of Brasov
FACULTY OF MECHANICAL ENGINEERING

20 Years of Excellence (2005–2025)

COMEC 2005-2025
20 YEARS

# The 11th International Conference on COMPUTATIONAL MECHANICS AND VIRTUAL ENGINEERING

# COMEC 2025

And

# The 48th International Conference on MECHANICS OF SOLIDS - "P.P. Teodorescu"

# FINAL PROGRAMME

BRAȘOV, ROMANIA
16 – 17 OCTOBER 2025

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- **Vasile GHEORGHE,** Lect. PhD Eng., Transilvania University of Brașov, Romania.

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- **Eliza CHIRCAN**, Lect. PhD Eng., Transilvania University of Brașov, Romania.

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- **Cristian Bolohan**, 4th year student at the Mechanical Engineering specialization, Faculty of Mechanical Engineering, Transilvania University of Brasov;
- **Alexandru Posea Cîrstea**, 4th year student at the Mechanical Engineering specialization, Faculty of Mechanical Engineering, Transilvania University of Brasov.

## WEBSITE MANAGER AND TECHNICAL SUPPORT TEAM

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- **Mircea MIHĂLCICĂ**, Assoc. Prof. PhD Hab. Eng., Transilvania University of Brașov, Romania.

## MAIN TOPICS

- Structural Mechanics;
- Mechanics of Solids, Modeling, Methods;
- Mechatronics and Robotics, Micro-Nano Systems;
- Acoustics and Vibrations;
- Finite Element Analysis (FEA) and Simulation;
- Innovative structural systems ;
- Machine Learning and Artificial Intelligence;
- Virtual Reality (VR) and Augmented Reality (AR);
- Additive Manufacturing (3D Printing);
- Digital Twin Technology;
- Sustainability and life-cycle;
- Bioengineering and Biomechanics;
- Applied Thermodynamics ;
- Fluid Mechanics.

**Thursday, 16 October 2025**

Location: Aula Magna, Transilvania University of Brașov

**$09^{00}$-$09^{30}$ – Registration & Welcome Coffee -Conference Hall Foyer**
**$09^{30}$-$10^{15}$ – Opening Ceremony - Welcome speeches by the Conference Chair**
**$10^{45}$ -$11^{00}$ – Keynote Lecture**
**$11^{00}$-$11^{15}$ – Coffee Break**
**$11^{15}$ -$13^{00}$ – Plenary Session - Computational Mechanics and Numerical Modeling**
**$13^{00}$-$14^{30}$ – Lunch Break**
**$14^{30}$-$16^{00}$ – Technical Sessions Topics: Virtual Engineering**
**$16^{00}$-$16^{15}$ – Coffee Break**
**$16^{15}$ -$18^{30}$ – Technical Sessions Topics: Material Modeling, Simulation Techniques**
**$19^{00}$ – Frameworking Dinner - A networking & celebration evening – 20 Years of COMEC**

**Friday, 17 October 2025**

Location: N building, Faculty of Mechanical Engineering, Transilvania University of Brașov

**$09^{00}$ - $11^{00}$ – The 48th International Conference on MECHANICS OF SOLIDS – "P.P. Teodorescu"**
**11.00 -11.30 – Conference Discussion Forum - Open discussion and reflections on the papers presented during the first day – highlights, scientific insights, and future collaboration ideas**
**11.30 – Social program**

# The 11th International Conference on COMPUTATIONAL MECHANICS AND VIRTUAL ENGINEERING - COMEC 2025

## Tuesday, 16 October 2025

Location: Aula Magna, Transilvania University of Brașov

**09:00 – 09:30 Registration & Welcome Coffee - Conference Hall Foyer**

**09:30 – 10:15 Opening Ceremony - Welcome speeches**

- **Maria Luminița SCUTARU, Prof. PhD Hab. Eng.,** Transilvania University of Brașov, Head of Mechanical Engineering Department, Romania;
- Ioan **Călin ROȘCA, Prof. PhD Hab. Eng.**, Transilvania University of Brasov, Dean of Mechanical Engineering Faculty, corresponding member of ASTR, Romania.

**10:15 -11:00 Keynote Lecture**

- **Andrei VASILESCU,** Prof. PhD Eng., Technical University of Construction, Bucharest, Romania;
- **Polidor Paul BRATU**, Prof. PhD Eng. DHC, Dunărea de Jos Galați University, CEO of ICECON Bucureşti, full member of ASTR, Romania.

11:00 -11:15 Coffee Break

11:15 -13:00 Plenary Session - Computational Mechanics and Numerical Modeling

CHAIRMAN:

Assoc.Prof. PhD Eng. Mircea MIHĂLCICĂ

- EXPERIMENTAL COMPARISON OF HIGH-SPEED IMAGING AND PIV OPTICAL MEASUREMENT TECHNIQUES FOR BUBBLE FLOW ANALYSIS

  Jozefkó Ferenc[1], Bencs Péter *[1], Bozzay Péter[1]

- INFLUENCE OF MATERIAL SELECTION ON FATIGUE LIFE PREDICTION OF AUTOMOTIVE EXHAUST MANIFOLDS USING THE SMITH–WATSON TOPPER PARAMETER

  Ouyoussef N.*[1], Moustabchir H.[1]

- SOLUTIONS IN A CLOSED FORM FOR COMPOSITE BEAMS WITH MATERIAL COUPLING BETWEEN THE BENDING AND TORSIONAL DISPLACEMENTS

  György SZEIDL *[1], László KISS[1]

- COMPLEMENTARY METHODS FOR ASSESSING INTEGRITY OF LAYERED MESOSTRUCTURES

Savin Adriana*[1], Faktorova Dagmar[2], Morăraș Ciprian Ionuț[3], Stanciu Mariana Domnica[4], Soare Marian[5] , Steigmann Rozina[1]

13:00 – 14.30 Lunch Break

14.30 – 16.00 Technical Sessions Topics: Virtual Engineering

CHAIRMAN:

Prof. PhD Eng. Hab. Silviu NĂSTAC

- ANALYSIS OF CHANGES IN ELASTIC CONSTANTS IN MULTIPHASE POLYCRYSTALLINE MATERIALS

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- ASSEMBLY OF A COIL PUMP FOR LABORATORY EXPERIMENTS AND ITS MEASURED PUMP CHARACTERISTICS

Norbert Tibor Szaszák*[1], Réka Ladányi[1]

- ANALYSIS OF THE PHYSICAL AND MECHANICAL PROPERTIES OF STEEL USED FOR COLD FORMING

Stanciu Mariana Domnica[1], Savin Adriana[2], Teodorescu Drăghicescu Horațiu[1], Ursărescu Andrei[1]

- DYNAMIC BEHAVIOR OF A BUILDING WITH BASE ISOLATION USING ANTI-SEISMIC DEVICES WITH DIFFERENT STIFFNESS AND DAMPING CHARACTERISTICS

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16:15 – 18:30 Technical Sessions Topics: Material Modeling, Simulation Techniques

CHAIRMAN:

Prof. PhD Eng. Hab. Călin ITU

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- TRIBOLOGICAL ANALYSIS OF JOINTS IN CONSTRUCTION EXOSKELETONS MANUFACTURED BY 3D PRINTING

Savaniu Ioan Mihail*[1], Popovici Ioana Aristia[1], Moldovan Ionuț[1], Munteanu Mihaela Violeta[2]

- THE SUPPORT OF AUTONOMOUS DRONES (UAV - UNMANNED AERIAL VEHICLES)

  **Savaniu Ioan Mihail*[1], Sescu Gal Cristina[1], Serban Claudiu[1]**

**19:00 Frameworking Dinner - A networking & celebration evening – 20 Years of COMEC**

## Friday, 17 October 2025

Location: N building, Faculty of Mechanical Engineering, Transilvania University of Brașov

**09:00 – 11:00 The 48$^{th}$ International Conference on MECHANIC OF SOLIDS "P.P. TEODORESCU" - Technical Sessions**

**CHAIRMAN:**

  **Prof. PhD Eng. Hab. Silviu NĂSTAC**

- SHAPE OPTIMIZATION AS A FUNCTION OF CONTACT AREA LOADING IN L- AND T-CLIP FASTENED JOINTS

  **Bencze Andrei*[1]**

- COMPARATIVE ANALYSIS OF THE THERMAL AND HYGROMETRIC BEHAVIOR OF THE CONSTRUCTION BEFORE AND AFTER INSULATION

  Munteanu Mihaela Violeta*[1], Petrici Andrei Victor[1], Purcărea Ramona[2]

- USE OF STRUCTURAL PARTICULATIES IN THE VIBRATION ANALYSIS OF SYSTEMS WITH SYMMETRIES.

  Vlase Sorin[1], Itu Călin[1], Bratu Polidor[2,3], Sabou Florin Lucian Petrică[1]

- MODEL OF THE MATERIALS WITH VOIDS FOR THE STUDY OF BONE BEHAVIOR

  Vlase Sorin[1], Sabou Florin Lucian Petrică[1], Dominte Lucian Gabriel[1], Munteanu Mihaela Violeta[1]

11:00 – 11:30 Conference Discussion Forum - Open discussion and reflections on the papers presented during the first day – highlights, scientific insights, and future collaboration ideas

11:30 Social program

# BOOK OF ABSTRACTS

# COMAT 2025

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# INFLUENCE OF MATERIAL SELECTION ON FATIGUE LIFE PREDICTION OF AUTOMOTIVE EXHAUST MANIFOLDS USING THE SMITH–WATSON TOPPER PARAMETER

**Ouyoussef Nouhaila*[1], Moustabchir Hassane[1]**

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***Abstract**: Automotive exhaust manifolds are continuously exposed to severe thermomechanical cycling, which promotes crack initiation and growth in regions of high stress concentration. The present study investigates the influence of material selection on the fatigue life prediction of exhaust manifolds through a finite element analysis combined with a strain-based fatigue criterion. Two stainless steels, AISI 304L and AISI 321, are considered due to their wide industrial use and distinct microstructural stability at elevated temperatures.*

*A thermo-mechanical finite element model was developed to simulate realistic operating conditions, including temperature gradients, mechanical constraints, and material nonlinearity. Fatigue life estimation was performed using the Smith–Watson–Topper (SWT) parameter, which accounts for both the maximum stress and strain amplitude in each cycle. This approach provides a reliable indicator of crack initiation under multiaxial thermo-mechanical loading.*

*The comparative results highlight the significant role of material properties in fatigue resistance. The titanium stabilization of AISI 321 enhances oxidation and creep resistance, leading to delayed crack initiation and improved durability compared to AISI 304L. The study confirms that accurate fatigue modeling coupled with appropriate material selection contributes to the robust design of high-temperature automotive components.*

***Keywords**: Exhaust manifold; Thermal fatigue; Finite element method; Smith–Watson–Topper parameter; Material selection.*

## COMPLEMENTARY METHODS FOR ASSESSING INTEGRITY OF LAYERED MESOSTRUCTURES

**Savin Adriana*[1], Faktorova Dagmar[2], Morăraș Ciprian Ionuț[3], Stanciu Mariana Domnica[4], Soare Marian[5] , Steigmann Rozina[1]**

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***Abstract:*** *Additive manufacturing (3D printing) offers the benefits of direct manufacturing of components with complex geometries. The Ti6Al4V (Ti64) alloy prepared by AM requires high-quality densification if outstanding mechanical properties are sought. The method based on laser powder bed fusion (L-PBF) can be accompanied by the appearance of micro-cracks/discontinuities in the case of the layer-by-layer thermal process. Nondestructive evaluation (NDE) based on ultrasound (US) and eddy current (EC) allow the detection and estimation of the location and size of discontinuities in metal parts. They are oriented towards automation and data sharing in various technologies at the initial stage of production, which can exclude defective construction materials and identify the causes of certain damages. Research focused on NDE using complementary methods can provide potentially relevant data for the transition to NDE automation through learning.*

***Keywords:*** *3D printing, titanium alloy, ultrasound, eddy current*

## THE SEVERITY OF STRUCTURAL VIBRATIONS TRANSMITTED BY VENTILATION DUCTING AND FLUID PIPELINES IN THE CERNAVODĂ NUCLEAR POWER PLANT

**Ion Dan[1,2], Cotoban Andrei[1,2]**

1. IMSAR, Institute of Solid Mechanics of the Romanian Academy, Bucuresti, Romania
2. ICECON, Bucuresti, Romania

***Abstract****: The paper presents the effect of vibrations transmitted both by the air ventilation piping in turbulent flow and by the process water piping system for reactors. In this way, the severity of structural vibrations transmitted to the reactor shell is analyzed.*

# ANALYSIS OF THE PHYSICAL AND MECHANICAL PROPERTIES OF STEEL USED FOR COLD FORMING

**Stanciu Mariana Domnica[1], Savin Adriana[2], Teodorescu Drăghicescu Horațiu[1], Ursărescu Andrei[1]**

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***Abstract:*** *Many industrial parts are obtained through cold stamping and forming operations as they present numerous advantages such as expanding the scope of application, by replacing cast or forged parts with stamped or stamped and welded parts, developing small-scale or one-off production; optimizing material consumption; achieving high precision of stamped or cold-formed parts; increasing the productivity of the finished product by mechanizing and automating the stamping and cold forming processes; using cold stamping and forming processes during assembly; achieving the longest possible life of dies and molds in large-scale and mass production. The efficiency of forming processes and the quality of the parts depend on the physical and mechanical properties of the mild steel materials used. The paper presents the results obtained in the tensile testing of some types of mild structural steels and analysis of mechanical properties with type of rolled steel and cutting direction information necessary in the manufacture of parts by stamping.*

***Keywords:*** *cold forming, mild steel, mechanical properties, micro-hardness.*

# ANALYSIS OF CHANGES IN ELASTIC CONSTANTS IN MULTIPHASE POLYCRYSTALLINE MATERIALS

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***Abstract:*** *Macroscopic elastic constants for multiphase polycrystalline materials are calculated within a two-level constitutive model. The transition from microscopic to macroscopic elastic constants is based on the principles of averaged relationships between the orthogonality of stress and strain tensor fluctuations and the mismatch between macroscopic measures and their corresponding microscopic counterparts. Numerical studies are conducted for polycrystals with a cubic crystal lattice. The numerical results obtained demonstrate nonlinear laws for the variation of macroscopic elastic constants depending on the phase weight.*

***Keywords:*** *stress, strain, anisotropy, discrepancy of measures, multiphase polycrystal*

## VALIDATION OF AN IN-HOUSE DEVELOPED TOPOLOGY OPTIMIZATION ALGORITHM

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***Abstract**: This paper presents the validation of an in-house developed structural topology optimization algorithm that automatically removes material from low-stress areas of monolithic structures, while reinforcing highly stressed zones by adding material within a predefined 2D or 3D design space. The results are validated through comparisons with reference 2D and 3D problems from the literature, as well as by benchmarking against those produced by the OptiStruct commercial solver. It is demonstrated that by properly selecting the finite element size, setting the threshold for removing weak finite elements, and establishing suitable stopping criteria, the results are accurate and competitive in terms of structural performance compared to the considered references.*

## CONTACT STRESSES IN THE SEALING ELEMENTS OF A HIGH PERFORMANCE SPHERICAL VALVE

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***Abstract:** This paper presents a static finite element analysis (FEA) to evaluate the stress distribution, contact behavior, and deformation of sealing system components under internal pressure. The sealing system consists of a movable ring and a seat made of stainless steel. The sealing system of high-performance spherical valves plays a critical role in ensuring operational safety and efficiency. Emphasis is placed on identifying potential failure zones and understanding how material properties and design parameters influence sealing performance. The results offer valuable insights for improving the mechanical reliability of spherical valves and contribute to the development of optimized designs suited for demanding industrial applications.*

***Keywords:** Contact stress, Sealing systems, Finite element analysis (FEA).*

# ASSESSMENT OF CYLINDRICAL SURFACES ACCURACY IN PLA PARTS PRODUCED BY MATERIAL EXTRUSION (MEX)

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***Abstract:*** *Material extrusion (MEX) additive manufacturing has emerged as a widely adopted technique for fabricating polymer components, primarily due to its cost-effectiveness and operational simplicity. However, achieving high dimensional accuracy remains critical, particularly for components intended for industrial applications. This study systematically evaluates the dimensional precision of polylactic acid (PLA) parts produced via MEX, focusing on both internal (bore) and external cylindrical geometries. The investigation includes the effects of nominal diameter, spatial orientation on build supports, filament color, and infill density on dimensional deviations. Results indicate that deviations are significantly influenced by the type of cylindrical surface and its nominal size, with smaller-diameter bores exhibiting higher percentage errors. These findings contribute to establishing a fundament for defining precision classes in polymer-based additive manufacturing using material extrusion.*

***Keywords:*** *material extrusion, FDM, PLA, cylindrical surfaces, accuracy*

# STUDY OF THE MECHANICAL PROPERTIES OF THE STRUCTURE OF 3D PRINTED MATERIALS MADE OF PLA AND PETG

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***Abstract***: *A laborious study was carried out on specimens made with the help of the Prusa 3D printer, having different densities, from PLA and PETG materials, which were subjected to bending, thus obtaining the mechanical properties. This method of printing objects facilitates the obtaining of objects with high properties, which can replace important components within some structures of medical devices or mechanical components. In this paper we will analyze the conclusions between the minimum and maximum values that we obtained.*

## ASSEMBLY OF A COIL PUMP FOR LABORATORY EXPERIMENTS AND ITS MEASURED PUMP CHARACTERISTICS

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***Abstract:*** *In this paper the assembly of a coil pump for laboratory experiments and the initial flow investigations are presented. The pump itself consists of a coil of transparent flexible plastic pipe rolled up on a horizontal axis cylinder. The cylinder with the pipe coil is partially submerged in water and rotated by an electric motor driven by a frequency converter at test speed. One end of the rotating pipe is connected to a fixed pipe with a sliding seal, whilst another end is fixed on the surface of the rotating cylinder so that water can flow in. The volumetric flow rate was investigated as a function of rotation speed and delivery height. It was found that both volumetric flow rate and the maximum delivery height are strongly depended on the rotation speed.*

***Keywords:*** *Wirtz-pump, coil-pump, delivery head, two-phase flow, characteristic curve*

## EXPERIMENTAL COMPARISON OF HIGH-SPEED IMAGING AND PIV OPTICAL MEASUREMENT TECHNIQUES FOR BUBBLE FLOW ANALYSIS

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***Abstract****: Several types of mass transfer reactors, such as tubular reactors, are widely used in industry for transferring specific reactants from the gas phase into the liquid phase. In this study, a gas-liquid two-phase system was modeled in a reactor designed explicitly for the fundamental investigation of bubble flows. The flow characteristics of air bubbles were analyzed using two optical measurement techniques: Particle Image Velocimetry (PIV) and high-speed imaging. In addition to configuring the measurement setup, specific operational parameters were tested, and the applicability of tracer particles was also evaluated. The measurement data were processed using dedicated MATLAB software. The study compares the results obtained with the two measurement techniques and the corresponding flow patterns. Furthermore, the bubble trajectories were also determined based on the experimental findings.*

***Keywords****: bubble flow, bubble reactor, optical measurement, high-speed imaging*

## SHAPE OPTIMIZATION AS A FUNCTION OF CONTACT AREA LOADING IN L-AND T-CLIP FASTENED JOINTS

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***Abstract:*** *The performance and reliability of fastened joints are critical in structural applications where lightweight and compact designs are required. Fastened L- and T-clip are widely used due to their ability to provide quick assembly, flexibility and load transfer efficiency. However, the shape and geometry of these clips significantly influence the stress distribution, contact area loading and overall joint integrity. This paper investigates the role of contact area loading in the shape optimization of L- and T-clip fastened joints. Using a combination of finite element simulations and analytical models, the study evaluates how different geometrical variations affect stress of the parts. Optimization techniques are applied to identify shapes that minimize localized stresses while maximizing load distribution and joint stiffness. The findings provide design guidelines for achieving an optimal balance between material efficiency and structural performance. Ultimately, this research contributes to the development of more durable and lightweight fastening solutions for aerospace, automotive, and mechanical applications.*

***Keywords:*** *fastened joints, contact, shape optimization, lightweight*

## MODELS FOR THE STUDY OF ELASTIC MULTIBODY SYSTEM WITH VOIDS

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***Abstract****: In engineering practice, there are situations where new materials are used, with special properties determined by the needs of the final application or by the manufacturing processes. In this paper, the authors propose a model for the study of elastic systems of the Multibody Systems (MBS) type made of materials with voids. The Finite Element Method (FEM) is used along with the description of the mechanism on topological models. The equations of motion for such systems under certain technical conditions are established. The proposed model thus allows an analysis of complex types of mechanical systems.*

## ANALYSIS OF BRIDGE CRANE OPERATION THROUGH MONITORING THE ENERGY PARAMETERS OF DRIVE MOTORS

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***Abstract:*** *This paper presents the results of experimental research regarding the analysis of bridge crane operation by monitoring the energy parameters of the drive motors. The study was carried out on a laboratory test stand – an bridge crane – which allowed the reproduction of real operating conditions. During the experiments, the energy parameters of the travel motors in both movement directions were recorded, with emphasis on the variation of the electrical power absorbed from the supply network. Special attention was given to simulating blockage situations, which may occur when encountering obstacles along the travel path. The analysis of the obtained data highlights the correlations between the motor's operating regime and the exploitation conditions, providing useful information for early diagnosis of possible malfunctions and for increasing operational safety in overhead crane use. The results obtained provide a basis for the development of modern methods for monitoring and optimizing energy consumption in lifting and mechanized transport processes.*

***Keywords:*** *Bridge crane; Energy parameters; Functional diagnostics*

## SOLUTIONS IN A CLOSED FORM FOR COMPOSITE BEAMS WITH MATERIAL COUPLING BETWEEN THE BENDING AND TORSIONAL DISPLACEMENTS

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***Abstract****: The main objective of the present paper is to establish Green's function for composite rotating beams. With the Green's function the equilibrium problem for any loads exerted on the beam can be give in a closed integral form. In addition to this dynamic problems can also be solved numerically if the Green function is known.*

*Keywords: Composite beams. Green's function, equilibrium problems*

## TRIBOLOGICAL ANALYSIS OF JOINTS IN CONSTRUCTION EXOSKELETONS MANUFACTURED BY 3D PRINTING

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***Abstract:*** *This study presents a tribological investigation of joint mechanisms in robotic exoskeletons intended for construction applications, employing advanced 3D printing technologies. A virtual exoskeleton model was developed to support and optimize operational efficiency in construction tasks. The core of the preliminary research involves experimental evaluation of the friction coefficient on additive-manufactured specimens, selected to represent the materials used in exoskeleton joints. The results provide an initial assessment of the tribological performance of these components, offering a robust foundation for the subsequent development of physical prototypes. This work underscores the potential of 3D printing to enhance joint design in robotic exoskeletons and contributes to advancing innovative solutions tailored to the construction sector.*

***Keywords:*** *Robotic Exoskeletons; Construction Industry; Additive Manufacturing; Tribology; Design Optimization*

## EVALUATION OF THE PERFORMANCE OF SOUND-ABSORBING MATERIALS IN THE REVERBERATION CHAMBER AT ICECON

**Vasile Ovidiu[1,2], Terteleacă Jasmina[1,2], Zlătoianu Sorina[1,2]**

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***Abstract****: The concept and construction system of the ICECON reverberation chamber are presented. On this basis, the testing method and procedure for determining the acoustic response in the presence of sound-absorbing materials as products to be installed are discussed.*

## THE SUPPORT OF AUTONOMOUS DRONES

## (UAV - UNMANNED AERIAL VEHICLES)

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***Abstract:*** *The paper addresses the possibilities of introducing Artificial Intelligence in the operation of construction equipment. Having as central point the use of autonomous drones for collecting operational data, the experimental study aimed to monitor a backhoe loader involved in the process of moving earth onto a construction site. The ideea is to use an authonomous drone equipped with a high-performance video camera and location systems for continuosly collect and record (or transmit) accurate data from the field. The research aimes to obtain and structure the relevant datasets necessary for the future development of an algorithm capable of analyzing the operation of the bucket and the travel trajectory of the machine with the help of AI. The data collected covered parameters such as the duration of work cycles, downtime and the degree of use of the machine. This information constitutes a solid basis for further research aimed at introducing the use of Artificial Intelligence for the purpose of monitoring and optimizing the performance of various construction equipment. The integration of AI algorithms based on data collected by autonomous drones has the potential to support managerial decisions, increase productivity, reduce consumption and contribute to reducing operational costs in the construction sector.*

***Keywords:*** *Artificial Intelligence; machine management; autonomous drones; operational monitoring; digitalization of constructions.*

## CONCEPTS, METHODS, AND SOLUTIONS FOR THE PRODUCTION OF SOUND-ABSORBING AND SOUND-INSULATING PANELS FOR HIGHWAYS

**Vasile Ovidiu[1,2], Zlătoianu Sorina[1,2], Terteleacă Jasmina[1,2]**

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*Abstract: The paper presents the issues involved in the design, manufacture, and installation of acoustic insulation panels for highways. It addresses geometric and material solutions for reducing road noise from moving vehicles.*

# ADVANCED STUDY ON THE EVALUATION OF ACOUSTIC CHARACTERISTICS FOR SOUND ABSORBING FOAMS

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***Abstract:*** *The aim of this work was to perform a comparative analysis of potential soundproofing capabilities provided by a set of foam type materials, additionally taking into account practical implementation requirements for each type of application. The analyses were based on experimental evaluations, in terms of sound absorption coefficient, performed using the impedance tube (also known as the Kundt tube) and the transfer matrix method. Additionally advanced analyses were carried out using a set of special applications developed within Matlab computational platform. The sound-absorbing materials were selected accordingly to their acoustic characteristics, market availability and practical relevance, also taking into account diverse potential applications, both in civil construction and in technical, commercial or industrial spaces. The results present particular relevance in noise control domain, especially for those practical applications that require and/or impose strictly on-site embedding conditions.*

***Keywords:*** *acoustics, soundproofing materials, impedance tube method, sound absorption coefficient.*

# DYNAMIC BEHAVIOR OF A BUILDING WITH BASE ISOLATION USING ANTI-SEISMIC DEVICES WITH DIFFERENT STIFFNESS AND DAMPING CHARACTERISTICS

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***Abstract****: The paper deals with a specific issue for a building under construction in Romania. Thus, the insulation system with elastomeric devices with distinct elastic and damping properties was designed by the authors of this paper. In this context, the technical conditions for elastic support are presented and the composite damping for the system is established. The rigid behavior of the building leads to a dynamic analysis with dominant triaxial translation movements. The degree of triaxial translation is established. The degree of dynamic isolation is established.*

## MODELS AND MODELLING FOR SOUNDPROOFING CAPABILITIES ANALYSIS OF FIBRES-BASED FOAMS

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***Abstract:*** *This study mainly presents an overview about computational models available for acoustical capabilities characterization of foams, especially those based on cellulosic fibres. It was considered both empirical Delany–Bazley model and its variants, and phenomenological group of models (Johnson-Champoux-Allard, Johnson-Champoux-Allard-Lafarge, Johnson-Champoux-Allard-Pride-Lafarge). Additionally, it was presented the Prediction of Sound Absorption Coefficient using the Transfer Matrix Method (PSAC-TMM). In order to evaluate transport properties, based on computational simulations, the Lattice Boltzmann Method – LBM was taken into account, and some practical examples using LBM were presented. Comparative analyses between compatible computational approaches were also provided. Thus, the concluding remarks have shown that computational models and modelling techniques, started and/or tuned using experimental datum, are able to provide relevant information about acoustical capabilities of large category of foams, including those developed based on cellulosic fibres.*

***Keywords:*** *computational acoustics, cellulose fibre, foam formed technology, soundproofing*

## MODAL ANALYSIS OF HUMAN BODY OSCILLATIONS AS A BIOMECHANICAL SYSTEM DURING BIPEDAL LOCOMOTION

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***Abstract****: The behavior of the human body is presented, moderate as a biomechanical system in bipedal movement, taking into account the geometric characteristics, mass, and elastic connections of the main organs with dominant movements. Thus, a case study is conducted on a system with six and nine degrees of freedom for the head, trunk, upper limbs, and lower limbs during bipedal locomotion with a periodic step movement of 0.5 m open as a constant amplitude.*

# COMPUTATIONAL ASSESSMENTS ON FRACTIONAL CALCULUS APPLICATIONS WITHIN VIBRATION CONTROL AREA

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***Abstract:*** *It is already known and accepted that fractional calculus and related computational approaches provide an adequate tool for behavioural estimation and analysis of vibration control and mitigation systems. This study tried to present the fact that alpha-derivative models of vibration insulation systems can facilely simulate the continuous and instant balancing between conservative and dissipative components, especially for systems with variable characteristics. A rubber-based vibration isolation device was considered for investigations, and both linear and nonlinear characteristics have taken into account. Experimental datum was considered in order to provide comparative and correlative background. The advantages of a computational schematization based on a single-tuning-parameter (e.g. alpha-derivative order) were discussed and underlined.*

***Keywords:*** *computational techniques, vibration control and mitigation, fractional calculus, nonlinear models*

# THE BIOMECHANICAL PHYSIOLOGICAL EFFECTS OF VIBRATIONS TRANSMITTED TO THE HUMAN BODY IN THE CASE OF CONSTRUCTION MACHINERY

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***Abstract***: *The experimental values for several construction machines regarding the vibrations transmitted to the operator in the cabin are presented. Acceleration measurements were performed on the seat (sitting), back, head, and hand. Based on the acceleration values, stress situations were established up to the health stress limit for exposure durations.*

## DESIGN AND STRUCTURAL OPTIMIZATION OF A FOUR-AXIS ROBOTIC MANIPULATOR

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***Abstract:*** *This paper presents the design and optimization of a four-axis robotic arm using a parallelogram linkage to maintain end-effector orientation. The manipulator, designed for a 600 mm working stroke and a 1.5 kg payload, incorporates four stepper-driven revolute joints and aluminum alloy 6061 components to ensure high rigidity and low mass. The kinematic model was developed and solved through the Newton–Raphson method, based on the precise geometry of the mechanism. Finite element analysis (FEM) in Altair HyperMesh supported structural evaluation and optimization through thickness reduction, rib reinforcement, and joint refinement. The resulting design offers an optimal stiffness-to-mass ratio, improved manufacturability, and modularity, making it suitable for educational and light industrial applications.*

***Keywords:*** *Four-axis robotic arm, kinematic modeling, structural optimization, FEM analysis, Newton–Raphson method.*

## THE IMPACT OF CABIN NOISE IN CONSTRUCTION MACHINERY ON THE PSYCHO-SENSORY BEHAVIOUR OF THE OPERATING MECHANIC.

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***Abstract****: The results of noise measurements in the cabins of construction machinery for various technological working regions and exposure durations are presented. Thus, the spectral composition of noise signals reveals the existence of 6-8 Hz (infrasonic), (200-500) Hz, and (1000-5000) Hz audio components that influence the health of the neuropsychic system. Exposure durations can be determined with physiological implications at the health limit.*

# SURFACE DEFECTS IDENTIFIED ON PARTS PRODUCED BY THE INJECTION MOLDING PROCESS

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***Abstract:*** *The injection molding process is a manufacturing technique based on the thermoplastic deformation of polymeric materials, in which the material is heated to a molten state and injected under high pressure into a closed mold, where it is subsequently cooled and solidified, resulting in a part whose shape and dimensions accurately correspond to the geometry of the mold cavity.*

*This paper aims to identify surface defects occurring on components used in the automotive industry, made from polymeric materials such as ABS and PC, as well as to formulate recommendations for preventing the occurrence of these defects in future processes. The technological parameters considered are temperature, pressure, injection speed, and cooling time.*

***Keywords****: Injection process, ABS Acrylonitrile-butadiene-styrene, PC Polycarbonate, Injection process parameters, Surface defects*

# COMPARATIVE ANALYSIS OF THE THERMAL AND HYGROMETRIC BEHAVIOR OF THE CONSTRUCTION BEFORE AND AFTER INSULATION

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***Abstract****: This paper aims to analyze thermal insulation systems, with a particular emphasis on the performance of basalt wool, with a case study based on the use of 150 mm thick Rockwool material. We will include an experimental evaluation to highlight the efficiency of this material in real conditions.*

*Basalt wool has stood out as a top solution due to its thermal performance, fire resistance and durability. This contributes significantly to reducing heat loss through external walls, which are the surface most exposed to heat transfer.*

***Keywords****: thermal insulation, basalt wool, thermal insulation*

## USE OF STRUCTURAL PARTICULATIES IN THE VIBRATION ANALYSIS OF SYSTEMS WITH SYMMETRIES.

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***Abstract**: This paper investigates the use of structural particularities in the vibration analysis of mechanical systems exhibiting symmetries. Certain symmetries in mechanical structures enable simplifications in the computation of dynamic responses, reducing the effort required to determine eigenvalues and eigenmodes. By exploiting these structural properties, the analysis of such systems becomes more efficient and computationally less demanding. The paper presents and categorizes several types of symmetries, illustrating how they can be applied to streamline vibration analysis and improve the understanding of system behavior*

## MODEL OF THE MATERIALS WITH VOIDS FOR THE STUDY OF BONE BEHAVIOR

**Vlase Sorin[1], Sabou Florin Lucian Petrică[1], Dominte Lucian Gabriel[1], Munteanu Mihaela Violeta[1]**

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***Abstract**: In recent decades, the study of materials with voids has attracted significant attention from researchers, due to their unique mechanical properties. Such voids may occur naturally during manufacturing or be intentionally introduced for specific purposes. This paper extends these studies to the analysis of human bone structures, aiming to apply and adapt existing models of porous materials to biological tissues. By doing so, the research seeks to improve the understanding of bone behavior, providing a framework for more accurate simulations and potential applications in biomechanics and medical engineering.*

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