

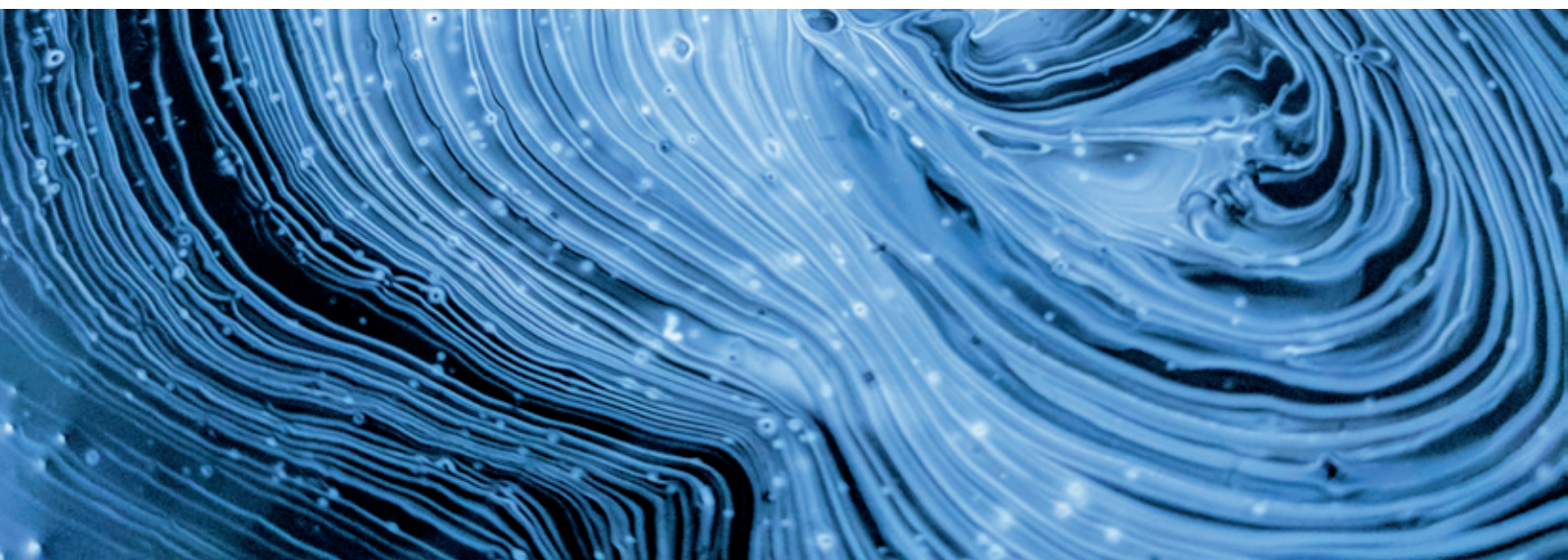
SCIENTIFIC RESEARCH AND DEVELOPMENT



120



POLYTECH
Peter the Great
St. Petersburg Polytechnic
University



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Corresponding Member of the Russian Academy of Sciences, Vice-rector for scientific work of SPbPU,

VITALY SERGEEV

The 21st century is extremely demanding to the quality of technical universities. The conceptual basis for the development of educational institutions is multilevel integration in the scheme “education - science - production”, transition to technosphere complexes, combination of advanced technologies in education, research and production.

Peter the Great St. Petersburg Polytechnic University has a prominent role in the scientific and educational community of the country and the world, seeking to integrate science and research activity into the educational process.

Science is not a thing in itself, it cannot develop in isolation. The future of the country depends on the development of science and technology. That is why Polytechnic University places such an emphasis on scientific activities.

We invite leading scientists, authorities and business representatives from different countries to show university capacities, and most importantly, to create a community of like-minded people determining the future of science.

In our work, we rely on a comprehensive approach to the development of scientific activity at SPbPU. On the one hand, it is necessary to increase involvement of active, motivated young specialists in scientific activities. On the other hand, it is important to support academics and research groups that have been working for the benefit of the university for many decades.

The world is surging forward and our main task is to be at the forefront of the scientific thought. State and industry require viable developments and technologies capable of meeting market demands. And we focus precisely on this kind of science at Polytechnic University.

HISTORY OF UNIVERSITY

NOBEL LAUREATES

Semenov Nikolay

Nikolai worked as a visiting professor at the Leningrad Polytechnic Institute. He introduced physical chemistry into the educational program.

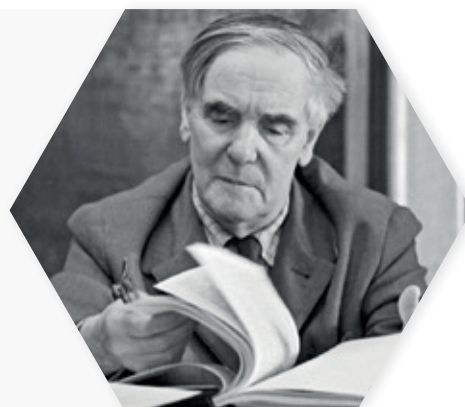
In 1956, he was awarded the Nobel Prize in Chemistry «for the research in the field of the mechanism of chemical reactions.»



Kapitsa Peter

Peter studied at the Electromechanical Faculty of the St. Petersburg Polytechnic Institute.

In 1978, he was awarded the Nobel Prize in Physics “for fundamental inventions and discoveries in the field of low temperature physics”.



Alferov Zhores

Zhores was the supervisor of the Institute of Physics, Nanotechnology and Telecommunications and professor at the Department of Experimental Physics of the Polytech.

In 2000 he was awarded the Nobel Prize in Physics «for developing semiconductor heterostructures used in high-speed- and opto-electronics».



NATIONAL PROJECTS



State electrification plan of the RSFSR

In 1920, the Polytechnic Institute started a group to develop a project for the electrification of the Northern region on the instructions of the State Commission for electrification of Russia. The group consisted of five polytechnics: A.V. Wulf-Chairman, A. A. Voronov, A. A. Gorev, T. F. Makariev, M. A. Shatel and the famous hydrologist V. G. Glushkov.



Atomic project of the USSR

Polytech became the cradle of the Soviet nuclear project. In 1940 I. Kurchatov, L. I. Rusinov, G. N. Flerov and Yu. b. Khariton appealed to the Presidium of the USSR a letter «About the energy use of uranium in a chain reaction». An uranium Commission was established in September. Its decisions formed the basis of the program for the first Soviet nuclear project.



USSR space program

The main event of 1961 for polytechnics was the flight of the world's first cosmonaut Yuri Gagarin. Employees of the Polytechnic University took part in the preparation of the launch. In SPbPU was organized an Experimental design Bureau, where was created equipment for processing orbital data of artificial earth satellites and developed control systems.

POLYTECH TODAY

19

specialties of
secondary vocational
education

8 500

international
students

89

postgraduate
programs

500

doctors of science

167

master's
programs

290

partner
universities



90+
international
programs

58
undergraduate
programs

32 000
students



1200
candidates
of science

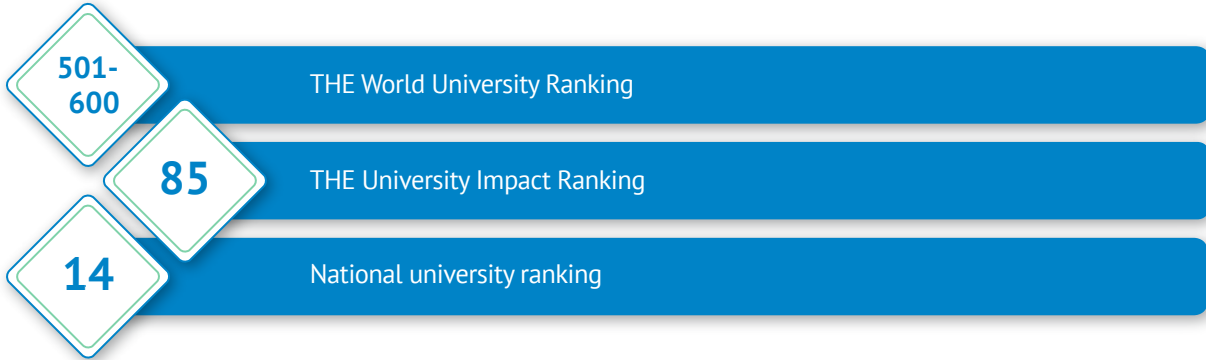
220
international
faculty

2 000
instructors

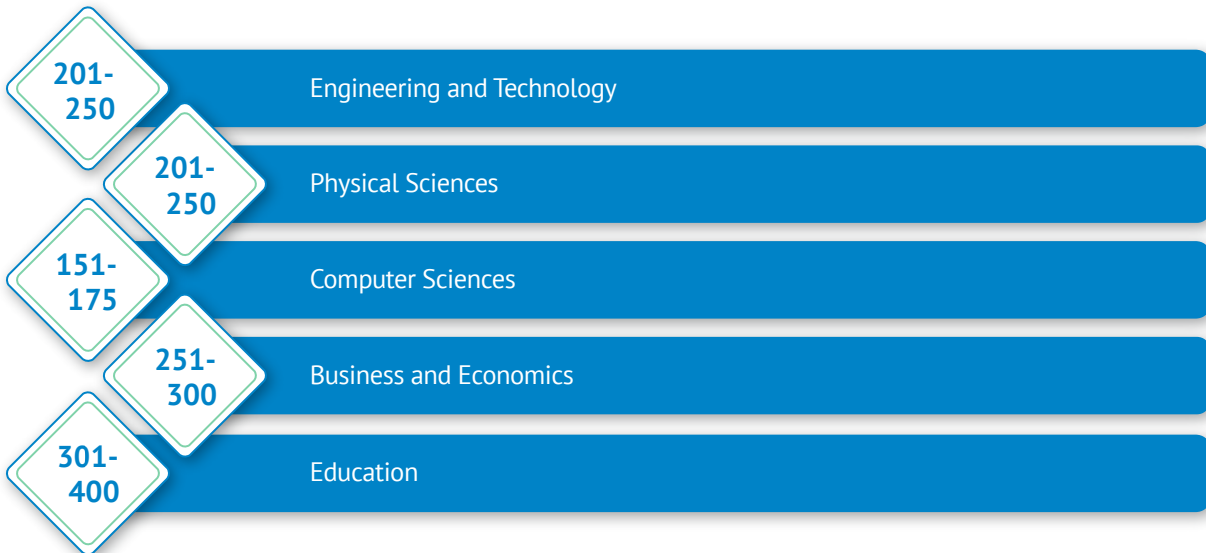
8
specialists
programs



POLYTECH IN INTERNATIONAL RANKINGS



THE WUR World University Ranking by Subject:



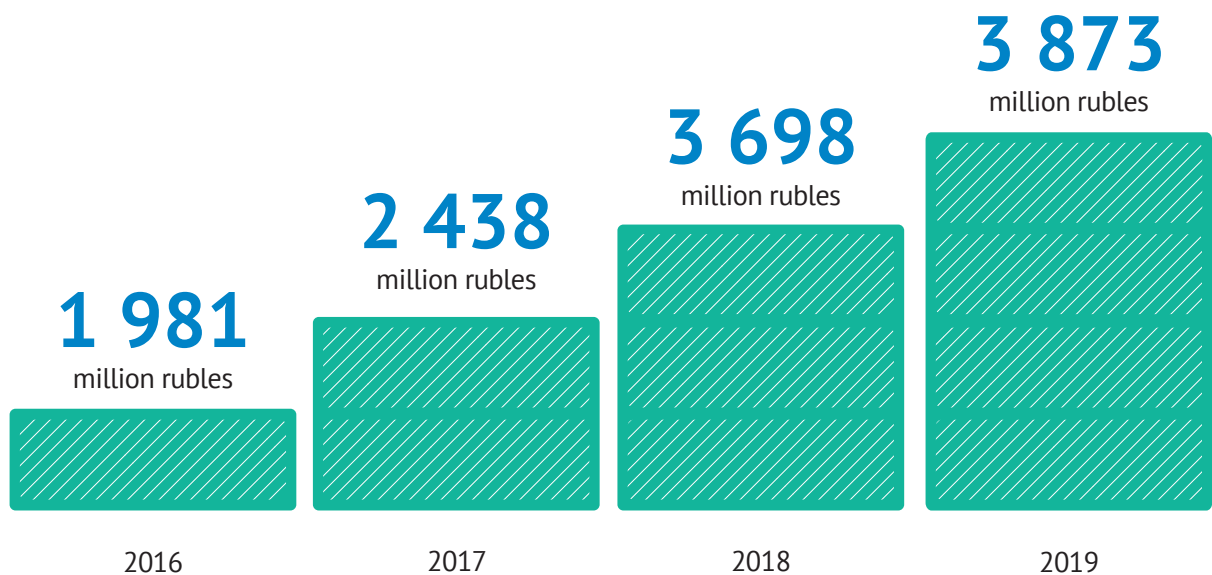
QS World University Ranking by Subject



SCIENCE IN NUMBERS



RESEARCH AND DEVELOPMENT WORK



TRAINING

POSTGRADUATE STUDIES

St. Petersburg Polytechnic University of Peter the Great since 2014 has been training scientific and pedagogical personnel in 84 specializations within 25 graduate programs. Russian Federation citizens with higher education confirmed by master's or specialists diploma are accepted for the program.

Intramural and extramural (including distance learning) postgraduate academic programmes are available. Full-time nonresident postgraduate students may apply for on campus hostel accommodation (without family members). First place accommodation is provided to budget graduate students.

2 entrance exams:

- Major related subject
- Foreign language.

Admission:

- 20.06.2019 - 10.09.2019 (intramural)
- 20.06.2019 - 18.09.2019 (distance learning)



Postgraduate Students Coordination Department
St.Petersburg, Polytechnicheskaya, 29,
I academic bld., r. 355
asp@spbstu.ru
+7 (812) 552-64-17

DOCTORAL STUDIES

Specialists with the degree of candidate of science and scientific achievements in the relevant field of knowledge, competent in fundamental, exploratory and applied research ;working in organizations engaged in educational or scientific activities are accepted for doctoral studies at SPbPU. Pedagogical and scientific work experience of applicants should be at least 5 years, the length of work experience in the directing organization- at least 1 year.

Doctoral studies admission to scientific specialties of functioning dissertation councils is carried out in accordance with the themes of research, development

and technological work, contracts for their implementation or contracts for the provision of work grants. Admission of SPbPU employees to doctoral studies is carried out on a budgetary basis. The cost of training in doctoral studies for employees of third-party organizations is approved annually by the decision of the Academic Council of the university. The length of doctoral students training is not more than three years.

Admission:

- from March 1st to April 1st;
- from September 1st to October 1st.;



Department of Dissertation Councils and Doctoral Studies

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SPBPU DISSERTATION COUNCILS

According to the Order of the Government of the Russian Federation of from August 27, 2018 No. 1766-r, Peter the Great St. Petersburg Polytechnic University has the right to award academic degrees of candidates and doctors of sciences independently.

At the moment there are 21 dissertation councils (including 4 combined ones) in 48 specialties, technical, physical and mathematical, chemical and economic fields of science. Detailed information on dissertation councils is presented on the SPbPU website www.spbstu.ru.



List of specialties

- 01/01/04 - Physical Electronics
- 04/01/10 - Physics of semiconductors
- 12/05/04 - Radio engineering, including television systems and devices
- 05.16.08 - Nanotechnology and nanomaterials
- 05.27.06 - Technology and equipment for the production of semiconductors, materials and electronic devices
- 05.16.01 - Metallurgy and heat treatment of metals and alloys
- 5.16.5 - Metal forming
- 5.16.6 - Powder metallurgy and composite materials
- 5.14.3 - Nuclear power plants, including design, operation and decommissioning
- 5.14.4 - Industrial heat power engineering
- 05/14/14 - Thermal power plants, their energy systems and units
- 04/01/14 - Thermophysics and theoretical heat engineering
- 04/05/12 - Turbomachines and combined turbine units
- 04/05/02 - Heat engines
- 04/05/06 - Vacuum, compressor technology and pneumatic systems
- 04/05/13 - Hydraulic machines and hydropneumatic units
- 11/05/01 - Instruments and methods of measurement (by type of measurement)
- 11/05/16 - Information-measuring and control systems
- 05.13.18 - Mathematical modeling, numerical methods and program complexes
- 09/05/01 - Electromechanics and electrical apparatus
- 05.14.02 - Power plants and electric power systems
- 05/14/12 - High voltage technique
- 02/05/02 - Engineering, drive systems and machine parts
- 02/05/05 - Robots, mechatronics and robotic systems
- 02/05/18 - Theory of mechanisms and machines
- 02/01/06 - Dynamics, strength of machines, instruments and equipment
- 05.13.18 - Mathematical modeling, numerical methods and program complexes
- 04/01/13 - Electrophysics, electrophysical installations
- 09/05/02 - Electrical materials and products
- 09/05/05 - Theoretical Electrical Engineering
- 05/14/08 - Power plants based on renewable energy
- 05.23.16 - Hydraulics and engineering hydrology
- 05.13.01 - System analysis, management and information processing (by industry)
- 05.13.05 - Elements and devices of computer technology and control systems
- 05.13.11 - Mathematical and software of computers, complexes and computer networks
- 09/05/03 - Electrical complexes and systems
- 09/05/10 - Electrotechnology
- 01/03/02 - Biophysics
- 04/01/02 - Theoretical Physics
- 04/01/07 - Condensed Matter Physics
- 04/01/16 - Physics of the atomic nucleus and elementary particles
- 5.2.8 - Engineering Technology
- 5.2.9 - Technologies and machines for pressure treatment
- 05.16.09 - materials science (by industry)
- 05.13.19 - Methods and systems of information protection, information security
- 05.26.01 - Labor protection (by industry)
- 25.00.36 - Geoecology
- 08.00.05 - Economics and National Economy Management
- 08.00.13 - Mathematical and instrumental methods of economics
- 5.23.2 - Foundations and foundations, underground structures
- 05.23.07 - Hydrotechnical construction

SCIENTIFIC RESEARCH AREAS



Rudskoy A.I.,
Academician of Russian Academy of Sciences,
Doctor of Science

New materials and technologies

Research in the field of nanotechnology in metallurgy, including the production of nanosized powders, nanostructured materials and products from them, as well as products and blanks from nanostructured materials by plastic deformation and thermomechanical processing. The main areas of scientific activity are the development of theoretical foundations and the creation of highly efficient technologies for producing nanostructured materials with high operational and special physicochemical properties. Work is underway to create a package of computer programs that implement quantitative mathematical models of structure formation processes in steels occurring during hot rolling and accelerated cooling.



Fedorov M.P.,
Academician of Russian Academy of Sciences
Doctor of Science

Energy Saving Technologies

Developments in the field of hydropower and environmental protection. Scientific research in the field of interaction and the study of functional relationships between technical object and natural environment, correcting the exchange of energy, substances and information, has allowed to form a new direction in the justification and design of energy objects - targeted formation of a natural-technical system. As a result of a multivariate analysis of the relationship between the quality indicators of the geosystem and the parameters of the production activity of the energy facility, simulation models of their interaction were created, which made it possible to assess environmental safety of using water resources.





Borovkov A.I.,
candidate of technical sciences

Computer engineering

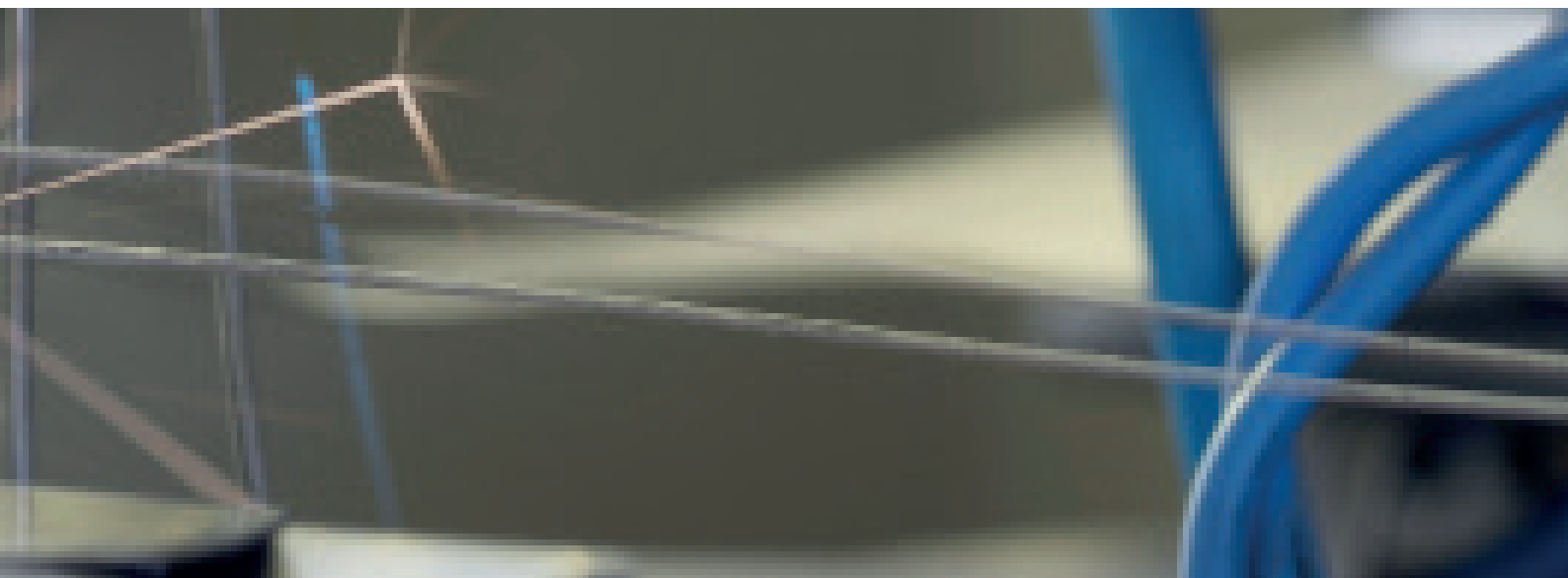
Multi- and transdisciplinary, cross-industry computer engineering is leading in the computer design market. It is based on modern approaches, theories and methods of mechanics of a deformable solid, mechanics of materials, composite structures and constructions, dynamics and strength of machines, methods and algorithms of computational mechanics, computational aero- and gas-hydrodynamics, heat and mass transfer and electrodynamics, etc. . It includes the entire set of high-tech computer technologies and is the fundamental basis and breakthrough technology for creating within the shortest possible period of time globally competitive and demanding new generation of products in high-tech sectors of the economy, as well as its support at all stages of life cycle.



Krivtsov A.M.,
Corr. RAS, Doctor of Physics and Mathematics

Discrete Mechanics

A mathematical and computer base has been developed for describing physical and mechanical processes in solids based on a discrete material concept. Results in fundamental and applied fields were achieved by mathematical methods and computational algorithms, for example, continuum description of discrete media of complex structure with moment interaction deformation, generalization of the Mie-Grüneisen equation for critical states of matter, analytical approach and a number of exact solutions for describing thermal processes in harmonic crystals, ambiguity of a number of mechanical properties of materials and determined boundaries of applicability of continuum mechanics at the nanoscale scale level.





Berdnikov Y.A., Doctor of Physics and Mathematics

Experimental nuclear physics

Polytechnic scientists participate in two world-class projects: the PHENIX project - an experiment to accelerate heavy ions at the RHIC accelerator (USA). Recent data on proton collisions at the relativistic heavy ion collider, obtained by an international team of physicists with the participation of a group of scientists from the Polytechnic University, unexpectedly showed a significant contribution of gluons to the total spin of the proton. And the ALICE project is an experiment at the Large Hadron Collider studying collisions of heavy ions, in particular, collisions of Pb-Pb nuclei at an energy in the center-of-mass system of 2.76 TeV per nucleon (LHC, CERN, Switzerland). According to the measurements made at ALICE, the temperature and energy density of the nuclear matter arising from this turned out to be sufficient for the creation of a quark-gluon plasma, that is, a state in which quarks and gluons are in a state of deconfinement.



Smirnov E.M., Doctor of Physics and Mathematics

Hydroaerodynamics

The scientific group is focused on creating computer methods for studying fundamental foundations and problems of hydroaerodynamics and heat transfer. The main directions of scientific research are the following:

- Numerical modeling of turbulent flows in areas of complex geometry;
- Development and study of the capabilities of the method of modeling disconnected eddies (MOV, DES) as applied to the modeling of turbulent separated flows. Computational aeroacoustics;
- Experimental study and modeling of flows;
- Experimental and calculated studies of non-stationary gas-dynamic flows;
- Development of software for solving the resource-intensive tasks of gas dynamics on high-performance cluster systems
- Hydrodynamics of blood circulation.



Kolbasnikov N.G., Doctor of Technical Sciences

Studies of materials structure and properties

At the Polytechnic University the following work is underway:

- modeling of physical processes (rolling simulation, welding simulation, heat treatment simulation, crystallization simulation);
- mathematical modeling of the formation processes of the microstructure as a result of various influences;
- development of models to describe dependences of final mechanical properties of the material on the determining parameters of its microstructure;
- development of new steels and technologies for their processing (automotive steels, pipe steels, shipbuilding steels);
- obtaining products with a given level of properties;
- development of technology for producing nanostructured materials.



Zaborovsky V.S., Doctor of Technical Sciences

Telematics and supercomputer technology

Modeling and analysis of processes, development of protection and information resource management technologies. Creation of our own information and telecommunication infrastructure for space purposes, using the latest achievements in the field of data transmission, storage and processing (protocol standardization, resource virtualization, etc.) to be applied in future space experiments, projects and missions.

Technology of secure information interaction and control of planetary robots with the ISS. Development of network-centric technologies for remote control of a group of cyber physical objects from a manned orbital station.



Vlasova O.L., Doctor of Physics and Mathematics

Medical physics

Research in the field of nanobiotechnology at the intersection of two fundamental sciences: physics and biology. The research is aimed at obtaining new fundamental knowledge about the mechanism of photons and high-energy ions impact on biological tissues. The possibilities of using various types of nanostructures to improve the radio and chemotherapy of cancer are being investigated.

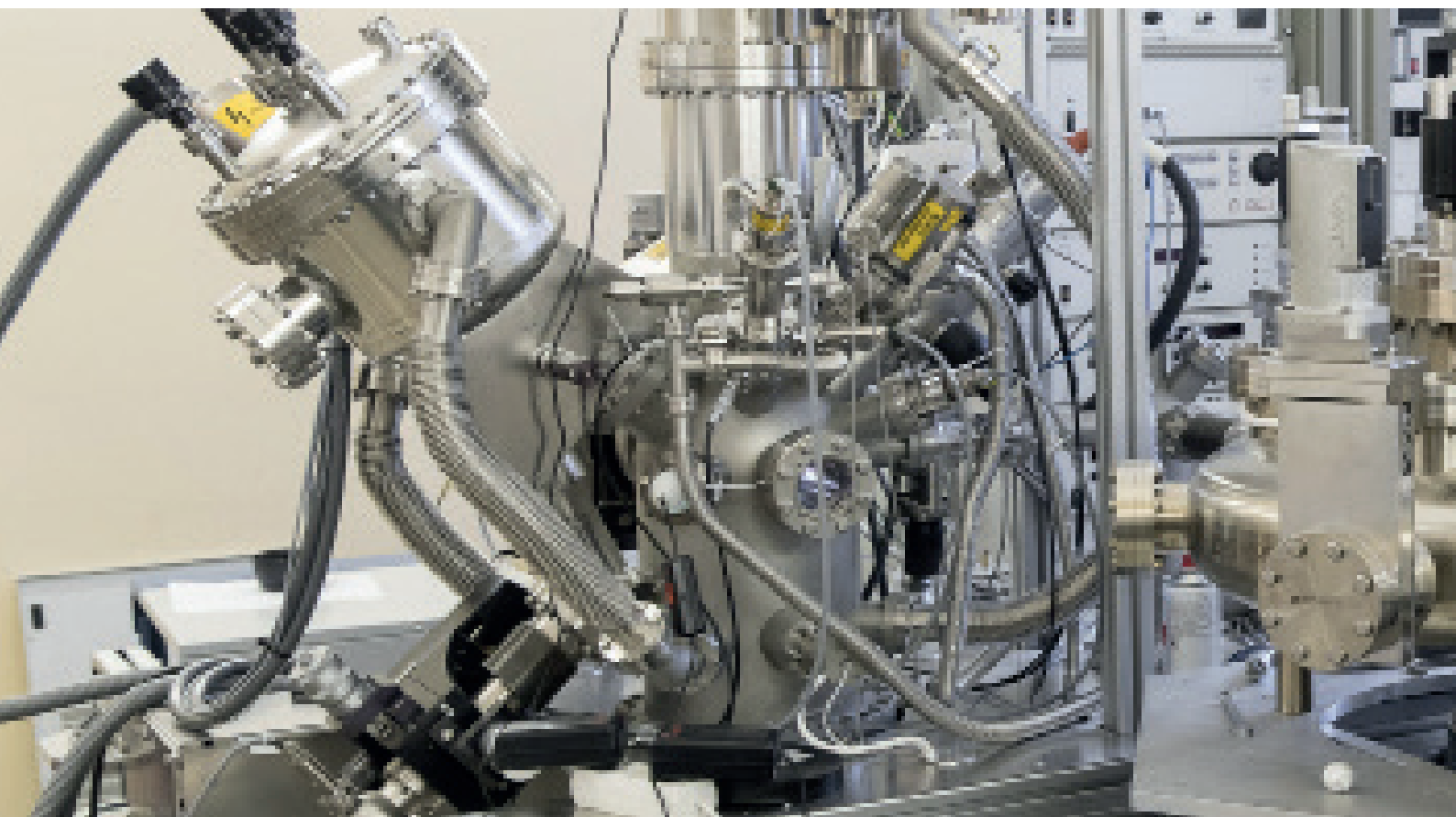
Work is underway to develop metal nanoparticles, that are versatile carriers capable of delivering substances to the site of tumor formation.



Popovich A.A., Doctor of Technical Sciences

Additive technology

For the mass transition from gasoline and diesel engines to electric motors installed on cars and buses, it is necessary to reduce the cost of lithium-ion batteries manufacturing. This can be done by replacing the expensive and scarce cobalt-based cathode material with a cheaper one. We develop scientific and technological foundations for the creation of new types of nanocomposite electrode materials for lithium-ion polymer batteries of increased efficiency using functional coatings. Resulting material has improved operational and functional characteristics.





Elistratov V.V., Doctor of Technical Sciences.

Renewable energy

Creation of new highly efficient modular energy complexes based on renewable energy sources, primarily wind-diesel, power plants (VDES), as well as modernization of existing inefficient diesel power stations using the developed technologies for the formation of energy complex, special equipment, management systems, methods of justification and evaluation of investments and construction technologies, adapted to Russia's northern conditions. Development of a conceptual design of a typical module of an autonomous energy complex based on renewable energy sources and traditional energy sources with a capacity of up to 200 kW.



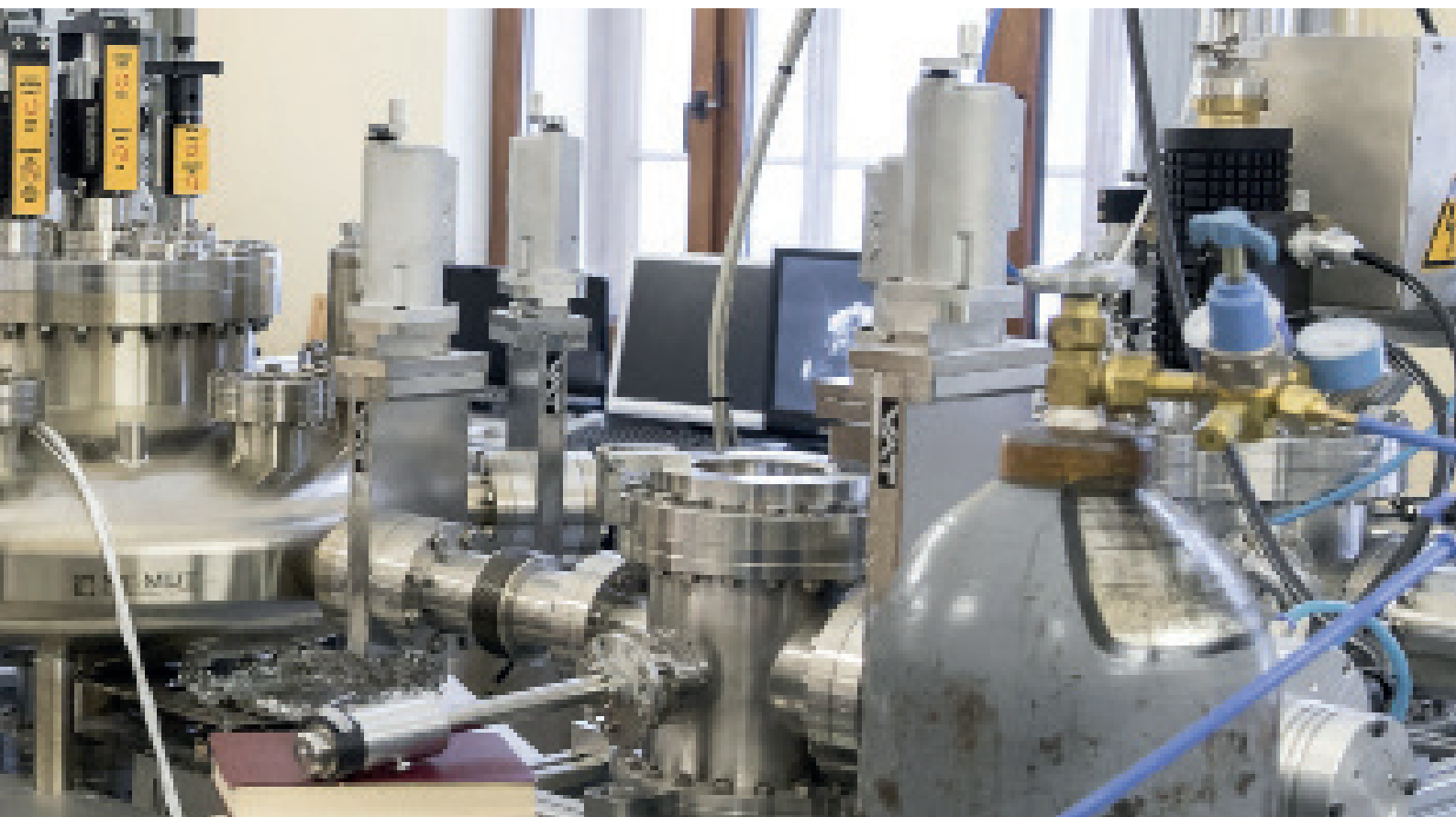
Zegzhda D.P., Doctor of Technical Sciences

Information Security

Providing control and protection of control channels for network equipment through the implementation of gateway technologies for access control and remote control of network devices:

- local and remote management of objects and monitoring of their events;
- access control to network infrastructure facilities;
- integrity control of configurations and software composition of objects.

Due to the introduction of access control to network equipment, it is protected from computer attacks, logging operator actions, and operational signaling of violations.





Kozinets G.L., Doctor of Technical Sciences

Construction of unique structures

Areas of scientific activity:

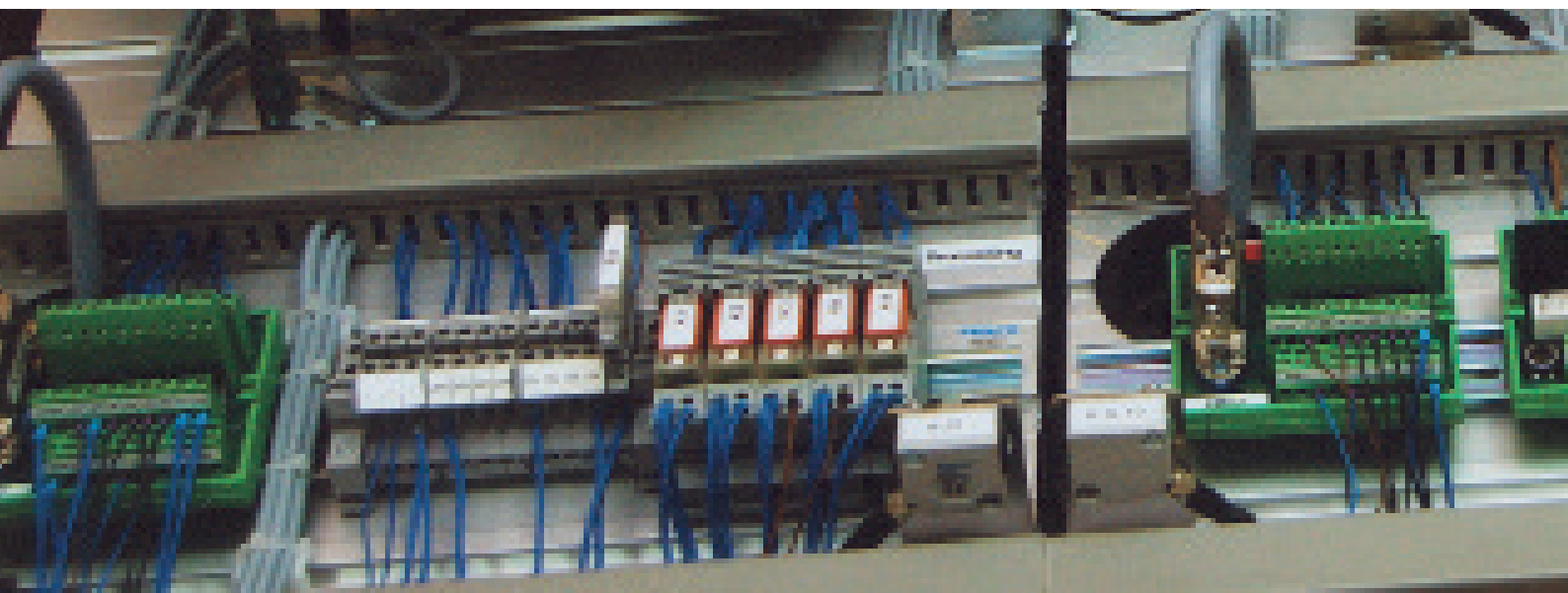
- Justification of strength and reliability of dams, hydropower units of hydroelectric power plants with equipment for static, thermal and dynamic loads. Calculation of floor response spectra at equipment marks. Modeling of structures together with the foundation in the SolidWorks software package (Cosmos / M). Calculations of strength, stability of structures, calculation of resonance, dynamic characteristics.
- Design and calculation of mechanical equipment, pipelines, valves, tunnels.
- Design and calculation of reinforced concrete and metal building structures.
- Calculation of equipment of nuclear power plants for dynamic and thermal loads. Experience in design, modernization, calculation justification of hydropower complexes in general with more than 40 hydroelectric power stations projects done.



Samsonova M.G., Doctor of Biological Sciences

Mathematical and Systems Biology

Any biological object or process is a system of interacting genes, RNA molecules, proteins and metabolites. Mathematical and system biology is looking for an answer to the main question: how do the interactions of these molecules lead to an organized and appropriate behavior of cells, organs and organisms? This field of knowledge brings together the efforts of mathematicians, biologists, physicists and programmers. Methods of mathematical and system biology include obtaining and analyzing high-precision experimental data, mathematical modeling of biological processes and numerical experiments, developing new programs for determining the parameters of mathematical models from experimental data. FlyEx database on the expression of segmentation genes, developed by Polytechnic scientists, is one of the most popular in the global scientific community.





Khodorkovsky M.A., candidate of physical and mathematical sciences



Utkin L.V., Doctor of Technical Sciences

Nanobiotechnology

- SPbPU uses the most modern experimental approaches to study composition and structure of the most complex biological objects, to identify their functions at the cellular and subcellular levels, to determine trace amount of metabolites in human waste products, to study the most complex biochemical processes on molecular level and dynamics of nanobio-machines at single molecular level and etc .:
- High resolution NMR spectroscopy;
- high-resolution chromatography and gas chromatography mass spectrometry;
- optical spectroscopy;
- high resolution (subdiffraction) fluorescence microscopy;
- a unique method for studying nanobiodynamics of biological structures at a single molecular level.

Artificial Intelligence

The main area of research is the development of new models of artificial intelligence and, in particular, machine learning with limited and incomplete information. The focus is on alternative approaches for deep neural networks including composition models, stacking algorithms, deep forest, combinations of neural networks and other models. We work on the problems of diagnosing oncological diseases and choosing the optimal treatment method, detecting abnormal behavior of various processes and other tasks of intellectualization of applied areas. In particular, we develop an intelligent system for the diagnosis of lung cancer using CT images and an intelligent system for analyzing patient survival and treatment choice within the framework of the concept of personalized medicine. These systems are based on completely new machine learning models that can make decisions based on limited information.





Kozlov A.P., Doctor of Biological Sciences

Molecular Virology and Oncology

Main focus of our studies is on molecular genetic features of the parenteral transmission of human immunodeficiency virus ; HIV variants responsible for parenteral transmission. Laboratory results are of great importance for the development of regional HIV vaccine and its testing. An expanded collection of blood samples from patients with acute HIV infection and epidemiologically related patients with chronic HIV infection, supplemented by behavioral information helps to establish the route of infection. The nucleotide sequences of HIV-1 env gene from the entire variety of viral variants found in patients' blood samples from the moment of infection to the development of chronic HIV infection will be deposited at GenBank to ensure access to them for all interested researchers. Molecular modeling data indicating the absence / presence of specific interactions in the human circulatory system.



Kazakov A.A., Doctor of Technical Sciences

Metallurgical Expertise

- Main areas of research:
- Development of metallurgical technologies to improve the quality of steels and alloys;
- through metallurgical examination from smelting to the finished product;
- development of methods for assessing the quality of the structure of steels and alloys using the Thixomet® image analyzer;
- computer simulation of phase formation processes in liquid and hardening steels and alloys;
- physico-chemical forecasting of new foundry dispersion-strengthened alloys and composites;
- development of technology and compositions of alloys for their processing in semi-solid state. We developed methodological foundations for modeling foundry. Currently we are working on the design of foundry technology, ensuring specified operational properties of steel casting based on a model that combines the results of solidification process modeling and modeling of the process of fatigue resistance of a part during its operation.



Filimonov A.V., Doctor of Physical and Mathematical Sciences

Physical electronics

Work is underway to create and research new nanomaterials for the electronics industry, such as:

- self-organized nanostructured materials for electronic technology. Main objects are perovskite-like compounds with non-isovalent substitution with chemically ordered systems and formed polar nano-regions.
- artificial nanocomposite structures based on dielectric porous matrices. We apply technologies of creating large volumes of nanostructured materials with controlled spatial characteristics.



Makarov S.B., Doctor of Technical Sciences

Telecommunications and Nanotechnology

Research is related to the development of systems and devices for mobile communications and monitoring, transmission of digital video images via radio channels, OFDM modems, signal synthesis for digital information transmission systems, cryptography and steganography.

Specialists work in such scientific fields as signal theory, methods and algorithms for receiving digital messages, noise immunity of communication systems, digital telecommunication protected systems, intelligent alarm systems.





Odnoblyudov M.A.,
candidate of physical and mathematical sciences

Optoelectronics and Microelectronics

Development of manufacturing technology for photon integrated circuits for lasers with passive mode locking and photodetectors in the 1300-1550 nm spectral range;
Studying principles of creating a measuring stand for testing photodetectors and lasers with passive mode locking;
Development of programs and methods for testing models, development of technological devices, manufacturing of models and devices, testing of models, sockets, plugs and adapters for them; Development and manufacture of optical modules based on optical keys, splitters and collimator connectors based on volumetric and surface micromechanics technology.



Galerkin Yu.B., Doctor of Technical Sciences

Gas-dynamic design

Research is aimed at clarifying the specifics of work processes. This is necessary to create physical models that underlie methods of primary design, i.e. a set of rules for choosing rational shape and aspect ratio of the flow part. Mathematical models for calculating gas-dynamic characteristics are based on physical models, that creat basis of computer program complexes for optimal design. We apply CFD methods providing more extensive and detailed information than physical experiments. Physical experiments are used to test CFD methods. We carry out continuous and intensive work in the field of gas-dynamic design.





Drobintsev D.F., candidate of technical sciences

Software engineering

- Our research areas are software engineering, computer systems development, computer science, embedded control systems, intelligent information processing systems and automation of various objects and systems.
- Scientific areas include:
 - Development of complex software and hardware systems;
 - Industrial technologies for software design;
 - Computer-aided design of embedded microelectronic systems;
 - Embedded control systems;
 - Intelligent information processing systems;
 - Information Search.

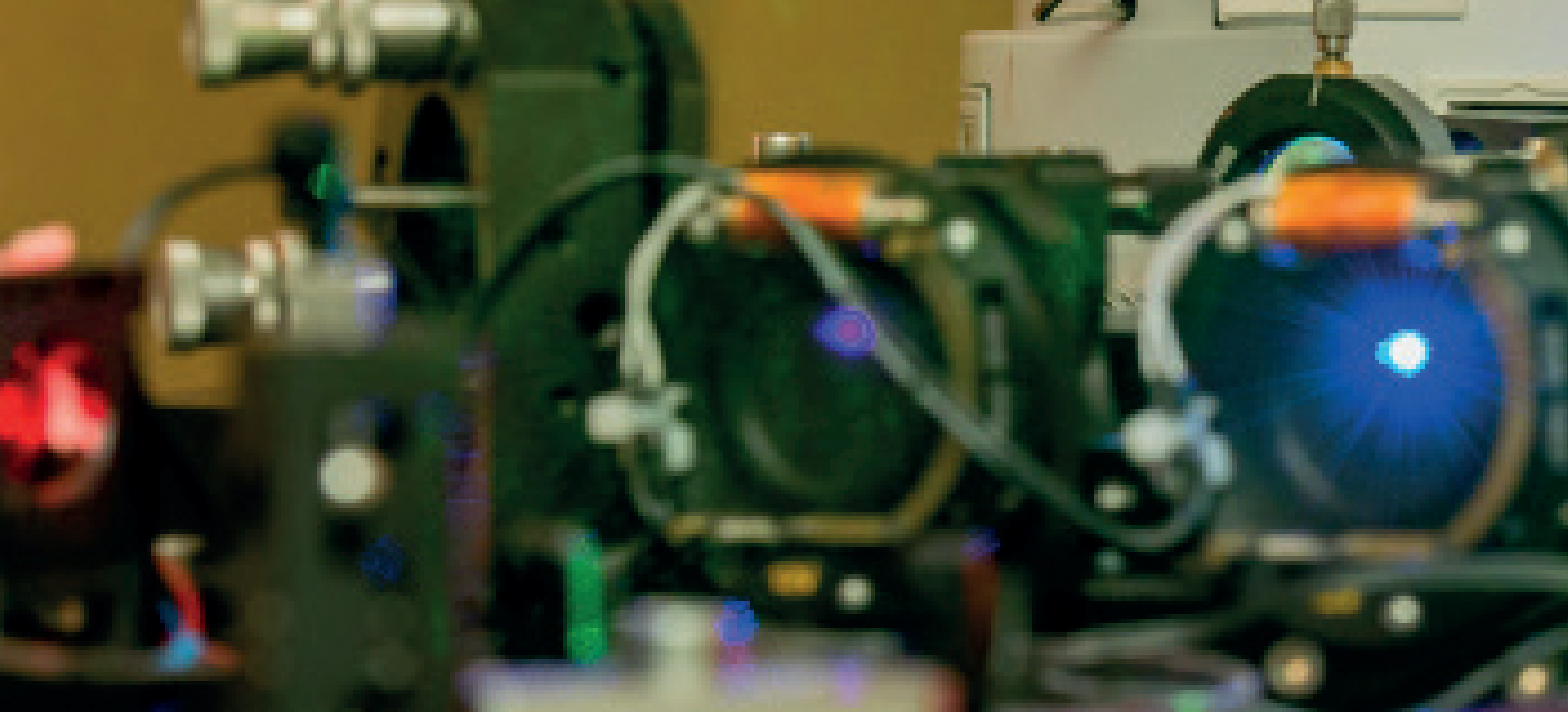


Berkovich A.E.

Ultrasound technology

Development of ultrasonic diagnostic module, which will make it possible to produce high-end diagnostic ultrasound device with Doppler modules and with quasi-3D visualization in real time of vascular fragments and neoplasms. When combined with the HIFU module this device will be able to control guidance and visualize the effects of HIFU on tissue or vessel portions, which will allow the creation of the latest complexes for vein obstruction and ablation of neoplasms of the mammary and thyroid glands. As a result of the project, a high-end ultrasound scanner with 64 receiving channels is prepared for production. It is possible to connect sensors with 128-256 number of elements to the device and apply it for a wide range of ultrasound studies of both tissues and vessels.





Semencha A.V., candidate of chemical sciences

New materials with significant practical properties

Research topics: chalcogenide materials, infrared optics, nonlinear optics, chalcogenide glass-ceramic composite materials. Researchers specialize in the synthesis and application of low-melting chalcogenide glass and glass ceramic composites. Extensive experience in the production of high-purity glasses and technological methods for their processing. Patented method for introducing halogens (Cl, Br, I) into the composition of chalcogenide glass. The most important scientific areas:

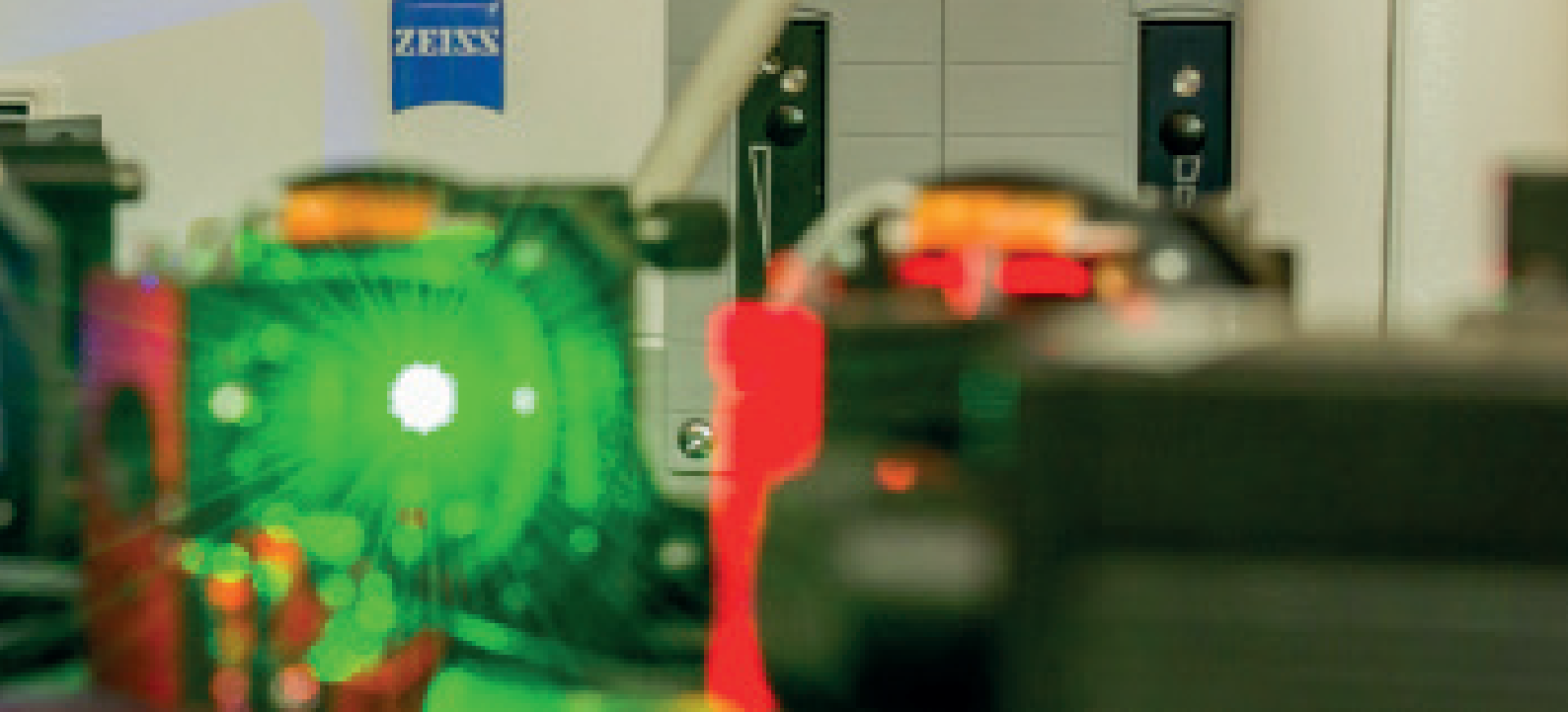
- liquid and solid immersion medium with a high refractive index,
- glass-ceramic composites from chalcogenides;
- Composites with nanoparticles ZnS, ZnSe, Bi, Sb, Bi₂S₃, Sb₂S₃, WS₂, WSe₂ and others.
- Fiber optic materials;
- fusible oxyhalide glass based on PbO;
- High contrast optical phase elements.



Kozhukhov Yu.V., candidate of technical sciences

Compressor technology

Calculation and design of highly efficient flow parts and model stages for centrifugal and axial compressors for oil and gas and other industries; improving methods for solving direct multidisciplinary (aerodynamics - strength - deformations) and non-stationary problems in turbocompressors and energy facilities using a supercomputer; development and improvement of a mathematical model for calculating turbochargers and pneumatic networks based on an array of experimental data. The author of the method for modeling the pressure characteristics of the impellers of centrifugal compressors based on the calculation of inviscid flow. Author of the methodology for setting up and conducting computational experiment for turbocompressors and their elements using methods of computational hydrodynamics, including the use of a supercomputer.



Zabelin N.A., candidate of technical sciences

Energyefficient turboexpanders

Polytechnic University is working on the creation of energy-efficient and environmentally friendly turbo expanders for generating electricity without burning additional fuel. Developed turboexpander generators are based on the use of high-pressure turbines of SPbPU design. New class of turbine stages was chosen as a unit converting internal energy of the working fluid - natural gas into the kinetic energy of its movement and then into mechanical work on the shaft. This class of turbines was developed for devices with strict mass and size restrictions, very large enthalpy drops and extremely low flow rates of the working fluid. About 50 trans- and supersonic nozzles and working gratings, nozzles and profiles were studied experimentally, and about 100 low-flow turbine stages of axial and radial type were blown on dynamic stands.



Parshin S.G., Doctor of Technical Sciences

Laser and welding technology

Areas of scientific activity:

- studies of physical processes under the influence of heat flows on materials
- mathematical modeling of the processes of arc, high-frequency arc, contact and electron beam welding, surfacing and heat treatment,
- welding technological installations for materials processing ,
- technologies of arc and hybrid welding, surfacing and heat treatment,
- development of engineering computer analysis tools for the processes of arc materials processing ,
- structural and technological design of welded structures,
- development of automated equipment for arc, plasma and other related technologies,
- development of measuring and control equipment.



Naumov A.A., candidate of technical sciences

Stir friction welding

Research and creation of new generation light materials with increased strength. Laboratory of Light materials and structures was created at SPbPU to focus on this task .It is equipped with a unique installation of pulsed friction welding with mixing. This is a new welding method in which there is a unique opportunity to weld almost all materials that cannot be welded by previously existing methods. The material is welded in a solid state without melting, which allows us to produce large complex structures with unique strength properties. So, for example, a lightweight boat with improved running characteristics was developed on the basis of SPbPU.

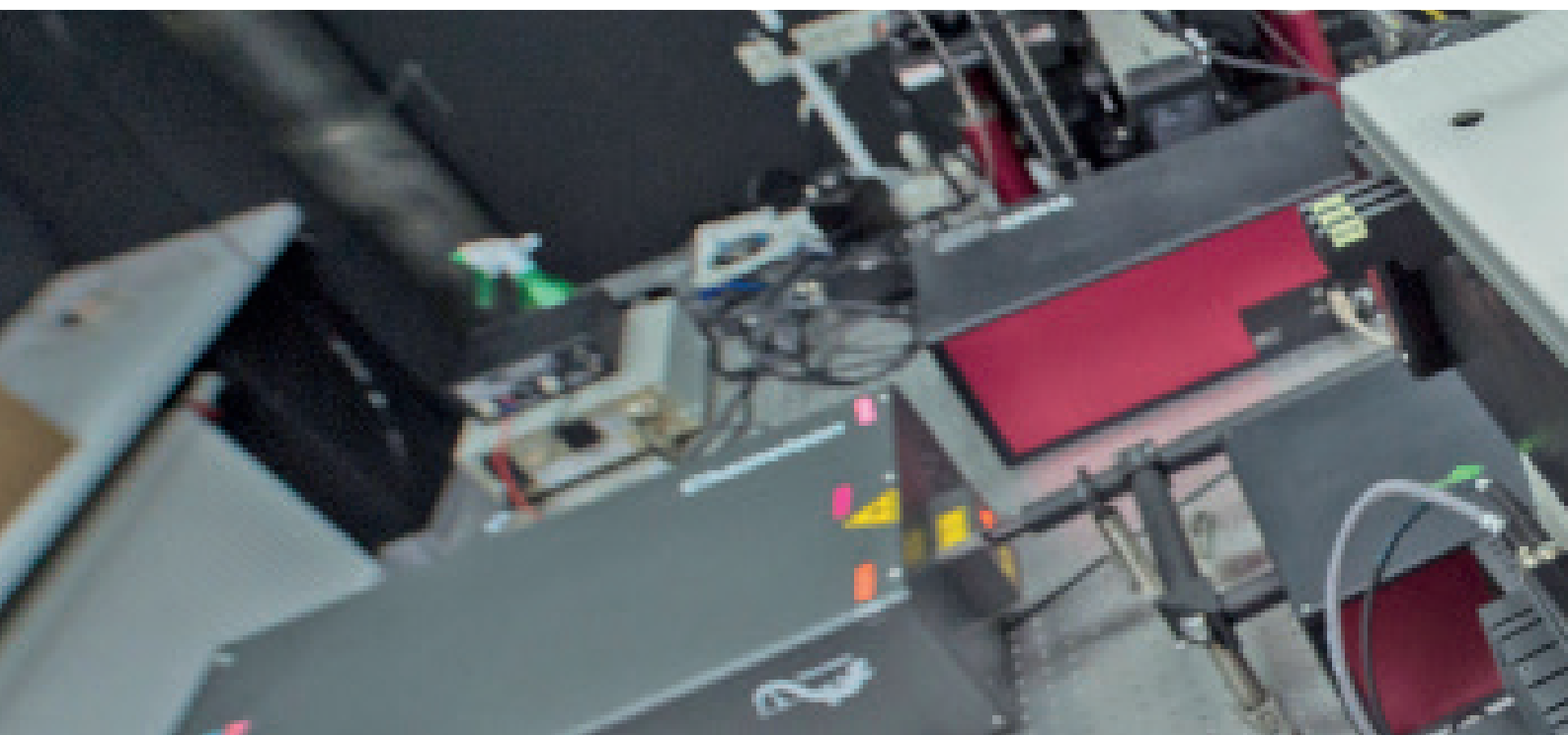


Belyaev A.N., Doctor of Technical Sciences

Autonomous power systems

Transient studies in integrated and autonomous energy systems:

- Development of technology and control system that ensures stable operation of generators at power plants connected to the electric power system and equipped with combined-cycle gas and gas turbine units.
- Improving the efficiency powerful gas piston units (from 1.5 to 18 MW) in combined and autonomous electric power systems with predominant motor and other rapidly changing loads.
- Expertise in the direction of “studying feasibility to select pilot projects for the intellectual network of the North-West OES”.





Zverev S.G., candidate of technical sciences

Development of plasma installation

Development of an effective technological process for the processing of fine particles in an RFI plasmatron jet using the example of purification and spheroidization of powders of electrical periclase MgO and quartz sand SiO₂. Creation of a mathematical model that adequately describes the interaction of the flow of solid particles with a plasma 2 jet to determine the main parameters during the melting of powder raw materials in plasma, assess the quality of the products obtained in this case, and also to select the optimal technological design HF installations for processing particles of various dispersed materials. A comprehensive study of heat transfer processes of particles moving in plasma was carried out. A new correction is proposed for the criterion dependence of heat transfer of spherical bodies in plasma flows.



Lazarev Yu.G., candidate of technical sciences

Highways

Research Areas:

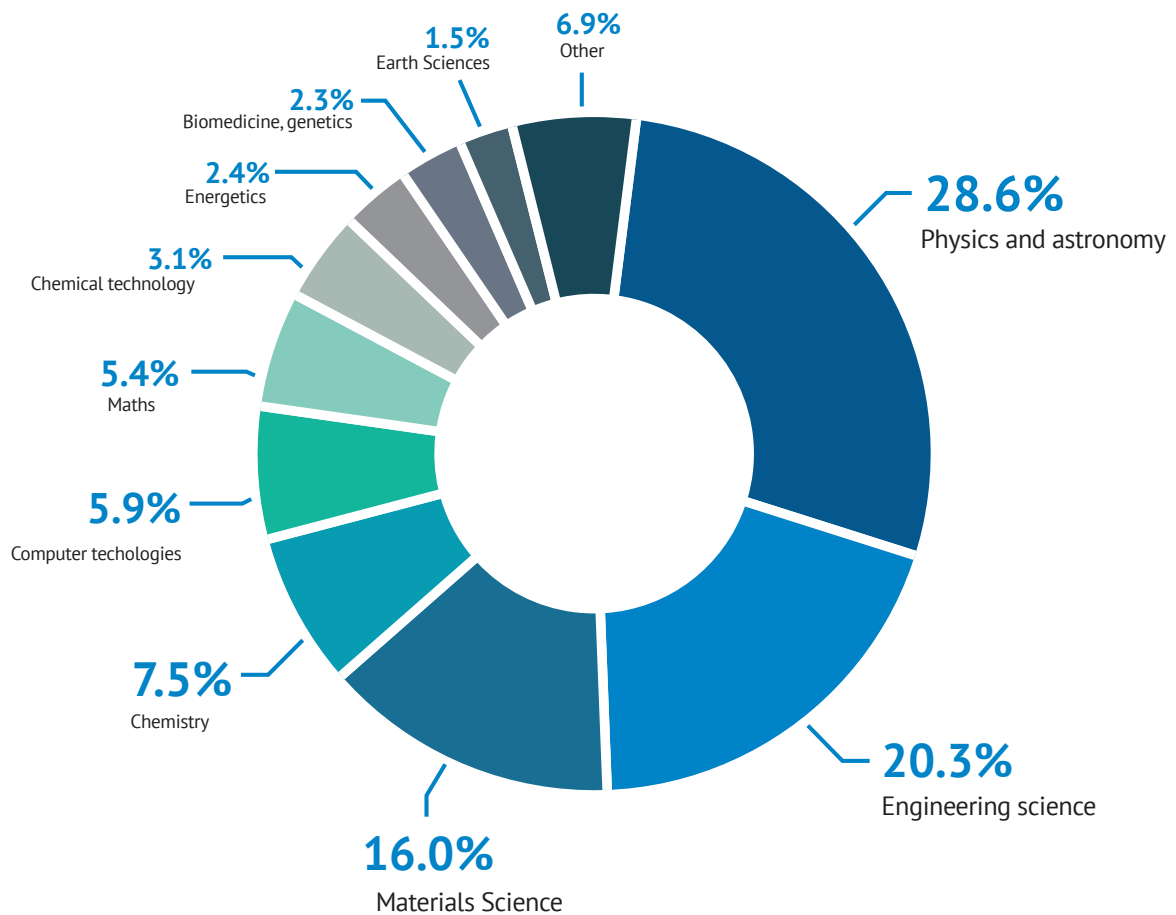
- production of road-building materials, products and structures;
- engineering surveys, development of design, design and survey and design estimates for construction, reconstruction, overhaul, repair and maintenance of roads;
- design, construction, reconstruction, overhaul, repair and maintenance of automobile and city roads and streets, bridges and overpasses, transport structures and other road infrastructure facilities;
- the use of machinery, equipment and technologies for the construction of reconstruction, overhaul, repair and maintenance of roads, industrial facilities, transportation facilities and other road infrastructure.



PUBLICATION ACTIVITY



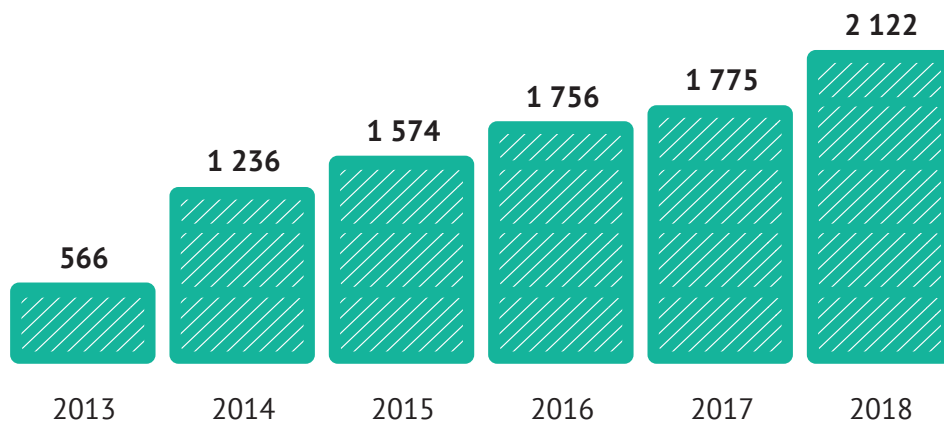
Topics of scientific publications



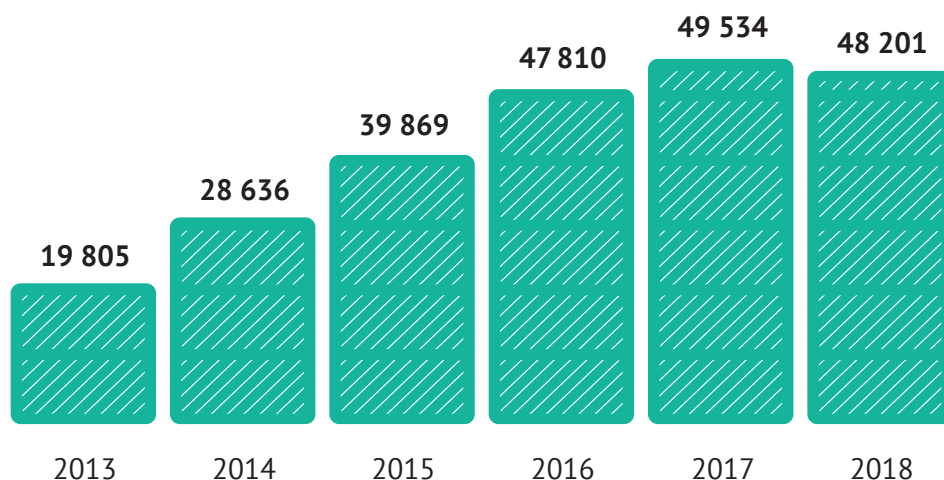
The Scopus scientometric database, which includes more than 21,000 journals, allows us to evaluate what is happening in the scientific world in almost any country, in any scientific field. Recently, we have been observing a trend towards multidisciplinary research, that is, more and more

research brings together scientists from different countries. The second trend is interdisciplinary from the point of view of science, that is, modern, breakthrough research in most cases takes place either at the intersection of several areas, either using the methods of one science in another.

Number of publications in Scopus*



The number of citations of publications in Scopus*



* As of December 31, 2018

TOP 10 authors of SPbPU by the number of publications

1	Fedin Oleg Lvovich	449	Department of Experimental Nuclear Physics
2	Kim Victor Timofeevich	331	Department of Experimental Nuclear Physics
3	Vatin Nikolai Ivanovich	144	Department of Unique Buildings and constructions
4	Berdnikov Yaroslav Aleksandrovich	113	Department of Experimental Nuclear Physics
5	Davydov Vadim Vadimovich	96	High School of Applied Physics and Space Technologies
6	Berdnikov Aleksandr Yaroslavovich	91	Department of Experimental Nuclear Physics
7	Lipovskiy Andrey Aleksandrovich	90	Department of Physics and Technology of Nanostructures
8	Nazarov Sergey Aleksandrovich	76	R&D Center for Science and Computer Technologies
9	Rudskoy Andey Ivanovich	73	Department of Technology and Material Research
10	Kotov Dmitriy Olegovich	70	Department of Experimental Nuclear Physics

TOP 10 authors of SPbPU by the number of citations

1	Fedin Oleg Lvovich	13622	Department of Experimental Nuclear Physics
2	Kim Victor Timofeevich	7678	Department of Experimental Nuclear Physics
3	Berdnikov Yaroslav Aleksandrovich	2268	Department of Experimental Nuclear Physics
4	Vatin Nikolai Ivanovich	1692	Department of Unique Buildings and constructions
5	Berdnikov Aleksandr Yaroslavovich	1081	Department of Experimental Nuclear Physics
6	Bezprozvannyi Ilya Borisovich	671	Department of Medical Physics
7	Ryabov Yury Germanovich	617	R&D Laboratory Physics of Elementary Particles and Neutron Research
8	Kotov Dmitriy Olegovich	604	Department of Experimental Nuclear Physics
9	Klimchitskaya Galina Leonidovna	509	High School of Applied Physics and Space Technologies
10	Turoverov Konstantin Leonidovich	503	Department of Biophysics

SCIENTIFIC JOURNALS OF POLYTECH

Publication in journals is open and free for all scientists, regardless of place of work. Original scientific articles and scientific reviews are accepted for publication. All articles undergo mandatory blind peer review.

Magazine of Civil Engineering



Frequency: 8 times a year.

ISSN 2071-0305; 2071-4726



The journal is included in the List of Russian peer-reviewed scientific journals in which the main scientific results of dissertations for the degree of Doctor and Candidate of Science should be published (List of Higher Attestation Commission).

The journal covers the following thematic areas:

- Building structures, buildings and structures
- Foundations and underground structures
- Heat supply, ventilation, air conditioning, gas supply
- Water supply, sewerage, water conservation building systems
- Building materials and products
- Hydrotechnical construction
- Design and construction of roads, subways, airfields, bridges and transport tunnels
- Hydraulics in construction.
- Construction mechanics.
- Fire safety in construction

Journal is indexed in:

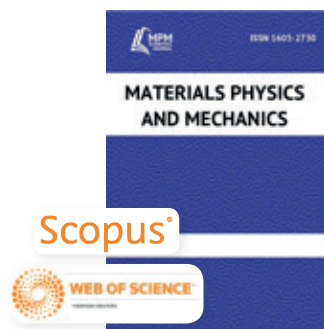
- Scopus,
- Web of Science (Core Collection),
- Compendex (Elsevier),
- EBSCO,
- Google Academia,
- Index Copernicus,
- ProQuest,
- Russian Science Citation Index (Web of Science),
- Ulrich's Serials Analysis System.

Chief Scientific Editor

Doctor of Technical Sciences, Prof.
Nikolai Vatin

Editor in Chief

Yekaterina Linnik
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Materials Physics and mechanics

Frequency: 8 times a year.

The journal is included in the list of HAC.
ISSN 1605-2730, 1605-8119

The journal is indexed by Web of Science (Core Collection), SCOPUS

The journal covers the following thematic areas:

- The mechanics of nanostructured materials (such as nanocrystalline materials, nanocomposites, nanoporous materials, nanotubes, nanostructured films and coatings, materials with quantum dots and wires).
- Physics of strength and ductility of nanostructured materials, physics of defects in nanostructured materials.
- The mechanics of the processes of deformation and fracture in traditional materials (solids).
- Physics of strength and ductility of traditional materials (solids).

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St. Petersburg Polytechnic University Journal - Physics and Mathematics

Frequency: 4 times a year.

ISSN 2304-9782, 2618-8686, 2405-7223

The journal is the journal is indexed in the following databases:

- Web of Science (Core Collection)
- RSCI
- Abstract journal and fund of scientific and technical literature AUSTIC RAS
- Ulrich's Periodicals Directory
- ScienceDirect (2014–2017)
- Google Scholar
- EBSCO
- Math-Net.Ru
- Proquest
- ROAD

The journal is included in the list of HAC in the following areas

- 04.01.00 - Physics
- 01.01.00 - Mathematics
- 02.01.00 - Mechanics

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SPbPU Journal. Computer Science. Telecommunication and Control Systems

Frequency: 4 times a year.

ISSN: 2304-9766, 2618-8694

The journal is indexed in the following databases:

- HAC
- RSCI
- Abstract journal and fund of scientific and technical literature AUSTIC RAS
- Ulrich's Periodicals Directory
- Google Scholar EBSCO
- Math-Net.Ru ProQuest
- Index copernicus

The journal is included in the list of HAC in the following areas

- 05.13.00 – Computer Science, computer engineering and management,
- 12.05.00 - Radio engineering and communications,
- 05.27.00 - Electronics.

Editor in chief:

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<https://infocom.spbstu.ru/en/>



St. Petersburg Polytechnic University Journal of Engineering Science and Technology

Frequency: 4 times a year.

ISSN: 2542-1239, 2618-866X

The journal is indexed in the following databases

- HAC
- RSCI
- Abstract journal and fund of scientific and technical literature AUSTIC RAS
- Ulrich's Periodicals Directory
- Google Scholar EBSCO
- Index copernicus
- Proquest
- ROAD
- Russian Science Citation Index (RSCI) hosted on the WoS platform

The journal is included in the list of HAC in the following areas:

- 04.04.00 - Power, metallurgical and chemical engineering,
- 09.09.00 - Electrical Engineering,
- 05.16.00 - Metallurgy and materials science

Editor in chief:

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St. Petersburg State Polytechnical University Journal. Economics

Frequency: 6 times a year.

Certificate of registration of PI FS77-514144 dated December 11, 2012

The journal is indexed in the following databases:

- HAC
- RSCI
- Abstract journal and fund of scientific and technical literature AUSTIC RAS
- Ulrich's Periodicals Directory
- Google Scholar
- EBSCO
- ProQuest
- ROAD

The journal is included in the list of HAC in the following areas:

- 08.00.01 - Economic Theory,
- 08.00.05 - Economics and national economy management,
- 08.00.10 - Finance, money circulation and credit,
- 08.00.13 - Mathematical and instrumental methods of economics

Editor in chief:

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SPbPU Journal. Humanities and Social Sciences

Frequency: 4 times a year.

Certificate of registration of PI No. FS77-52145 dated December 11, 2012

The journal is indexed in the following databases:

- HAC
- RSCI
- Proquest
- Index Copernicus international

The journal is included in the list of HAC in the following areas:

- 07.00.00 - Historical Sciences,
- 09.00.00 - Philosophical sciences,
- 13.00.00 - Pedagogical sciences.

The printed version of the journal is distributed:

- through the catalog of the CIS countries,
- through the Joint Catalog «Press of Russia»
- through the online catalog «Subscription Press»

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SCIENTIFIC LABORATORIES

MEGASCIENCE PROJECTS



The development of stable relations with foreign universities and the involvement of foreign professors in research are systematic in the Polytechnic University. With the support of the competitiveness improvement program (Decree of the Government of the Russian Federation No. 220), a number of laboratories were opened under the guidance of invited leading scientists based on already established

strong scientific groups of the university. The mega-grant program is recognized as one of the most successful science initiatives that has been undertaken in recent years. Polytech is one of the leading universities in the number of scientists who won megagrants for the entire period of the program. Currently there are three laboratories under the leadership of leading scientists.



Vladimir Putin
President of the Russian Federation

“We need to develop effective mechanisms that could attract leading scientists of the world to Russia, as well as Russians who have worked abroad for a long time. It is necessary to set ambitious, interesting, scientific tasks and launch research projects with a long-term funding horizon”.

Laboratory of molecular neurodegeneration



Bezprozvanniy Ilya
Dr. Sci. Biol., Prof. Of South-West Medical
Center of Texas University

The laboratory carries out research in the field of cutting edge problems of modern molecular medical science and neurodegeneration. Scientists study the mechanisms of Alzheimer, Huntington and Parkinson's disease. The results of research will help to understand molecular basis for these disorders and also trace potential objects for the development of treatment methods and drugs.

Laboratory of molecular microbiology



Severinov Konstantin
Dr. Sci. Biol., Prof. Of Rarter University

Scientific research of the laboratory is linked to a wide spectrum of problems connected with bacteria metabolism. One of them is a development of approaches for heterological co-expression of protein complexes in surrogate host cells in order to get new biologically active components (antibiotics and microcines) from uncultivated bacteria, natural samples and metagenomes.

Laboratory for creation of new materials and constructions



Panchenko Oleg
PhD in Technical Sciences

The laboratory carries out development of one-layer and multilayer light materials and components with macrostructured surface, technologies for their manufacturing and manufacturing of quality constructions. Apart from that, specialists develop and implement materials and methods for manufacturing new products for transport industry, energy industry and construction industry.

“One of the main tasks facing us is that leading researchers, laboratory leaders come to us, not joining the existing system of scientific research, but bring something new, from research methods to subjects. As a result, we enriched our traditional scientific potential and opened up a host of new directions at the university.”



Andrey Rudskoy
Rector, SPbPU

RASA-POLYTECH CENTER

The active involvement of universities in the international scientific community is one of the main factors in world scientific and technological progress. Science is not driven by modern infrastructure and high-tech equipment, but by the people who stand behind it and the professors who lead the world's leading research groups. One of the ways to integrate Russian science into the global scientific and educational space is

The Polytech's collaboration with scientists from the RASA (Russian-speaking Academic Science Association).

The RASA-SPbPU Scientific Research Center is a new platform for a whole cluster of laboratories with a mainly biomedical orientation. The center includes 3 laboratories led by specialists from leading scientific centers in Europe and the USA.

Laboratory of Microencapsulation



Gleb Suhorukov
Prof. of London University of Queen Mary

The laboratory is focused on development and creation (with the help of nanoengineering) of interactive controllable host systems of biologically important matters to be successfully implemented into medical practice.

Laboratory of synthetic biology



Andrey Pichugin
Prof. of Gustave Roussy Institute in Paris

The laboratory is specializing in the development of technology of automated production of synthetic genes without mutations to be used in research and pharmacology.

Laboratory of Bioinformatics



Dmitry Frishman
Prof. of Munich Technical University

Scientists of the laboratory are dealing with the development of identification methods of illness-leading mutations producing an impact on protein interactions and resulting in the loss or acquisition of functions.



KAWASAKI INDUSTRIAL ROBOTICS CENTER



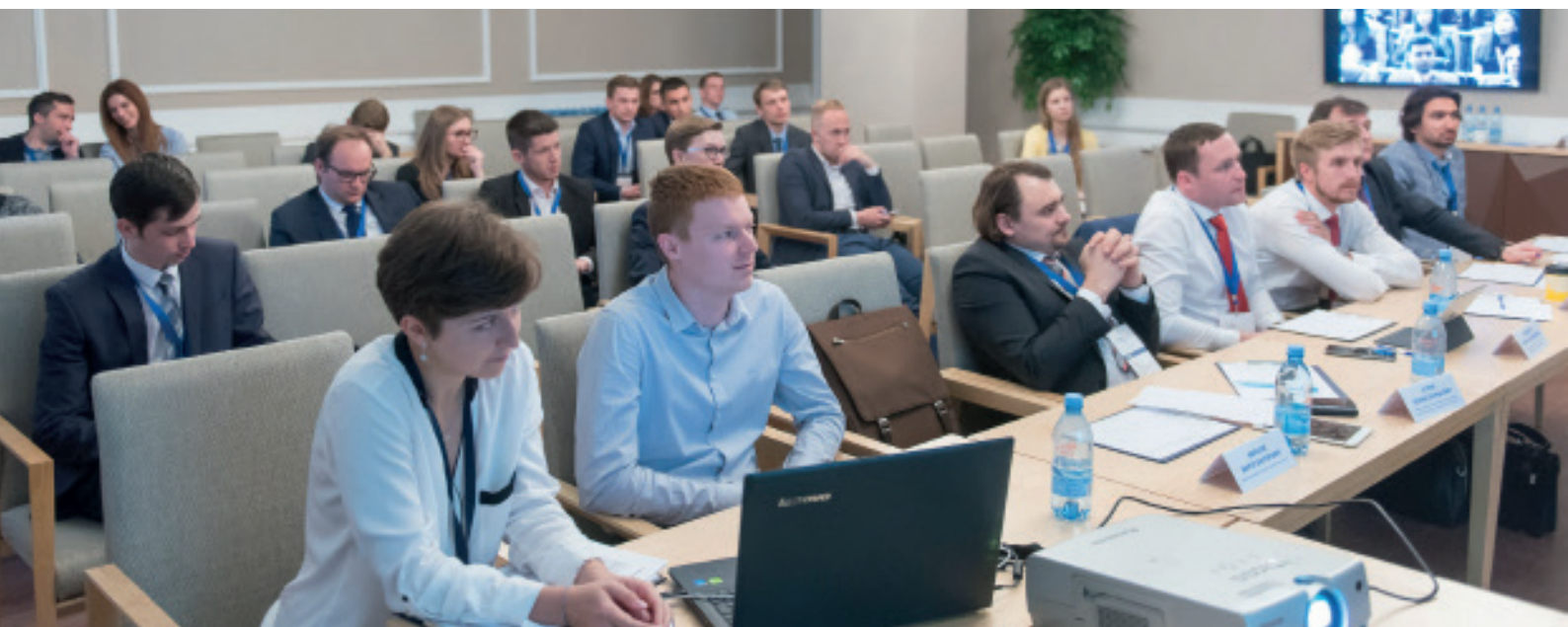
The site of the Peter the Great Polytechnic University operates the largest scientific and educational center for industrial robotics in Russia in collaboration with one of the largest industrial concerns Kawasaki Heavy Industries. On the basis of the Kawasaki-Polytech Center, educational programs of the university are being implemented, as well as cooperation with industrial enterprises

with the aim of developing and introducing production automation technologies. The center includes: a demonstration platform for robots and technologies, a training center, and a laboratory. The demonstration hall features 10 robotic complexes, including: robotic arc and spot welding, milling, pailing, assembly, painting, sorting and stacking of products.

Activities

- Familiarity with the capabilities of industrial robots and advanced manufacturing technologies.
- The use of the material and technical base of the Center in the basic educational programs of the University in various specialties.
- Consultations on automation of technological processes of the enterprise.
- Personnel training in programming and maintenance of industrial robots.
- Technology testing in simulators and on real equipment in the laboratory.
- Development of technological processes and specialized software.

SCIENTIFIC AND EDUCATIONAL CENTER «GAZPROMNEFT-POLITEH»



The main goal of creating the center is to carry out research and development work in the interests of Gazprom Neft, as well as to train highly qualified personnel for the oil and gas industry. Representatives of SPbPU and LLC

Gazprom Neft NTC for Gazprom Neft developed a targeted master's program in Mathematical Modeling of Oil and Gas Production. The master's program is implemented on the basis of the Department of Theoretical Mechanics of SPbPU.

The main activities

- Comparative analysis of mathematical models of the hydraulic fracturing process embedded in commercial simulators.
- Assessment of empirical relationships between geological and technological parameters of hydraulic fracturing.
- Development of quasi-three-dimensional modeling algorithms for hydraulic fracturing.
- Modeling hydraulic fracturing in fractured reservoirs using the particle dynamics method.
- Development of algorithms for three-dimensional modeling of proppant dynamics in hydraulic fractures.
- Development of a compact installation for modeling hydraulic fracturing in laboratory conditions. Analysis of the scale factor during laboratory tests on hydraulic fracturing.
- Development of algorithms for modeling microseismic phenomena in hydraulic fracturing based on the boundary element method.
- Development of methods for describing the interaction of multiple cracks and study of their influence on the effective properties of materials.
- Modeling the process of vibration drilling of hard rocks.

SUPER COMPUTER CENTER «POLYTECHNIC»



RCC «Polytechnic» is one of the most powerful supercomputer centers in Russia with peak performance of more than 1.1 PFLOPS, as well as the first project in the CIS based on the latest Intel® Xeon® E5-2600 v3 server processors. RCC computing environment, with a total peak performance of more than 1.2 PFlops.

Scientists of the country's research organizations can use its capabilities to solve pressing problems in various fields of mechanics, hydro- and aerodynamics, solid state physics, plasma physics, materials science, electronics, computational and quantum chemistry, biophysics and biotechnologies, developments in astrophysics, chemistry, radioelectronics and in the field of control systems.

RCC includes

- heterogeneous cluster of 668 2 processor nodes with the latest 14-core Intel Xeon E5 2695 v3 processors and 64 GB of RAM; peak cluster performance is 938 TFlops;
- a unique computer system with mass parallelism and ultra-high multithreading on Intel Xeon Phi processors, containing 256 nodes; peak system performance - 259 TFlops;
- massively parallel supercomputer with cache-coherent globally addressable memory with a capacity of more than 12 TB and peak performance of 30TFlops;
- The engineering infrastructure contains all the necessary equipment to support the operation of the RCC, the power consumption of which is almost 1 MW. More than 90% of the heat inflow generated by the computing equipment is removed by means of direct water cooling of the units.

INNOVATIVE CENTER «SCIENCE - TECHNOLOGIES»



The Center “Science - Technologies” is a modern scientific and technological center for the synthesis and research of materials, furnished with equipment from leading world manufacturers with an international research team.

The purpose of the center is cooperation in the field of research activities in the areas of: additive technologies, new materials and technologies, materials for batteries.

The center is equipped with the latest semi-industrial and experimental equipment for manufacturing products using additive technology. As part of the Center’s opening, two contracts were signed: “Creation of new nanocomposite materials for lithium-ion batteries capable of working at high charge / discharge speeds” and “Development of technology for producing highly alloyed powder alloys from secondary raw materials (chips) for additive manufacturing.”

The main activities

- Creation of nanocomposite electrode materials based on transition metal oxide systems with functional coatings.
- Creating thin-film electrodes for lithium-ion batteries.
- Development of technology for producing powder alloys for additive production.
- Development of a lithium-ion battery control system

SCIENTIFIC RESEARCH LABORATORY «INDUSTRIAL SYSTEMS OF ARTIFICIAL INTELLIGENCE» SIEMENS



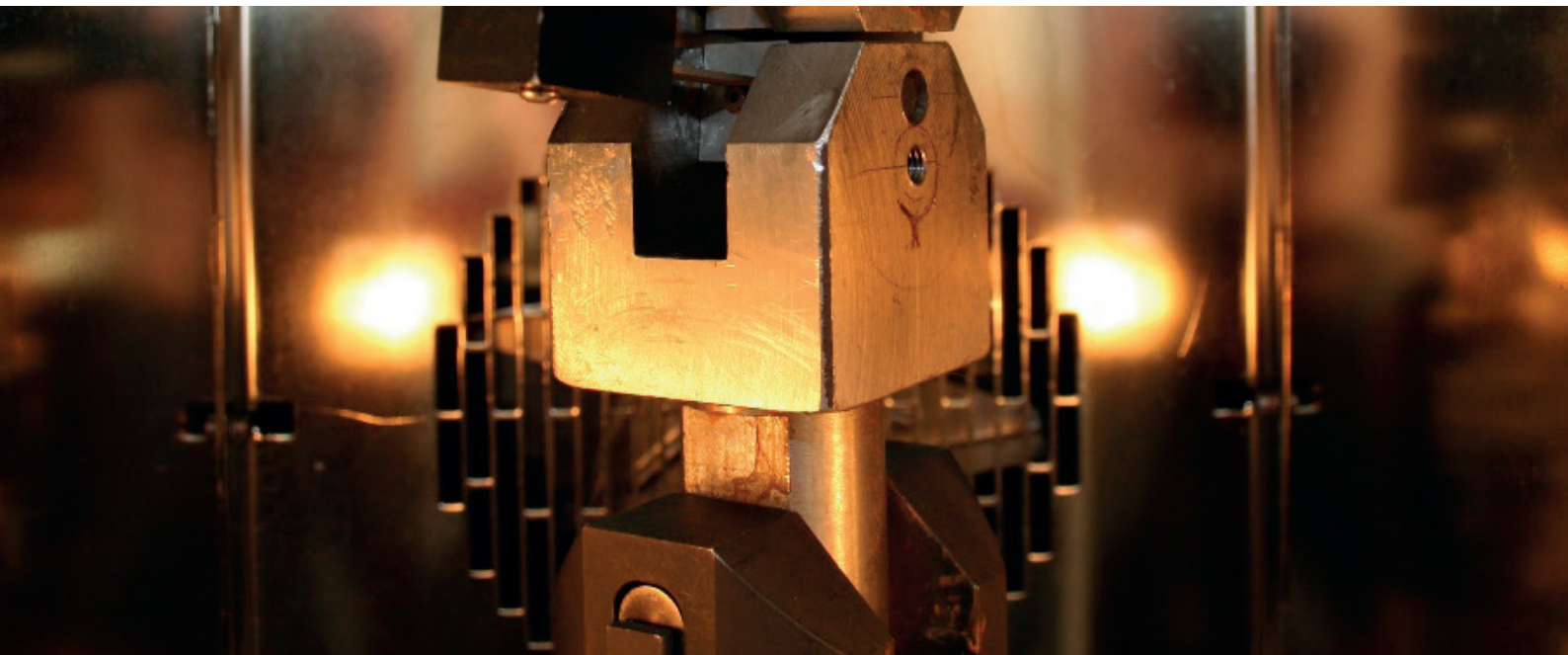
Research laboratory “Industrial Artificial Intelligence Systems” was created in conjunction with Siemens. The German concern provided software and equipment for the laboratory. The integration of a specialized supercomputer with a capacity of about 1 petaflops with the Polytechnic Supercomputer Center increased the capacity of the complex to 2 petaflops, providing an opportunity to solve world-class tasks.

The supercomputer will solve problems in the field of artificial intelligence and machine learning. It is the only system of this class in Russia, with the latest calculators.

The supercomputer allows you to solve deep machine learning tasks that require multi-user equipment with a petaflop level of performance.

With the help of artificial intelligence, the laboratory monitors and diagnoses industrial systems and devices. The research results will be applied in the oil and gas and energy industries, and other high-tech industries. The equipment of the laboratory also allows solving the problems of managing the urban economy and regional logistic systems.

INTERNATIONAL RESEARCH CENTER «WESERFORD POLYTECHNIK»



Competencies of the Center

- Electrochemical studies, including the construction of polarization curves, determining the nature of the potential change over time, conducting research on a rotating disk electrode;
- Assessment of the corrosion properties of materials under conditions simulating operational conditions, including at elevated temperature and pressure, in aggressive gas-saturated media;
- Development of techniques and bench equipment for testing simulating non-standard conditions of material operation, close to real ones;
- Comparative studies of the erosion and corrosion-erosion properties of materials and coatings used in oilfield equipment;
- Studies of hydrogen sulfide and carbonic acid corrosion;
- Tribological testing;
- Analysis of the causes of destruction of equipment material;
- Metallographic, fractographic studies;
- Development of recommendations on the choice of material for oil and gas equipment;
- Development of recommendations for protecting the material from exposure to aggressive media;
- Conducting standard corrosion tests for general corrosion, intergranular corrosion, corrosion cracking, fatigue corrosion testing, hydrogen cracking;
- Carrying out research and development work in the field of material science with the aim of extending the life of the equipment.

CENTER FOR ARCTIC TECHNOLOGIES



Tasks of the Center

- assistance to the structural divisions of the University in conducting inter-industry scientific research on the problems of Arctic exploration;
- development of the range of services provided by SPbPU in the field of research, development, technological and design work in demand in the development of the Arctic territories;
- preparation, comprehensive presentation and promotion of relevant information on advanced Arctic technologies and University developments on the Internet;
- search and systematization of work with potential customers of innovative Arctic technologies and developments of the University from the Russian Federation and international.

Competencies of the Center

- developers of the interdepartmental integrated target program “Arctic Technologies”;
- development of cyber-virtual methods for modeling tests and practical application of ground-based military robotic complexes in the Arctic;
- development of methods for high-precision positioning and modeling of the marine environment, deployment of underwater communications equipment, marine robotic systems of military, special and dual-use in non-equipped areas of the Arctic zone of the Russian Federation.

POLYTECH IN INDUSTRY 4.0

ENGINEERING CENTER «CENTER FOR COMPUTER ENGINEERING» (CompMechLab®)

The Center for Computer Engineering Engineering (CompMechLab®) of St. Petersburg Polytechnic University of Peter the Great, is a leader in the development of original technologies, designs, equipment and products based on advanced manufacturing technologies (primarily digital design and modeling, computer and supercomputer engineering, computer optimization technologies and additive technologies).

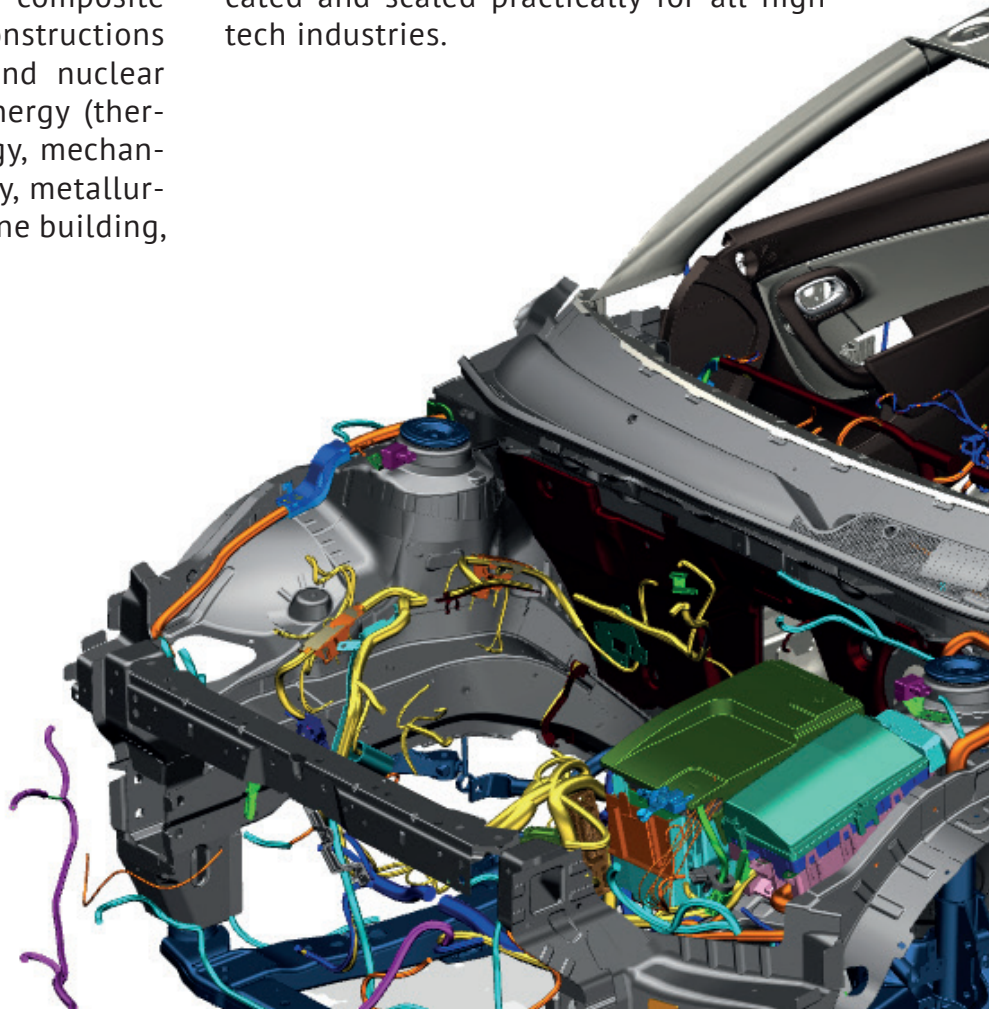
CompMechLab® specialists perform R&D in the interests of enterprises of various industries: automobile manufacturing, aircraft manufacturing (primarily composite materials and composite constructions (structures), nuclear energy and nuclear engineering, thermonuclear energy (thermonuclear reactors), metallurgy, mechanical engineering (special, heavy, metallurgical, petrochemical, etc.), engine building,

shipbuilding, space rocket technology, instrumentation, etc.

As part of the «road map» directions On the basis of the Engineering Center and the Institute of Advanced Production Technologies of SPbPU, Tekhnet NTI created a test site - a reference training ground for the Factory of the Future. The landfill serves to create and debug the production chain, starting from the planning stage, when the basic principles of a competitive product are laid down, and ending with the creation of a sample prototype. Solutions and technologies worked out within the framework of the project can be replicated and scaled practically for all high-tech industries.

CML
CompMechLab

www.fea.ru

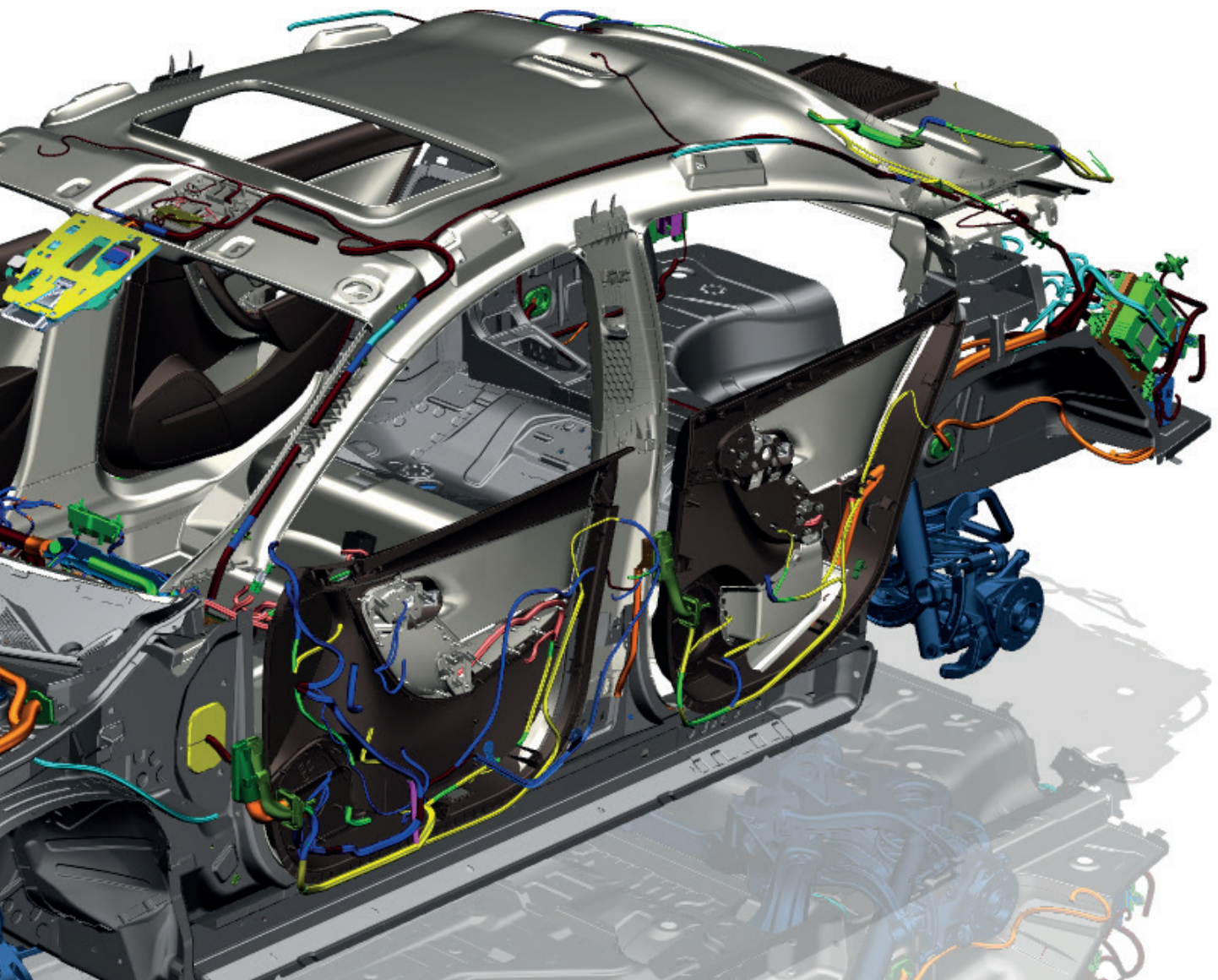


The main activities

- performing R&D on a regular basis, ensuring the development and creation of fundamentally new and globally competitive “best-in-class” optimized new generation products / parts / products / structures for leading companies in the world and Russian industry;
- training (through the implementation of custom R&D) of globally demanded engineers of a new generation (“engineering and technological special forces”);
- “Integration” into technological chains and production of industrial companies-leaders of the world market (development, adaptation and development of “cutting-edge technologies”), export of highly intelligent services, development and transfer of technological chains with high added value (know-how) to domestic industry.

Partners and Customers

The CompMechLab® team has many years of successful work experience for companies and corporations such as Airbus Group, Boeing, General Electric, General Motors, Daimler / Mercedes, BMW, Rolls-Royce, Audi, Porsche, Volkswagen, Schlumberger, Weatherford, Siemens, LG Electronics, etc.



COMPETENCE CENTER “NEW PRODUCTION TECHNOLOGIES”

NTI SPbU Competence Center is a leading Russian competence center with the largest project consortium in the field of “New Production Technologies” created on the basis of the ecosystem of innovations of St. Petersburg Polytechnic University of Peter the Great.

The center is an infrastructural basis for the interaction of scientific, educational and industrial organizations in order to ensure global competitiveness of leading domestic companies in the market of NTI and high-tech industries. The key activity of the center is the development of solutions for creating world-

class high-tech products using new manufacturing technologies and cross industry and multidisciplinary competencies of engineers and scientists of SPbPU and also members of the project consortium which as of February 1, 2019 has 50 members and more than 25 partner companies.

Also the NTI SPbPU center develops the competencies of the enterprises in the field of advanced production technologies (APT), trains specialists and organizes implementation of APT to the enterprises, transfers new production technologies into high-tech industries.



Key competencies of the Center

- Digital design and modeling (CAD-CAE-HPTC-CAO-CAM-CAAM), Digital Twins, bionic design (Simulation & Optimization) - Driven Bionic/Generative Design, Smart Digital Twins, (CAD, CAE, CAO, CAM, CAAM, Simulation & Optimization) - Driven Bionic Design, PDM, PLM & Advanced Manufacturing).
- Smart-Manufacturing technologies and hybrid manufacturing technologies.
- New materials (composite materials, nanomaterials, metamaterials, metal powders for additive manufacturing).
- Additive technologies and additive manufacturing including 3D printers, technologies, approaches and ways of working with raw materials, development and production of metal powders and a set of services for 3D printing.

Partners and customers



Results of the center's activities in 2018

In 2018, the center's specialists, together with partners and participants of the project consortium, participated in the implementation of 56 research and development projects in the interests of 44 enterprises.

High-tech solutions were developed for the construction of a gas turbine engine of a new generation, cars, electric car vehicles; the carrier system of a helicopter, Antarctic sledge for transportation of bulky mul-

ti-ton cargo, a drilling fluid cleaning system, an amphibian aircraft and others.

Apart from the projects implemented by representatives of Competence Center of NTI SpbPU, members of the project consortium realized research and development projects in the field of cut-through technology "New Production Technologies" for the value of more than 1,4 billion rubles.

SCIENTIFIC CONFERENCES

NATURE. INTERNATIONAL CONFERENCE «ACHIEVEMENTS AND APPLICATIONS OF PLASMA PHYSICS»

Advances and Applications in Plasma Physics AAPP 2019

Plasma is the so-called fourth aggregate state of matter in which atoms are ionized to form a gas from charged particles. Despite the impressive progress achieved over the past decades in understanding plasma, physicists still face many interesting problems, especially when it comes to design developments for a number of practical applications.

The purpose of the conference, held by Nature in conjunction with the Peter the Great St. Petersburg Polytechnic University is to provide a platform for discussing the latest achievements between scientists working in different fields of plasma physics, as well

as promote new coverings, the expansion of fundamental knowledge and the search for new practical applications in this exciting field of research.

The conference aims to bring together experts and young scientists from various fields of plasma physics, including thermonuclear fusion, space plasma physics, industrial use of plasma, dusty plasma, and the interaction of laser radiation and plasma. We hope that communication within the framework of the conference will bring together experimenters and theorists, and will also help create new connections between various scientific communities in the field of plasma physics.

a nature conference

The main sections of the conference

- Thermonuclear Fusion
- Low Temperature Plasma
- Astrophysical Plasma
- Laser Plasma

Key speakers



David B. Go

Aerospace and mechanical engineering, Notre Dame University, US



Hantao Ji

Princeton plasma physical laboratory, US



Josefine H.E. Proll

Eindhoven university of technology, The Netherlands



Gregor Morfill

Max Planck institute for extraterrestrial physics, Germany



Paul McKenna

University of strathclyde, UK

Coordinator of the conference

Aleksandra Kolgatina
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+7 (812) 294-22-85

Russia, St. Petersburg,
Polytechnicheskaya st., 29

www.aapp.spbstu.ru

SCIENTIFIC AND PRACTICAL CONFERENCE WITH INTERNATIONAL PARTICIPATION «SPBPU SCIENCE WEEK»



“SPbPU Science Week” is an annual scientific and practical conference for students, post-graduate students and young researchers from Russia, countries of the near and far abroad.

Among the main research areas there are energy, energy saving and ecology, new materials and technologies, technologies of living systems, IT technologies, etc. Most of the reports of the participants of the con-

ference covers basic sciences, in particular, space physics, physics of nanostructures, biophysics and mechanics.

Traditionally, students and scientists from leading universities and research organizations of Russia, near and far abroad (China, Germany, Belarus, Kazakhstan, Latvia, Lithuania, Poland, Ukraine, Finland, Estonia) come to the conference with reports.

The main sections of the conference

- Biomedical systems and technologies
- Biotechnologies. Food Technology
- Military
- Humanitarian sciences
- Information Technologies and Systems
- International Educational Programs
- Metallurgy, mechanical engineering and transport systems
- Advanced manufacturing technologies
- Construction and architecture
- Theoretical and applied mathematics and mechanics
- Technosphere safety
- Physics, Nanotechnology and Telecommunications
- Physical Culture, Sports and Tourism
- Economics and Management Technologies
- Energy and Transport

INTERNATIONAL CONFERENCE «CORROSION IN THE OIL AND GAS INDUSTRY»



The oil and gas industry is the backbone of the global economy, and remains the high-tech and knowledge-intensive industry and the largest consumer of innovative solutions for metallurgical, mechanical engineering, and chemical enterprises in the field of new materials and technologies to increase the efficiency of various processes from the development of the fields to the final processing of hydrocarbon products.

Of course, the issues of material operability are the cornerstone in the issues of reliable operation of oil and gas infrastructure. Corrosion and its related processes are the main factors that reduce the reliability of equipment.

These problems arise at all stages of the life cycle of hydrocarbon production - from drilling and production to pipeline transportation and processing. Company losses caused by equipment accidents and subsequent repair operations, downtimes, lost profit are calculated hundreds of millions of dollars.

Thus, one of the key tasks facing the international community of oil and gas producing and refining companies is the development of complex, often non-standard approaches to improving equipment reliability and protecting materials from the aggressive impact of operating conditions.

The main sections of the conference

- Well construction and operation
- Corrosion of linear pipelines
- Corrosion at oil refineries and petrochemical enterprises
- Analysis of the causes of destruction
- Corrosion protection technologies - coatings, inhibitor, cathodic protection
- Corrosion mechanisms and test methods,
- Corrosion in marine conditions.



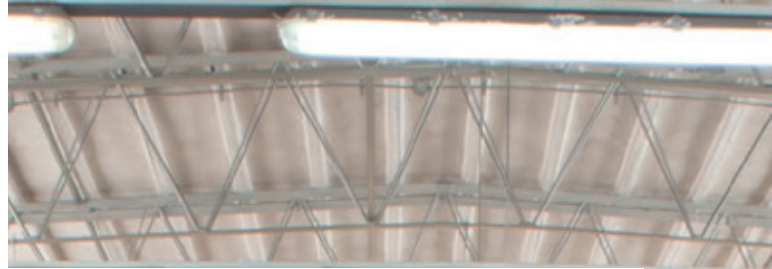
International Summer School-Conference «Advanced Problems in Mechanics»

The main goal of the conference is to bring together specialists from various branches of mechanics in order to provide a platform for mutual exchange of ideas. The list of problems under study is not limited to mechanical engineering, but includes almost all the advanced problems of mechanics, which is reflected in the title of the conference.

The main attention is paid to problems at the border of mechanics with other fields of research, which stimulates research in such fields as micro- and nanomechanics, materials science, solid state physics, molecular physics, astrophysics, and many others. The conference “Actual problems of mechanics” helps to maintain existing contacts and establish new ones between foreign and Russian scientists.

Main Topics of the Conference

- theory of micropolar, acoustic metamaterials, etc.
- nano-, micro- and mesomechanics
- geomechanics
- phase transitions and nonlinear elasticity
- plasticity
- solids and structures
- applications in mechanical and civil engineering
- fluid and gas
- wave motion
- computational mechanics
- nonlinear and multibody dynamics
- problems of the oil and gas sector



International Symposium «Compressors and compressor equipment» named after K.P. Seleznev

The purpose of the symposium is to ensure interaction between consumers and manufacturers of compressors and compressor equipment on the problems of supply, packaging, commissioning, operation, maintenance, diagnostics and repair, automation, development and design of compressor equipment.

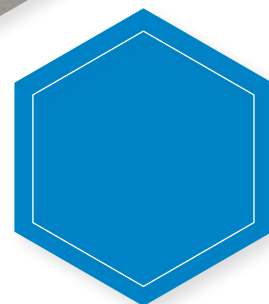
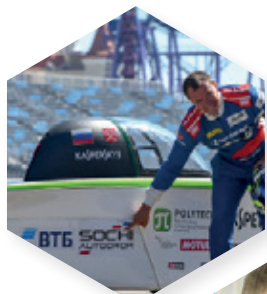
Currently, the Symposium “Compressors and Compressor Equipment” named after K.P. Seleznev is the only independent scientific and technical specialized event in Russia for the interaction of consumers and manufacturers of compressors and compressor equipment.

Main Topics of the Conference

- Actual operational characteristics, operating experience, maintenance, diagnostics and repair of compressors and compressor equipment;
- Packaging and development of technical tasks for compressors and compressor equipment;
- Issues of acceptance of compressors and compressor equipment by the customer;
- The interaction of the customer and the supplier during the life cycle of the compressor equipment;
- Modern advances in the design and manufacture of compressor technology and packaging, as well as in the field of automation systems and regulation of compressor equipment.



YOUTH PROJECTS AND ELABORATIONS

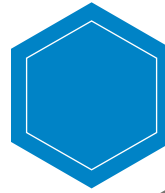
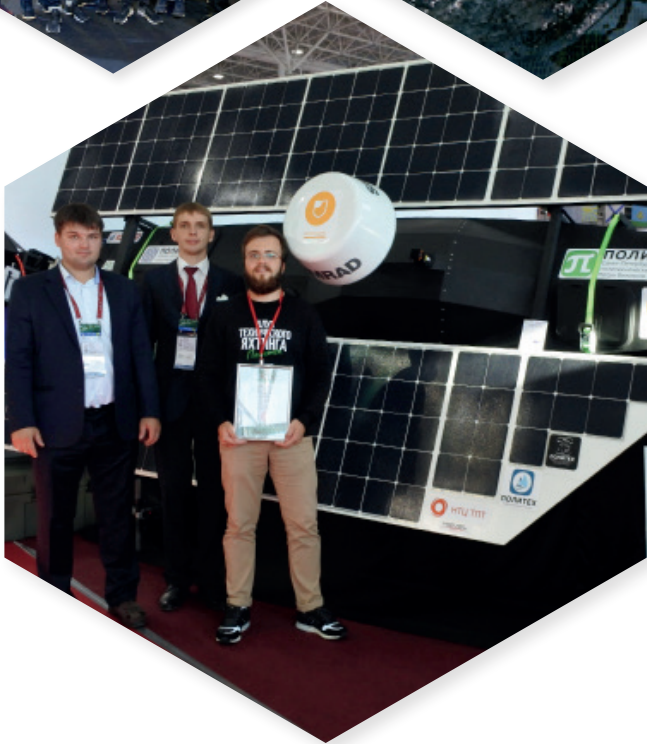


POLYTECH SOLAR TEAM

A team of students and graduate students of the Polytechnic University designed and prepared the first solar-powered car in Russia for production. The SOL vehicle became the first Russian participant in the history of the American Solar Challenge in the USA. The Russian team became the best among the debutants of the race. The project participants are actively engaged in the popularization of «green» transport in Russia, demonstrating its advantages, as well as the prospects of alternative energy sources.

POLYTECH NCM

On December 1, 2015, at the Peter the Great Polytechnic University of St. Petersburg, a presentation of a sports student car UNO, built by a team of students of SPbPU, took place. Polytech North Capital Motorsports is the only team in the Northwest Region to participate in Formula SAE. Polytech NCM team successfully passed all stages of the project: modeling a race car, assembling, conducting tests, preparing documentation, as well as speaking at the international stage of the competition.

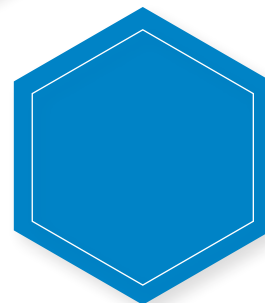
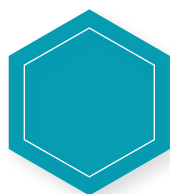
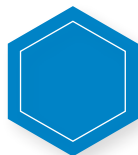


SOLAR PANEL BOAT

Young scientists of SPbPU are engaged in the elaborating and development of the basics of eco-vehicles based on a solar-powered boat with the possibility of unmanned control.” The main tasks facing engineers at the moment for the development of the energy-efficient transport industry are to reduce aerohydrodynamic resistance, reduce friction on the environment, create adaptive energy consumption, energy storage and recovery systems, create intelligent control and navigation systems of the vehicle.

BIONIC HAND PROSTHESIS

A student of SPbPU developed a bionic prosthesis of the hand, which allows partially compensate for the functions of the lost limb. Robohand was made using 3D technology. Using sensors on the glove, it is able to duplicate the movements of the operator. This development was made specifically for a 13-year-old girl who will control her hand through the neural interface. A planned line of prostheses includes: finger prosthesis, hand prosthesis, forearm prosthesis with a palm, prosthesis of the entire upper limb.



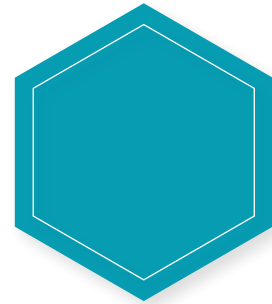
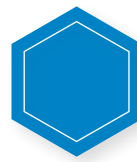
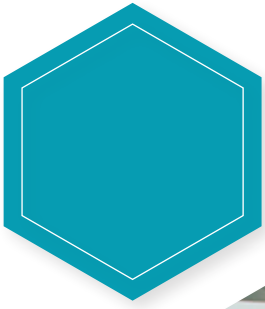
THE CENTER FOR SCIENTIFIC AND TECHNICAL CREATIVITY FABLAB

FabLab Polytech is part of a global network of high-tech manufacturing laboratories. The obligatory basis of the equipment in them consists of a 3D printer, a 3D scanner, an engraver, a laser and milling machines. The facilities of the premises make it possible to use Fablab as a zone of technological coworking and conduct research seminars, practical training, master classes and trainings. The main goal of Fablab is to provide students and schoolchildren with the opportunity to realize their technical ideas within the walls of SPbPU.

FABPRO DIGITAL PRODUCTION EDUCATIONAL COURSE

An educational course for students of Polytech, organized by the staff of Fablab Polytech in order to teach university students how to work with modern machines and other technological equipment.

During the course, students of the Polytechnic University receive the necessary knowledge and experience in order to independently implement their scientific and technical projects in Fablab.



RECTOR CUP ENGINEERING COMPETITIONS

“Rector’s Cup” is one of the stages of the largest European engineering competitions European BEST Engineering Competition Challenge. They have been held since 2003 and include 88 local stages in 32 countries. There are teams in two categories: Team Design and Case Study. If the guys in the Case Study category need to solve a hypothetical business problem, then Team Design participants must put the theoretical solution into practice and create a mechanism from predefined materials. Polytechnic Engineering Competition “The Rector’s Cup” is held annually to unite students to develop their technical abilities, creative thinking, unleash potential, acquire teamwork skills and broaden their horizons.

TEDxSPbPU CONFERENCE

The TED event is a prestigious event for enthusiasts from all over the world who share “ideas worth spreading” in their Ted Talks speeches. TEDxSPbPU is a one-day conference held at the Polytech. The main goal is to provide an opportunity to share unique ideas worth spreading. The conference is a series of six lectures on various relevant topics prepared by the speakers. Participation in TEDxSPbPU provides a unique opportunity to bring out a unique idea to a wide audience. Each participant’s performance is recorded and the speaker receives the TEDx speaker status.



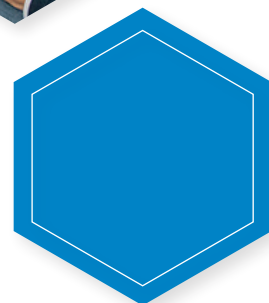
SCIENCE SLAM POLYTECH

“Science Slam” is an international project to popularize science, invented by Gregor Buining in 2010. Scientists who have completed a course in public speaking with a personal trainer should present the results of their research to a wide audience in 10 minutes. The best speaker is determined by the sound level meter - by the volume of applause. The event is aimed at popularizing science, stimulating students’ interest in scientific activities, and also provides an opportunity for young scientists to express themselves. In stand-up format, they talk about their research even to an unprepared audience. Science Slam Polytech is a unique chance to get acquainted with the achievements of students of the Polytechnic University.

STUDENT TOURNAMENT OF THREE SCIENCES

The Three Sciences Tournament has existed since 2013 and is an effective platform for the interaction of students, the business community and government authorities with the subsequent employment of talented participants. In 2016, the Tournament acquired the status of a federal project, and from that moment on every spring in each federal district of the country there are qualifying stages, the winners of which will meet in the final in autumn.

The Three Sciences Tournament is an annual team competition between students of Russian universities to solve pre-published scientific problems, present solutions in the form of presentations and protect them during polemics during scientific fights. The solution of these problems requires knowledge in the fields of physics, chemistry and biology.



POLYTECH RISE WEEKEND'19 FORUM

Polytech Rise Weekend '19 is a platform for acquaintance of students, inventors, investors and large companies, which allows participants to build their careers in science and innovation, as well as receive resources for the implementation of business in the technological field.

- Science and innovations. Grant organizers will talk about how to get financing for the development of their project. In addition, participants will have the chance to enter the finals of the UMNIK contest and become one step closer to the grant of 500 thousand rubles.
- Engineering creativity. Specialists from student engineering societies will talk about current contests, available free resources and working business-models, as well as about ways to earn money and build a career.
- Entrepreneurship. Forum guests will be representatives of business incubators, accelerators and venture capital funds, who, thanks to the open format of the meeting, can ask interesting questions, ask for advice, and agree on financing.

«UMNIK» SCHOOL

The school is held at the SPbPU Center for the Development of Technological Projects and Entrepreneurship and will be useful to anyone who wants to prepare their project for participation in the UMNIK scientific and technical grant and "UMNIK-NTI", competently fill out a project application, learn more about the rules for a successful presentation, and also receive feedback on its application from leading experts from the Polytechnic University to help evaluate the scientific and technical level of the project, including scientific novelty, technical significance and relevance of the idea.

After completing the School, participants will present their projects as part of the final or regional stage of the program selection "UMNIK" held at SPbPU. The winners of the competition are provided with a 2-year grant in the amount of 500 thousand rubles for the implementation of their research work.

YOUTH DESIGN OFFICE OF SPbPU ON THE BASIS OF CJSC «BALTIC INDUSTRIAL COMPANY»



Baltic Industrial Company CJSC (BPK) is a modern engineering center, one of the leaders in the development and implementation of import substitution programs in machine tool building.

The Polytechnic University, represented by the Institute of Metallurgy, Engineering and Transport, acts as a scientific base, developing design documentation, technical specifications and offering its own innovative solutions. Machines for the program under development are produced under the brand FORT, an abbreviation for the English words Force, Opportunities,

Russian Technologies. The English name is a reserve for the future when domestic production machines will be in demand all over the world, and all steps are being taken for this.

During the cooperation of the Polytechnic University and CJSC “BPK”, a number of projects were implemented. For example, the development of hybrid technologies, the creation of mobile robots and remotely controlled trolleys, the development and manufacture of a prototype of a tool store for a five-axis processing center, etc.



The design bureau is located in the new research and production complex of Baltic Industrial Company. In order to train highly qualified specialists in the field of machine tools in the Design Bureau, already during the training, subject-oriented, targeted

training of future engineers as part of an individual program is underway. Here, students do not study the material on posters or even on 3D models, but together with professionals they create and assemble the units in the workshop.



D.E. Kaledina
General Director of CJSC "BPK"

We do not see the development of machine tools without the introduction of new technical solutions. A special role in this process is played by the Polytechnic University, which is the scientific base of the Machine Tool Construction project.

CENTER FOR DEVELOPMENT OF TECHNOLOGICAL PROJECTS AND ENTREPRENEURSHIP

The mission of the Center is to help and assist technology entrepreneurs in turning an innovative idea into a real-life manufacturing business, creating new jobs and increasing the flow of budget revenues, creating a spirit of technological entrepreneurship in society that allows creating new breakthrough products and technolo-

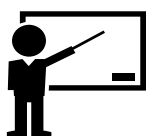
gies ensuring the increase of the power of the Russian state. The Center interacts with novice entrepreneurs, startups, developers, projects and IPIs of all SPbPU universities and its partners to commercialize their developments and helps to turn business ideas into a working business.



Who is it useful for



Students
and startups



Cooperation with
teachers faculty



Investors



Business

CENTER SERVICES

CONSULTING

- Evaluation of Business Ideas
- Project Expertise
- Advising the project team on their status and further development
- Assistance in preparing documents for grants and competitions
- Assistance in the registration of intellectual property and IPI
- Informing novice technology entrepreneurs about the opportunities available for business development

EDUCATION

- Educational seminars and trainings on project management
- Education for successful business in the framework of acceleration programs
- Direction for training at business schools and courses

PROJECT WORK

- Assistance to project teams in developing and scaling a business
- Marketing consulting
- Assistance in the formation of effective project teams
- Attracting investment in projects
- Technology transfer
- Attracting mentors / business mentors to work with the project team.
- The use of the capabilities of the prototyping, collective use centers, technical competencies for prototyping and small series of products.
- Support in the creation of a pilot batch.

ACTIVITIES

- Preparation of project teams for participation in start-up competitions
- Organization of project participation in relevant events

WORK WITH COMPANIES

- Search for business partners, clients and investors
- Placing orders for the production of prototypes for projects, receiving government orders from large industrial enterprises, participants in production clusters
- Attracting orders to SPbPU projects from enterprises and corporations

INTERNATIONAL SCIENTIFIC COUNCIL OF SPbPU



Frank Henning



Mars Hasanov



Martin Gitsels



Stephan De Spiegeleire



Andrew Wachtel



Michel W. Barsoum



Takeshi Egami



Dusan Losic



Igor Kornev



Jūras Banys



Ning Dai



Joeri Aerts



Leonid A. Vaisberg

chairman of the scientific council

«The international scientific Council will monitor the implementation of strategic initiatives of the University, provide advice on further development, as well as solve problems to eliminate the negative results of activities, if any. The Council has a very responsible mission to create an international image of SPbPU as an advanced University of the country and the world.»

The International Scientific Council of SPbPU is a permanent collegial advisory body, established to advise on research, international, innovative and other activities of the University to advance the University's position in the international scientific community and to strengthen the University's reputation.

The main tasks of the Council:

- Determining scientific agenda of the University;
- Developing strategy to improve the academic reputation of the University;
- Advancing the University's position within the framework of the Program for improving the international competitiveness;
- Improving the reputation and ranking of the University in the global scientific space;
- Attracting leading scientists to give lectures and participate in research collaborations.

The main activities of the Council:

- Performing international expertise of scientific and innovative projects of the University;
- Providing advice on shaping and delivering the development strategy for research and other activities of the University;
- Developing recommendations to improve the national and international competitiveness of the University;
- Consulting and assisting in preparation and implementation of major research and innovation projects of the University;
- Developing existing relations with Russian and foreign partners and establishing new contacts;
- Providing assistance for improving the scientific publication activity of the University's staff and students.

Eugeny Zahlebaev
Secretary of the Council

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