XLIX International Summer School – Conference Advanced Problems in Mechanics

June 21–25, 2021

APM 2021 PROGRAMME

http://apm-conf.spb.ru

IPME RAS

POLYTECH
Peter the Great
St.Petersburg Polytechnic
University

ГАЗПРОМ НЕФТЬ

Russian Academy of Sciences

Санкт-Петербургский
научный центр РАН

The International Summer School-Conference “Advanced Problems in Mechanics - 2021” is the forty nine in a series of annual summer schools held by Russian Academy of Sciences. The Conference is organized by Peter the Great St.Petersburg Polytechnic University (SPbPU), Russian National Committee on Theoretical and Applied Mechanics (RNCTAM) and Institute for Problems in Mechanical Engineering of Russian Academy of Sciences (IPME RAS) under the patronage of Russian Academy of Sciences (RAS). General sponsor of the conference “Advanced Problems in Mechanics - 2021” - company Gazpromneft Science & Technology Centre.

General Information

The International Conference **"Advanced Problems in Mechanics 2021"** is the forty ninth in a series of annual summer schools held by Russian Academy of Sciences. The Conference is organized in commemoration of its founder, Ya.G. Panovko by the Institute for Problems in Mechanical Engineering of the Russian Academy of Sciences (IPME RAS), Peter the Great St. Petersburg Polytechnic University (Institute of Applied Mathematics and Mechanics), Scientific Council on Solid Mechanics (RAS) (chairman N.F. Morozov), Russian National Committee on Theoretical and Applied Mechanics (chairman I.G. Goryacheva) under the patronage of the Russian Academy of Sciences (RAS).

In connection with the COVID-19 pandemic, the annual international conference "Advanced Problems in Mechanics" was held in an unusual online format last summer and in a mixed format last fall. It was an unforgettable experience that demonstrated that the conference can be successful even under quarantine conditions.

The list of problems under investigation is not limited to questions of mechanical engineering, but includes practically all advanced problems in mechanics, which is reflected in the name of the conference. The main attention is given to problems on the boundary between mechanics and other research areas, which stimulates the investigation in such domains as micro- and nanomechanics, material science, physics of solid states, molecular physics, astrophysics and many others. The conference "Advanced Problems in Mechanics" helps us to maintain the existing contacts and to establish new ones between foreign and Russian scientists.

One of the major purposes of conference is transfer of scientific experience from well-known scientists to their young colleagues.

The special scientific session ≪Vibration in Science and Technology≫ dedicated to the memory of outstanding Russian researcher in the area of mechanics, applied mathematics and engineering, Professor Iliya Izrailevich Blekhman (29.11.1928 - 3.02.2021) will be held within the framework of the conference.

Session Organizers: Scientific adviser of IPME RAS, Corresponding member of RAS Professor Dmitry Indeitsev Professor of Structural Dynamics at the Karlsruhe Institute of Technology, Alexander Fidlin IPME RAS Head of Lab., IEEE Life Fellow, Professor Alexander Fradkov.

History of the School

The first Summer School was organized by Ya.G. Panovko and his colleagues in 1971. In the early years the main focus of the School was on nonlinear oscillations of mechanical systems with a finite number of degrees of freedom. The School specialized in this way because at that time in Russia (USSR) there were held regular National Meetings on Theoretical and Applied Mechanics, and there existed many conferences on mechanics with a more particular specialization. After 1985 many conferences and schools on mechanics in Russia were terminated due to financial problems. In 1994 the Institute for Problems in Mechanical Engineering of the Russian Academy of Sciences restarted the Summer School. The traditional name of "Summer School" has been kept, but the topics covered by the School have been much widened. The School

has been transformed into an international conference. The topics of the conference cover now all fields of mechanics and associated into interdisciplinary problems.

Scientific Committee

- D.A. Indeitsev (IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia) — Co-Chairman
- A.M. Krivtsov (Peter the Great St. Petersburg Polytechnic University, IPME RAS, Russia) — Co-Chairman
- P.A. Dyatlova (Peter the Great St. Petersburg Polytechnic University, IPME RAS, Russia) — Scientific secretary
- H. Altenbach, Otto-von-Guericke University Magdeburg, Germany
- M.B. Babenkov, IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia
- V.A. Babeshko, Southern Scientific Center RAS, Rostov-on-Don, Russia
- A.K. Belyaev, IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia
- I.E. Berinskii, Tel Aviv University, Israel
- I.I. Blekhman, IPME RAS, Mekhanobr-Tekhnika, St. Petersburg, Russia
- V.A. Bratov, IPME RAS, St. Petersburg, Russia
- A.A. Burenin, Institute of Metallurgy and Mechanical Engineering Far-Eastern Branch of RAS, Komsomolsk-na-Amure, Russia
- A.V. Cherkaev, University of Utah, Salt Lake City, USA
- F. Dell'Isola, Università di Roma La Sapienza and MEMOCS centre, Italy
- V.A. Eremeyev, Gdansk University of Technology, Poland
- V.I. Erofeev, Mechanical Engineering Research Institute of RAS or MERI RAS, Russia
- A.B. Freidin, IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia
- M.E. Frolov, Peter the Great St. Petersburg Polytechnic University, Russia
- S.N. Gavrilov, IPME RAS, St. Petersburg, Russia
- I.G. Goryacheva, Institute for Problems in Mechanics RAS, Moscow, Russia
- E.F. Grekova, IPME RAS, St. Petersburg, Russia; University of Seville, Spain
- N. Gupta, Indian Institute of Technology Delhi, India
- M.A. Guzev, Institute of Applied Mathematics of Far-Eastern Branch of RAS, Russia
- H.E. Huppert, University of Cambridge, United Kingdom
- H. Irschik, Johannes Kepler University of Linz, Austria
- M.L. Kachanov, Tufts University, Medford, USA
- B.L. Karihaloo, Cardiff University, UK
- D. Koroteev, Center for Hydrocarbon Recovery, Scoltech (Digital Petroleum), Russia
- S.V. Kuznetsov, IPMech RAS, Russia
- V.A. Kuzkin, Peter the Great St. Petersburg Polytechnic University, IPME RAS, Russia

- V.A. Levin, Lomonosov Moscow State University, Russia
- A.M. Linkov, IPME RAS, Russia; Rzeszow University of Technology, Poland
- I.I. Lipatov, Moscow Institute of Physics and Technology, Russia
- O.S. Loboda, Peter the Great St. Petersburg Polytechnic University, IPME RAS, Russia
- E.V. Lomakin, Lomonosov Moscow State University, Russia
- G. Mishuris, Aberystwyth University, UK
- N.F. Morozov, St. Petersburg State University, IPME RAS, Russia
- W.H. Müller, Technical University of Berlin, Germany
- U. Nackenhorst, Leibniz University of Hannover, Germany
- E. Pavlovskaia, University of Aberdeen, UK
- S.V. Petinov, IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia
- Y.V. Petrov, St. Petersburg State University, IPME RAS, Russia
- A.V. Porubov, IPME RAS, Saint Petersburg, Russia
- D. Prikazchikov, Keele University, UK
- J.-N. Roux, Université Paris-Est, Laboratoire Navier, France
- M.B. Rubin, Israel Institute of Technology, Haifa, Israel
- A.I. Rudskoi, Peter the Great St. Petersburg Polytechnic University, Russia
- S. Rudykh,University of Wisconsin-Madison, USA
- S.H. Sargsyan, Gyumri State Pedagogical Institute, Armenia
- V.V. Sergeev, Peter the Great St. Petersburg Polytechnic University, Russia
- I. Sevostianov, New Mexico State University, USA
- M. Simonov, Gazpromneft Science & Technology Center, Russia
- A. Sokolov, TU Berlin, Germany
- M. Wiercigroch, Aberdeen University, Scotland
- H.A. Wu, University of Science and Technology of China, Chinese Academy of Sciences
- P. Venkitanarayanan, Indian Institute of Technology, India
- E.N. Vilchevskaya, IPME RAS, Peter the Great St. Petersburg Polytechnic University, Russia

Local Organizing Committee

- Polina Dyatlova (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Mikhail Speranskii (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Varya Shubina (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Maria Loboda (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Ekaterina Saprykin (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Anastasia Vilchevskaya (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Yekaterina Moisseyeva (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)
- Kristina Plokhova (Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia)

The conference is organized with help of our **service agency "Monomax PCO"**: `www.monomax.ru`

Scientific Programme

Presentations devoted to fundamental aspects, or widening the field of applications of mechanics, are invited. We are particularly keen to receive contributions that show new effects and phenomena or develop new mathematical models. The topics of the conference cover all fields of mechanics, including, but not restricted, to

- complex media: micropolar theory, chemomechanics, biomechanics, acoustic metamaterials etc.
- fluid mechanics
- nano-, micro- and mesomechanics
- solids and structures
- nonlinear and multibody dynamics, chaos and vibration
- mechanical and civil engineering applications
- heat transfer
- vibration in science and technology

The Summer School — Conference has two main purposes: to gather specialists from different branches of mechanics to provide a platform for cross-fertilization of ideas, and to give the young scientists a possibility to learn from their colleagues and to present their work. Thus the Scientific Committee encouraged the participation of young researchers, and did its best to gather at the conference leading scientists belonging to various scientific schools of the world.
We believe that the significance of Mechanics as of fundamental and applied science should much increase in the eyes of the world scientific community, and we hope that APM conference makes its contribution into this process.

We are happy to express our sincere gratitude for the help in organization to the Russian Foundation for Basic Research, the Russian Academy of Sciences (RAS), the Ministry of education and science of the Russian Federation. This support has helped substantially to organize the conference and to increase the participation of young researchers.

Minisymposia

MS1 "Minisymposium on biomechanics"

Organizer: **Olga S. Loboda** (Peter the Great St. Petersburg Polytechnic University, Russia) **Svetlana M. Bauer** (St. Petersburg State University, Peter the Great St. Petersburg Polytechnic University, Russia)

MS2 "Extreme loading on structures"

Organizers: **Danila Prikazchikov** (Keele University, UK), **Nikita F. Morozov** (St. Petersburg State University, IPME RAS, Russia), **Vladimir A. Bratov** (IPME RAS, Russia)

MS3 "Nonlinear waves in continuous media"

Organizer: **Vladimir I. Erofeev** (Mechanical Engineering Research Institute of the Russian Academy of Sciences or MERI RAS, Nizhniy Novgorod, Russia), **Alexey V. Porubov** (IPME RAS, St. Petersburg, Russia)

MS4 "Earthquakes and Seismic Protection"

Organizers: **Tzu-Kang Lin** (National Taiwan University, Taiwan), **Sergey V. Kuznetsov** (IPMech RAS, Russia), **Vladimir Bratov** (IPME RAS, Russia)

MS5 "New approaches for multiphase gas condensate flow simulation"

Organizers: **Yekaterina Moisseyeva** (Peter the Great St. Petersburg Polytechnic University, Russia), **Falk Ahnert** (Wintershall Holding GmbH, Germany),

MS6 "Mathematical modeling in petroleum engineering"

Organizer: **Liliana Rybarska-Rusinek** (Rzeszow University of Technology, Poland) **Alexander M. Linkov** (IPME RAS, Russia; Rzeszow University of Technology, Poland) **Vitaly A. Kuzkin** (Peter the Great St. Petersburg Polytechnic University; IPME RAS, Russia)

MS7 "Anomalous energy transfer on a nano-scale"

Organizer: **Wolfgang H. Müller** (Technical University of Berlin, Germany) **Alexey V. Porubov** (IPME RAS, Russia) **A. Sokolov** (TU Berlin, Germany)

June 21, Monday

Room A

June 21

Plenary lectures

Chairperson Anton M. Krivtsov

ZOOM ID 81250245340

Password: 323769

9:00 – 9:30	**Registration, Hall**
9:30 – 10:00	**Welcome Coffee-break and Photo exhibition opening "Flights over St. Petersburg" by Julia Asaturova and Alina Krivtsova**
10:00 – 10:10	**Welcoming address by Andrei I. Rudskoi, rector of Peter the Great St.Petersburg Polytechnic University**
10:10 – 10:35	**Opening ceremony**
10:35 – 11:10	**Lomakin E.V., Fedulov B.N., Fedorenko A.N.** Models characterizing nonlinear deformation and failure of composite materials
11:10 – 11:45	**Sevostianov I.** Challenges and opportunities of additive manufacturing: micromechanical analysis
11:45 – 12:20	**Huppert H.E., Moffat H.K., Guest H.** Spreading or contraction of viscous drops between plates: single, multiple or annular drops; with a hint of rotation, with co-authors H. K. Moffat and H. Guest
12:20 – 12:55	**Goryacheva I.** Discrete Contact Problems for Deformable Bodies

---

13:00 - 14:00 Lunch

Room B

June 21

Minisymposium "Nonlinear waves in continuous media"

Organizers: Vladimir I. Erofeev and Alexey V. Porubov

Chairperson Alexey Porubov

ZOOM ID 81250245340

Password: 323769

14:00 – 14:30 **Erofeev V.I., Korsakov M.I., Leonteva A.V.** Slepyan-Palmov model for describing dispersion, dissipative and nonlinear effects for the propagation of a plane longitudinal wave

14:30 – 14:50 **Khusnutdinova K., Hooper C., Ruiz P., Huntley J.** Generation of longitudinal undular bores in PMMA bars following tensile fracture

14:50 – 15:10 **Malkhanov A.O., Leonteva A.V., Erofeev V.I.** Magnetoelastic wave in damaged material

15:10 – 15:30 **Bulygin A.N., Pavlov Yu.V.** Solution of problems on die movement on semi-space surface on the basis of nonlinear model of crystal medium deformation

15:30 – 15:50 **Bochkarev A.** Multisoliton complexes in chains of active Morse - Van der Pol particles

15:50 – 16:10 **Porubov A.V.** Nonlinear waves in metamaterials

16:10 – 16:30 **Kunitskikh A.A., Guzev M.A., Turbakov M.S., Kozhevnikov E.V., Kobiakov D.V., Qi C.** Reservoir rock treatment by mechanical waves

Coffee break

Plenary lectures

Chairperson to be confirmed

17:15 – 17:50 **Golden K.M.** On thinning ice: modeling sea ice in a warming climate

17:50 – 18:25 **Kachanov M., Pronina Y., Mishakin V.** Fatigue of Austenitic Steel: Micromechanics aspects

18:25 – 19:00 **Cherkaev A.** Compatibility Condition and Damage Spread in Dense Lattices

---

19:00 - 20:00 Welcome party

Room C

June 21

Fluid mechanics

Chairperson Yekaterina Moisseyeva

ZOOM ID 81553193834

Password: 978030

14:00 – 14:20 **Khishchenko K.V.** Stability of shock waves in a two-phase vapor-liquid mixture of a metal

14:20 – 14:40 **Karabanova V.D., Puzikova V.V.** On the LS-STAG immersed boundary cut-cell method usage for numerical incompressible flow simulation around airfoils system

14:40 – 15:00 **Izmailova Y.** The T-schemes for the boundary integral equation solving in vortex methods of two-dimensional flow simulation around airfoils

15:00 – 15:20 **Marchevsky I., Shcheglov G., Dergachev S.** 3D meshless vortex loops method with improved approach to the boundary integral equation solution

15:20 – 15:40 **Ryltseva K., Shrager G.** Effect of thermal wall boundary conditions on a viscous fluid flow through an abrupt contraction

15:40 – 16:00 **Chernyh J.** Hybrid Barnes-Hut/multipole fast algorithm in vortex methods for 2D flow simulation around airfoils

16:00 – 16:20 **Fatkullina N.** Numerical investigation of the droplets dynamics in microchannel with hydrodynamic traps

16:20 – 16:40 **Hegaj E.I., Garbuzov D.N.** Numerical simulation of the tank filling with a viscous fluid under pressure by the VOF method

16:40 – 17:00 **Abdukhakimov Farrukh, Vedeneev V.V.** Investigation of flutter of rectangular plate at non-zero flow yaw angle

Coffee break

19:00 - 20:00 Welcome party

Room D

June 21

Complex media: micropolar theory, chemomechanics, acoustic metamaterials etc.

Chairperson Ksenia Frolova

ZOOM ID 87966764413

Password: 970372

14:00 – 14:20 **Frolova K., Vilchevskaya E.N.** Boundary layer formation due to the stress-induced diffusion in micropolar media

14:20 – 14:40 **Morozov A.V., Freidin A.B., Müller, W.H.** On stability of propagating chemical reaction fronts in elastic solids

14:40 – 15:00 **Grigoreva P.M., Polyanski V.A.** Modelling the skin effect in metals appearing due to hydrogen absorption using various diffusion models

15:00 – 15:20 **Sargsyan S.** Moment-Membrane Dynamic Theory of Elastic Thin Shells and Variation Principles

15:20 – 15:40 **Fomicheva M., Bessonov N., Vilchevskaya E.N., Müller W.H.** Modeling of granular media grinding process with a variable viscosity coefficient

15:40 – 16:00 **Dudin D.S., Keller I.E.** Interdiffusion Description at Elastic Body with Microstructure Changing by Marker Approach

16:00 – 16:20 **Urazlin V., Podolskaya E.A** Description of the mechanical properties of graphyne based on paired interaction potentials

16:20 – 16:40 **Shorkin V.S., Vilchevskaya E.N.** Micropolar theory with non-local potential interactions

16:40 – 17:00 **Drepin M., Grekova E.F.** Dynamics of the simplest Kelvin's medium in the vicinity of a nonlinear equilibrium

Coffee break

19:00 - 20:00 Welcome party

June 22, Tuesday

Room A

June 22

Plenary lectures

Chairperson Kuzkin Vitaly

ZOOM ID 81250245340

Password: 323769

10:00 – 10:35 **Smirnov N.** Digital modeling of multiscale combustion processes: problems and solutions

10:35 – 11:10 **Indeitsev D.** On dynamicity of linear thermal expansion coefficient

11:10 – 11:45 **Efendiev Ya.** Multiscale modeling: Modeling subgrid effects and temporal splitting

11:45 – 12:20 **Polyanskiy V., Tretyakov D.A., Frolova K.P., Yakovlev Yu.A.** Skin effects and boundary layer in solid

12:20 – 12:55 **Lurie S., Belov P.** Extended system of semi-equivalent formulations of boundary value problems of gradient elasticity, choosing problem of realized boundary conditions

---

13:00 - 14:00 Lunch

Room B

June 22

New approaches for multiphase gas condensate flow simulation

Chairperson Moisseyeva Yekaterina

ZOOM ID 81250245340

Password: 323769

14:00 – 14:30 **Ahnert F.** From simulation to digitalization, new solutions for condensate field development

14:30 – 14:50 **Schießl R., Drost S., Maas U.** Rapid Compression Machine studies on the synthesis of unsaturated hydrocarbons and hydrogen from natural gas

14:50 – 15:10 **Drozdov A., Galerkin Y.** Theory and practice of gas-dynamic design of centrifugal compressors. Role of CFD-calculations and mathematical modeling

15:10 – 15:30 **Vassilenko I.** Multiphase simulation in pipeline design

15:30 – 15:50 **Aiupova G., Saitova A.** Evaluation of changes in the composition of a gas with a high content of hydrocarbon components C2+ based on phase equilibrium at high pressures

15:50 – 16:10 **Kukharski F., Moisseyeva Ye.** Flow pattern modeling for gas-condensate flow in pipeline

Coffee break

Nonlinear and multibody dynamics, chaos and vibration

Chairperson Fomicheva Maria

17:20 – 17:40 **Sidorenko V., Neishtadt A,, Sheng K.** Stability analysis of apsidal alignment in double averaged restricted elliptic three body problem

17:40 – 18:00 **Riabokon E.P., Guzev M.A., Turbakov M.S., Kobiakov D.V., Kozhevnikov E.V., Poplygin V.V., Wiercigroch M.** Experimental studies of the mechanical characteristics of rocks under dynamic loading

18:00 – 18:20 **Rybalova E., Strelkova G.** Dynamics of autowaves under the influence of noise in a system of coupled map-based neuron models

18:20 – 18:40 **Gorbikov S. P.** Topological Equivalence of Local Qualitative Singularities of Dynamical Systems with Impact Interactions

18:40 – 19:00 **Ismailov Sh.M., Arapov Yu.D., Kamenev V.G.** Holographic and interference methods for registering the surface shape in gas-dynamic experiments

19:00 – 19:20 **Tovstik T.P., Kulizhnikov D.B., Belyaev A.K., Morozov N.F., Tovstik P.E., Tovstik T.M.** Attraction basin for the generalized Kapitsa's problem of stability of inverted pendulum

Room C

June 22

Vibration in Science and Technology

Chairperson Fidlin Alexander

ZOOM ID 81553193834

Password: 978030

14:00 – 14:10 **Indeitsev D.** Opening speech

14:10 – 14:30 **Fradkov A.** Vibration and control: inspired by Iliya Izrailevich Blekhman

14:30 – 14:50 **Sorokin V., Demidov I.V.** On representing stochastic excitations by deterministic ones for interpreting the stochastic resonance phenomenon

14:50 – 15:10 **Cartmell M., Gordon I., Johnston D., Liang Sh., McIntosh L., Wynne B.** Modelling the dynamics of a large-scale industrial manipulator for precision control

15:10 – 15:30 **Vedeneev V.** New mechanism of the onset of aeroelastic divergence

15:30 – 15:50 **Pogromsky A., Kawan C., Matveev A.** Unidirectional synchronization under communication constraints

15:50 – 16:10 **Panovko G.Y., Shokhin A.E.** Self-synchronization of inertial vibration exciters in a system with an elastic limiter

16:10 – 16:30 **Andrievsky B.** Mechatronic vibration setup: experiments on synchronization and control

16:30 – 16:50 **Kostin G.V., Gavrikov A.A.** Energy-Optimal Control by Boundary Forces for Longitudinal Vibrations of an Elastic Rod

16:50 – 17:10 **Fidlin A., Drozdetskaya O., Genda A., Schröders S., Yüzbasioglu T.** Systems with partially strongly damped variables in engineering: from Sommerfeld effect to escape dynamics

Coffee break

Vibration in Science and Technology

Chairperson Fradkov Alexander

17:20 – 17:40 **Filippenko G., Zinovieva T.V.** Effect of hydrogen embrittlement on the torsional vibrations of a thin-walled tube

17:40 – 18:00 **Yaroshevich N.** Slow oscillations in vibration machines with inertial vibration exciters (in Russian)

18:00 – 19:00 Discussion in commemoration of Iliya Izrailevich Blekhman (in Russian)

Room D

June 22

Nano-, micro- and mesomechanics

Chairperson Sokolov Alexey

ZOOM ID 87966764413

Password: 970372

14:00 – 14:20 **Gutkin M.Yu., Smirnov A.M., Krasnitckii S.A.** Micromechanics of misfit stress relaxation in core-shell nanowires with long prismatic cores of square cross section

14:20 – 14:40 **Nasedkin A.V., Iovane G., Nasedkina A.A.** Numerical homogenization of porous nonuniformly polarized piezocomposites by using 3-0 algorithm of ACELAN-COMPOS package and effective moduli method with various types of boundary conditions

14:40 – 15:00 **Nikonov A.Y., Bibko A.A., Lychagin D.V.** Calculation of the stress level at the simulation of the interaction of dislocation in aluminum bronze

15:00 – 15:20 **Krasnitckii S.A., Kolesnikova A.L., Gutkin M.Yu., Romanov A.E.** The phenomenon of residual stress relaxation in decahedral particles via void formation

15:20 – 15:40 **Gudkina Z., Krasnitckii S.A., Gutkin M.Yu.** The dilatation line in a wedge-shaped elastic body with free surfaces

15:40 – 16:00 **Zamula Yu.S., Musin A.A., Mavletov M.V., Kovaleva L.A.** Determination of the effective surface tension at the interface in water-in-oil emulsion using AFM

16:00 – 16:20 **Shuvalov G., Kostyrko S.A.** Stability analysis of nanoscale surface patterns in ultrathin film coating

16:20 – 16:40 **Zavorotneva E.V., Lukin A.V., Popov I.V.** Nonlinear dynamics of Disk-based MEMS Coriolis Vibrating Gyroscope under parametric excitation of vibrations

16:40 – 17:00 **Mozhgova N.V., Lukin A.V., Popov I.A.** Nonlinear dynamics of electrostatic comb-drive with variable gap

Coffee break

Nano-, micro- and mesomechanics

Chairperson Sokolov Alexey

17:20 – 17:40 **Lobanov S.M., Mamchic A., Semenov A.S.** Modeling of domain structure evolution in ferroelectroelastic materials under monotonic and cyclic loading

17:40 – 18:00 **Gazaryan A.V., Chirkov V.A.** Numerical and experimental investigation of electrohydrodynamic flow current characteristics for different electrode configurations

June 23, Wednesday

Room A

June 23

Plenary lectures

Chairperson Sokolov Alexey

ZOOM ID 81250245340

Password: 323769

10:00 – 10:45 **Krivtsov A.** Nonsteady heat transfer: ballistic to diffusive

10:45 – 11:30 **Politi A.** Energy-diffusion suppression in oscillator chains

11:30 – 12:15 **Dhar A.** Blast in the one-dimensional cold gas: from Newton to Euler and Navier-Stokes-Fourier

12:15 – 13:00 **Kuzkin V.** Ballistic heat transport and thermoelasticity

---

13:00 - 14:00 Lunch

Room B

June 23

Minisymposium on biomechanics

Chairperson Bauer Svetlana

ZOOM ID 81250245340

Password: 323769

14:00 – 14:40 **Giorgio I., dell'Isola F., Lekszycki T.** A model to describe the biological stimulus for bone remodeling with a diffusive behavior

14:40 – 15:20 **Aizikovich S.M., Vasiliev A.S.** Analytical model for analysis of nanoindentation of thin coatings

15:20 – 15:40 **Venatovskaya L., Bauer S.M., Avershina L.A., Pikusova S.M.** Evaluation of biomechanical characteristics of the eye after surgical hyperopia correction

15:40 – 15:55 **Malysheva V., Cherepennikov G.A., Stosh A.O., Zaynullina D.M.** Wireless ECG monitoring device with the ability to collect and analyze the received data

15:55 – 16:10 **Khafizova A.F., Sherstneva M.A., Artamonov N.A., Potekhin V.S.** Balloon dilation angioplasty of aortic coarctations in one-year-old children

16:10 – 16:25 **Kulchitskiy I.** Algorithmic modeling of the heart based on CT scans

16:25 – 16:40 **Varvarkina E.A., Daiboun S.A.** Modelization and processing of motor cortex EEG signals for biomechanical applications

16:40 – 17:00 **Radchenko I.** Multifunctional Microstructures for Encapsulation, Sensing and Remote Controlled Delivery of (Bio)-Chemicals

Coffee break

17:20 – 17:40 **Kotliar K.** Retinal pulse wave velocity: non-invasive assessment of arterial stiffness in the central microcirculation

17:40 – 18:00 **Sadyrin E.V., Swain M.V., Yogina D.V., Maksyukov S.Yu.** Influence of dental treatments on mineral density of white spot lesions using X-Ray microtomography: ex vivo investigation

18:00 – 18:20 **Perelmuter M.N., Kasparova E.A.** Effect of bone density on the stress state near screw retained dental implants

18:20 – 18:35 **Shipov R.** to be confirmed

Room C

June 23

Extreme loading on structures

Chairperson Vladimir Bratov

ZOOM ID 81553193834

Password: 978030

14:00 – 14:30 **Nobili A.** Wave propagation in microstructured media for nondestructive testing

14:30 – 14:50 **Tkachenko O.P., Ryabokon A.S.** Stress-strain state of T-shaped joint of thin-walled elastic pipes

14:50 – 15:10 **Dal Corso F., Koutsogiannakis P., Misseroni D., Papathanasiou T., Bigoni D.** ELASTICA AND OSCILLATORY CONFIGURATIONAL FORCES

15:10 – 15:30 **Lamzin D.A., Bragov A.M., Gonov M.E., Konstantinov A.Yu., Lomunov A.K.** Response of fine-grained fiber-reinforced concretes under dynamic compression

15:30 – 15:50 **Lanzoni L., Falope F.O., Tarantino A.M.** On the anticlastic bending of solids at finite strains

15:50 – 16:10 **Manna S., Dipendu P.** Impact on the dispersive wave due to impulsive point source at the interface of anisotropic poro-elastic layer and non-homogeneous infinite extend medium

16:10 – 16:30 **Chaki M.S.** Surface waves in electro-elastic layered structures with imperfect contact and surface stresses

16:30 – 16:50 **Radi E.** Non-standard contact conditions between a beam and a couple stress elastic half-plane

Coffee break

17:20 – 17:40 **Wilde M.V.** Fundamental edge waves in a plate with asymmetric non-rectangular edge profile

17:40 – 18:00 **Sahin O., Kaplunov J.** Dynamic problems for a perturbed elastic rectangle subject to end loadings

18:00 – 18:20 **Tak S.K., Iqbal M. A.** Comparative analysis of energy absorption and deformations of metallic tubes with different configurations under axial impact

18:20 – 18:40 **Kazarinov N.A., Khvorov A.A.** Using artificial neural networks to predict impact strength of targets with perforation

18:40 – 19:00 **Shubchinskaya N.** On the influence of inhomogeneity on a nonlinear elastic cylinder with internal stresses under torsion

19:00 – 19:20 **Alexandrov S.** Singular solutions in plasticity

19:20 – 19:40 **Evard M.E., Volkov A.E., Belyaev F.S., Starodubova M.S.** Calculation of the lattice deformation tensor for DO3-18R martensitic transformation in Cu-Al-Be shape memory alloy

19:40 – 20:00 **Bisht M.** Numerical study of Ultra-High-Performance concrete parameters in RHT model for predicting the response of concrete panels to ballistic impact

Room D

June 23

Anomalous energy transfer at nanoscale

Chairperson Wolfgang Müller and Sokolov Alexey

ZOOM ID 87966764413

Password: 970372

14:00 – 14:30 **Kovaleva M.** Energy transport and nonlinear waves in nonlinear discrete chains

14:30 – 14:50 **Sokolov A.A., Müller W.H.** Deterministic and stochastic processes in a one-dimensional quasicontinuum

14:50 – 15:10 **Liazhkov S.** Discrete and continuum approaches to description of heat transport in a semi-infinite free end Hooke's chain

15:10 – 15:30 **Rubinova R.** Heat transfer in infinite one-dimensional crystal considering the N-th coordination sphere

15:30 – 15:50 **Maznev A.** Studying nanoscale thermal treansport and acoustic waves with extreme ultraviolet transient gratings

15:50 – 16:10 **Murachev A.S., Krivtsov A.M.** Thermal and diffusion processes in one-dimensional crustal

16:10 – 16:30 **Murtazin I.R., Melnikov B.E., Semenov A.S.** SIMULATION OF INELASTIC RESPONSE OF POLYCRYSTALLINE NICKEL BASED ON MICROMECHANICAL MODEL HOMOGENIZATION

Coffee break

June 24, Thursday

Room A

June 24

Plenary lectures

Chairperson Sokolov Alexey

ZOOM ID 81250245340

Password: 323769

10:00 – 10:45 **Gendelman O.** Kapitza thermal resistance in linear and nonlinear chain models

Mechanics and entrepreneurship

Chairperson Sokolov Alexey

11:00 – 12:00 **Le Zakharov A.** Photomechanics - history of success. Creating a manufacturing tech company in a competitive environment

12:00 – 13:00 **Gusika N.** System SmartLocker and modern design thinking methods

---

13:00 - 14:00 Lunch

Room B

June 24

Minisymposium "Earthquakes and Seismic Protection"

Organizers: Tzu-Kang Lin, Sergey V. Kuznetsov and Vladimir Bratov

Chairperson Vladimir Bratov

ZOOM ID 81250245340

Password: 323769

14:00 – 14:30 **Kuznetsov S.** Granular metamaterials for seismic protection

14:30 – 14:50 **Bratov V.** Complex shape seismic barriers

14:50 – 15:10 **Prikazchikov D., Kaplunov J.** Dynamic sliding contact for a thin elastic layer

15:10 – 15:30 **Javkhlan S.** Analysis of effectiveness of pile barriers from rayleigh surface waves when pile field geometry changes

15:30 – 15:50 **Gadzhibekov T.** Dependence of the dispersion curves of Pochhammer-Chree waves on the elastic modulus and geometry of a hollow cylinder

15:50 – 16:10 **Dudchenko A., Dias D., Kuznetsov S.** Numerical analysis of Rayleigh wave interaction with seismic barriers and pile fields taking into account the elasto plastic behavior of soil

16:10 – 16:30 **Smirnov A., Kazarinov N.A., Petrov Y.V.** Simple mass-spring model to address dynamic fracture effects

16:30 – 16:50 **Galybin A.N.** Stress field reconstruction in layered rocks by using the data on principal stress orientations

Room C

June 24

Solids and structures

Chairperson to be confirmed

ZOOM ID 81553193834

Password: 978030

14:00 – 14:20 **Kashtanova S.V., Rzhonsnitskiy A.V.** Stress field for a cylindrical shell with a circular hole under different boundary conditions

14:20 – 14:40 **Kuchumova I.D., Cherkasova N. Yu., Batraev I.S.** Wear resistant of Fe-based metallic glass detonation coatings

14:40 – 15:00 **Montaser M., Lychev S.A., Fekry M.** Residual stresses in a thermo-viscoelastic additively manufactured cylinder subjected to induction heating

15:00 – 15:20 **Kiselev A.P., Zlobina E.A.** Revisiting A. V. Popov's diffraction problem

15:20 – 15:40 **Sedova O., Yu.G.Pronina** On some effects of different temperatures on the lifetime of thick-walled vessels under mechanochemical corrosion conditions

15:40 – 16:00 **Shamina A.A., Zvyagin A.V.** Numerical modeling of fractures with a bend in space

16:00 – 16:20 **Sedova Yu.S., Polyanskiy V.A., Bessonov N.M.** Accounting for the skin effect in hydrogen-charged samples in the HEDE model of cracking

16:20 – 16:40 **Solomentseva P.V., Lukin V.V.** Modification of the Lagrange multiplier method with a detached contact boundary for modeling bodies interaction

16:40 – 17:00 **Tishin P.V., Lomakin E.V.** Bending a beam made of material with strain state dependent properties

17:00 – 17:20 **Banichuk N.V., Ivanova S.Yu.** Equal-strength design of axisymmetric shell penetrating into condensed media

17:20 – 17:40 **Grigoriev A.S., Shilko E.V., Smolin A.Yu.** A discrete element modelling of wear particle formation in contact between sliding metals

17:40 – 18:00 **Savikovskii A.V., Gordeev A.N., Michailov A.A., Antonova O.V., Semenov A.S.** Numerical aspects of the J-integral estimation for thermal loading

Room D

June 24

Mechanical and civil engineering applications

Chairperson to be confirmed

ZOOM ID 87966764413

Password: 970372

14:00 – 14:20 **Furtat I., Gushchin P.** Stability, Instability Study and Control of Autonomous Dynamical Systems Based on Divergence Method

14:20 – 14:40 **Melkumova E., Golubev Yu.F., Koryanov V.V.** Insectomorphic Robot Rescue from an Emergency on the Back under the Interference of Influence

14:40 – 15:00 **Reztsova A.M.** Mathematical Modelling of Ice Field Deflection Dynamics

15:00 – 15:20 **Lycheva T.N., Lychev S.A.** Contact interaction of a system of rigid punches with an elastoplastic half-plane

15:20 – 15:40 **Prozorova E.** Effects the angular momentum in mathematical models of continuous environment mechanics

15:40 – 16:00 **Semenov A.** Nonuniform deployment of mobile agents over the segment of the curve

16:00 – 16:20 **Kondakov I., Levchenkov M., Guseva N.** Bionic Civil Aircraft Structures Based on Lattice Composite Grids and Protective Coatings

16:20 – 16:40 **Tretyakov D.A., Belyaev A.K.** Investgation of localized plastic deformation by reconstruction of acoustic anisotropy fields

16:40 – 17:00 **Subhan A., Kumar K.** Effect of ground furnace slag on axial capacities of concrete-filled steel tubes

17:00 – 17:20 **Kravchenko D.A., Shadelko P.V., Modestov V.S.** The analysis of forced vibrations of a rectangular beam

17:20 – 17:40 **Atroshenko S.A., Nikolaeva E.M.** Influence of aerothermoacoustic treatment on the characteristics of casting aluminum alloys

June 25, Friday

Room A

June 25

Plenary lectures

Chairperson Sokolov Alexey

ZOOM ID 81250245340

Password: 323769

10:00 – 10:35 **Frolov M.** Bubnov-Galerkin method in computational solid mechanics, a posteriori error estimates and adaptive algorithms

10:35 – 11:10 **Dauxois T.** Internal waves attractors

11:10 – 11:45 **Maas U., Bykov V., Yu C.** Hierarchical models for the coupling of detailed chemical kinetics with molecular transport and flow

11:45 – 12:20 **dell'Isola F.** Piola transformation of stress and double stress in second gradient continua

12:20 – 12:55 **Kantorovich L.** Electron dynamics of tip-tunable oxygen species on TiO2 surface

---

13:00 - 14:00 Lunch

Room B

June 25

Mathematical modeling in petroleum engineering

Organizer: Liliana Rybarska-Rusinek, Alexander M. Linkov and Vitaly A. Kuzkin

Chairperson Vitalii Kuzkin

ZOOM ID 81250245340

Password: 323769

14:00 – 14:30 **Linkov A., Rejwer-Kosinska E., Rybarska-Rusinek L.** Towards micromechanics of local fields

14:30 – 14:50 **Kozhevnikov E.V. , Turbakov M.S., Gladkikh E.A., Poplygin V.V., Riabokon E.P., Wiercigroch M.** PERMEABILITY EVOLUTION DURING FLOODING

14:50 – 15:10 **Pashkin V.D., Lezhnev K.E.** Coupled model of deep-bed-filtration and cake filtration in porous media for gravel pack modelling

15:10 – 15:30 **Poplygin V., Kozhevnikov E., Turbakov M., Riabokon E., Wiercigroch M.** Investigation of the permeability hysteresis during sequential loading and unloading of rocks

15:30 – 15:50 **Skryleva E.I., Dushin V.R., Nikitin V.F., Skryleva E.I., Makeeva M.N.** Modeling the displacement of oil from a porous medium taking into account thermochemical interactions between phases

15:50 – 16:10 **Simonov M.** Machine learning framework for PDE solving. Application for reservoir engineering

16:10 – 16:30 **Ospishchev S.A., Evseenkov A.S., Kuchkildin D.K., Krechetov K.I., Kotezhekov V.S.** Development of a model for short-term production forecasting based on a hybrid probabilistic approach

ZOOM ID 81250245340

Password: 323769

18:00 – 18:20 **Closing Ceremony**

Room C

June 25

Heat transfer and wave motion

Chairperson Loboda Olga

ZOOM ID 81553193834

Password: 978030

14:00 – 14:20 **Shepelev I.A., Kolesnikov I.D., Korznikova E.A., Dmitriev S.V.** Features of shock waves induced in a phosphorene nanoribbon

14:20 – 14:40 **Mikhalchenko E.V., Mikhalchenko, Nikitin V.F., Goryachev V.F.** Simulation of a detonation engine on an acetylene-oxygen mixture.

14:40 – 15:00 **Knyazeva A.G.** Influence of the stress-strain state on the composition of synthesis products in the gap between two inert materials

15:00 – 15:20 **Stamov L.I., Kushnirenko A.G., Mikhalchenko E.V., Smirnova M.N., Tyurenkova V.V.** Computer simulation of the combustion chamber of hybrid engine

15:20 – 15:40 **Udalov P.P., Popov I.A., Lukin A.V.** Peltier element model with temperature-dependent materials

15:40 – 16:00 **Gavrikov A., Kostin G.** FEEDFORWARD OPTIMAL CONTROL WITH CONSTRAINTS FOR A CYLINDRICAL THERMOELECTRIC SYSTEM ACTUATED BY A PELTIER ELEMENT

Solids and structures

Chairperson Babenkov Mikhail

16:00 – 16:20 **Polyakova P., Julia A. Pukhacheva, Julia A. Baimova** Atomic diffusion analysis of aluminum-based composites: Al-Ti, Al-Mg

16:20 – 16:40 **Safina L., Karina K. Krylova, Ramil T. Murzaev, Julia A. Baimova** STUDY OF THE MECHANICAL PROPERTIES OF GRAPHENE-NICKEL COMPOSITE BY MOLECULAR DYNAMICS

16:40 – 17:00 **Digilov A., Sergey A. Lychev** Nonlinear boundary value problem for circular elastic plate

17:00 – 17:20 **Saitova R.** Analytical and numerical solutions of the modified system of interrelated kinetic equations for creep and long-term strength of metals

17:20 – 17:40 **Meshcheryakova A.R., Tsukanov I.Yu.** Study of the effect of the rail welded joint geometry on the contact interaction in wheel-rail system

17:40 – 18:00 **Yakovenko A.A., Goryacheva I.G.** Cylinder indentation into a viscoelastic layer taking into account the surface microrelief

ZOOM ID 81250245340

Password: 323769

18:00 – 18:20 **Closing Ceremony**

Room D

June 25

Fluid mechanics

Chairperson to be confirmed

ZOOM ID 87966764413

Password: 970372

14:00 – 14:20 **Shcherbinin S., Evseenkov A., Shvarev N.** Creation of surrogate model for prediction the effectiveness of chemical enhanced oil recovery methods: generation of the training set with the aid of tNavigator hydrodynamic simulator

14:20 – 14:40 **Zavorokhin G.L., Kozlov V.A., Nazarov S.A.** Modelling fluid flow through a flexible vessel with elastic walls

14:40 – 15:00 **Gimadeev A.V., Musin A.A., Kovaleva L.A.** Study of the non-isothermal separation of water drops in the emulsion taking into account the dependence of the viscosity of the oil on temperature

15:00 – 15:20 **Iulmukhametova R.R., Musin A.A., Kovaleva L.A.** Numerical research of suspension flow in rectangular channel with permeable walls

15:20 – 15:40 **Valiullina V.I., Galeev R.R., Shaisitdikova I.I., Mullayanov A.I., Musin A.A., Kovaleva L.A.** Investigation of the low-frequency electrical effect on the emulsion in the presence of convective flows

15:40 – 16:00 **Pigusov E.A., Pavlenko O.V., Petrov A.V., Alesin V.S.** Study on application of tangential jet blowing on adaptive high-lift wing

16:00 – 16:20 **Smirnov I.V., Mikhaylova N.V., Volkov G.A.** Determination of acoustic cavitation thresholds depending on acoustic wave frequencies

16:20 – 16:40 **Galeev R.R., Mullayanov A.I., Musin A.A., Kovaleva L.A., Valiullina V.I.** Study of an emulsion under the action of an electric field in the presence of a hydrodynamic flow

16:40 – 17:00 **Osipova R.Sh., Mullayanov A.I., Musin A.A., Kovaleva L.A.** Separation of emulsions under the action of an inhomogeneous alternating electric field

17:00 – 17:20 **Tretyakov D.A., Belyaev A.K.** Investgation of localized plastic deformation by reconstruction of acoustic anisotropy fields

ZOOM ID 81250245340

Password: 323769

18:00 – 18:20 **Closing Ceremony**