

THE NUMERICAL SIMULATION OF DYNAMICS PROBLEMS IN HETEROGENEOUS MEDIA

Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**

Mode of study: **full-time**

Duration: **4 years**

Availability of free education: **yes**

Price: **375 000 RUB**

Programme webpage at the university website:

<https://eng.mipt.ru/programs/the-numerical-simulation-of-dynamics-problems-in-heterogeneous-media/>

Programme curator: **Denis Ustyuzhaninov**

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Entry requirements:

- Master's degree / equivalent in a related field
- B2 level of English
- Good track record of publications related to the topic of the intended research
- Strong research proposal 1,500 - 3,500 words

Research supervisor:

[Vasily Golubev](#)

PhD

Supervisor's research interests:

My research work is connected with the development of novel numerical methods for simulation of dynamic processes in complex media. Many phenomena and technological processes are described by hyperbolic systems of equations: the earthquake initiation, the seismic survey of oil and gas deposits, the non-destructive testing of composite materials, etc. In our research group, we are concentrated on the extension of the grid-characteristic method for more complicated medium models. Acoustic, anisotropic elastic, fluid-saturated porous and nonlinear continuum approaches and approximations are investigated. The internal research software is developed on C++ language supporting OpenMP, MPI and GPGPU systems. We are seeking motivated young students interested to expand their scientific knowledge in the simulation area.

Research highlights:

- Participation in real-life research projects supported by RFBR, RSF and other scientific foundations.
- Presentation of obtained scientific results at major international conferences: EAGE, SEG, etc.
- Collaboration with specialists from oil and gas companies.
- Chance to achieve a good experience in a team of talented young people.

Supervisor's specific requirements:

- Strong background in numerical methods (finitedifference schemes, finite-volume methods, PDEs).
- Good knowledge of the physics of deformable solid media (acoustic, linear elasticity, visco-plasticity).
- Experience in programming: C++, Python, MPI and OpenMP technologies.
- Self-sufficiency, ability to deal with scientific papers.

Main publications:

- Golubev, V.I., Shevchenko, A.V. & Petrov, I.B. Simulation of Seismic Wave Propagation in a Multicomponent Oil Deposit Model. International Journal of Applied Mechanics. <https://doi.org/10.1142/S1758825120500842> (2020)
- Petrov, I.B., Golubev, V.I. & Shevchenko, A.V. Problem of Acoustic Diagnostics of a Damaged Zone. Dokl. Math. 101, 250–253 (2020).
- Golubev, V.I., Shevchenko, A.V., Petrov, I.B. Taking into Account Fluid Saturation of Bottom Sediments in Marine Seismic Survey (2019) Doklady Mathematics, 100 (2), pp. 488-490.
- Golubev, V.I., Voinov, O.Y., Petrov, I.B. Seismic Imaging of Fractured Elastic Media on the Basis of the Grid-Characteristic Method (2018) Computational Mathematics and Mathematical Physics, 58 (8), pp. 1309-1315.
- Beklemysheva, K.A., Vasyukov, A.V., Golubev, V.I., Zhuravlev, Y.I. On the Estimation of Seismic Resistance of Modern Composite Oil Pipeline Elements (2018) Doklady Mathematics, 97 (2), pp. 184-187.

Specializations within this programme