Knowledge of high achievements

Peter the Great St.-Petersburg Polytechnic University is one of the oldest leading institutions of higher education in the country. Opened at the beginning of the twentieth century with an entirely new mission in mind. In its creators’ plan, it was supposed to be a unique temple of new ideas. » Throughout the history, the best traditions of polytechnic education were laid and formed and the basis has been created for the training of the best national scientific and engineering personnel. Now, at the beginning of the third millennium, the University is focused on the innovative way of development and integration into the global educational community. We solve major problems aimed at forming a new image of the University.

Today our University is named after the great reformer — Peter the Great. It sets the bar high. Today, the efforts of many thousand strong community of Polytech are aimed at the development and modernization of the Polytechnic University as a University of a new type — a leader in multidisciplinary scientific research in suprasectoral technology and knowledge-intensive world-class innovation. Polytech has a rich educational, scientific and innovation infrastructure. Research at the University are conducted on the orders of the world giants, and it is about a hundred of international companies. Lectures are delivered by the eminent professors and a system of international educational programs has been developed. The University has everything to prepare top-notch professionals in-demand in the labor market who are capable, in the future, to make a brilliant career in science and science-intensive business. We have already done a lot on the way to the stated objective. The timely transformational changes allowed our University to win a very important victory — to become a member of the academic excellence program, by entering the list of the best Russian universities pretending to be a world-class institutions.

In the struggle for competitiveness «science» sounds as not the only dominant, but to declare oneself in full force in the world — that, nowadays, can be done mainly due to the scientific potential.

For scientific and university community, it is important to always be on the frontier and to answer the challenges we receive from the global economy in a most competent way.
The University, since its foundation, plays a special role in the development of new scientific fields — physics, energetics, metalurgy, mechanical engineering and economics. Polytechnicians have contributed to the history of the world of science, and many of their discoveries can be considered as a real breakthroughs.

1899
Dmitri Mendeleyev. The creator of the periodic table of chemical elements.

1910
Minister Sergei Witte, Prince Alexei Gagarin, the founder of the first Russian rocket scientist.

1920
The Polytechnic University joins the design of the first Soviet warship, the cruiser "Aurora".

1930
The Polytechnic Institute of Moscow, named after the Polytechnic University of St. Petersburg.

1940
A graduate of the Polytechnic Institute, Professor Abram Zelinsky, invented the world's first gas mask.

1950
Professor Nikolai Semyonov starts at the Physico-Technical Institute, formulated the theory of half-decay.

1960
The Polytechnic University is one of the founders of Chemical Physics. The 114th superheavy element is named after George Gamow, the world's first gas mask.

1970
The Polytechnic University is one of the founders of Chemical Physics. The 114th superheavy element is named after George Gamow.

1980
The Polytechnic University is one of the founders of Chemical Physics. The 114th superheavy element is named after George Gamow.

1990
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2000
The Polytechnic University is one of the founders of Chemical Physics. The 114th superheavy element is named after George Gamow.

2010
The Polytechnic University is one of the founders of Chemical Physics. The 114th superheavy element is named after George Gamow.
DYNAMICS OF CHANGES
WHERE WE ARE NOW

The main strategic aim of Peter the Great St. Petersburg Polytechnic University — the modernization and development of the University as a globally competitive research and education center that integrates multidisciplinary research and world-class technology and which is one of the world’s leading universities. Participation in major government projects for modernization of higher education during the last decade had a significant impact on the effectiveness of scientific research and technological development in the University. The funding of research projects during this time was greatly increased, by several times, resulting in greatly expanded range of areas to develop scientific research.

A WORLD-CLASS UNIVERSITY

Global Strategic goal of Peter the Great St. Petersburg Polytechnic University is modernization and development of university as world-level competitive scientific and educational centre, which integrates multidisciplinary scientific research and top-level technologies, one of the leading world universities.

Institute of Civil Engineering
Institute of Advanced Manufacturing Technologies
Institute of Physics, Nanotechnology and Telecommunications
Institute of Energy and Transport Systems
Institute of Computer Science and Technology
Institute of International Educational Programs
Institute of Metallurgy, Mechanical Engineering and Transport
Institute of Applied Mathematics and Mechanics
Institute of Industrial Management, Economics and Trade
Institute for Military Engineering and Safety Research
Institute of Physical Education, Sport and Tourism
Institute of Humanities

Polytech’s research themes
Russia
St.Petersburg
Polytech

International perspective

120
HECTARES
CAMPUS
AREA

200
ACADEMIC
BUILDINGS

▲50 NEW
ACADEMIC
PARTNERS
Strengthening our university relations with the world’s leading universities and research organizations

▲40 LEADING
SCIENCES
We build strong links at institutional and individual researcher level with other academics across the world

▲50 NEW LABORATORIES
AND RESEARCH
GROUPS
Open new labs headed by outstanding scientists and academicians

Collaboration with leading (TOP500 of world university rankings) universities, by countries

- AUSTRIA
- BELGIUM
- BRAZIL
- UK
- GERMANY
- ISRAEL
- SPAIN
- ITALY
- PEOPLE’S REPUBLIC OF CHINA
- NETHERLANDS
- NORWAY
- USA
- FINLAND
- FRANCE
- SWITZERLAND
- SWEDEN

Yuri Vasiliev
SPbPU Scientific Supervisor
Academician of Russian Academy of Sciences, Professor, DSc

We are confident in our abilities. And this confidence is based not only on strong traditions, but also on the achievements of today. Our solutions are widely used in many domestic industries. We are improving the learning process in close connection with science, keeping all the best, that has been accumulated over the years and decades in the national system of higher polytechnic education.
A distinguishing feature of our University is that it is an interdisciplinary complex of the most important fields of modern science and technology. The most modern physics, nanotechnology, radio electronics, medical physics — that is an interdisciplinary level of future
SCIENCE

THE SCIENTIFIC LANDSCAPE
RESEARCH EXCELLENCE

Comprehensive analysis of the university research environment allowed us to focus on the priority research areas and identify potentially strong areas for the future. A significant focus on supporting research groups, projects and scientists — this is what lies at the heart of strategic development of science policy.

New materials and technologies

Materials with unique properties

Conducted unparalleled research in the field of nanotechnology in materials, including production of nano-powders, nanomaterials and products, and goods.

Mikhail Kordyukov
Academician, RAS

Sophisticated design products. Reduces the cost of production, saving of raw materials.

by-layer synthesis requires less time for production and chemical properties. Interesting is the combination with high technologies for the production of nanostructured work is development of theoretical bases and creation of materials by methods of plastic deformation and products and preparations of nanostructured nano-powders, nanostructured materials and products, nanotechnology in metallurgy, including production of hydrogen energy based on local fuel resource. This requires the development of innovative technologies to create installations on the basis of the fuel cell system — one of the priorities in modern world of hydrogen energy. Kansas City;

Biofuel energy-efficient technologies

Technology energy-efficient recycling and use of energy potential of organic waste

Development of scientific and technical bases for the creation of energy-efficient technologies to produce high-quality biofuels from organic wastes for utility purpose. Given the availability of large sources and subject to an effective technology for biorefinery and hydrogen-consuming fuel, an opportunity arises for autonomous development of hydrogen energy based on local fuel resources. This requires the development of innovative technologies to create installations on the basis of the fuel cell system — one of the priorities in modern world of hydrogen energy. Kansas City;

Nanoalphotobiology

Studying the Composition and Structure of the Most Complex Biological Objects

The NEC uses modern experimental approaches to the study of complex biological objects, identifying their functions at the cellular and molecular levels. Determination of these amounts of metabolites in human waste, the study of complex biotechnological processes and the molecular level; the research on the nanoscale level of biotechnology dynamics. The NEC is a unique method for studying the dynamics of biological structures on the nanoscale level.

Alexander Borovskiy
Academician, RAS

For these purposes, laboratories are equipped with modern equipment:

- Neutron spectrometer (Varian 700, USA)
- Mass spectrometer ion cyclotron resonance Fourier transform FTMS and low ionization ion source; electrospray and MALDI; Varian (USA)
- Chromatography-mass spectrometer LC/MS-HPLC (Shimadzu, Japan)
- Comprehensive system for the study of the dynamics of high energy-based (DSI) laser tweezers.

Experimental nuclear physics

Particle physics and neutron research in major science projects

Scientists are involved with the launch of two major experiments for the study of nuclear and particle interactions — PHENIX experiment at the RHIC heavy ion collider (BNL, USA) and the ALICE experiment at the Large Hadron Collider (CERN, Switzerland). They are designed for the study of phenomena in the nuclear and subnuclear levels, at different energies. With the assistance of the research team, several unique track detectors for high energy experiments were built for center PHENIX experiment detectors — drift chamber and muon chambers on ALICE detector. Researchers participated in preparations of the work during PHENIX and ALICE experiments and made an important contribution to the functionality of the detectors, experimental data collection and their physical analysis and interpretation.

Yuriy Berdnikov
Professor, DSc

Multiple-disciplinary research (deformable solids, mechanical structures, machinery, instruments, equipment, installations and structures, dynamics and controllability of machines, mechanics of composites and composite structures, fracture mechanics, structural mechanics, the mechanics of plastic metal-forming). 

Space Research

Astronautics, Cosmology, Origin of the Universe

The scientific team is involved in the study of various astrophysical objects and phenomena. These are non-thermal emissions in the altitude range from several kilometers up to several tens of kilometers, supermassive black holes which are a central engine of active galactic nuclei, colliding galaxies, at different energies. With the assistance of the research team, several unique track detectors for high energy experiments were built for center PHENIX experiment detectors — drift chamber and muon chambers on ALICE detector. Researchers participated in preparations of the work during PHENIX and ALICE experiments and made an important contribution to the functionality of the detectors, experimental data collection and their physical analysis and interpretation.

Dmitry Varshalovich
Academician of Russian Academy of Sciences, Professor, DSc

- Study several directions. Cosmology: Primordial Nucleosynthesis, Primordial Recombination, physical conditions and chemical composition of the Early Universe, problems of dark matter and dark energy.

- Application and development of advanced science-intensive computer technologies.

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**THE SCIENTIFIC LANDSCAPE**

**LEADING GROUPS**

**Development and implementation of comprehensive programmes to improve the efficiency and competitiveness of prospective systems for collecting, transmitting and processing information, including optical and fiber-optical sensors, micro- and nanoelectronic components and devices.**

**Research activities related to the development and improvement of terrestrial and satellite radio communication systems, radio navigation and radar systems for various purposes, as well as modern communication systems.**

**Scientists develop promising cathode and anode materials for lithium-ion polymer batteries, and nanostructured coatings and gas-phase mechanochemical methods of synthesis, including using the installation «PICOSUN». Research of processes of mechanical alloying and sps processes and vacuum-compression sintering.**

**Key project is to aim at creation of advanced nanocomposite cathode material on the basis of Li$_2$FeSiO$_4$ for lithium-ion batteries.**

**We have a wide range of works in the field of designing of buildings and constructions, engineering networks and systems, testing of building construction and materials. Researchers pay special attention to such fields of research as purification of air and industrial gases from dust by inertial separation. Scientific work is carried out to improve, optimize and enhance the reliability of systems of heat and gas supply, heating, ventilation and air conditioning.**

**Nanotechnology and telecommunications**

**Modern infocommunication systems**

**New materials and additive technology**

**Functional materials and nanocomposites for lithium-ion batteries**

**Construction of buildings and structures**

**Design of building, engineering networks, systems and materials**

**Anatoly Popovich**
Professor, DSc

**Vladimir Zatorov**
Professor, DSc

**Nikolay Vatin**
Associate Professor, PhD

**Sergey Makarov**
Professor, DSc

**Physical electronics**

**Physics of Nanocomposite Materials, investigations of the nanofluid.**

**The main tasks of the scientists are research and development of new nanomaterials for the electronics industry, as well as training professionals able to independently develop similar materials and production technologies. Among the promising areas include the development of:**

- microwave generation systems on the basis of regular arrays of Josephson junctions
- monolithic plates based on porous matrices
- adaptive elements of microwave optics
- «accumulators of mechanical energy» based on nanoporous materials.

**Investigation and modeling of structure and properties of metallic materials**

**Investigation and modeling of structure and properties of metallic materials**

**The laboratory of plastic metal processing technology develops steels and alloys, including high-strength automotive steel sheet, characterized by unique consumer properties — formability, weldability, durability, impact energy absorption during collisions. Researchers developed intelligent information technology to describe the process of thermo-mechanical treatment of steels and alloys with a given level of mechanical properties, optimizing chemical compositions while maintaining the level of mechanical and performance properties of the steels to optimize the energy-power parameters, taking into account changes in the chemical composition and structural state of alloys.**

**Among the promising areas include the development of:**

- microwave generation systems on the basis of regular arrays of Josephson junctions
- monolithic plates based on porous matrices
- adaptive elements of microwave optics
- «accumulators of mechanical energy» based on nanoporous materials.

**Interdisciplinary Research**

**IDPC for biological systems**

**Studies aimed at gaining new fundamental knowledge about the mechanisms of the impact of ionizing radiations on the molecular-biological tissue and the development of diagnostics and treatment of diseases based on this knowledge. The approach is based on the efficient use of space computing and diagnostic devices.**

**Vladimir Zaborovsky**
Professor, DSc

**Nikolai Kolbasnikov**
Professor, DSc

**Alexey Filimonov**
Professor, DSc

**Pavel Yakutseni**
Professor, DSc

**18 SCIENCE**
Renewable Energy

Renewable energy sources and technologies of independent power supply

Conducted basic research in the field of conversion and energy storage for renewable sources and applied research in the field of engineering solutions for design of renewable energy facilities. Developed expert-information technologies to ensure the efficiency and reliability of power plants and complexes based on renewable energy. Conducted comprehensive research into solar, biomass, wind and hydro-power plants on the basis of physical and mathematical modeling, as well as computer-aided design and mathematical modeling of hydro and water facilities.

Data visualization in Virtual Reality in Engineering

Computer simulation technology in virtual reality systems

The field of activity of the scientific group — the creation and development of virtual engineering technologies using virtual surround systems. Competence of the research group is focused on the development of algorithms for solving extraordinary problems of science and technology in the field of the analysis of the results of predictive modeling based on virtual surround systems, use of multiprocessor systems. One of the first Russian high school hardware and software system virtual environment based on the system of 3-sided CAVE 3D (Computer Aided Virtual Environment) was created at the department using 3 transparency screens, video cluster, optical tracking system and Display Wall based on 16 LCD Monitors NEC 46 UN.

Real-time 3D graphics

3D computer graphics in real-time

Main research areas: 3D computer graphics real-time processing and analysis of images, massive parallel computing on GPUs.

• Modeling and simulation of physical processes in real-time — the spread of fire and smoke in the fire simulator, the flow in the wind for testing building structures.
• 3D reconstruction at computer tomography and US — recovery 3D models biological object by output data computer tomograph or ultrasound scanner.
• Processing and analysis of medical images — detection of pathological changes in the areas of X-ray and tomographic images, ultrasonic scan pictures.
• Software development for a new generation of computer tomography: having the ability to track and compensate for movement of the heart during the scan.

Quantum computing

New technologies for practical realization of quantum multi-bit registers

The development of the technology and methods of electronic components is needed to ensure the practical realization of quantum multi-bit registers, which are regarded as promising components of hybrid systems, high-performance cloud computing.

Creating scientific and technological potential for wide use of silicon nanowires and qubits, promising component of hybrid systems, new-generation high-performance cloud computing.

Fluid Dynamics

Solving fundamental and applied problems of fluid dynamics and heat transfer

The scientific team is focused on the development of modern computing methods and tools for the study of fundamental and applied problems of fluid dynamics and heat transfer at low and high speeds. The highly developed supercomputer computational fluid dynamics package SINF, implemented by the group for solving threedimensional Navier-Stokes equations on the finite volume method using a multi-block grids, is being used for the study of turbomachinery problems, thermal power, nuclear power, shipbuilding, industrial aerodynamics. RANS- and eddy-resolving approaches are used for turbulence modeling. Activities of the research group also cover the issues of interaction of flows and designs, trends in the field of mass flows, the dynamics of flows with a free surface, the conjugate heat and mass transfer in multiphase flows.

Computational hydroacoustics and turbulence

Mathematical modeling of turbulent flows

The main activity — carrying out research work in the field of computational fluid dynamics and heat and mass transfer. The company has long-standing partnerships with leading aircraft and engine-building companies as well as company ANSYS, which is one of the leaders in the development of software for computational fluid dynamics.

Victor Elistratov
Professor, DSc

Nikolay Shabrov
Professor, DSc

Igor Shurts
Professor, DSc

Viktor Ilyin
Professor, DSc

Evgeny Smirnov
Professor, DSc

Michael Strelets
Professor, DSc

Nikolay Bagrayev
Professor, DSc

Nikolay Shabrov
Professor, DSc

Igor Shurts
Professor, DSc

Ventislav Milanov
Professor, DSc

Evgeny Smirnov
Professor, DSc

Michael Strelets
Professor, DSc

Nikolay Bagrayev
Professor, DSc

20
Bioinformatics
Mathematical biology of systems, relationship of variability and stability in biological systems

Mathematical biologists seek to answer the main question: how the interactions of the molecules limit the orderly and efficient behavior of cells, organs, and organisms. This area of knowledge allows the efforts of mathematicians, biologists, physicists and programmers. Developed by the authors of the project, FlyEx database of gene’s segmentation is one of the most popular in its field among the world scientific community.

Maria Samsonova
Professor, DSc

Molecular Virology and Oncology
Breakthrough into a Evolutionary Oncology and HIV

Areas of research covers a wide range of theoretical and practical issues, from molecular and evolutionary biology to the prevention of infectious diseases and the development of HIV vaccines.

Research group is studying the molecular and genetic characteristics of parenteral HIV transmission using deep sequencing techniques and will be studied thousands of virus variants for each sample. The vaccine, developed by Prof. Kozlov, has successfully passed Phase II clinical trials.

Andrei Kozlov
Professor, DSc

Systems biology
Development of vesicular transport model

Development and validation of the mathematical models of neurotransmitter dynamics in humans. The work is carried out on a unique experimental material – artificial organs grown from some cells of healthy and sick patients with schizophrenia. The basis of the project is mapping genetic variability of the phenotypic is the study of gene regulatory network that controls the structure of the body plan in the fruit fly Drosophila. Scientists create a database of standardized time series of changes of vesicular transport in the cells, and is developing a mathematical model of vesicular transport

Sergey Mazhutin
Professor, DSc

Testing technologies and programming
Improving the quality of software products

In the focus of attention of scientists is technology and tools that automate the processes of creating a quality software product from formulation of requirements in natural language, analysis and symbolic verification to automatically generate test code and actual testing. The peculiarity of the technology is to verify satisfaction of the requirements in natural language, analysis and automated cycle of creating a quality software product from requirements in natural language, analysis and testing.

Vyesvold Kotlapov
Associate Professor, PhD

Adaptive Control Systems
Methods of adaptive control of distributed system

Research and advancements in the areas of fundamental approaches, development and application of new methods for the intelligent control of distributed systems, technologies, processes, artificial neural networks based computational mathematics, computer technologies and theory of artificial intelligence. Development of new adaptionistic methods in computational mathematics and mechanics.

Dmitry Arseneev
Professor, DSc

Superstrong pulsed magnetic fields
High Voltage Equipment

Research group focuses on the technological application of pulsed electric fields and discharges. However work is underway in the field of superstrong magnetic fields, based on the use of solenoids with quasi-force-free winding. This work opens the possibility of achieving field induction above $10^9$ T Tesla-metric magnetic fields.

Oleg Tolochko
Professor, DSc

Materials and Technologies
Nanoparticles synthesis by different methods

Areas of scientific activity: Nanoparticles synthesis by different methods (gas phase synthesis, microwave synthesis, spray dry and sonication, electrochemical synthesis) and its applications, composite and hybrid functional materials, materials with special properties (electric, optic, magnetic, tribological). Main scientific research and experiments carried out Magnetic nanoparticles synthesis and applications, Synthesis structure and properties of transition metals chalcogenides thin layers and nanoparticles, Synthesis structure and properties of carbon nanomaterials by CVD. Medical composite materials reinforced by nanofibres, Polymer-based composite materials

Eugene Plyushchev
PhD

Microsystems technology
Research and development in the field of Nano- and Micromechanical systems

Research laboratory has extensive experience creating devices Microsystems devices based on the developed technological base and physical methods and mathematical modeling.

Innovative projects:
• The highly sensitive strain gauges;
• High temperature strain sensors;
• Test Manager the medical catheter to measure pressure in the internal cavities of a patient;
• Vacuum micropropelled industrial manipulators;
• Power strain gauge-type microsensor.

Herman Shevchenko
Corresponding member of Russian Academy of Sciences, Professor, DSc

Oleg Tolochko
Professor, DSc

• Power strain gauge-type microsensor.

Nano- and Microsystem technology
Development of vesicular transport model

Mathematical biology of systems, relationship of variability and stability in biological systems

Mathematical systems biology seeks to answer the main question: how the interactions of the molecules limit the orderly and efficient behavior of cells, organs, and organisms. This area of knowledge allows the efforts of mathematicians, biologists, physicists and programmers. Developed by the authors of the project, FlyEx database of gene’s segmentation is one of the most popular in its field among the world scientific community.

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Herman Shevchenko
Corresponding member of Russian Academy of Sciences, Professor, DSc

Oleg Tolochko
Professor, DSc
Scientists engaged in the development and study of the theory of plastic deformation and failure processes in new super strong materials. This will affect the production technology of materials with a unique combination of ultrahigh strength and functional plasticity.

The software development laboratory conducts research in the area of improving software quality using formal methods. For this purpose used deductive methods of verification the methods of complete and bounded model checking, static program analysis, automated testing and synthesis tests, automated software re-engineering, dynamic program analysis, etc. These approaches are applied to software systems written in C, C++, Java, and software and hardware systems that are modeled using the SystemC language.

High-speed analog to digital converters (ADC) are vital for development of next generations of ultra high-speed mobile networks, smart sensors systems, advanced high resolution radar systems etc. However, further progress in development of analog-to-digital converters (ADC) for the frequencies beyond 2.5 GHz based on microelectronics is limited by fundamental physics. An alternative approach is to use light to carry high frequency signals and accomplish conversion of signal from analog to digital form on optical level. The target of the project is to develop advanced photonics components: mode-locked lasers and photodetectors for new generation of all-optical analog to digital converters.

The works of chief scientific officer come in two major clusters: one associated with the specification of the fundamental constants, the other - with the study of polarization and x-rays. His work on the two-loop calculations of QED effects in atoms without an expansion in the external field received an international recognition. The work on the calculation of the anomalous magnetic moment of the bound electron, which resulted in a more accurate value of the electron mass, is widely cited.

Laboratory of virtual-simulation performs a variety of interdisciplinary projects on computational mechanics and related areas. Development of specialized software, a comprehensive analysis of engineering problems arising in industrial companies. Simulation and calculation of stress-strain state of complex mechanical systems. Modeling of composite materials. Stationary and non-stationary calculations, the study of influence of forces and vibrations. Stationary and non-stationary calculations flow of liquid and gas in areas with complex geometry. Calculations using supercomputer technologies and the world’s leading CAD / CAE, FEM and CFD software systems.
The main focus of the lab is to model the behavior of materials with complex internal structure at the nano, micro, meso and macro scales. The developed models and algorithms are used to describe the processes associated with strong deformation and fracture of materials, as well as the creation of new materials with unique properties.

The field of activity of the scientific group — the creation and development of virtual engineering technologies using virtual surround systems. Competence of the research group is focused on the development of algorithms for solving extraordinary problems of science and technology in the field of the analysis of the results of predictive modeling based on virtual surround systems, the use of multiprocessor systems. One of the first Russian high school hardware and software virtual environment based on the system of 3-sided CAVE 3D (Computer Aided Virtual Environment) was created in the department using 3 transparency screens, video cluster, optical tracking system and Display Wall based on 16 LCD Monitors NEC «46 UN.

The aim of the group is to develop the scientific bases and technology development for reproducible synthesis of semiconductor nanostructures, investigation of new physical effects and phenomena in them, development, simulation and experimental study of devices based on those new effects and phenomena.

Integrated Circuitry Communication Systems

nano- and microelectronic component base

Metallurgical Engineering Expertise

ensuring the quality of the finished product in the production of steels and alloys

The RL is developing technical recommendations to improve the quality of finished products in the production of steel and alloys, quantitative methods of assessing the quality of steel. The laboratory is equipped with optical microscopes, image analyzers with integrated Thixomet SmartDrive for panoramic study the structure of materials, there is a complete line of machines for shrift preparation.

Micromechanics of destruction

Modeling of the materials behavior

The main focus of the lab is to model the behavior of materials with complex internal structure at the nano, micro, meso and macro scales. The developed models and algorithms are used to describe the processes associated with strong deformation and fracture of materials, as well as the creation of new materials with unique properties.

Physics and Technology of heterogeneous materials and nanoheterostructures

Reproducible synthesis of semiconductor nanostructures

The aim of the group is to develop the scientific bases and technology development for reproducible synthesis of semiconductor nanostructures, investigation of new physical effects and phenomena in them, development, simulation and experimental study of devices based on those new effects and phenomena.

Optics laboratory of nonequilibrium electrons

Development of physical bases of semiconductor optoelectronic devices

The main direction of scientific research is optical phenomena and optics of hot electrons in semiconductors and semiconductor nanostructures associated with intraband transitions of charge carriers. Development of physical bases of semiconductor optoelectronic devices based on thermionic and tunneling range. The laboratory is equipped with world-class equipment vacuum Fourier spectrometer Bruker Vertex 80v at spectral range of 0.5–1000 microns, lattice spectrometers, photodetectors, closed cycle cryostats for temperatures 4.2–350K, measuring equipment (lock-in amplifiers and boxcar integrators).

Metallurgical Engineering Expertise

ensuring the quality of the finished product in the production of steels and alloys

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Reproducible synthesis of semiconductor nanostructures

The aim of the group is to develop the scientific bases and technology development for reproducible synthesis of semiconductor nanostructures, investigation of new physical effects and phenomena in them, development, simulation and experimental study of devices based on those new effects and phenomena.
Strong and superstring pulsed magnetic fields generation

Shneerson, German A. / Dolotenko, Mikhail I. / Krivosheev, Sergey I. De Gruyter, 2014

Strong pulsed magnetic fields are important for several fields in physics and engineering, such as power generation and accelerator facilities. Basic aspects of the generation of strong and superstrong pulsed magnetic fields technique are given, including the physics and hydrodynamics of the conductors interacting with the field as well as an account of the significant progress in generation of strong magnetic fields using the magnetic accumulation technique. Results of computer simulations as well as a survey of available field technology are completing the volume.

Advances in the Casimir effect


In 2014 the Oxford University was published a revised edition of the Advances in the Casimir effect, a book co-authored by professors of the Quantum Electronics department of SPbPU. The theoretical and experimental results of a study of the Casimir force that is of quantum nature and that occurs due to zero fluctuations of vacuum and thermal photons were stated in this book for the first time. The Casimir effect has numerous applications in solid-state physics, nuclear physics, elementary particle physics and cosmology. Nowadays the applications of the Casimir effect in nanotechnology are actively studied in order to create the next generation micro- and nanoelectromechanical devices, in particular, using graphene and other carbon nanostructures.

Evolution by Tumor Neofunctionalization

Andrei P. Kozlov. The Role of Tumors in the Origin of New Cell Types, Tissues and Organs

Evolution by Tumor Neofunctionalization explores the possibility of the positive role of tumors in evolution of multicellular organisms. This unique perspective goes beyond recent publications on how evolution may influence tumors, to consider the possible role of tumors in evolution. Widespread in nature tumors represent a much broader category than malignant tumors only. The majority of tumors in humans and other animals may never undergo malignant transformation. Tumors may differentiate with the loss of malignancy, and malignant tumors may spontaneously regress. Cellular oncogenes and tumor suppressor genes play roles in normal development. Many features of tumors could be used in evolution, and there are examples of tumors that have played a role in evolution.

Origin of the Moon. New Concept

Galimov E.M., Krivtsov A.M. De Gruyter, 2012

The origin of the Moon remains an unsolved problem of the planetary science. Researchers engaged in celestial dynamics, geophysics, and geochemistry are still discussing various models of creation of our closest cosmic neighbour. The birth and development of a planet-moon system always plays a role in the formation of an entire planetary system around our Sun or around another star. All this has motivated the authors of this book to consider a new concept and to compare the currently discussed theories, analyzing their advantages and shortcomings in explaining the experimental data.
MEGAGRANTS

In order to strengthen governmental support for the development of science and innovations in tertiary education and to improve the quality of higher education, in 2010, the Government of the Russian Federation instituted monetary grants that are made available on a competitive basis to support of scientific research projects implemented by the world’s leading scientists at Russian institutions of higher learning.

Resolution No. 220 pursues the following goals:

- To bring world-renowned scientists, including scientists from among Russian citizens residing abroad, to Russian institutions of higher learning;
- To create scientific research laboratories capable of competing with the world’s leading laboratories;
- To ensure achievement of world-class research results;
- To create conditions required to improve the professional quality of the faculty and research specialists of Russian institutions of higher learning, as well as to create an effective and efficient system of motivation of scientific work;
- To encourage young people to pursue professional development in the fields of science, education, and high technologies;
- To help create sustainable links between Russian institutions of higher learning and the world’s leading universities and science schools;
- To facilitate commercialization of the research results and new technologies developed in the course of the scientific research projects supported under the program.

KONSTANTIN SEVERINOV, PROFESSOR, DSC
Laboratory of molecular microbiology
The objective is the establishment in the Saint Petersburg Polytechnic University of a modern laboratory of molecular, ecological, and applied microbiology. The laboratory faces a number of research problems to solve, covering a wide range of issues associated with bacterial metabolism.

ILYA BEZPROZVANNY, PROFESSOR, DSC
Laboratory of molecular neurodegeneration
Creation of a laboratory of a world level that would specialize in research of brain and neurodegenerative diseases, identification of the role of cytoplasmatic calcium in development of neuronal pathologies, experimental verification of calcium hypothesis on cell and animal models of Alzheimer disease (AD), Huntington disease (HD), and spinocerebellar ataxia (SCA).

VESELIN MIKHAYLOV, PROFESSOR, DSC
Laboratory of light materials and structures (KMS)
The goal is to set up a leading center for development of materials and structures, operating technology in Russia and abroad. The laboratory at the University will open up a new research area of the world level, connected with development and implementation of materials and structures with high specific strength, operating life, reliability, and cost effectiveness.

GEORGY PAVLOV, PROFESSOR, DSC
Laboratory of astrophysics of objects with extreme energy generation
The goal of the project is to create a modern scientific center for fundamental interdisciplinary studies in the field of astrophysics and space research.

FRIDRICH WANNE, PROFESSOR, DSC
Laboratory of physics of improved containment of the plasma of tokamaks (picpt)
Organization of LPICPT relies on the Executive Committee and the Scientific Committee and is focused on the long-term efforts in the field of fusion. LPICPT is involved in the research program of the Ioffe IPH for creation of the Globus-M2 device. For the purpose of education and training an accredited program of post-diploma training was developed.
SPbPU played the core role at the initial stage of the collaboration between Russian universities and RASA. SPbPU’s rector Andrey Rudskoy was invited to come to Russian Embassy in Washington D.C. to participate in round table with RASA-USA Coordination Council to discuss the possibilities of using USA experience in Russian research and educational system enhancement processes.

Vyacheslav Safarov
Head of RASA-SPbPU Centre
Professor, DSc
PLACE WHERE EUROPE & ASIA MEET
REPRESENTATIVE OFFICE IN SHANGHAI, CHINA

April 21, 2016, in a modern building on the territory of the High-Tech Park in the Pudong New Area, Shanghai (PRC), Peter the Great St. Petersburg Polytechnic University held the opening ceremony of its representative office. The Polytechnic University has been the first Russian University to establish a representative office in China.

The mission of the University’s Representative Office in Shanghai is to represent and safeguard the interests of the University in China and other countries of the Asia-Pacific region; promote international cooperation in education, research and the public sphere; promote contacts and cooperation with Chinese and international scientific, expert, academic and research institutions, industrial enterprises and companies, governmental agencies and NGOs; provide international counterparts with up-to-date information regarding the University’s activities; compile and analyze information regarding cooperation opportunities in fields with international partnership potential; make use of the University’s communication channels promote the University in this region as a place of innovation, engineering and international repute.

Shanghai office will help the University settle science and technology relations with both educational and business communities of PRC and other states of the Asia-Pacific Region. Presence in Shanghai - one of the largest Chinese cities, major industrial, financial and cultural center - is extremely important for our University and the prestige of the Russian higher education as a whole.

Dmitry Arseniev
Vice-Rector for International Relations

Denis Borisov
Consul on Science and Technology at the Russian Consulate General in Shanghai

Miao Yuan
Consul for Science and Technology of the General Consulate of the PRC in St. Petersburg

I am glad to participate in the occasion of opening the representative office of one of the oldest and leading Russian universities in China. The representative office is opened in the wake of the dynamic development of relations between our countries, and Shanghai today is becoming one of the world’s leading innovation centers.

The Polytechnic University is starting to play an increasing role in the expansion of scientific technological and educational cooperation between Russia and the People’s Republic of China. New promising projects, especially in the area of Hi-Tech, microelectronics, engineering and ecology are currently emerging. I hope, that SPbPU’s office in Shanghai will become an important ground for the expansion of science and technology cooperation.
Our laboratory has excellent cutting-edge biophysical equipment, possibly unique for Russia. In addition, Polytech has many skilled professionals - physicists and engineers. This is particularly important because, rather often than not, the research requires engineering approach.
We are open for cooperation and we continue to think of new mechanisms for cooperation and future projects. The RSF constantly works with foreign experts. For us, the issue of international cooperation is the main question. At the end of 2014, Germany has become our strategic partner. We appreciate the efforts of Polytech in the organization of international meetings. We learned a lot about the modern grant system.

### Eco-friendly Turbine Generators

The concept of using the energy of compressed natural gas for electric power generation in turbine generators for own needs of the gas transportation system. Such turbogenerators will enable to create environmentally friendly sources of generating electricity without burning additional fuel.

**Nikolai Zabelin, Associate Professor, PhD**

### Ultrasonic theranostics

The lab of Alexander Berkovich is working on the development of new device for theranostics of varix dilatation. The device encapsulate at least two technologies – wellknown ultrasound diagnostics and therapeutic ultrasound action, due to which high energy can be concentrated inside the body without damaging the tissue.

**Aleksandr Berkovich**

### Mobile distributed system IBS

The cooperation between Polytech and IBS company, largest Russian IT-company, became possible in the framework of Governmental program for stimulating cooperation between industry and universities. Huge experience of our partners and knowledge-intensive solutions of our university laid down as a base for the development of modern commercial software product.

**Alexander Samochadin, Associate Professor, PhD**

### Origin of the Moon. New Concept

The origin of the Moon remains an unsolved problem of the planetary science. Researchers engaged in celestial dynamics, geophysics, and geochemistry are still discussing various models of creation of our closest cosmic neighbour. The birth and development of a planet-moon system always plays a role in the formation of an entire planetary system around our Sun or around another star. All this has motivated research team to consider a new concept and to compare the currently discussed theories, analyzing their advantages and shortcomings in explaining the experimental data.

**Anton Krivtsov, Corresponding member of Russian Academy of Sciences, Professor, DSc**

Polytech researchers in collaboration with European Space Agency has developed the cosmic models needed for managing of landing process.
EXPLORE OUR RESEARCH PROJECTS
CROSSING BORDERS

Polytech actively supports international grant making which helps to build direct connection with numerous academic and industrial partners from around the world. Many years of experience in implementing projects within the framework of various international programs to support collaborative research allows Polytech to act now as a credible participant in international consortia. Mechanisms of international collaborative and coordinated competitions held as a part of the FTP, RSF, RFFI and other funds make it possible to concentrate the efforts of research teams from different countries to solve a variety of challenges.

Despite the political tensions in the world, the scientific community is confident in maintaining professional and collegial relations. Authoritative scientific organizations and foundations have great respect for Russia’s achievements and contribution into the global system of science and education. A scientist is always a man of the world, he (or she) seeks to unite people, and each discovery is a big step towards a great change and the future of all mankind. Representatives of the business community and scientific and educational organizations should understand the problem of teamwork and must have a clear understanding of mutual expectations. The aim of the project is to develop innovative technologies for emergency tokamak discharge quench and for the first wall maintenance by means of injection of high speed dusty jets into the plasma. Fast quenching of tokamak discharges in case of expected major disruption or other emergencies has been performed using killer pellets and intensive gas jets. Both technologies are based on injection of cool material hydrogen or noble gases (or solid oxide cooled) placed in wave-guide channel compatible over certain ranges that are the line plasma partitions. It is necessary to use the wave-guide or gas into plasma in few milliseconds after the tokamak disruption which requires lower or higher velocities. For killer pellets the main technological problem is complicated injection devices and substantial time spent for pellet acceleration.

The service potential of the southern and eastern Baltic Sea region is of high value for the transport and logistics sector. However, this potential is often hidden, just like amber. With the EU-project Amber Coast Logistics it shall be brought into the light of day.

The objective of the project is to increase the knowledge of Arctic climate change for safety and sound petroleum production and transport. Joint educational activity organized for Norwegian and Russian students improve and develop relations between Norway and Russia in the Barents Sea region including Svalbard.

The objective of the project is to develop new algorithms for host pathogen interactions of high medical relevance, with its host at the systems level. Guided by biological data, PATHOSYS focuses on the design of novel algorithms and mathematical methods for systems biology. Based on developed models and using systems analysis, PATHOSYS and its partners contribute to the understanding of the regulation and transport of hydrocarbons from the Barents Sea region, improves relations between Norway and Russia in the Barents Sea region including Svalbard.

Sergey Kozyrev
Head of the Center for advanced studies, Professor, DSc

«The focus of our attention — a palette of promising areas of modern science, from quantum phenomena to the human world»

Gregor Berghorn
Head of DAAD Representative in Moscow

Research...
Polytech has a fleet of modern and unique equipment. The real breakthrough was the construction of modern scientific research campus building, which fits well into the existing infrastructure – leading laboratories have new opportunities for further development.

**Supercomputer Center Polytechnic**

SCC — a complex and multi-faceted complex, equipped with the most modern computer systems. Peak total output during calculations is around 1.3 petaflops. This is Russia’s first supercomputer cluster on the basis of Intel Xeon E5-2600 processors belonging to v3 family (12x6 CPU, 18704 x86 cores). It represents the first large-scale implementation of innovative solutions in the supercomputer industry — massively parallel ultra-threading RSC PetaStream calculator built on a 60-core processor Intel Xeon Phi.

**Laser tweezers**

The unique integrated system for the study of the nanomachine dynamics has been designed for research in the field of living systems. It allows one to measure the dynamic and mechanical properties of single molecules to obtain information that is not accessible by any other means. This opens up an entirely new opportunity for direct study of mechanisms of action and the work of individual molecules in living systems.

**Installation for friction stir welding**

Installation, set up by the company MATEC Maschinenbau, Germany, weighs 88 tons and is designed to develop ultra-light materials and structures. This type of welding has unique characteristics — joined elements do not fall into the liquid phase, allowing the physical properties of metals to remain stable. The materials are needed in the industry since reduced weight design increases the economic feasibility of their use.

**Confocal microscope**

A modern two-photon confocal microscope for spatial visualization of nerve cells is used in the Laboratory of Molecular Neurodegeneration. The device allows to reach a qualitatively new level in the study of the structure and function of nerve cells.

**Gleeble 3800**

A special testing facility, Gleeble System 3800, is designed to test the properties of metals and alloys, and allows you to simulate the majority of metallurgical processes: continuous casting, processing semi-solid, hot rolling, forging, extrusion, welding rings, butt welding, diffusion welding, continuous annealing, rolling, heat treatment, powder metallurgy, sintering and synthesis of new materials.
We know design, technological and manufacturing processes of world leading companies from inside. In our educational programs we are going from industrial tasks-challenges, based on fundamental physical and mathematical background and modern technologies. We are sure that this is the only way to educate scientific-technological and engineering elite of the nation.
Scientists from Polytech did their bit to the preparations for the 2018 FIFA World Cup – they have developed a unique design withdrawable field of the new stadium, "Zenith". All components necessary for the implementation of major structural withdrawable field were produced at Russian plants while exclusive design drawings were developed with the participation of polytechnicians, specifically for this object. Stadium on Krestovsky will be the only one in Russia and one of the few stadiums in the world equipped with a roll-out field.

The employees of the Department of automata have participated in the decision of design and technological challenges to create the scenery in the leading theaters of Moscow and St. Petersburg. From the "Ring of the Nibelungs" to "Nutcracker" — dozens of performances gained the most complicated scenery. This work is reflected in the Russia's only doctoral thesis on the theatrical machinery.

During the restoration of the Peter-and-Paul Cathedral, a need had arisen to meet the challenge of calculating load bearing characteristic of the spire and weather vane by computer simulation. The refurbished symbol of St. Petersburg — 750-pound vane Angel — took off on the spire of Peter-and-Paul Cathedral on the 300th anniversary of the city, where he continues to shine to this day.

Polytech Scientists made valuable suggestions during the construction of the St. Petersburg dam. Modification form flaps, conducted with the help of computer simulations, allowed to provide efficient and stable operation of a navigation channel, which speeded up the completion of the dam needed to protect St. Petersburg from flooding.

Polytech scientists take on the project for all complex specialized works and services for the creation of innovative hydraulic actuators and hydraulic drive mechanism for a variety of industries. Under the guidance of Professor Ashcheulova, reconstruction of hydraulic drives movable mechanisms was carried out for the famous bridges of St. Petersburg — Novsky, the Trinity, the Big Okhta, Volodarsky.
BREAKTHROUGH PROJECTS
MISSION OF CHANGES

Within the project the technology of designing of endoprosthesis of hip-joint was developed. Based on tomography data of hip-joint the exact 3D model is building and missing part of bone tissue is detecting. On the next stage based on this hip-joint 3D model a new 3D model of missing bone tissue part is developing and optimizing for printing. Later on the implant is produced from titanium on the SLM-installation. In particularly, the joint of the patient was digitally scanned, polystyrene models were created and then metal prosthesis was built from special titanium alloy also developed by Russian scientists. Polytech was the first Russian centre, where the 3D printing of metal joint for particular patient was manufactured. The first surgery intervention was successful.

In Russian-Chines laboratory the technology of producing cathode materials for polymer Li-ion batteries was developed. The new material allowing battery work in extreme temperature conditions. As a result – the end-point technological product – will be the sample laboratory battery in a form of “tablet” with only 20mm diameter.

Technologies of autonomous energy supply based on traditional and renewable sources of energy. Scientists are aimed on the development of intelligent technologies for autonomous energy supply based on traditional and renewable sources of energy for the extreme climate conditions. Within the project the scientists are developing the interactive map for evaluation and estimation of the resources available on different heights and different level of energy power needed.

Specialists of the Industrial Heat Power Engineering laboratory fulfilled the project on the design of the development program for all engineering networks of Ekaterinburg for the next 10 years. Developed mathematical models allowed to make expert selection of most effective and economically proved variants. For the next 10 years the program inludes particular action plans for both community facilities services on decreasing costs and improving quality and reliability of services. The new program will allow city to attract private and state investments for renovating networks and improving services.

The laboratory of «System Dynamics» is developing a scientific and methodological principles of formation of conditions for the existence of the process of socio-economic development of the Arctic zone taking into account risk and uncertainty geo-economic strategy of Russia. It is about the theory and practice of synthesis of adequate leading model of regional policy in Russia.
BREAKTHROUGH PROJECTS FOR GLOBAL INDUSTRY

The University has created all conditions for realization of the most daring ideas, the implementation of technical and creative projects. It is no accident that the first laboratory in St. Petersburg for open digital manufacturing — the Fablab — was opened in the heart of the University campus in the famous Water Tower (Gidrobashnya).

Modelling of assembly process of wing load carrying structure for the aircraft Airbus A320

ASRP is the joint project of SPbPU and Airbus on the development, testing and implementation of specialized software for airframe assembly. During the 10 years the hundreds thousands rows of code were written, the computational core and user interface were developed. This development was certified according to NASA standards and recommended for implementations on Airbus. Joint project on assembling aircrafts A350 and A320NEO allowed to optimize the assembly technologies of main parts of the airframe.

We have an objective to develop human resource, technological, manufacturing facilities in order to take a rightful place in the currently forming global markets. It is extremely important to build up a community of engineering centers, which could effectively cooperate with the existing development institutes, state corporations and foreign partners — and a Polytechnic University has a lot to be proud of in this field.

Denis Manturov
Minister of Industry and Trade of the Russian Federation

PHILIPS

Signal processing and image reconstruction

Fundamental research in the areas of new scintillation materials and new mathematical methods of signal processing and image reconstruction. Sustainable cooperative links with four leading European universities were established.

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Important works on study of processes in steam and hydraulic turbines and turbine generators are performed by universities according to our orders. A significant part of orders is treated by St. Petersburg Polytechnic University, whose management is actively promoting the cooperation of university and industry.

Yuri Petrenya
Technical Director of Power Machines JSC
Professor, Corresponding member of RAS

We have a wide range of projects in the field of nuclear energy: modernization of control systems and control algorithms of NPP turbines, a comprehensive examination of the elements and systems to extend the life of nuclear power units, enhancing nuclear, technical and fire safety, as well as improving the efficiency of cooling systems, etc.

Gazprom is one of the strategic partners in terms of integration. The corporation considers the University both as an educational and a research center and that is why we want to become not only a supporting university of Gazprom but also an intellectual-technological environment for joint developing and introducing technologies within the framework of the import substitution program. Interaction of PAO Gazprom with the Polytechnic University is a bridge between industry and science. The cooperation of the university and the corporation in introducing Russian research and development into the domestic industry already has results – employees of the Computer Engineering Center (CompMechLab®) of SPbPU have developed and produced a rotary support pin of a crane, which is required for the functioning of the ice-resistant oil platform «Prirazlomnaya» for JSC Gazprom Neft.

Polytechnic University was the first University partner of GC «Rostechnologii» in St. Petersburg. There are joint integrated applied research in the promising areas of development and production of high-tech products on the basis of the analysis, forecasting and marketing to domestic and foreign markets. A particular challenge is to reduce terms of the creation of high-tech products and its cost through the introduction of advanced technologies.

Modern cooperation of the enterprise and Polytech is aimed at developing long-term engine for helicopter (MPE), which is conjucting by JSC «Klimov» and the research institutes. A promising direction of research and production cooperation is the study of additive technologies and computational design methodologies. The results of research works have already found their application in the creation of new helicopter engine TV7-117V development of «Klimov», which will be installed in the latest Russian helicopter Mi-38.

OJSC «Power machines» and Polytech are collaborating in the interests of the Russian power engineering industry and higher education to achieve common goals for the development of modern technologies based on last achievements of science. Among the subjects of research demanded by the world’s leading industrial concern, - heat power engineering, energy and transportation engineering.

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INTERNATIONAL CENTRES
TANDEM OF INDUSTRY AND EDUCATION

International Research and Education Centers (IREC) established in cooperation with some of the top manufacturing companies of the world are one of the key application areas for the research and education activities of the Polytechnic University. Currently, SPbPU hosts over 30 IREC operating as its organizational units. They are engaged in research projects spanning a wide range of the natural sciences: materials science, mechanics, power engineering, laser technologies, mechanical engineering, etc. The main benefit of integrating such centers into the University structure is that it ensures that the problems below are solved in a prompt manner and in close cooperation with an industry partner.

Research and Education Center «LG – Polytechnic»

Established in 2004 in cooperation LG Electronics, South Korea.
The Center conducts the following activities:
• search for and training of high-quality specialists in mobile device technologies in compliance with the profile of the LGE Russia R&D Centre
• running recruitment campaigns among final-year SPbPU students, and professional development courses for SPbPU staff and employees;
• initial training of students, the further training and retraining of LGE Russia R&D Centre staff, Korean students and LG Electronics employees;
• conducting research in line with the innovation program of LG Electronics;
• performing project and design works or outsourcing as part of cooperation with the LGE Russia R&D Centre.

Research and Technology Center «Motul – Polytechnic»
The Center was established in 2013 in cooperation with «Motul Deutschland GmbH», a leader in the high-tech engine lubricants market.
• «Motul Deutschland GmbH» is a world-famous producer of high-performance motor oils and industrial lubricants. The company has a strong global presence (among its international offices, there is one in Russia) and has secured an impressive foothold in the Russian market. Motul’s research and development laboratories, including those located in Russia, are dedicated to the development of breakthrough technologies in the automotive and other industries.
The research work of «Motul – Polytechnic» is aimed at conducting joint research in the field of chemmotology, namely, promising lubricants and motor oils.
The education activities of the Center include the tailored training of professionals fitting the company’s profile.

The International Scientific-Educational Center Embedded Microelectronics Systems (ISEC EMS)

Created in 2004 as a result of strong, long-standing partnerships between Polytechnic University, industry-leading technology companies (Xilinx Inc., Altera Inc.) and Microelectronics Support Centre, Rutherford Appleton Laboratory (UK)
The International Scientific-Educational Center Embedded Microelectronics Systems (ISEC EMS) implements the joint project «Research and Development of System Tools for Modeling the Features of Secure Hardware-Software Data Storage Complexes».

EMC²
IREC «Polytechnic – EMC²»
The Center was established in 2003 on the premises of ITIM in cooperation with «EMC Corporation (EMC²)», a global leader in the area of cloud computing, big data handling, and IT protection.

Key Science Activities:
• conducting joint research projects related to cutting-edge information technologies;
• sharing scientific and engineering information on the research and development in the areas of the company’s interests;
• implementing the joint project «Research and Development of System Tools for Modeling the Features of Secure Hardware-Software Data Storage Complexes».

IREC «Weatherford – Polytechnic»

Activity Areas:
• developing and updating drilling and well operation equipment;
• operations research and equipment testing;
• managing specialized training for the oil and gas industry;
• The Center’s training programs are a strong blend of classical university education and on-the-ground experience provided by Weatherford International.

IREC «Polytechnic – ЕМС»

The Center was established in 2013 on the premises of IITM in cooperation with «ЕМС Corporation (ЕМС²)», a world-famous producer of high-performance motor oils and industrial lubricants. The company has a strong global presence (among its international offices, there is one in Russia) and has secured an impressive foothold in the Russian market.
The International Scientific-Educational Center Embedded Microelectronics Systems (ISEC EMS)

The Laboratory was established in 1995. With support from Motorola’s Saint-Petersburg Software Design Center, the Laboratory is engaged in work along the following lines:
• Java technologies;
• automotive telematics;
• remote access solutions and tools;
• telecommunications software.

IREC «Weatherford – Polytechnic – Motorola»
The Laboratory was established in 1995. With support from Motorola’s Saint-Petersburg Software Design Center, the Laboratory is engaged in work along the following lines:
• telecommunication software.

LG

Research and Education Center «LG – Polytechnic»

Established in 2004 in cooperation LG Electronics, South Korea.
The Center conducts the following activities:
• search for and training of high-quality specialists in mobile device technologies in compliance with the profile of the LGE Russia R&D Centre
• running recruitment campaigns among final-year SPbPU students, and professional development courses for SPbPU staff and employees;
• initial training of students, the further training and retraining of LGE Russia R&D Centre staff, Korean students and LG Electronics employees;
• conducting research in line with the innovation program of LG Electronics;
• performing project and design works or outsourcing as part of cooperation with the LGE Russia R&D Centre.

Weatherford

Research and Education Laboratory «Polytechnic – Motorola»
The Laboratory was established in 1995. With support from Motorola’s Saint-Petersburg Software Design Center, the Laboratory is engaged in work along the following lines:
• Java technologies;
• automotive telematics;
• remote access solutions and tools;
• telecommunications software.
Robot «Butterfly»

Robot «Butterfly» is able to solve a variety of problems on calculations and stabilization of periodic motion of nonlinear mechatronic systems for robots’ movement control, nondestructive capture of objects, etc. The system includes such components as electromotor, gearing, technical vision and real-time control system.

Project LeninCraft

LeninCraft company is working in the area of 3D scanning science year 2013. Started from 3D scanning of human body today the company provides the full range of services – scanning, modeling and 3D printing of objects of any kind and any complexity. Besides this services, the company offers training courses on 3D scanning and modelling.

Smart implant

Implantable interface (neural-interface) to be used as sensor of remaining motion activity for the tasks of prosthesis-orthopedic devices and as test-systems of pharmacological influence on brain structure during neurodegenerative diseases treatment. Also can be used as diagnostic systems in cardiology and skeletal muscles treatments.

Development of innovative architecture and infrastructure projects contributes to form a comprehensive system of support and commercialization programs for research, development and engineering works, including programs of business incubation and acceleration of high-tech start-up projects.

The mission of Polytech Strascheg is to develop entrepreneurial culture among young people in the Northwest Region of Russia. By encouraging an entrepreneurial perspective on problem solving generally, we believe that Polytech Strascheg fosters not only business skills but also leadership qualities amongst its participants.

Together we create the future of our alma-mater. Polytech is not only the source of knowledge, but also the environment for self-development, mutual source of inspiration for the active and entrepreneurial people.

Olga Borscheva
Head of business incubator “Polytechnic”
Youth creativity
The University has created all conditions for realization of the most daring ideas, the implementation of technical and creative projects. It is no accident that the first laboratory in St. Petersburg for open digital manufacturing — the Fablab — was opened in the heart of the University campus in the famous Water Tower (Gidrobashnya).

Center of scientific and technical creativity of youth since opening in 2013, actively involve pupils and students of St. Petersburg, Russia and Europe in its activities. Based on the University Fablab, they created broad options for creativity and self-realization, mainly due to the variety of project areas: Robotics, neuroscience, additive technologies, technologies for photo and video, art projects and souvenirs, interactive and exhibits, furniture and equipment for the smart home, vehicles — just a few trends that have developed.

Learning how to work with modern equipment, a variety of workshops and training programs, order fulfillment for private companies, aid in the implementation of ideas for all visitors — from the opening of «Polytech Fablab», it was visited by more than 10,000 people. Fablab is a means of attracting young people of all ages to the technical activities, education and self-realization tool, an interface to communicate between the schools of the city and the University. There are special programs and intensives, thematic tours and lectures, engineering competitions, implementation of projects under the supervision of students — among the participants, there are more than 2,000 secondary school students annually. Capacities and special features of the Fablab premises allow to use it as a zone for technological co-working and conduct seminars, workshops and trainings. The ability to verify rapidly technical solutions and innovations is very attractive for developers, investment companies and venture capital funds. The Center for Scientific and Technical Creativity becomes the feed medium for a business incubator, small and medium business innovation, sci-entifico-technological associations.

Polytech race car
Students began work on the creation of their own car — the first in the Northwest «Formula Student» prototype racing car class. Power of «Uno» is 100 km/4sec. Under the hood of the car — 80 horsepower, weight, along with a driver — 270 kg.

Power management thought
In the project «Neurolab», they not only create devices controlled by neurointerface, but also organize competitions on neurogaming, in parallel, creating simulators for the brain.

See the stratosphere
The team under the direction of school students managed to create a reliable and cost-effective platform for the study of the atmosphere and the stratosphere — the guys had a successful launch of the probe ball and got pictures of the planet.

«Smart» regatta
The unmanned Solar trimaran — a source of pride for the participants of technical yachting section, in which students learn to yacht, win international sports and technical competitions.

Robohand
A hand printed on a 3D printer, assembled directly at the FabLab, and with the help of sensors on the glove, it duplicates operator movement. The young researchers have created a prosthesis for 13-year-old girl who uses it in her daily life.

Robofootball
The student robofootball team SPURT, led by Professor Starkevich, develops programs for the anthropomorphic robot Nao. Global objective — winning the RoboCup world championship.

YOUTH CREATIVITY
MAJOR EVENTS

Week of Science / annual in December
A huge International Forum with a history of several decades is the main scientific event of the year for Polytechnicians. Nowadays Science Week includes marathon of discussions, varied formats, numerous guest speakers, rating competitions among young people. The numbers of the event are impressive: there are more than 5,000 participants annually from more than 15 countries.

Polyfest / annual in May & September
Alternative winter science week has become a summer festival of scientific creativity, initiated by FabLab-team. Polyfest is an opportunity for young people to realize their potential and observe their research in new dimension. The festival is an important event in the St. Petersburg - it transforms into a real scientific picnic on campus. The target audience not only teenagers but families.

Rise Weekend / annual in May & September
City youth forum is organized by Business Incubator “Polytehnichesky” twice a year in three areas: “Science and innovation”, “Entrepreneurship” and “Engineering creativity.” It is unique opportunity for young scientists - invited experts speak about current contests and grants, top-managers talk about the corporate programs for youth and give specific projects.

Summer School / from June to September
We offer a wide range of courses in various fields of studies: biophysics, microelectronics, energy, engineering, architecture and design, information technologies, business and management, Russian language and culture. Students may combine 1-2 weeks modules to build own study schedule and accumulate appropriate amount of ECTS.
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