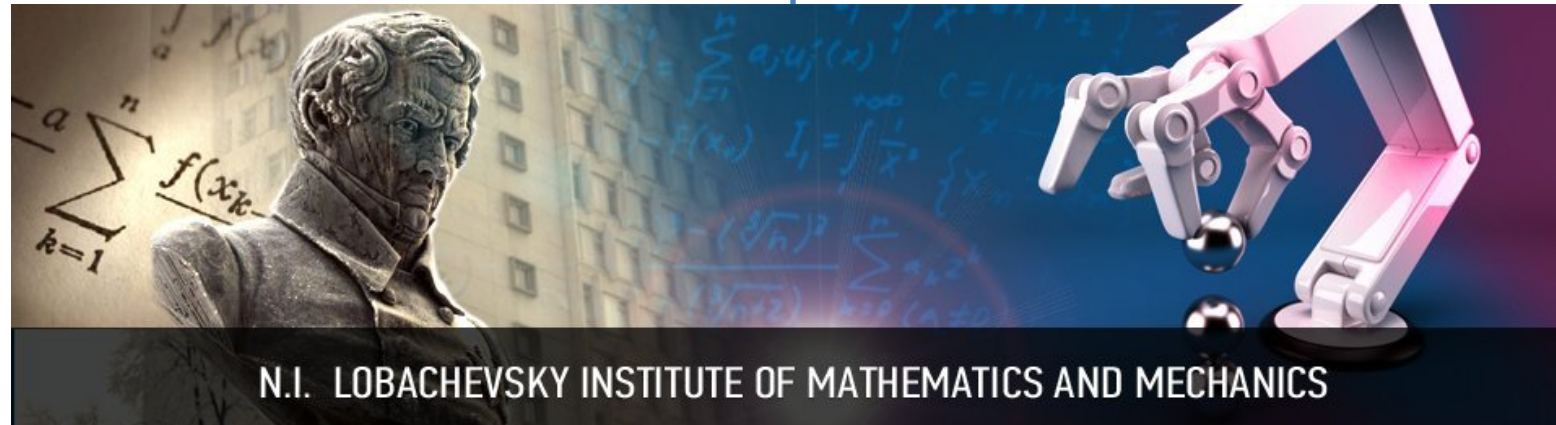




**Kazan Federal
UNIVERSITY**



Division of Mathematics

Division of Mechanics

**Division of Pedagogical
Education**

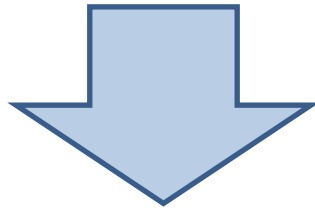
**Fluid Mechanics
Department**

**Solid Mechanics
Department**

Educational programs and profiles

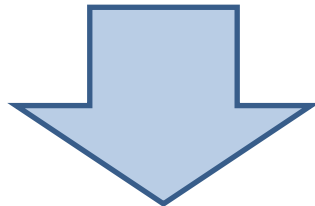
Bachelor Program (4 years)

Mechanics and Mathematical Modeling



Master Program (2 years)

Mechanics and Mathematical Modeling



Graduate Profile (4 years)

Mechanics of fluid, gas and plasma

Profiles for Master Degree

1. Mechanics of fluid, gas and plasma
2. Mechanics of oil and gas reservoir

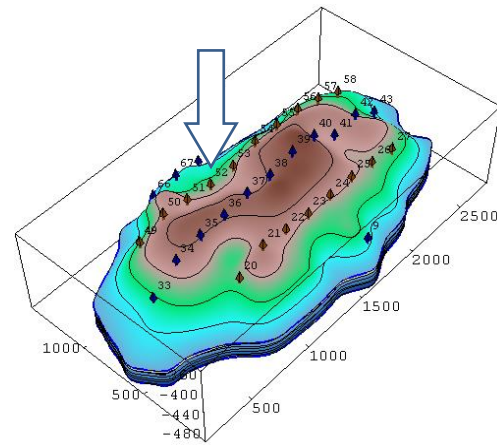
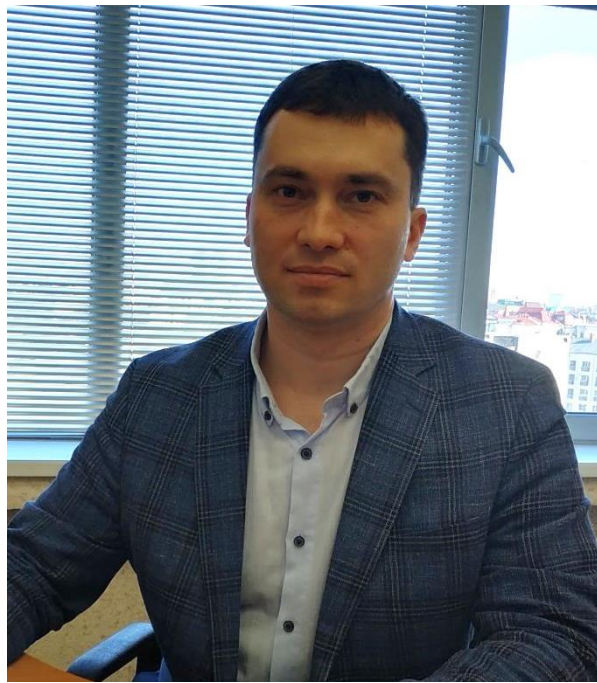


Staff of the Department

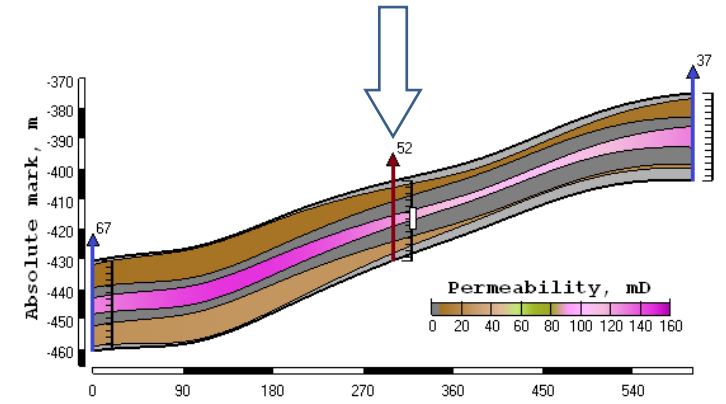
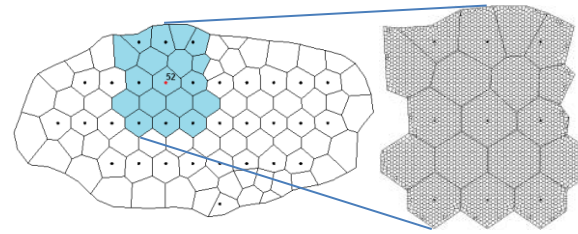
#	Name	Position	Academic degree
1	Konstantin Potashev	Head of Department	Doctor (Physics and Mathematics)
2	Andrey Egorov	Professor	Doctor (Physics and Mathematics)
3	Alexander Mazo	Professor	Doctor (Physics and Mathematics)
4	Dmitrii Maklakov	Professor	Doctor (Physics and Mathematics)
5	Damir Gubaidullin	Professor	Doctor (Physics and Mathematics)
6	Alexander Kosterin	Professor	Doctor (Physics and Mathematics)
7	Renat Mardanov	Associate Professor	Candidate (Physics and Mathematics)
8	Sergey Soloviyov	Associate Professor	Candidate (Physics and Mathematics)
9	Artem Nuriev	Senior Lecturer	Candidate (Physics and Mathematics)
10	Airat Kamalutdinov	Assistant	Candidate (Physics and Mathematics)

The average age of the department staff is 50.





Research illustrations



Multiscale modeling of global waterflooding of oil fields and local formation effects

Konstantin Potashev

Doctor of Phys. and Math. Sciences

Associate Professor

Head of Department

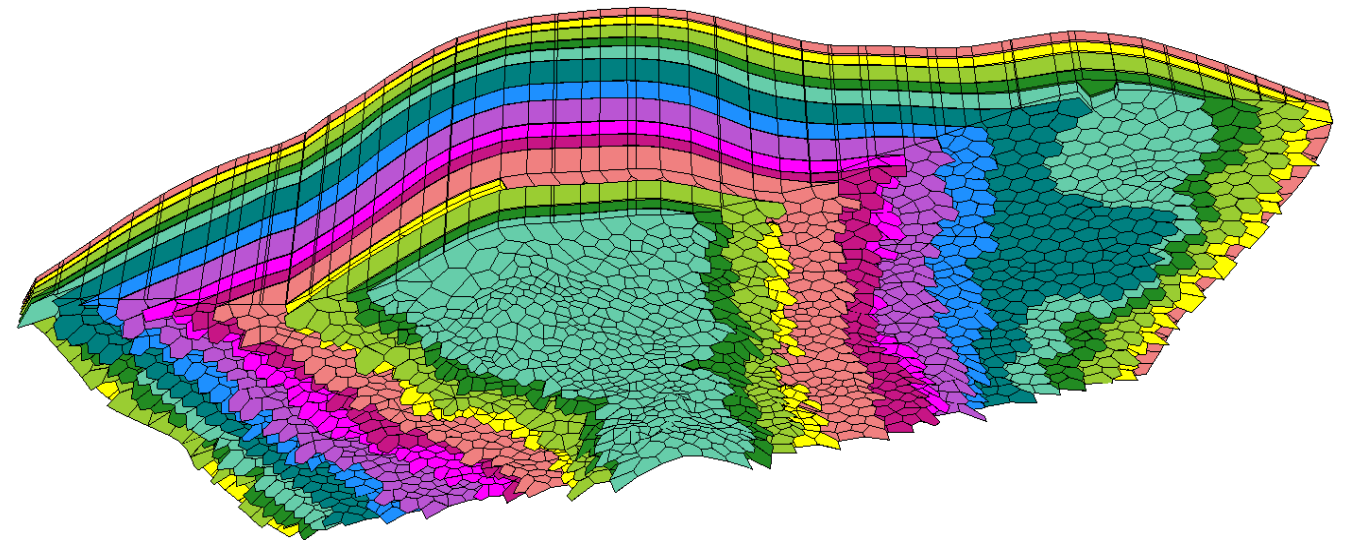
Konstantin.Potashev@kpfu.ru

Research Interests

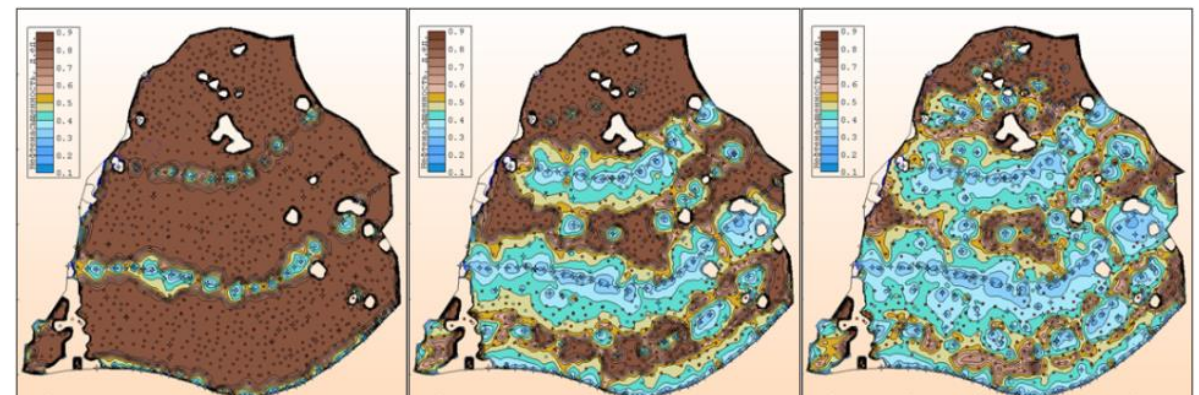
- oilfield hydromechanical simulation
- mathematical modeling in problems of ecology

Taught Disciplines

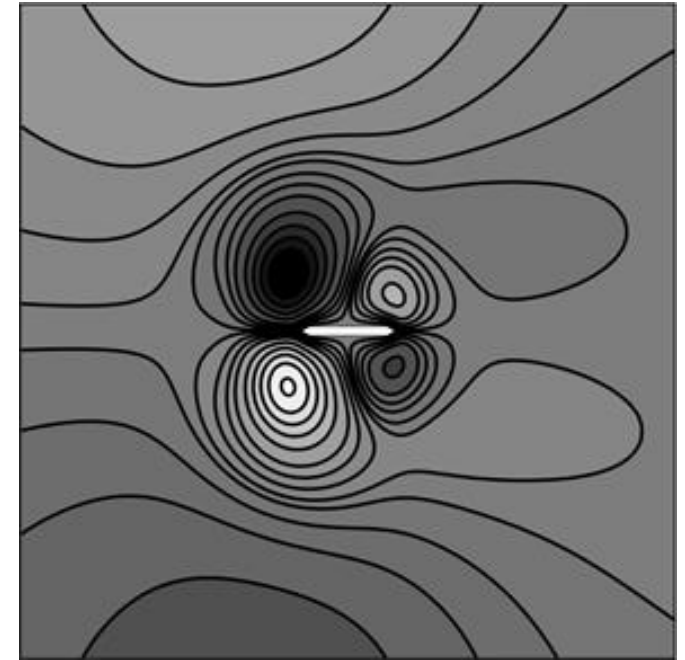
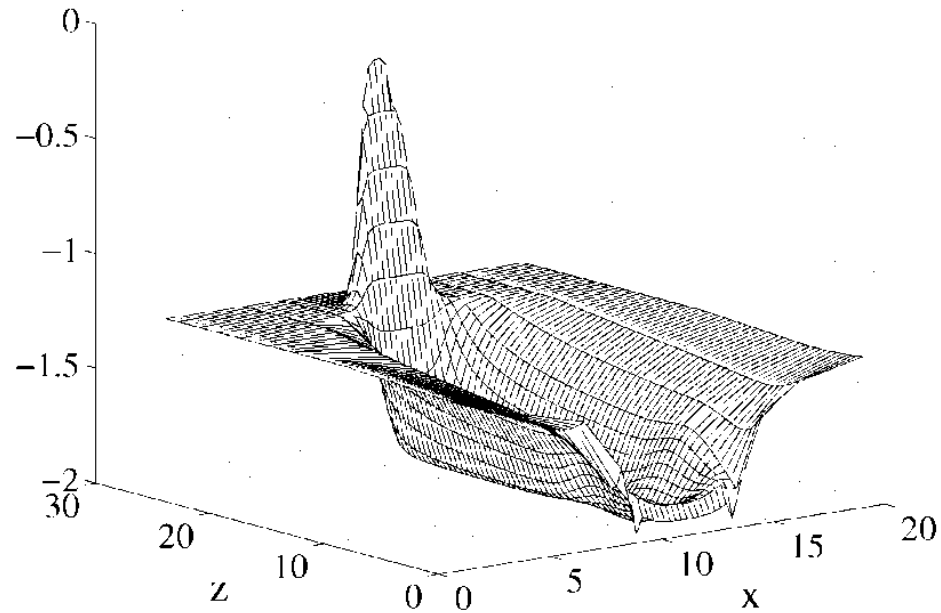
- continuum mechanics
- physical and mechanical practice
- multiphase flow in porous media
- underground fluid mechanics



A multi-layer oil reservoir coverage by a super-element computational grid



Dynamics of oil saturation at the Romashkinskoye oilfield (results of super-element modeling)



Andrey Egorov

Doctor of Phys. and Math. Sciences
Professor

Andrey.Egorov@kpfu.ru

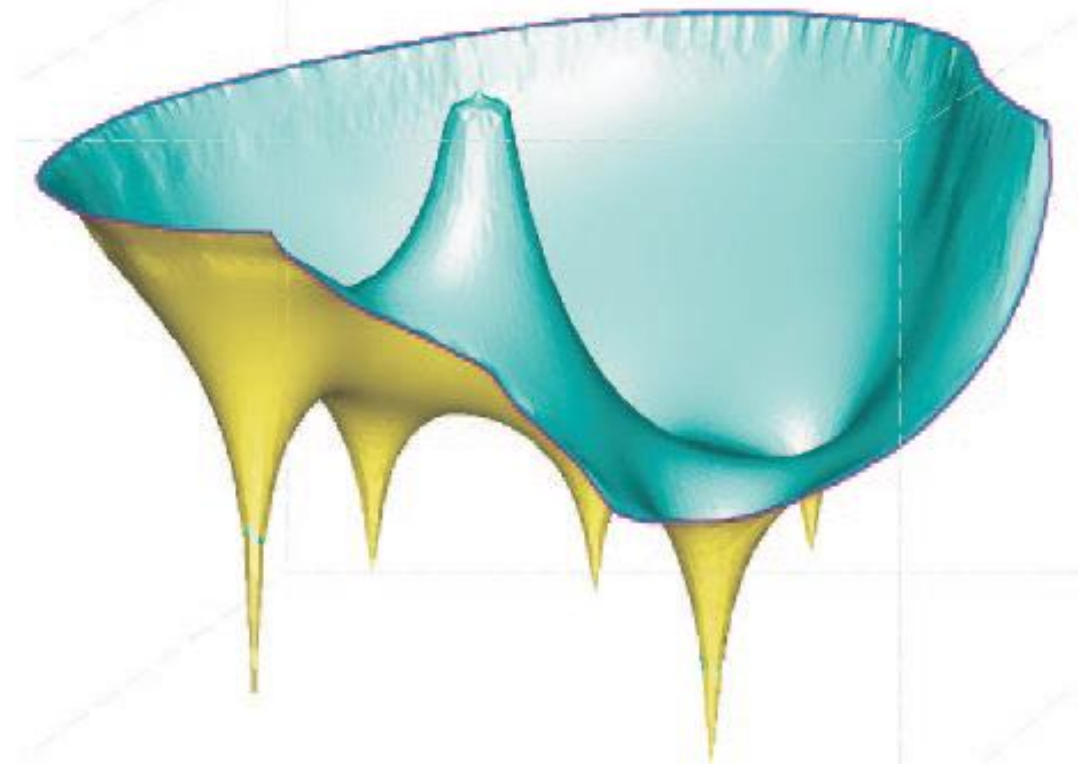
Research Interests

- Asymptotic methods for mechanical problems solve
- Turbulent Flow Modeling
- Problems of multiphase flow through porous media

Taught Disciplines

- Theoretical and applied mechanics, statics
- Asymptotic methods in mechanical problems
- Underground Fluid Dynamics
- Hydrodynamic stability
- Fluid, gas and plasma mechanics

Secondary flow near oscillating plate



Isobar map of the area of Tournaisian oil deposit



SIV
experiment



DNS
simulation

Transition to turbulence and intensification of heat exchange past a rib

Alexander Mazo

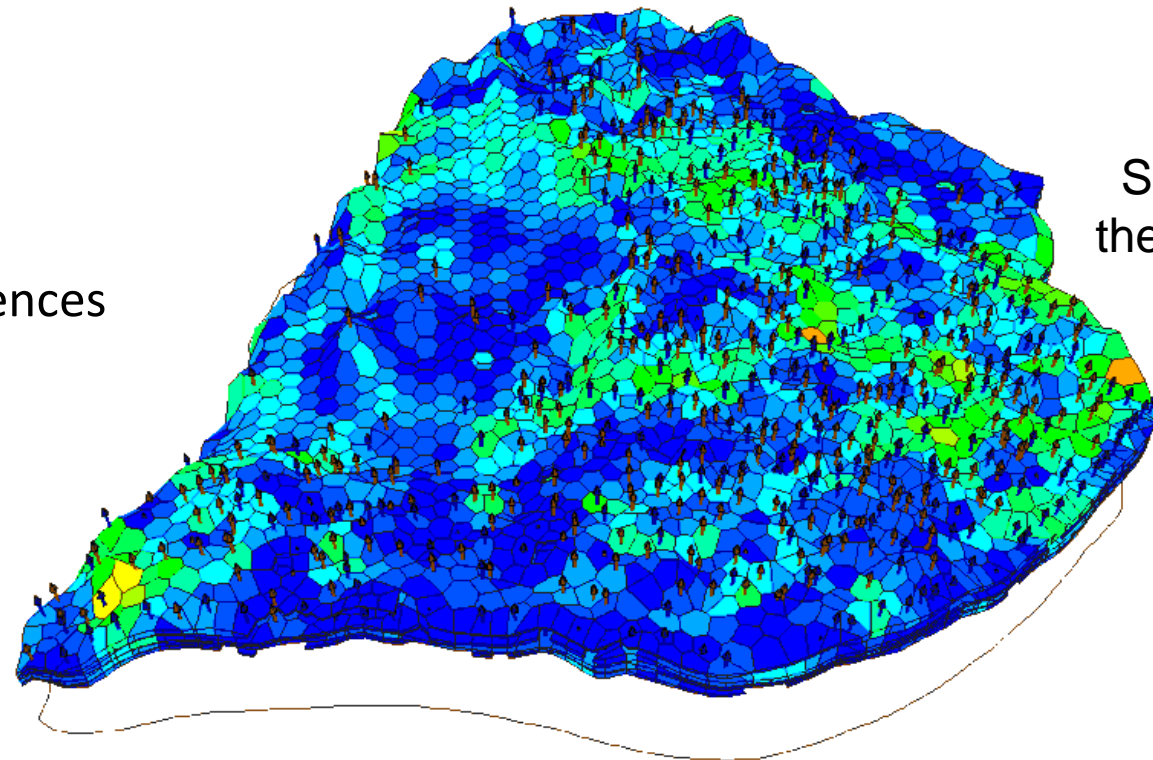
Doctor of Phys. and Math. Sciences
Professor

Research Interests

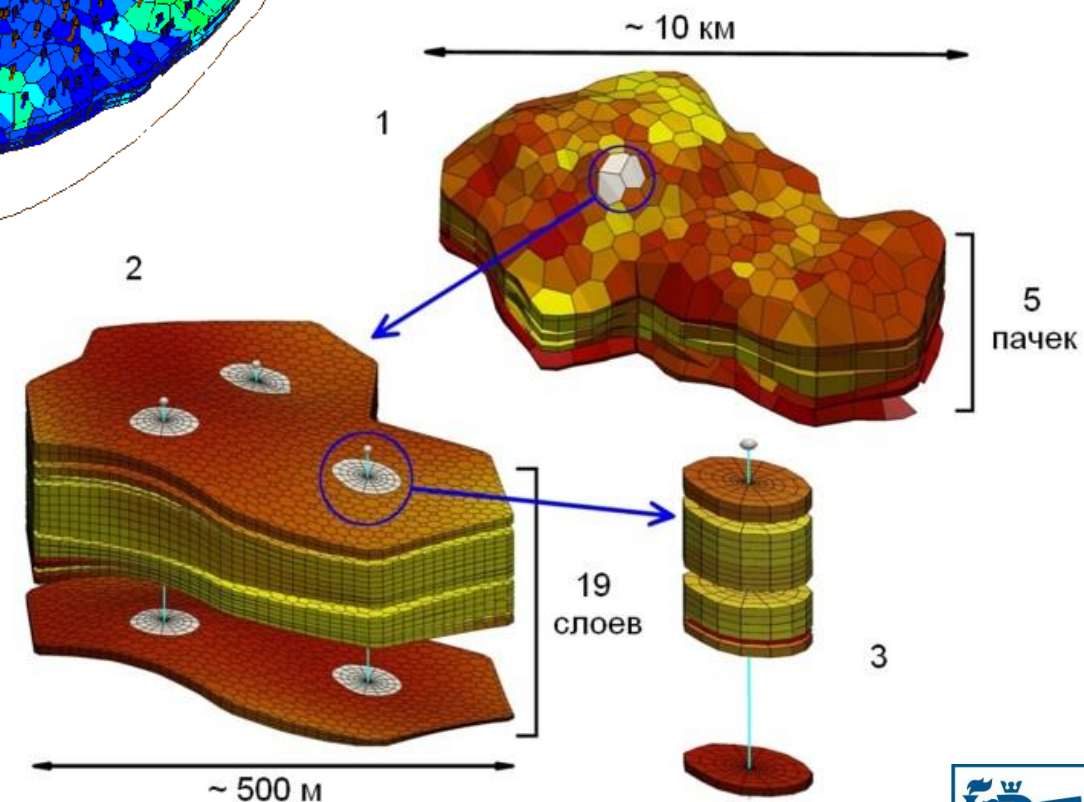
- CFD
- Turbulent flow modelling
- Heat transfer
- Simulation of oil reservoir development

Taught Disciplines

- Turbulence and heat transfer
- CFD
- Methods of solving grid equations



Super element grid for
the oil deposit simulation



Multiscale simulation of oil reservoir development





Dmitry Maklakov

Doctor of Phys. and Math. Sciences
Professor

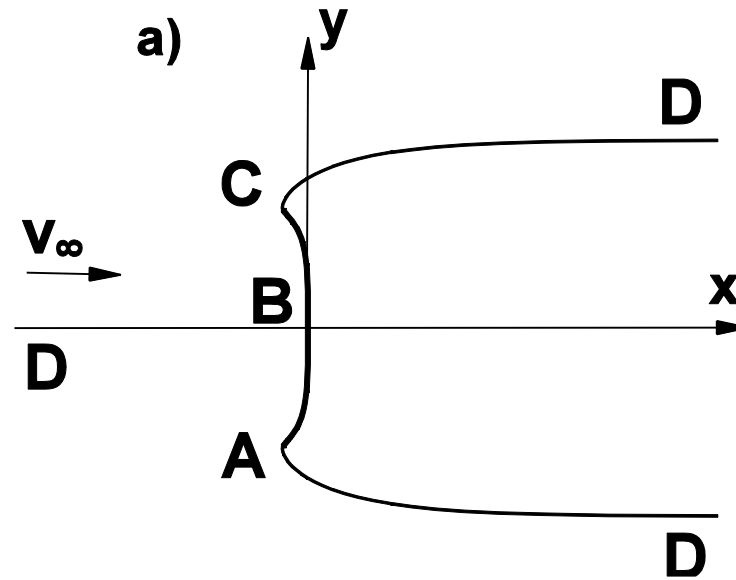
Dmitri.Maklakov@kpfu.ru

Research Interests

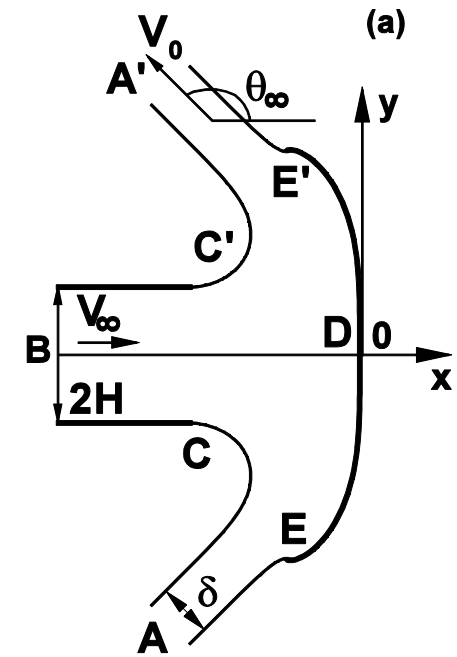
- Numerical-analytical methods of fluid mechanics
- Jet and cavitation flows
- Problems of the theory of waves on water
- Complex analysis

Taught Disciplines

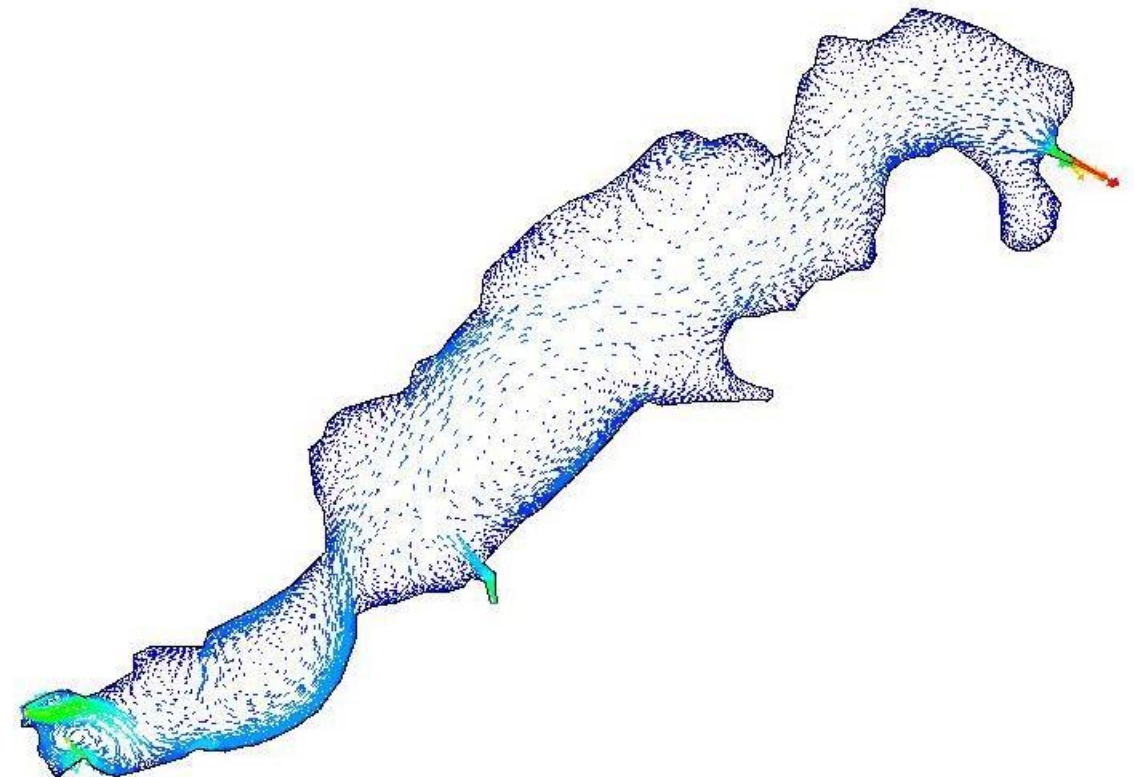
- Advanced chapters of fluid and gas mechanics
- Theory of jet and cavitation flows
- Numerical-analytical methods of fluid mechanics
- Analytical methods of hydrodynamics



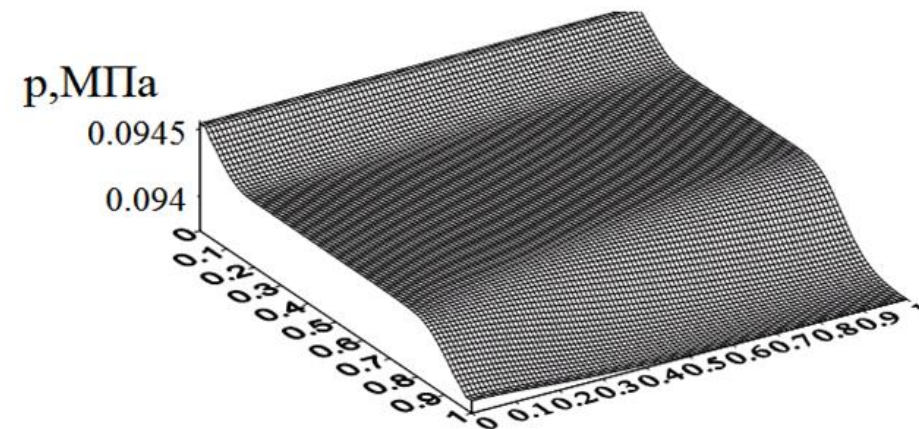
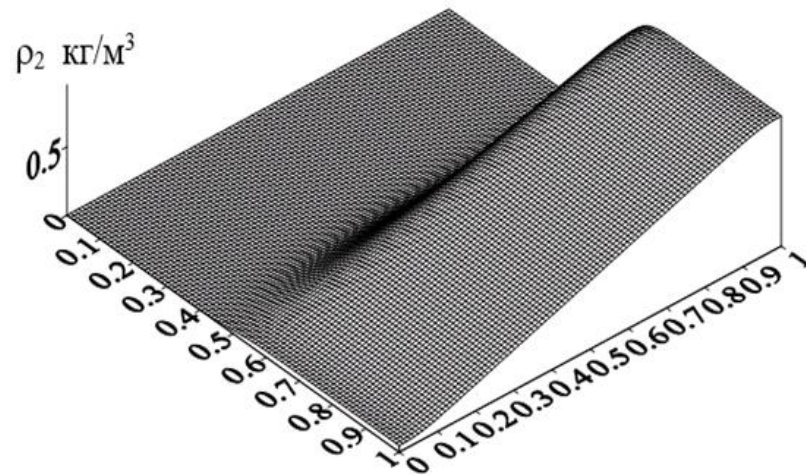
Optimal parachute form



The best form of jet deflector



Simulation of water flow in the Lake Sredny Kaban taking into account the heat release from the CHP



Two-dimensional shock waves in a gas suspension with an non-uniform distributed dispersed phase

Damir Gubaidullin

Doctor of Phys. and Math. Sciences

Professor

Corr. member of Russian Academy of Science

DAGubaidullin@kpfu.ru

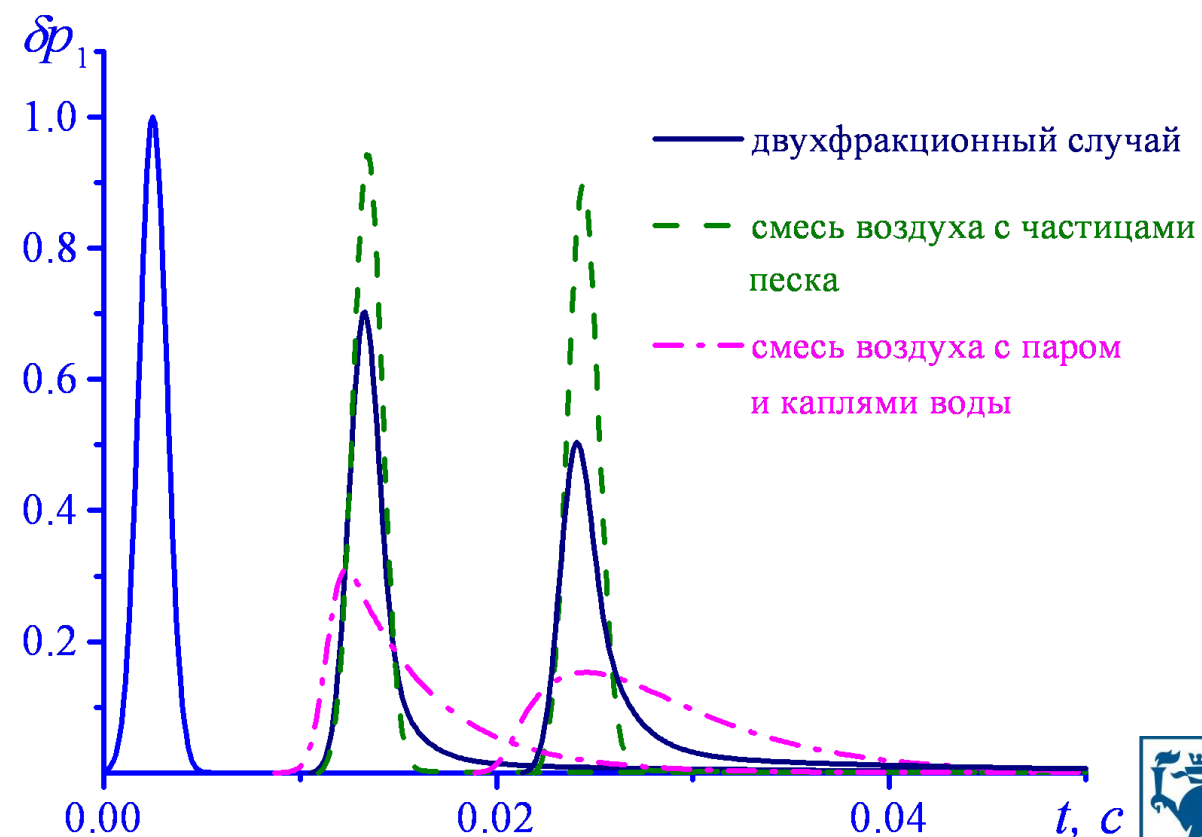
Research Interests

- Dynamics and thermophysics of multiphase media

Taught Disciplines

- Mechanics of multiphase media

Evolution of the impulse perturbation of a Gaussian form in a mixture of air with steam, water droplets and sand particles





Alexander Kosterin

Doctor of Phys. and Math. Sciences

Professor

Russian Academy of Natural Sci. member

Alexander.Kosterin@kpfu.ru

Research Interests

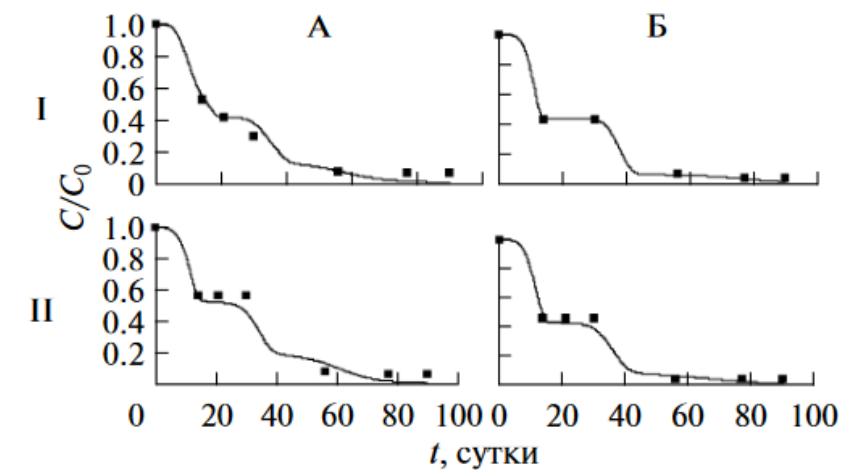
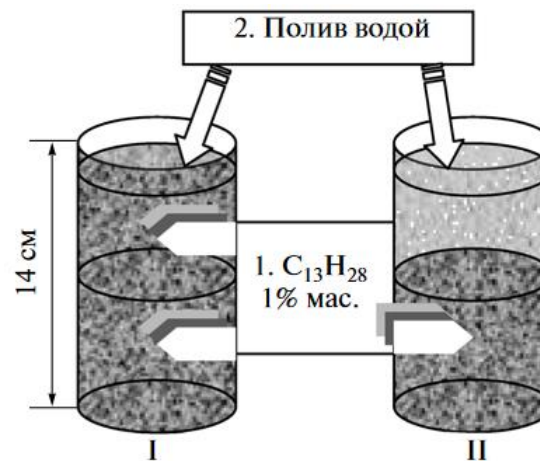
- Theoretical mechanics
- Consolidation of saturated porous media
- Mathematical modeling in problems of ecology

Taught Disciplines

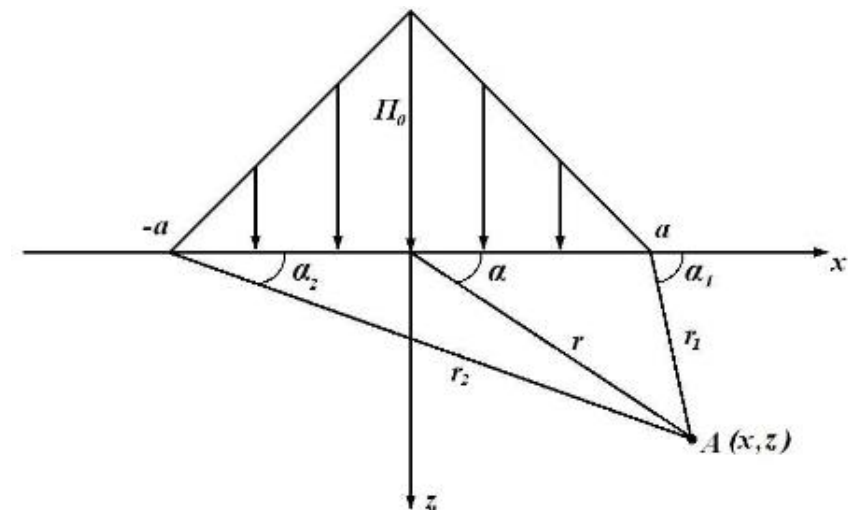
- Theoretical mechanics
- Mathematical modeling
- Concepts of modern science



Spreading a drop of wetting liquid on a solid surface



Estimated and actual dynamics of pollutant concentration in the process of bioremediation



Loading of a saturated porous medium surface



Renat Mardanov

Candidate of Phys. and Math. Sciences
Associate Professor

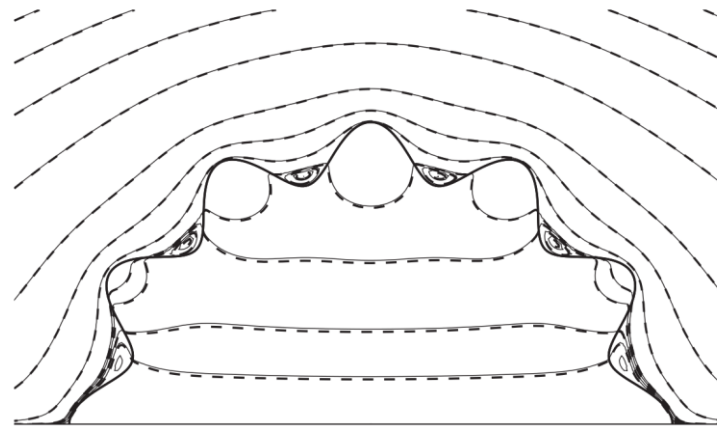
Renat.Mardanov@kpfu.ru

Research Interests

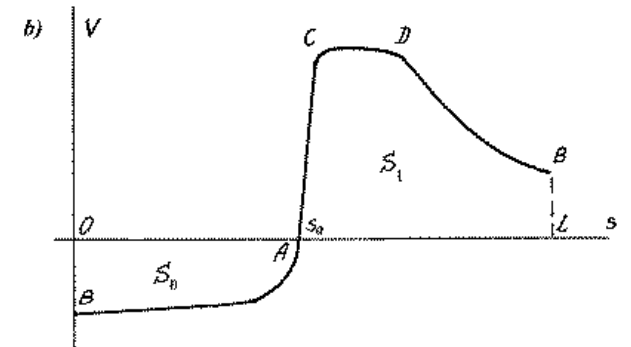
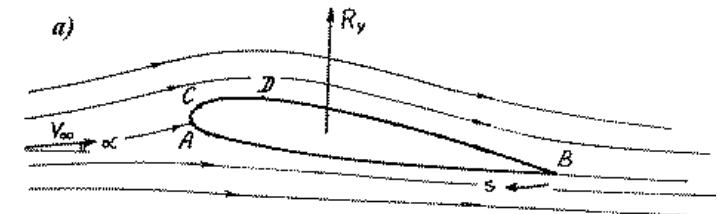
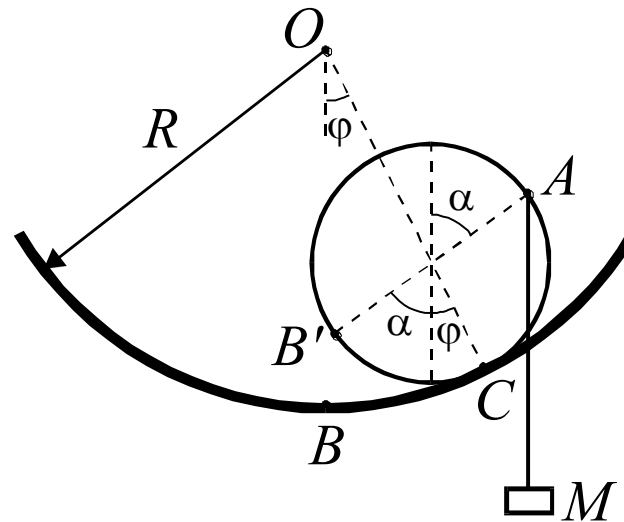
- Inverse boundary value problems of aerohydrodynamics
- s of gas suspension in homogeneous porous areas
- Olympiad problems on theoretical mechanics

Taught Disciplines

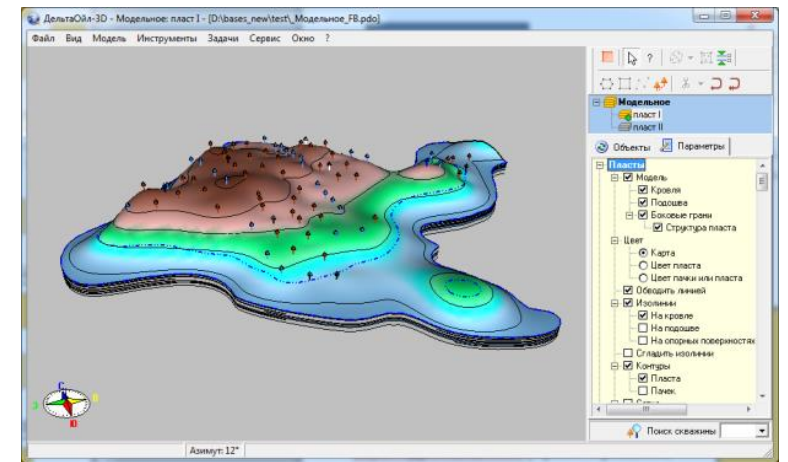
- Boundary value problems of aerohydrodynamics
- Theoretical mechanics
- 3D computer graphics OpenGL
- Database



Flow in homogeneous porous area



Airfoil design



3D visualization



Retrieving RDBMS Data Using SQL





Nuriev Artem

candidate (Physics and Mathematics)
Senior lecturer

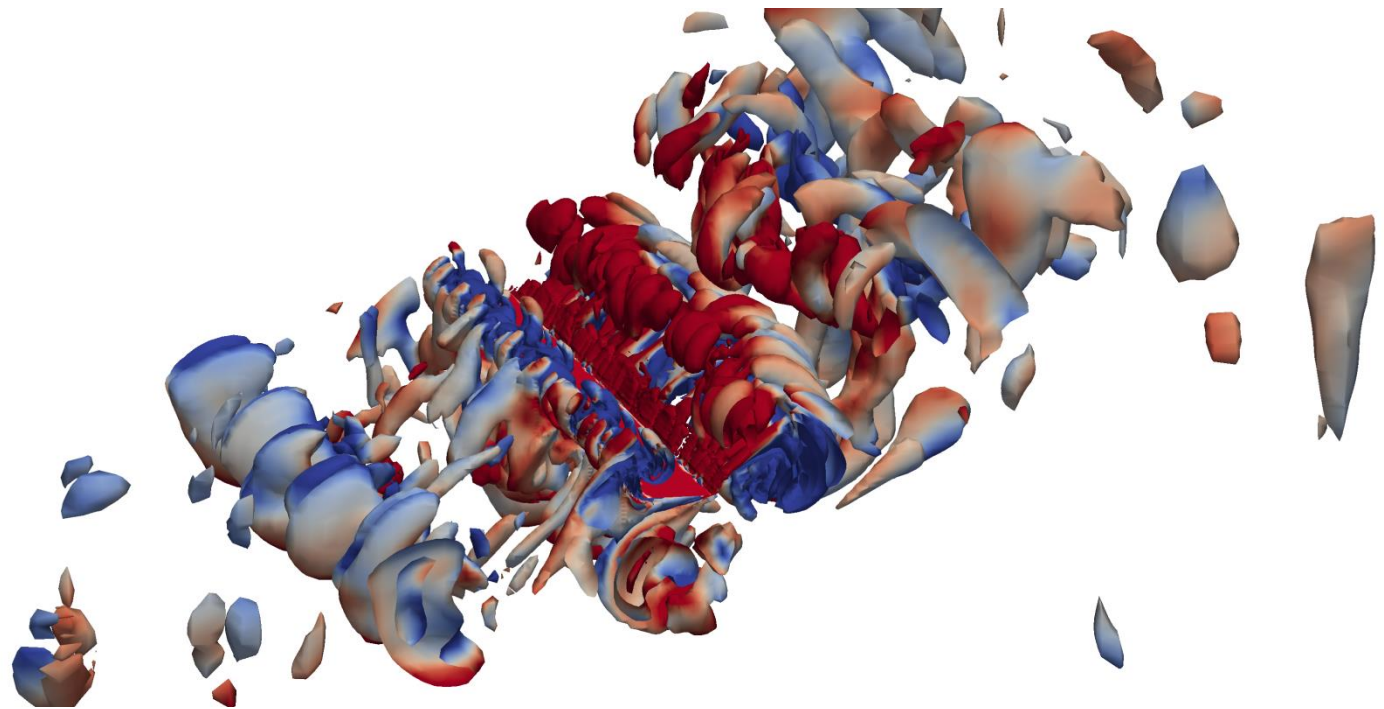
Artem.Nuriev@kpfu.ru

Research Interests

- Fluid and gas mechanics
- Computational Fluid Dynamics
- Modern CFD packages
- Parallel computing
- Bifurcation analysis of dynamic systems

Taught Disciplines

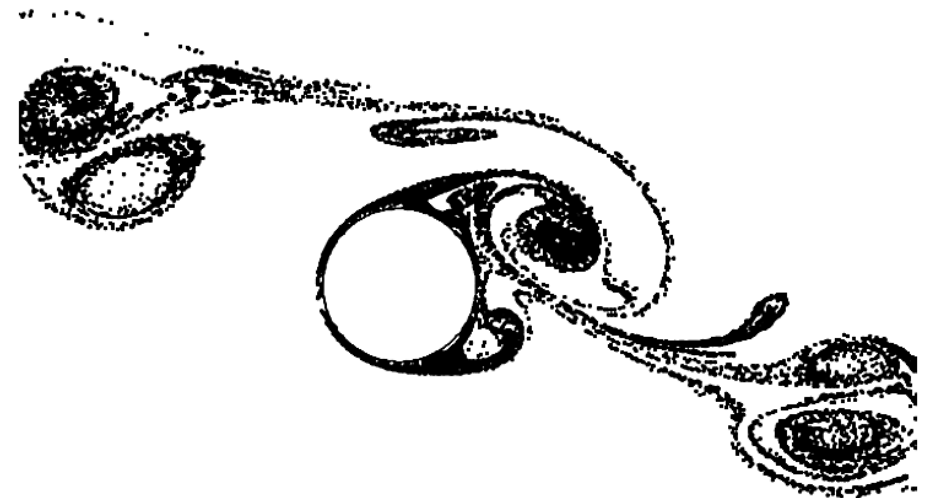
- physical and mechanical practice



Development of 3D Honji type instability near body in periodic motion



Motion of a vibration driven robot in a viscous fluid



Flow around oscillating cylinder



Sergei Solovev

Candidate of Physical and Mathematical Sciences (PhD)

Associate Professor

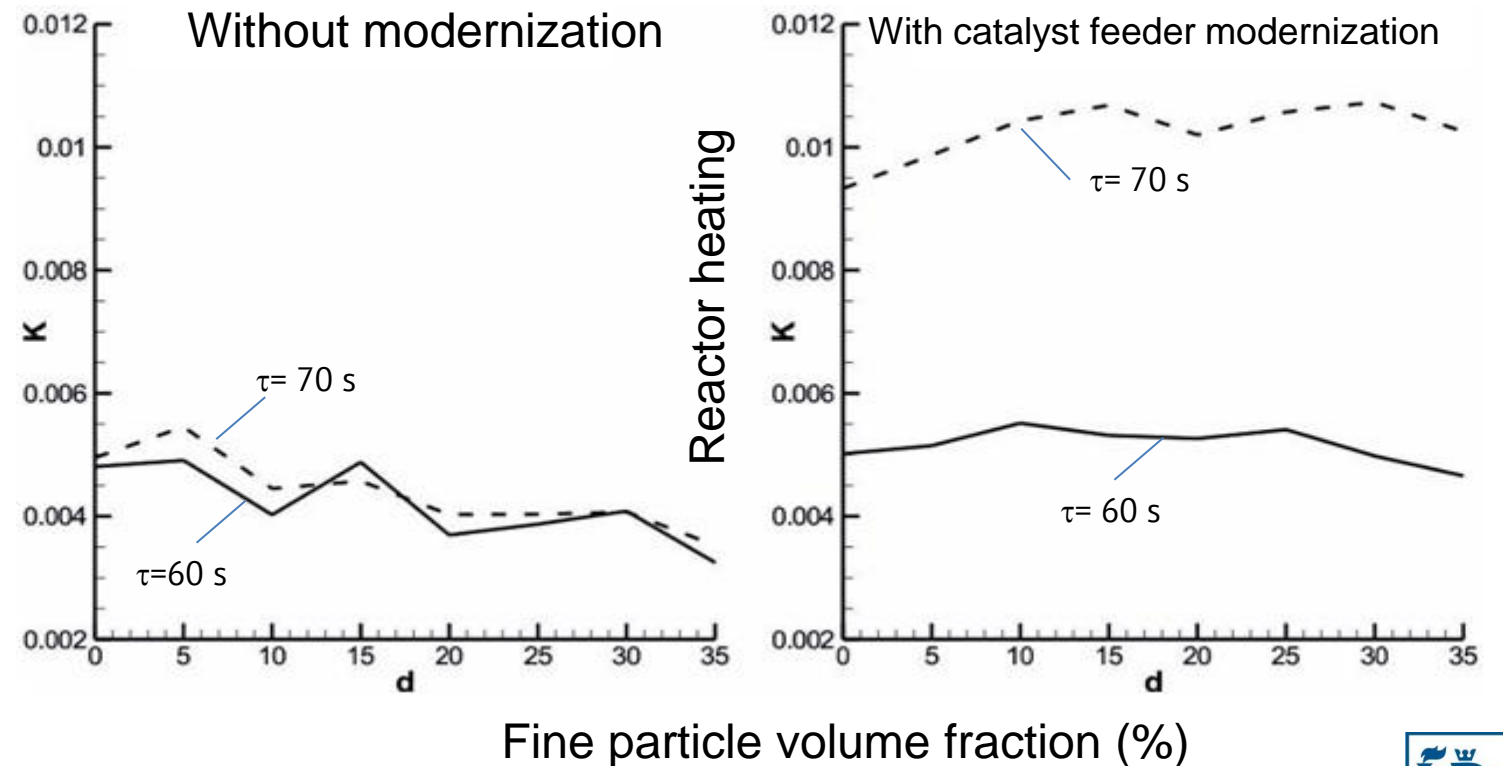
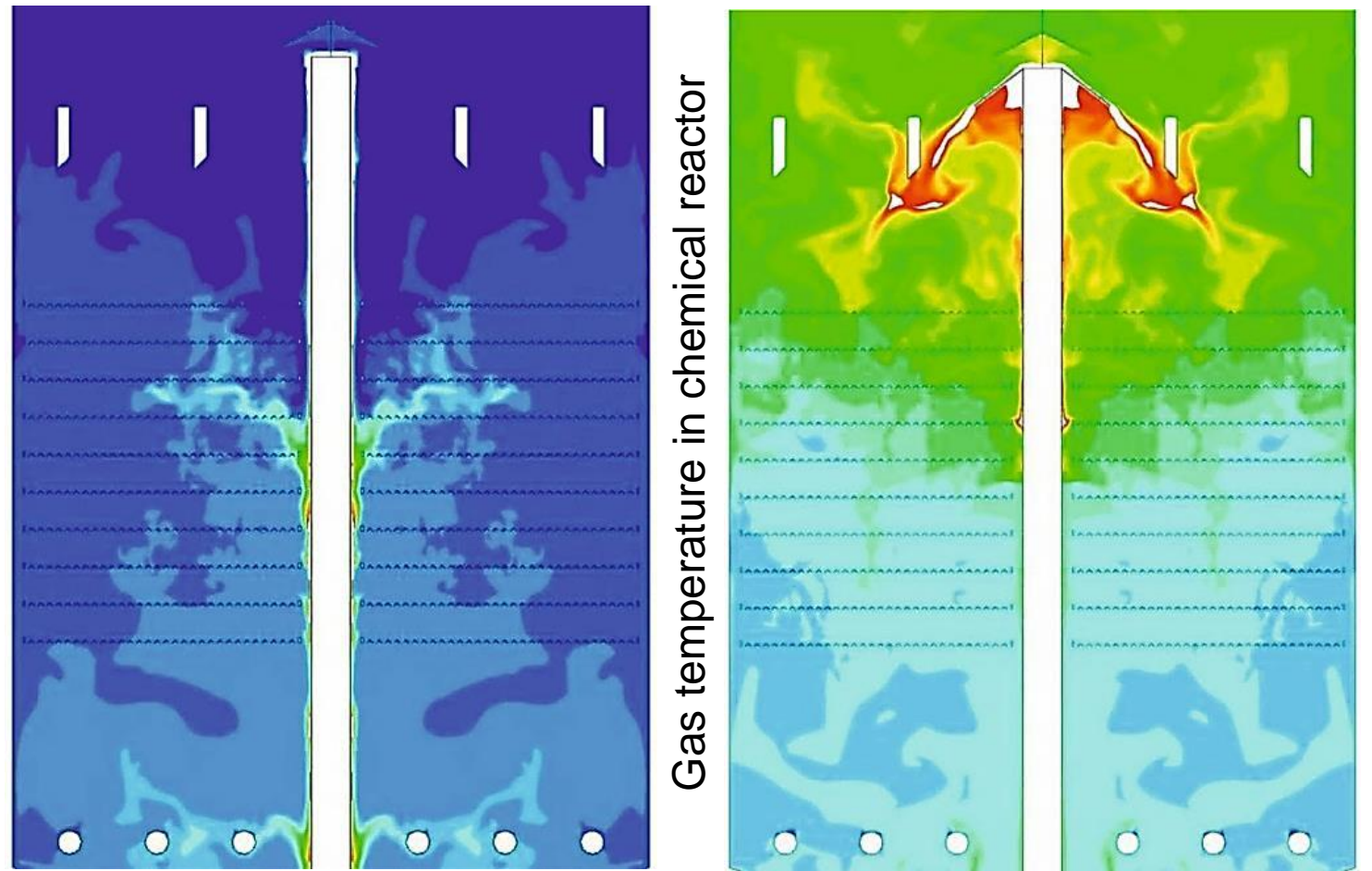
Sergey.Solovyov@kpfu.ru

Research Interests

- Dynamics of Multiphase Flow
- Computational Fluid Dynamics
- Modern CFD soft
- Biphasic flow in porous media
- Chemical reactor modernization

Taught Disciplines

- Gas Dynamics
- Multicore Computing





Kamalutdinov Airat

Candidate of Phys. and Math. Sciences
Assistant

AMKamalutdinov@kpfu.ru

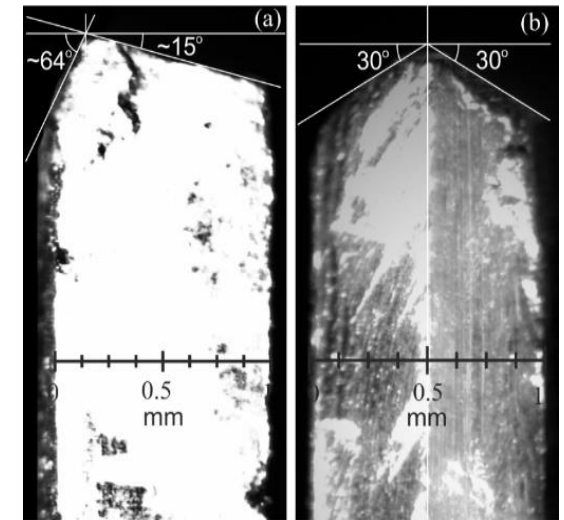
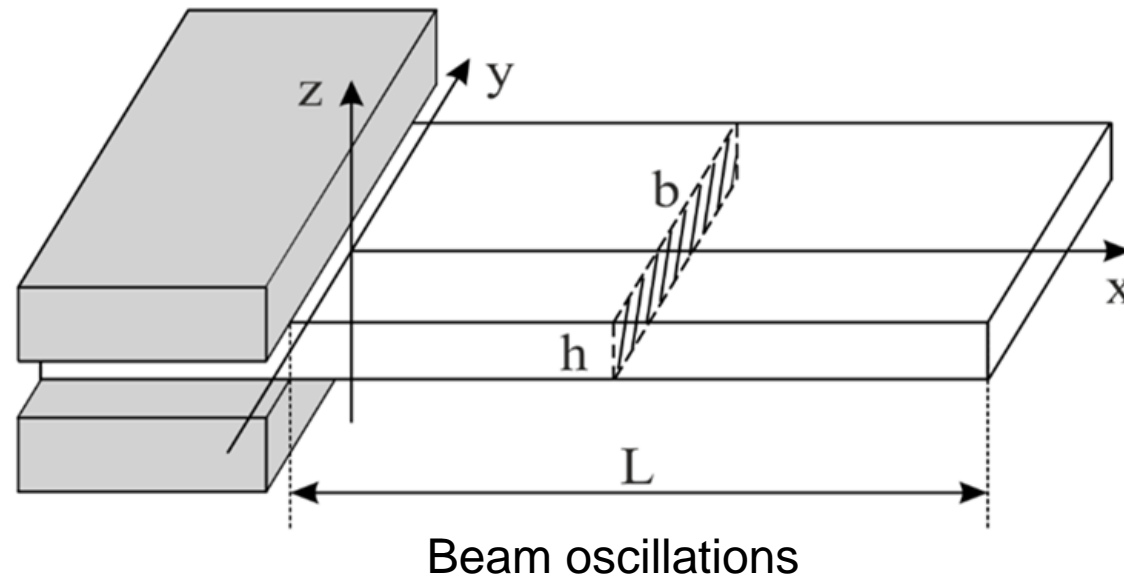
Research Interests

- Computational Fluid Dynamics (CFD)
- Fluid–Structure Interaction (FSI)
- theoretical and experimental methods
- mechanical vibrations

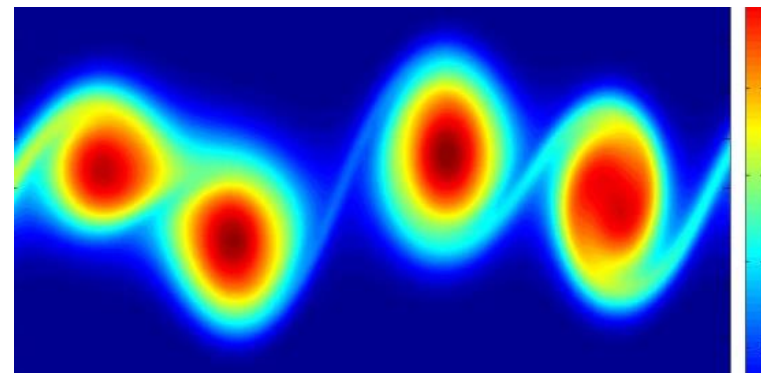
Taught Disciplines

- physical and mechanical practice
- theoretical mechanics

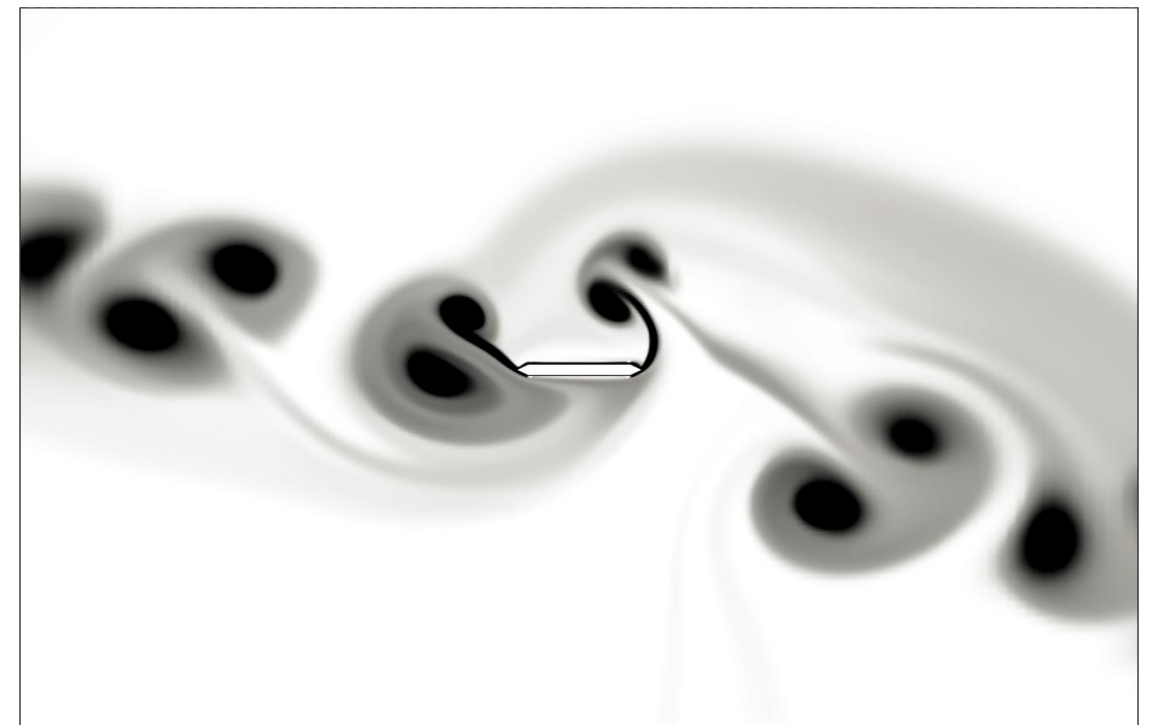
Research illustrations



Shape of the beam's cross-section



Kelvin–Helmholtz instability

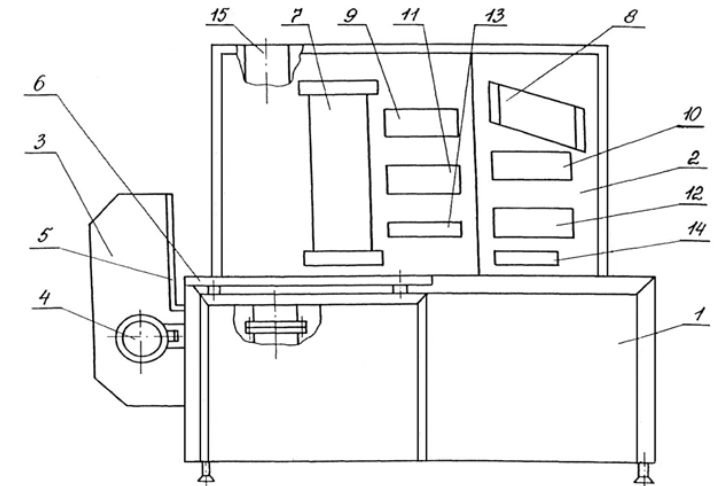
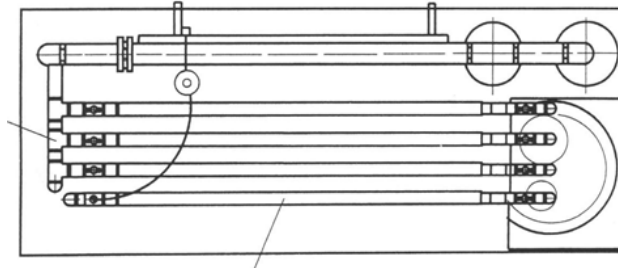
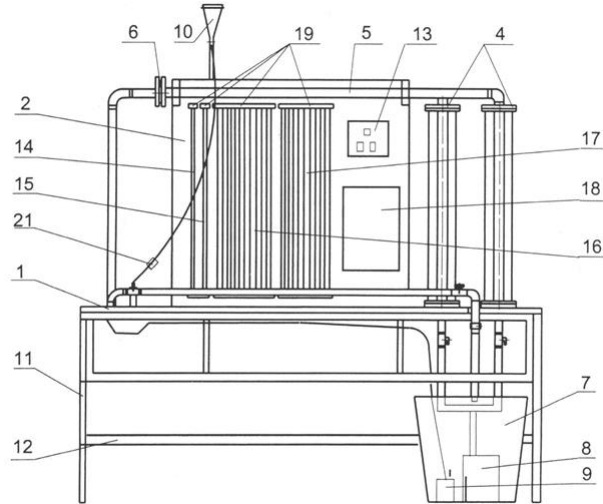


2D CFD analysis plate oscillation

Examples of master's thesis (2018/2019 year)

- ✓ Construction of downscaling technique for saturation field (multiscale simulation).
- ✓ Problems of wave dynamics of two-phase media.
- ✓ Saturated/unsaturated flow in fractured porous medium.
- ✓ Periodic motion of a sphere in a viscous fluid.
- ✓ Multistage hydraulic fracturing of oil reservoir. Simulation of fluid flow.
- ✓ Gliding a curved plate over the free surface of the liquid.
- ✓ Investigation of the flow around the periodic packing of cylinders by the Stokes flow.
- ✓ Mathematical modeling of the kinetics of a chemical reaction in a pseudo fluidized bed reactor.
- ✓ Determination of hydrodynamic forces acting on plate-dampers of SPAR-platforms in the conditions of a standing wave.
- ✓ Development of flat and three-dimensional numerical hydrodynamic models of wind generators.
- ✓ The study of the influence of the relative thickness of the plate on the aerodynamic forces acting on the plate.

Physical and mechanical practice. Laboratory works



HYDRAULICS

- ✓ 1. Head loss along the length in a round pipe
- ✓ 2. Head loss on a sudden expansion
- ✓ 3. Bernoulli equation diagram
- ✓ 4. Modes of flow

HYDRAULICS OF OPEN CHANNELS

- ✓ 1. Thin-wall spillway
- ✓ 2. Spillway with wide threshold
- ✓ 3. Spillway with practical profile
- ✓ 4. Hydraulic jump
- ✓ 5. The coefficient of roughness determination

AERODYNAMICS

- ✓ 1. Head loss along the a round pipe
- ✓ 2. Head loss along the rectangular channel
- ✓ 3. Initial and stabilized region
- ✓ 4. Flow around circular cylinder
- ✓ 5. Flow around wing profile
- ✓ 6. Flows in diffusers

Employer participation in the learning process

Reading special courses
by specialists of
employing organizations



Practicing
on the basis of employing
organizations



Performing of theses
on the basis of employing
organizations



Some specialized organizations in
which our graduates work:

**Fraunhofer IWES (Wind energy and
energy system technology),
Fujitsu,
REDE Consulting,
Rock Flow Dynamic LLC,
Schlumberger,
TGT Oilfield Services;
ООО «Камэнергостройпром»,
ЗАО НИЦ «Инкомсистем»,
ОАО «ТАНЕКО»,
ООО "Трак-Центр Казань",
ООО "БАРС Групп",
ООО «DeltaOil Project»,
ГК «Mirrico»,
ООО «BioLabMed»,
ГК «Современные технологии»,
ICL-КПО ВС; АН РТ, ИПИ РАН, КазНЦ
РАН, РФЯЦ-ВНИИЭФ, КФУ, КГТУ
(КХТИ), КГТУ (КАИ), КГАСУ, ИЭУП,
Ministry of Ecology and Natural
Resources of the Republic of
Tatarstan**



THANKS FOR ATTENTION!

Contact us

Fluid Mechanics Department, Institute of Mathematics and Mechanics, KFU

Phone: Head: +7 (843) 233-77-31

Secretary: +7 (843) 231-52-30

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