

Booklet of Abstracts

“1st International Conference on Mathematical Modelling in Mechanics and Engineering”

**Mathematical Institute of the Serbian Academy of Sciences and Arts
Belgrade, 08.-10. September 2022.**

Editors: Ivana Atanasovska, Milan Cajić, Danilo Karličić

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PREFACE

It's our pleasure to be the chairs of the '1st International Conference on Mathematical Modelling in Mechanics and Engineering', organized by the Mathematical Institute of the Serbian Academy of Sciences and Arts, and co-organized by the Faculty of Mechanical Engineering, University of Belgrade; the Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac; and Institute for Information Technologies, University of Kragujevac. The conference will be held in hybrid form at the Mathematical Institute of the Serbian Academy of Sciences and Arts, Belgrade, Serbia, from 8th to 10th of September, 2022.

This conference is planned as the first event in the series of conferences which will be held every two or three years and bring together leading academic scientists, researchers and research scholars to exchange and share experience and research results on various aspects of mathematical modelling in mechanics and engineering. It will bring an interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, theories, algorithms, as well as practical challenges encountered and solutions adopted in the fields of Classical Mechanics, Solid and Fluid Mechanics, Computational Mechanics, Biomechanics, Applied Mathematics and Physics, Structural Mechanics and Engineering. A considerable number of prominent scientists and professors submitted their abstracts and confirmed their attendance at the conference. The scientists and researchers from different countries in Europe and the world (Netherlands, UK, Norway, Greece, Spain, USA, Kazakhstan, Italy, Montenegro, India, Malaysia, Slovenia etc.) also have confirmed participation at the conference. We expect that the conference presentations will cover modelling with analytical/numerical and data driven solutions to study complex media, composite aerospace and periodic structures and metamaterials, and capture essential features of linear and nonlinear dynamics and wave propagation behaviour that can lead to new designs of such systems. Some presentations will include new experimental setups to study engineering materials and novel control strategies based on classical or fractional derivative models used to control the dynamics of multibody, flexible and/or electromechanical systems. Finally, we believe that the sessions' discussions will have high potential to give significant contribution to the developments of new and advanced mathematical models of real-world engineering mechanical systems.

We're very proud to announced that the number of accepted contributions to be presented at this Conference is 106, with 7 plenary and 4 invited lecture presentations. We would like to express our gratitude to the institutions that support conference financially: The Ministry of education, science and technological development of the Republic of Serbia; METALFER STEEL MILL doo, Serbia; and SHIMADZU, Serbia. We are especially grateful to the members of the Scientific committee and participants who gave their contribution to this international scientific meeting with their advices and abstracts' reviews. We also thank to the support of the co-organizers of this Conference: The Faculty of Mechanical Engineering, University of Belgrade, Serbia; The Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac, Serbia; and Institute for Information Technologies, University of Kragujevac, Serbia.

We hope that this conference will be success beginning of a recognized series of international conference events during next decades. We use the opportunity to wish to all participants a successful presentation of their scientific results.

Cordially,

Ivana Atanasovska, Conference Chair
Milan Cajić, Conference Vice-Chair
Danilo Karličić, Conference Vice-Chair



CONTENTS

PLENARY LECTURES

| | |
|--|----|
| MODELING OF STRUCTURAL MATERIALS | |
| H. Altenbach | 17 |
| FURTHER RESULTS ON ADVANCED CONTROL AND STABILITY ISSUES OF FRACTIONAL-ORDER DYNAMICAL SYSTEMS | |
| Mihailo P. Lazarević | 18 |
| MODELLING OF COMPOSITE STRUCTURES: USING BUCKLING FOR MORE FLEXIBLE AND SUSTAINABLE AIRCRAFT | |
| Chiara Bisagni | 20 |
| UNCERTAINITY QUANTIFICATION IN STRUCTUREAL DYNAMICS | |
| Sondipon Adhikari | 21 |
| ON THE GENERALITY OF SMEARED FINITE ELEMENT APPROACH TO MODEL FIELD PROBLEMS AND MECHANICS IN BIOLOGICAL TISSUE | |
| Miloš Kojić | 22 |
| MATHEMATICAL MODELS OF PURELY NONLINEAR OSCILLATORS: FROM SOLUTIONS TO PHENOMENA | |
| Ivana Kovacic | 23 |
| FEM-BASED REAL-TIME SIMULATIONS – VIRTUAL REALITY AT ITS BEST | |
| Dragan Marinkovic | 24 |

INVITED LECTURES

| | |
|--|----|
| SERPENTINE MOTION IN ROBOTICS: WIND CAR, TRIMARAN, SNAKEBOT | |
| Liubov A. Klimina, Marat Z. Dosaev and Yury D. Selyutskiy | 27 |
| ALGEBRAIC MESH GENERATION IN SPUR GEAR DRIVES | |
| Victor Roda-Casanova, Radu Andrei-Matei, and Francisco Sanchez-Marin | 28 |
| ENERGY BALANCE FOR FRACTIONAL WAVE EQUATIONS | |
| Dusan Zorica and Ljubica Oparnica | 29 |
| SYNTESIS FRAMEWORK FOR NEW BREED OF ROBOTS. SOFT LOCOMOTION ROBOTS | |
| Andrija Milojević | 30 |

GENERAL SESSIONS

| | |
|---|----|
| COMPUTATIONAL FRACTURE MECHANICS | |
| Aleksandar S. Sedmak | 33 |
| AGING OF SOLAR CELLS UNDER OPERATING CONDITIONS | |
| Vesna Trifunović-Dragišić | 34 |
| OPTIMIZATION OF ENGINEERING DESIGN PROBLEMS USING HONEY BADGER ALGORITHM | |
| Đorđe Jovanović, Branislav Milenković | 35 |



| | |
|---|----|
| EXTREMAL THRUST FOR BRACHISTOCHRONE PROBLEM O. Cherkasov, E.Malykh..... | 37 |
| COMPUTATIONAL MODELING OF AIR FLOW IN THE COOLING TOWER E. Berberović, S. Bikić | 38 |
| INHIBITORY POTENCY OF USNIC ACID TOWARD PHOSPHODIESTERASE TYPE 5 Jelena R. Đorović Jovanović, Svetlana R. Jeremić and Zoran S. Marković..... | 39 |
| TOWARDS NOVEL COMPUTATIONAL ROBUST GEAR TCA SOLUTION WITH PARAMETRIC STUDY OF MISALIGNMENTS AND PROFILE MODIFICATION Maksat Temirkhan, Hamza Bin Tariq, Konstantinos Kaloudis, Christos Kalligeros, Vasileios Spitas and Christos Spitas | 40 |
| DELAY DIFFERENTIAL EQUATIONS GOVERNING DYNAMICS OF A LANDSLIDE MECHANICAL MODEL Srđan D. Kostić, Nebojša T. Vasović | 42 |
| PARALLEL COMPUTATIONS IN FLUID DYNAMICS USING MULTICORE/MANYCORE PROCESSORS Ivan D. Tomanović, Srđan V. Belošević, Nenad Đ. Crnomarković, Aleksandar R. Milićević and Andrijana D. Stojanović | 43 |
| FRAMEWORK FOR MODELLING GENUINE GROUND REACTION FORCES DUE TO WALKING Vitomir Racić | 45 |
| SIMULATING FLOW IN SILICON Y-BIFURCATED MICROCHANNELS Jelena M. Svorcan, Milče M. Smiljanić and Miloš D. Vorkapić..... | 46 |
| FREE VIBRATIONS OF FGM PLATES WITH IMPERFECTIONS USING LAYERWISE FINITE ELEMENT Marina V. Cetkovic..... | 47 |
| A SIMULATION-INFORMED MODELING OF DEPTH OF PENETRATION OF RIGID RODS INTO QUASIBRITTLE SOLIDS Sreten Mastilovic | 49 |
| LES OF FLOW AROUND NACA 4412 AIRFOIL AT HIGH ANGLE-OF-ATTACK Jelena M. Svorcan and Kevin Patrick Griffin | 50 |
| PERFORMANCES OF REPAIRED HONEYCOMB SANDWICH PANEL Younes Djemaoune, Branimir Krstić..... | 51 |
| INHIBITION POTENCY OF 1,2,4-TRIHIDROXYANTHRAQUINONE AND 1,2,4- TRIHIDROXYXANTHONE TOWARD PENICILLIN-BINDING PROTEIN 1A Svetlana R. Jeremić, Jelena R. Đorović Jovanović and Zoran S. Marković..... | 53 |
| MODAL PARAMETERS IDENTIFICATION AND DYNAMIC PERFORMANCE OF A STEEL FOOTBRIDGE WITH A SIGNIFICANT 3D BEHAVIOUR Victor Roda-Casanova, David Hernandez, Joaquin L. Sancho-Bru and Maria D. Martinez-Rodrigo | 54 |



| | |
|--|----|
| GENERATIVE ADVERSARIAL NETWORKS FOR THE ESTIMATION OF 3D TURBULENT FIELDS WITH WALL-MEASUREMENTS Antonio Cuellar Martin, Alejandro Guemes, Andrea Ianiro, Oscar Flores, Ricardo Vinuesa, and Stefano Discetti | 55 |
| FEATURES OF BODY BALANCE ON HINGED AND MOVABLE SUPPORTS Marat Z. Dosaev, Vitaly A. Samsonov | 58 |
| ROTATION IN HORIZONTAL PLANE OF THE FRICTION-POWERED ROBOT WITH UNBALANCED ROTOR AND FLYWHEEL Marat Z. Dosaev, Vitaly A. Samsonov, Mikhail A. Garbuz..... | 59 |
| GALLOPING-BASED WIND POWER HARVESTER WITH SEVERAL MOVING MASSES Yury D. Selyutskiy, Andrei P. Holub, and Boris Ya. Lokshin | 60 |
| LIGHT-WEIGHT DESIGN OF AN OVERHEAD CRANE'S GIRDER WITH A NON- SYMMETRIC BOX CROSS-SECTION Goran V. Pavlović, Mile M. Savković, Radovan R. Bulatović, Nebojša B. Zdravković and Goran Đ. Marković | 61 |
| MATHEMATICAL MODELING OF THE CHAOTIC DYNAMICS OF POROUS NANOBEAMS INCLUDING GEOMETRIC NONLINEARITY AND ELASTIC-PLASTIC DEFORMATIONS Irina V. Papkova, Anton V. Krysko and Vadim A. Krysko | 62 |
| OPTIMIZATION OF ADHESIVE JOINTS BY TOPOLOGICAL OPTIMIZATION METHODS Pavel V. Dunchenkin, Anton V. Krysko, Maxim V. Zhigalov, Vadim A. Krysko | 63 |
| WRINKLING OF THIN ELASTIC FILMS ON COMPLIANT VISCOELASTIC SUBSTRATES UNDER COMPRESSIVE LOADS Jan Zavodnik and Miha Brojan..... | 64 |
| EQUILIBRIUM OPTIMIZER FOR OPTIMIZATION OF TRUSS STRUCTURE WITH DISCRETE DESIGN VARIABLES Hammoudi Abderazek and Ivana Atanasovska | 65 |
| OPTIMIZATION OF TURNING PROCESS PARAMETERS USING A HYBRIDE VOLUTIONARY ALGORITHM Hammoudi Abderazek, Aissa Laouissi, Mourad Nouioua, and Ivana Atanasovska | 66 |
| INVESTIGATION OF EEG SIGNALS OF PATIENTS WITH ALCOHOL DEPENDENCE BY METHODS OF NONLINEAR DYNAMICS Tatiana V. Yakovleva, Stanislav A. Galkin, Andrey Teryaev and Vadim A. Krysko | 67 |
| EFFECTS OF DYNAMIC ABSORPTION CAUSED TO CURVATURES IN GEOMETRY OF COUPLED NANO-STRUCTURES Marija Stamenković Atanasov, Ivan R. Pavlović | 68 |
| COMPLEMENTARY TOPOLOGICAL METHODS FOR THE ANALYSIS OF NONLINEAR TIME SERIES Miroslav Andjelkovic and Slobodan Maletic..... | 69 |
| WAVE PROPAGATION CHARECTERISTICS OF CURVED HEXAGONAL LATTICE S. Mukherjee, M. Cajić and S. Adhikari | 70 |



| | |
|--|----|
| DESIGN AND ANALYSIS OF BONE TISSUE SCAFFOLDS: A TWO-WAY FLUID STRUCTURE INTERACTION MODEL Rakesh Kumar, Harsha Pandey and Santosh Patil..... | 71 |
| ENSTROPHY IN TURBULENT SWIRLING FLOW IN PIPE Đorđe S. Čantrak, Novica Z. Janković and Dejan B. Ilić..... | 72 |
| ON SOME FEATURES OF THE LOSS OF STABILITY OF FLEXIBLE CYLINDRICAL NANOPANELS ON A RECTANGULAR PLAN Vadim A. Krysko-jr, Leonid A. Kalutsky, Svetlana A. Mitskievich and Tatiana V. Yakovleva..... | 73 |
| INFLUENCE OF STING PLUNGING OSCILLATIONS ON MEASUREMENT OF PITCH- DAMPING DERIVATIVES M. Samardžić..... | 74 |
| APPLICATION OF MARINE PREDATORS ALGORITHM IN DESIGN OF RAILWAY VEHICLES SUSPENSION MADE OF COIL SPRINGS Milan B. Bižić, Radovan R. Bulatović, Dragan Z. Petrović..... | 75 |
| ON EULERIAN-BASED APPROACH TO EVALUATE BLOOD MIXEDNESS IN THE PATIENT-SPECIFIC FONTAN CIRCULATION D. H. K. Gaillard, R. E. Bolt, F. M. Rijnberg, J. J. M. Westenberg, H. J. Lamb, M. G. Hazekamp, M. R. M. Jongbloed, A. A. W. Roest, J. J. Wentzel, and S. Kenjeres..... | 77 |
| ESTIMATION OF EXTREME LOADS ON A WIND TURBINE BLADE AT LARGE ANGLE-OF-ATTACK AND HIGH VELOCITY Dragoljub Tanović, Marija Baltić and Miloš Vorkapić..... | 79 |
| OPTIMIZATION OF SUPPLIER SELECTION USING ANALYTICAL HIERARCHY PROCESS IN FUZZY ENVIRONMENT Dr. Mohammad Rizwanullah, Dr. K.K. Kaanodiya..... | 80 |
| EFFECT OF MEASUREMENT NOISE ON MPC FOR DRAG REDUCTION L. Marra, A. Meilan-Vila, and S. Discetti..... | 82 |
| ON USING LMP LIMITERS IN SIMULATION OF GAS FLOW IN CONVERGING-DIVERGING NOZZLE BY RKDG METHOD Victoria N. Korchagova..... | 85 |
| CFD ANALYSIS OF PRESSURE DROP FROM THE AIR SIDE IN AUTOMOTIVE HEAT EXCHANGER USING POROUSMEDIA APPROACH Marija V. Milivojevic, Aleksandar S. Čočić, and Matej M. Tomic..... | 86 |
| CONCEPTUAL DESIGN OF SOLAR-POWERED HIGH-ALTITUDE LONG ENDURANCE AIRCRAFT Mohammad Sakib Hasan, Jelena Svorcan..... | 87 |
| PROSPECTS OF DRAFT GEAR MODELLING FOR TRAINS IN EUROPE Marija N. Vukšić Popović..... | 88 |
| LAYERED MODEL OF RED BLOOD CELL MEMBRANES AS VISCOELASTIC SHELLS Liliya Batyuk, Natalya Kizilova..... | 89 |
| EFFICIENT FLOW-FIELD DESIGN FOR PROTON EXCHANGE MEMBRANE FUEL CELLS | |



| | |
|---|-----|
| Abdelhakim Merdjani, Natalya Kizilova..... | 90 |
| OPTIMIZATION OF COMPACT FRACTAL-TYPE HEATERS/COOLERS FOR AEROSPACE ENGINEERING | |
| Saiyadhasan Naqvi, Natalya Kizilova..... | 91 |
| WATER-DRIVEN POLUTIONS TRANSFER AND ACCUMULATION AT THE FLUID- SOLID INTERFACES | |
| Natalya Ruchak, Natalya Kizilova..... | 92 |
| INVESTIGATION OF SHAPE MEMORY ALLOYS CONSTITUTIVE MODELING | |
| Vladimir Lj. Dunić..... | 93 |
| PHYSIOLOGICAL LOADING AND ITS EFFECT ON STREAMING POTENTIAL GENERATED BY INTERSTITIAL FLUID FLOW INDISORDERED BONE'S CANALICULI | |
| Nikhil V. Shrivasa, Abhishek K. Tiwari, Santosh Patil and Dharmendra Tripathi..... | 94 |
| NUMERICAL SIMULATION OF COLUMN BASE PLATE BEHAVIOR | |
| M.A Aichouche, A. Abidelah, Dj.D Kerdal and V. Dunić..... | 96 |
| NUMERICAL INVESTIGATION OF THE INFLUENCE OF GEOMETRY ON THE THERMAL PROPERTIES OF A HEAT PIPE | |
| Milica M. Ivanović, Toni D. Ivanov and Aleksandar M. Kovačević..... | 97 |
| AN OVERVIEW OF FORWARD DYNAMICS ALGORITHMS AND THEIR USE IN OPEN-SOURCE DYNAMICS ENGINES | |
| Nikola LJ. Zivkovic, Jelena Z. Vidakovic and Mihailo P. Lazarevic..... | 98 |
| STATICS OF THE FLEXIBLE MESHED CYLINDRICAL NANOSHHELL IN THE TEMPERATURE FIELD | |
| E. Krylova..... | 100 |
| ANALYTICAL MODELING OF HARDNESS IN THE HEAT AFFECTED ZONE DURING WELDING A PLATES MADE OF STEEL P355GH BY GMAW PROCESS | |
| M. Rasinac, M. Bjelić, M. Miodragović, J. Perić..... | 101 |
| A REVIEW ON GROUND SOURCE HEAT PUMP | |
| Harsh Surana, Gourav Moonka, S P Akash, Dhananjay Singh Parmar and Dr. Hemant Raj Singh..... | 102 |
| ROUV HEADING BY A FRACTIONAL-ORDER PI CONTROLLER | |
| N. Svishchev, P. Lino, G. Maione, A. Rybakov, M.P. Lazarević..... | 103 |
| APPLICATION OF BIOLOGICAIHY INSPIRED ALGORITHMS FOR OPTIMIZATION IN MACHINING PROCESS | |
| Aleksandra V. Petrović, Stefan M. Pajović, Mladen S. Rasinac, Vladan R. Grković..... | 104 |
| NUMERICAL AND ANALYTICAL STUDY OF A BAR DAMPER DEVICE | |
| Andrija Zorić, Marina Trajković-Milenković..... | 105 |
| STABILITY OF PRESTRETCHED CIRCULAR COMPOSITE PLATES | |
| Miha Brojan, Jan Zavodnik..... | 106 |
| CAM PROFILE OPTIMIZATION FOR MINIMAL JERK | |
| Marko Todorović, Radovan Bulatović, Goran Marković, Marina Bošković, and Mile Savković..... | 107 |
| COMPUTED TORQUE CONTROL SIMULATION FOR 6DOF | |



INDUSTRIAL ROBOT

Jelena Z. Vidakovic, Mihailo P. Lazarevic, Nikola Lj. Zivkovic, Pavle Lj. Stepanic, and Stefan M. Mitrovic 109

**MODELING, SIMULATION AND CONTROL OF PROPELLER
DRIVEN SEESAW SYSTEM WITH ASYMMETRIC GEOMETRY
USING PID CONTROLLER**

Aleksandar M. Kovačević, Jelena M. Svorcan and Toni D. Ivanov 111

**UNMANNED AERIAL VEHICLE TRAJECTORY VISUALIZATION AND
RECONSTRUCTION USING THE CHANGES IN SIGNIFICANT
VARIABLES OVER TIME**

Milica P. Milic, Jelena Svorcan 112

WAVE ATTRACTORS IN LARGE ASPECT RATIO DOMAINS

Stepan Elistratov, Ilias Sibgatullin, and Xu Xiulin 113

FEM ANALYSIS OF CONTINUOUS TRACKS

Snežana D. Vulović, Miroslav M. Živković, Marko D. Topalović, Rodoljub S. Vujanac and Ana Pavlović 114

**DEVELOPMENT OF INTERFACE FOR IMPLEMENTATION AND APPLICATION OF
USER CONSTITUTIVE MODELS IN FEM SOFTWARE PAK**

Ljubica M. Milanović, Vladimir Lj. Dunić 115

**APPLICATION OF ITERATIVE LEARNING CONTROL FOR PATH FOLLOWING OF
3DOFS ROBOT ARM**

Petar D. Mandić, Mihailo P. Lazarević, Tomislav B. Šekara, Guido Maione and Paolo Lino 116

**CAN FULLY CERAMIC GEARS PROVIDE A FEASIBLE ALTERNATIVE TO THEIR
STEEL COUNTERPARTS IN INDUSTRIAL APPLICATIONS**

G. Vasileiou, N. Rogkas, A. Markopoulos and V. Spitas 118

**NUMERICAL COMPUTATIONS OF ELASTIC TORSION USING
THE FINITE-VOLUME METHOD**

Aleksandar S. Čoćić 120

**ANALYSIS OF CONTACT STIFFNESS IN ROLLING BALL BEARINGS WITH OUTER
RING DAMAGE**

Nataša D. Soldat, Ivana D. Atanasovska 121

**ANALYSIS AND OPTIMIZATION OF REGULAR T-SHAPED
FRACTAL SYSTEM**

Abdulmuttalib A. MUHSEN 122

**RAPID AND ACCURATE OPTIMISATION OF THE PARTICLE-IN-CELL MODELLING
OF GRIDDED ION ENGINES**

Joseff I. Parke Sturrock, Zoran D. Jelic and Ben. J. Evans 123

**ANALYSIS OF CROSSING AND VEERING PHENOMENA IN PLANAR FRAME
STRUCTURES**

Marko A. Veg, Aleksandar M. Tomović and Aleksandar M. Obradović 124

**NON-RECIPROCAL WAVE PROPAGATION IN PERIODICALLY
STRUCTURED TIMOSHENKO BEAMS**

Nevena Rosić, Danilo Karličić, Milan Cajić and Mihailo Lazarević 125



| | |
|---|-----|
| NONLINEAR PERIODIC CHAINS WITH FRACTIONAL DAMPING Milan Čajić, Danilo Karličić, Stepa Paunović and Sondipon Adhikari..... | 126 |
| IMPROVING THE PERFORMANCE OF PIEZOELECTRIC FRACTIONALLY DAMPED DYNAMIC ABSORBERS FOR BRIDGES S. Paunović, M. Čajić and D. Karličić | 127 |
| COMPARATIVE STUDY OF FLUID TRANSPORTATION PROPERTIES OF REGULAR AND IRREGULAR FRACTAL-TYPE PIPELINES-A REVIEW Abdulmuttalib A. MUHSEN | 128 |
| EFFECT OF CENTRAL POINT ON THE ACCURACY OF A FRACTIONAL-ORDER MODEL IDENTIFICATION METHOD BASED ON THE PROCESS REACTION CURVE Juan J. Gude and Pablo García Bringas | 129 |
| NONLINEAR VIBRATIONS OF A CYLINDRICAL PIPE EMBEDDED IN A FRACTIONAL DERIVATIVE MEDIUM Marina V. Shitikova, Vladimir V. Kandu..... | 131 |
| NUMERICAL SIMULATION OF THE FRAME STRUCTURE DYNAMIC BEHAVIOR BY THE APPLICATION OF THE NONLOCAL IN TIME DAMPING MODEL Vladimir N. Sidorov, Elena S. Badina, Elena P. Detina, Marina V. Shitikova | 132 |
| SPECIAL SESSION 1 | |
| FRACTIONAL ORDER PID CONTROL ON STRUCTURAL RELIABILITY OF STOCHASTIC DYNAMICAL SYSTEMS Wei Li, Lincong Chen, Junfeng Zhao and Natasa Trisovic..... | 137 |
| FLIGHT DYNAMICS MODELLING AND FLIGHT SIMULATION Petar Dimitrov..... | 138 |
| NON-LINEAR DYNAMICS OF A DAMAGED STIFFENED COMPOSITE LAMINATED PANEL Beatriz Henriques, Pedro Ribeiro and Marcelo F.S.F. de Moura | 139 |
| BIO-INSPIRED SHAPE OPTIMIZATION FOR STRUCTURAL RESISTANCE Renata Troian and Chunmei Liu..... | 140 |
| STOCHASTIC DYNAMICS OF A SNAP-THROUGH TRUSS OSCILLATOR Aasifa Rounak, Rohit Chawla and Vikram Pakrashi..... | 142 |
| THEORETICAL SOLUTIONS OF THE MULTI-STABLE ENERGY HARVESTERS Dongmei Huang, Shengxi Zhou | 143 |
| DYNAMIC ANALYSIS OF A THREE-DEGREE-OF-FREEDOM VIBRATION-IMPACT SYSTEM WITH RANDOM PARAMETERS Guidong Yang, Zicheng Lin, Xiaocheng Liu | 144 |
| DESIGN FOR INSPECTION AND SAFETY – NOVEL CONCEPT OF CABLING MACHINE Maja Čavić, Milan Kostić, Miodrag Zlokolica | 145 |



MODELLING OPTIMIZATION FOR A COMPOSITE WING COMPONENT

Ivana D. Atanasovska, Milica P. Milic and Nataša Trišović 147

SPECIAL SESSION 2

EXAMINATION OF THE PHYSICAL-CHEMICAL AND MECHANICAL PROPERTIES
OF HELICAL CYLINDRICAL COMPRESSION SPRINGS PRESERVED IN THE
LEGACY IN THE NIKOLA TESLA MUSEUM

Bratislav N. Stojiljković, Dejan B. Momčilović 153

NEURAL NETWORK MODEL FOR THE CONDITION ASSESSMENT OF HYDRO
TURBINES

Dragoljub Ilić, Dragan Milošević and Dejan B. Momčilović 154

OPTIMIZATION OF ALUMINOTHERMIC RAIL WELDING BY
MODELING AND SIMULATION OF BASIC PARAMETERS OF
THERMITE STEEL CASTING

Milorad Gavrilovski, Alen Delić and Vaso Manojlović 155

FAILURE ANALYSIS OF BEAM OF UNMANNED AERIAL VEHICLE

Milica Milić, Ivana Atanasovska, Ognjen Ristić and Dejan B. Momčilović 156

EXPERIMENTAL MECHANICS – VISION OF EXCELLENCE IN SCIENCE BY
SHIMADZU

Aleksandar Žurkić 157

SPONSORS 158

SIMULATING FLOW IN SILICON Y-BIFURCATED MICROCHANNELS

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ABSTRACT

Microfluidic devices are excessively used for various biomedical, chemical, and engineering applications. The most common microfluidic platforms are obtained from polydimethylsiloxane (PDMS). Platforms based on etched silicon wafers anodically bonded to Pyrex glass are more mechanically rigid, have better sealing and there is no gas permeability compared to those obtained from PDMS [1,2]. The aim of our work is to numerically analyze fluid flow in anisotropically etched silicon microchannels sealed with Pyrex glass. We present simulations of fluid flow in Y-bifurcated microchannels fabricated from the etched {100} silicon in 25 wt% tetramethylammonium hydroxide (TMAH) water solution at the temperature of 80°C [3]. We have explored two symmetrical Y-bifurcations that are defined with acute angles of 36.8° and 19° with the sides that are along the <310> and <610> crystallographic directions in the masking layer [3], respectively. The angles between obtained sidewalls and {100} silicon of two ingoing microchannels for the first and second Y-bifurcation are 72.5° and 80.7°, respectively. The sidewalls of outgoing microchannel in both cases are defined with <100> crystallographic directions and they are orthogonal to the surface of {100} silicon wafer. The appropriate widths of ingoing and outgoing microchannels are 300 and 400 μm, respectively. The depth of microchannels is 55 μm. All simulated flows are three-dimensional (3D), steady and laminar [4], while the investigated fluid is water. Velocities and pressure values are defined at the inlet and outlet boundaries, respectively. The resulting flows are illustrated by velocity contours. The obtained conclusions from fluid flow simulations of presented simple Y-bifurcations provide guidance for future fabrication of complex microfluidic platforms by a cost-effective process with good control over microchannel dimensions.

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