15th International Conference on
Electromechanics and Robotics
"Zavalishin's Readings"

ER(ZR)-2020

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14th International Conference
**"Vibration-2020.
Vibration technologies,
mechatronics and controlled machines"**

5th International Conference
**"Electric drive, electrical technology and
electrical equipment of enterprises"**

Conference Programme

**Ufa, Russia,
April 15-18, 2020**

Zavalishin's Readings | 2020

SUAI   SPIIRAS   SWSU   RFBR   USPTU

Organizers

- o St. Petersburg State University of Aerospace Instrumentation (SUAI, St. Petersburg, Russia)
- o St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences (SPIIRAS, St. Petersburg, Russia)
- o Southwest State University (SWSU, Kursk, Russia)
- o Ufa State Oil Technical University (USPTU, Ufa, Russia)

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Keynote Lectures

Oleg Darintsev, Head of "Robotics and control in technical systems" Laboratory Mavlyutov Institute of Mechanics, Ufa Investigation Center, R.A.S., Professor Ufa State Aviation Technical University, Ufa, Russia

Lecture Title: The micro grippers: principle of operation, construction and control method

Abstract: The micromanipulation operations are a complex problem, so specific approaches are required in the development of microgripper designs and synthesis of its control systems. Different examples of microgrippers are given, ways to control them are discussed. The problem of performing micromanipulation operations, the main effects acting in the contact zone of parts and a gripper, as well as the features of the implementation of operations to grip objects with dimensions less than 1 mm are considered. The classification of microgripping devices of robots used in the assembly of microsystems or planned for use is given. Particular attention is paid to specific techniques for the design of microgrippers, original technical and technological techniques.

Vladimir Fetisov, Professor of Information and Measuring Technologies Department at Ufa State Aviation Technical University, Ufa, Russia

Lecture Title: Aerial Robots and Infrastructure of Their Working Environment

Abstract: Aerial robots (also known as UAVs – unmanned aerial vehicles) are increasingly being introduced into our life. Today we can see aerial robots in agriculture, building industry, delivery services, security and monitoring systems and so on. More frequently not single UAVs but their groups are used. And it would be reasonable to control such groups at all functioning stages, including on-ground maintenance, in automatic mode. Development of infrastructure for automatic service and maintenance of aerial robots has appeared on the agenda of many companies specializing in unmanned aerial systems. Some aspects of such infrastructure creation are discussed in this paper with special emphasis on charging stations for UAVs with electrical propulsion system.
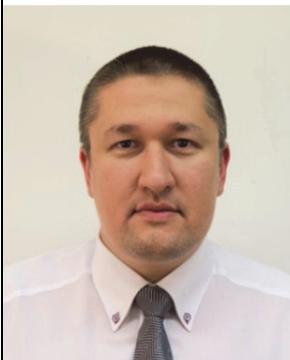
Ilshat Mamaev, employee of the group of intellectual industrial robotics of the Institute of Anthropomatics and Robotics Karlsruhe Institute of Technology, Karlsruhe, Germany

Lecture Title: Towards human-robot collaboration

Abstract: Nowadays robots are shifting from highly structured industrial environment into human everyday life. This implies new requirements to the robot control, perception, cognitive abilities and safety. In this talk an overview of current research and industrial projects with a focus on human-robot collaboration will be given. Besides of control aspects of such systems, new proximity tactile sensor technology and its applications in robotics will be shown. Finally, some examples of AI/Machine Learning methods and it's applications in robotics will be presented.

Sergey Konesev, Associate Professor of the Chair «Electrical Engineering and Electrical Equipment Enterprises», FSBEI HE "USPTU", Ufa, Russia
Lecture Title: Multi-function integrated electromagnetic component for secondary power sources
Abstract: The development of digital, intelligent energy, electromechanics, electrical engineering leads to the active use of secondary power sources, frequency converters, inverter technology, power electronics. The desire to reduce the mass and dimensions of electrical devices and systems, increase their specific power creates the need to use key (pulse) modes of electric energy converters. To reduce electromagnetic interference, as well as dynamic losses during switching, it is advisable to use the resonant modes of the inverter technology. A multifunctional integrated electromagnetic component (MIEC) has been developed, capable of performing the functions of inductance (inductor), capacitor and transformer at the same time.

Jesus Savage, Professor of the Department of electronics and engineering of the National Autonomous University, Mexico City, Mexico
Lecture Title: Robotics, AI and Machine Vision conjunction paradigm
Abstract: A semantic reasoning analysis mechanism is discussed, based on symbolic AI methods and digital signal processing for VIRBOT robotic system, being used in service robot testing for RoboCup-at-Home competitions, where a robot has incomplete data and acquires missing pieces of data, interacting with users.

Robert Sattarov, Professor of Electromechanic Department, Ufa State Aviation University, Ufa, Russia
Lecture Title: Worm-like locomotion systems for in-pipe robots and its fuzzy sliding controller design
Abstract: Worm-Like Locomotion Systems (WLLS) for a class of in-pipe robots is considered, and a novel fuzzy sliding mode controller is designed for the velocity tracking problem in the WLLS. Because of the strong nonlinearity, an estimator for a friction force is created and it is used into the construction of the sliding mode controller. A sliding mode surface is provided based on the tracking error of the longitudinal displacement and a center of mass velocity. Fuzzy rule is formed to tuning one of sliding mode designable parameters. Simulation results verify the effectivity of the presented fuzzy sliding mode control method

Lingfei Xiao, Associate Professor and Deputy Director of Control Engineering Department, College of Energy and Power Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, China
Lecture Title: Intelligent sliding mode control and its application in mechanical & power systems
Abstract: Sliding mode control (SMC) is an effective control method with strong robustness, intelligent optimization algorithms have good effects for SMC on attenuating chattering, facilitating the parameter tuning, enhancing the robustness to mismatched uncertainties and improving the fault tolerance. In this talk, several kinds of intelligent sliding mode control methods will be given, the steady and dynamic control performance, robustness and fault tolerance will be shown on some mechanical & power systems.

Conference at a glance

Wednesday, April 15, 2020		
12:00-17:00	**On-line registration**	
Thursday, April 16, 2020		
09:30-10:00	**Opening Ceremony**	
10:00-10:30	**Keynote Lecture 1:** *Ilshat Mamaev.* Towards Human-Robot Collaboration	
10:30-11:00	**Keynote Lecture 2:** *Vladimir Fetisov.* Aerial Robots and Infrastructure of Their Working Environment	
11:00-11:10	**Joint Photography of Conference Participants**	
11:10-11:30	Coffee break	
11:30-13:30	**Oral Session 1:** Robotics and Automation	**Oral Session 2:** Robotics and Automation	**Poster Session 1**
13:30-14:30	Lunch break	
14:30-15:00	**Keynote Lecture 3:** *Robert Sattarov.* Worm-Like Locomotion Systems for In-Pipe Robots and Its Fuzzy Sliding Mode Controller Design	
15:00-15:30	**Keynote Lecture 4:** *Jesus Savage.* Robotics, AI and Machine Vision conjunction paradigm	
15:30-17:30	**Oral Session 3:** Robotics and Automation	**Oral Session 4:** Robotics and Automation	**Poster Session 2**
17:30-20:00	**Social event**	
Friday, April 17, 2020		
10:00-10:30	**Keynote Lecture 5:** *Oleg Darintsev*. Microgrippers: Principle of Operation, Construction and Control Method	
10:30-11:00	**Keynote Lecture 6:** *Sergey Konesev.* Multi-Function Integrated Electromagnetic Component for Secondary Power Sources	
11:00-11:30	Coffee break	
11:30-13:30	**Oral Session 5:** Robotics and Automation	**Oral Session 6:** Electromechanics and Electric Power Engineering	**Poster Session 3**
13:30-14:30	Lunch break	
14:30-15:00	**Keynote Lecture 7:** *Lingfei Xiao.* Intelligent Sliding Mode Control and Its Application in Mechanical and Power Systems	
15:00-17:00	**Oral Session 7:** Electromechanics and Electric Power Engineering	**Oral Session 8:** Electromechanics and Electric Power Engineering	**Poster Session 4**
17:00-17:30	**Closing Ceremony**	
Saturday, April 18, 2020		
11:00-15:00	**Social event**	

Conference Programme

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12:00-17:00	**On-line registration**
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09:30-10:00	**Opening Ceremony**
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10:30-11:00	**Keynote Lecture 2:** *Vladimir Fetisov.* Aerial Robots and Infrastructure of Their Working Environment
11:00-11:10	**On-line Joint Photography of Conference Participants**
11:10-11:30	**Coffee break**
11:30-13:30	**Oral Session 1:** Robotics and Automation
	Mikhail Khachumov. Tactical Level of Intelligent Geometric Control System for Unmanned Aerial Vehicles *Tagir Muslimov and Rustem Munasypov.* Three-Dimensional Consensus-Based Control of Autonomous UAV Swarm Formations *Valeriia Izhboldina, Igor Lebedev and Aleksandra Shabanova.* Approach to UAV Swarm Control and Collision-Free Reconfiguration *Egor Aksamentov, Konstantin Zakharov, Denis Tolopilo and Elizaveta Usina.* Approach to Robotic Mobile Platform Path Planning upon Analysis of Aerial Imaging Data *Peter Trefilov, Mark Mamchenko, Maria Romanova and Igor Ischuk.* Improving Methods of Objects Detection Using Infrared Sensors Aboard the UAV *Elena Efremova and Vladimir Soldatkin.* Integrated Sensor System for Controlling of Altitude-Velocity Parameters of Unmanned Aircraft Plane on the Basis of Vortex Method
11:30-13:30	**Oral Session 2:** Robotics and Automation
	Andrey Trifonov, Sergey Filist, Sergey Degtyarev, Vadim Serebrovsky and Olga Shatalova. Human-Machine Interface of Rehabilitation Exoskeletons with Redundant Electromyographic Channels *Haci Mehmet Guzey.* Neuro Sliding Mode Control for Exoskeletons with 7 DoF *Andrey Karlov, Ekaterina Saveleva, Andrey Yatsun and Aleksey Postolny.* Modeling of the Exoskeletal Human-Machine System Movement Lifting a Load *Sergey Jatsun, Andrey Malchikov, Andrey Yatsun and Ekaterina Saveleva.* Mathematical Modeling of Load Lifting Process with Industrial Exoskeleton Usage
	Dmitriy Blinov, Anton Saveliev and Aleksandra Shabanova. Deep Q-Learning Algorithm for Solving Inverse Kinematics of Four-Link Manipulator *Sergei Savin, Oleg Balakhnov and Alexander Maloletov.* Linearization-based Forward Kinematics Algorithm for Tensegrity Structures with Compressible Struts

11:30-13:30	*Sergey Jatsun, Boris Lushnikov, Oksana Emelyanova and Andres Santiago Martinez Leon.* Synthesis of SimMechanics Model of a Quadcopter using SolidWorks CAD Translator Function *Aleksandr Nikitin, Vyacheslav Soldatkin and Vladimir Soldatkin.* Technology for Constructing Multifunctional Controlling System of Motion's Parameters of Unmanned Single-Rotor Helicopter *Vinh Nguyen, Quyen Vu and Andrey Ronzhin.* Mathematical Modeling of Stable Position of Manipulator Mounted on Unmanned Aerial Vehicle *Denis Milyakov, Vladimir Verba, Vladimir Merkulov and Andrew Plyashechnik.* Active Phased Antenna Arrays for Long-Range Mobile Radars Based on Quadcopters *Youshaa Murhij and Vladimir Serebrenny.* Hand Gestures Recognition Model for Augmented Reality Robotic Applications *Denis Ivanko, Dmitry Ruymin and Alexey Karpov.* An Experimental Analysis of Different Approaches to Audio-Visual Speech Recognition and Lip-Reading *Maxim Kolomeec, Ksenia Zhernova and Andrey Chechulin.* Unmanned Transport Environment Threats *Alexander Denisov and Oleg Sivchenko.* Conceptual and Set-Theoretic Models of Wireless System for Information Exchange *Eugene Larkin, Tatiana Akimenko, Alexey Bogomolov and Konstantin Krestovnikov.* Mathematical Model for Evaluating Fault Tolerance of On-Board Equipment of Mobile Robot
13:30-14:30	**Lunch break**
14:30-15:00	**Keynote Lecture 3:** *Robert Sattarov.* Worm-Like Locomotion Systems for In-Pipe Robots and Its Fuzzy Sliding Mode Controller Design
15:00-15:30	**Keynote Lecture 4:** *Jesus Savage*. Robotics, AI and Machine Vision conjunction paradigm
	Oral Session 3: Robotics and Automation
15:30-17:30	*Elvira Chebotareva, Kuo-Hsien Hsia, Konstantin Yakovlev and Evgeni Magid.* Laser Rangefinder and Monocular Camera Data Fusion for Human-Following Algorithm by PMB-2 Mobile Robot in Simulated Gazebo Environment *Ramil Safin, Roman Lavrenov and Edgar Alonso Martinez-Garcia.* Evaluation of Visual SLAM Methods in USAR Applications Using ROS/Gazebo Simulation *Dmitriy Levonevskiy, Evgenii Karasev and Egor Aksamentov.* Architecture and Algorithms of Geospatial Service for Navigation of Robotic Complexes *Ayrat Migranov.* Cloud-Based Task Distribution System Infrastructure for Group of Mobile Robots *Nikolay Teslya, Alexander Smirnov, Artem Ionov and Alexander Kudrov.* Multi-robot Coalition Formation for Precision Agriculture Scenario based on Gazebo Simulator *Petr Neduchal and Milos Zelezny.* Environment Classification Approach for Mobile Robots

15:30-17:30	**Oral Session 4:** Robotics and Automation
	Rinat Galin and Roman Meshcheryakov. Collaborative Robots: Development of Robotic Perception System, Safety Issues and Integration of AI to Imitate Human Behavior
	Mark Mamchenko, Pavel Ananyev, Alexander Kontsevoy, Anna Plotnikova and Yuri Gromov. The Concept of Robotics Complex for Transporting Special Equipment to Emergency Zones and Evacuating Wounded People
	Sergey Kharchenko, Roman Meshcheryakov, Yaroslav Turovsky and Daniyar Volf. Implementation of Robot-Human Control Bio-Interface When Highlighting Visual Evoked Potentials Based on Multivariate Synchronization Index
	Dinar Bogdanov. Continuum Manipulator Motion Model Taking into Account Specifics of its Design
	Eldar Mingachev, Roman Lavrenov, Evgeni Magid and Mikhail Svinin. Comparative Analysis of Monocular SLAM Algorithms Using TUM and EuRoC Benchmarks
	Бушуев А.Б., Литвинов Ю.В., Хунг Нгуен, Петров В.А., Чащина М.М. Алгоритмы выявления препятствий и определения расстоянии до них при движении мобильного робота по пересеченной местности
15:30-17:30	**Poster Session 2**
	Акопов В.С. Повышение быстродействия механизма торможения колес автомобиля
	Голубков В.А., Федоренко А.Г., Ватаева Е.Ю., Шишлаков В.Ф. Моделирование узлов манипулятора
	Городецкий А.Е., Курбанов В.Г., Тарасова И.Л. Алгоритм формирования языка ощущения робота
	Ефремова Е.С., Солдаткин В.М. Интегрированная сенсорная система контроля высотно-скоростных параметров беспилотного летательного аппарата на основе вихревого метода
	Купченко С.М., Эль-Салим С.З. Перспективные направления развития авиационного транспорта
	Муравьев К.Ф., Боковой А.В., Яковлев К.С. Оценка качества алгоритмов картирования и локализации на основе видеоданных в симуляционных средах
	Никитин А.В., Солдаткин В.В., Солдатки В.М. Технология построения многофункциональной системы контроля и управления движением беспилотного одновинтового вертолета
	Савельев А.С., Неретин Е.С. Предварительный анализа безопасности активных сайдстиков при работе автопилота
	Шишлаков Д.В., Гончарова В.И. Математическая модель звена с распределенными параметрами
	Дергачев С.А., Яковлев К.С. Алгоритм THETA и ORCA в задаче децентрализованной навигации группы мобильных роботов
17:30-20:00	**Social event**

| Friday, April 17, 2020	
10:00-10:30	**Keynote Lecture 5:** *Oleg Darintsev.* Microgrippers: Principle of Operation, Construction and Control Method
10:30-11:00	**Keynote Lecture 6:** *Sergey Konesev.* Multi-Function Integrated Electromagnetic Component for Secondary Power Sources
11:00-11:30	**Coffee break**
11:30-13:30	**Oral Session 5:** Electromechanics and Electric Power Engineering
	Nikolay Lopatkin. Quarter-Wave Symmetric Space Vector PWM with Low Values of Frequency Modulation Index in Control of Three-Phase Multilevel Voltage Source Inverter
	Vladimir Bocharov, Alexander Danilov, Viktor Burkovsky, Konstantin Gusev and Pavel Gusev. Analysis of Resource Availability of Production Enterprise Based on Fuzzy Neural Network
	Vladislav Shishlakov, Elizaveta Vataeva, Nataliia Reshetnikova and Dmitriy Shishlakov. Synthesis of Nonlinear Impulse Systems
	Yuriy Obzherin, Mikhail Nikitin and Stanislav Sidorov. Hidden Markov Model Based on Signals from Blocks of Semi-Markov System's Elements and Its Application for Dynamics Analysis Energy Systems
	Sergej Solyonyj, Oksana Solenaya, Aleksandr Rysin, Vladimir Kuzmenko and Evgeny Kvas. Robot for Inspection and Maintenance of Overhead Power Lines
	Igor Lebedev, Anton Ianin, Elizaveta Usina and Viktor Shulyak. Engineering Solution of a Base Station for UAV Maintenance Automation
11:30-13:30	**Oral Session 6:** Electromechanics and Electric Power Engineering
	Konstantin Krestovnikov, Ekaterina Cherskikh and Eldar Zimuldinov. Combined Capacitive Pressure and Proximity Sensor for Use in Robotic Systems
	Ildar Nasibullayev, Oleg Darintsev, Elvira Nasibullaeva and Dinar Bogdanov. Piezoelectric Micropumps for Microrobotics: Operating Modes Simulating and Analysis of the Main Parameters of the Fluid Flow Generation
	Dmitriy Ershov and Irina Lukjanenko. Vibration Amplitude and Frequency Parameters of Technological Equipment Drives
	Комарова Е.А., Романова М.С. Особенности схем блоков быстрого разряда ITER
	Лазерко В.А. Разработка системы индукционного нагрева с внедрением ВТСП-технологий
	Малатынская Е.Ю., Маркелов А.И. Определение индуктивных параметров дискового синхронного генератора с постоянными магнитами
11:30-13:30	**Poster Session 3**
	Белоусов А.С. Минимально-максимальная пространственно-векторная модуляция для управления двухфазным электроприводом
	Ефимов А.А. Энергетические показатели активного преобразователя напряжения в авиационной системе генерирования электроэнергии
	Ляшенко А.Л. Разработка математической модели тепловых полей инкубатора
	Ляшенко А.Л., Морева С.Л. Разработка системы управления уровнем воды в барабане парового котла

	Мкртычян А.Р., Николаенко А.А., Положенцев Д.С., Филатов Ю.К., Казаков Е.П. Вопросы проектирования электропривода перспективного управляющего двигателя-маховика
	Положенцев Д.С., Казаков Е.П. Преобразователь угол-код на базе микросхемы 1310НМ025
	Решетникова Н.В., Ватаева Е.Ю. Методы исследования САУ в условиях нестационарности
	Акопов В.С., Салова И.А. Исследование влияния диаметров водопроводных труб на процессы теплообмена в них
	Сотник Л.Л., Сиваченко Л.А. Моделирование процесса деформирования материала в вибровалковом измельчителе
	Булатов В.В., Соленый С.В., Лопаткин А.С., Лопаткин А.С. Исследование функциональных возможностей современных пневмоприводов
13:30-14:30	**Lunch break**
14:30-15:00	**Keynote Lecture 7:** *Lingfei Xiao*. Intelligent Sliding Mode Control and Its Application in Mechanical and Power Systems
	Oral Session 7: Electromechanics and Electric Power Engineering
15:00-17:00	*Маркелов А.И., Малатынская Е.Ю.* Определение основных электромагнитных нагрузок и главных размеров дискового синхронного генератора
	Соколова А.И. Система оперативной коммутации тока для системы электропитания ИТЭР
	Солёная О.Я., Дранникова В.Р. Анализ влияния гололедных нагрузок на надежность воздушных линий электропередачи
	Армашова-Тельник Г.С., Соколова П.Н. Анализ ключевых аспектов цифровизации в электроэнергетической отрасли
	Елина Т.Н., Мыльников В.А. Модель безопасности облачного сервиса с полным перекрытием угроз
	Солёная О.Я., Пруссак Н.И., Важник В.С. Вторичные энергоресурсы: виды, характеристики и области применения
	Oral Session 8: Electromechanics and Electric Power Engineering
15:00-17:00	*Даев Ж.А., Кайракбаев А.К.* Применение методов нечеткой логики в целях совершенствования характеристик автоматических систем контроля и измерения расхода газа
	Ляшенко А.Л. Моделирование объектов управления с подвижным теплоносителем с помощью распределенных передаточных функций
	Ефимов А.А., Мельников С.Ю. Энергетические показатели электроприводов постоянного тока с активными преобразователями
	Мартынов А.А. Трехфазная поплавковая волновая электростанция
	Салова И.А. Исследование влияния глубины паза при двухсторонней зубчатости на гармонический состав магнитной проводимости воздушного зазора
	Фомичева С.Г., Жемелев Г.А. Методы визуализации и параметрического синтеза систем управления

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	Poster Session 4
15:00-17:00	*Елтышева И.В., Елтышев Б.К.* Возможность применения стандартов функциональной безопасности при проектировании АСЗИ
	Ершов Д.Ю., Лукьяненко И.Н. Амплитудно-частотная характеристика привода технологического оборудования
	Мартынов А.А. Устройства для заряда и разряда аккумуляторных батарей
	Павлюков В.А., Ткаченко С.Н., Коваленко А.В. Подсистема САПР первичных соединений ответственных электроустановок переменного тока
	Армашова-Тельник Г.С., Соколова П.Н. Вопросы координации функционирования электроэнергетического сектора в России
	Семенова В.А. Текущие результаты и ориентиры развития энергетического сектора России
	Елина Т.Н., Мыльников В.А. Моделирование действий нарушителя информационной безопасности предприятия с использованием сетей Петри
	Тимофеева Е.В., Афонин А.Н., Иващук О.А. Мобильные системы видеонаблюдения в животноводстве
	Елина Т.Н., Мыльников В.А. Анализ алгоритмов обнаружения объектов на изображениях
17:00-17:30	**Closing Ceremony**
	Saturday, April 18, 2020
11:00-15:00	**Social event**

Electronic Format of the Conference

In connection with the adoption of measures to prevent the spread of a new coronavirus infection, the International Conference "Zavalishin's Readings 2020" is held in electronic format. The teleconference will include speeches by leading scientists and discussion of scientific reports. The teleconference will be implemented on the platform of the Ufa State Petroleum Technical University. The conference website has a link to the registration page of teleconference participants.

Venue and routes

The conference will be organized in the main campus of the Ufa State Petroleum Technical University (USPTU, Russia, Ufa, 1 Kosmonavtov St.).
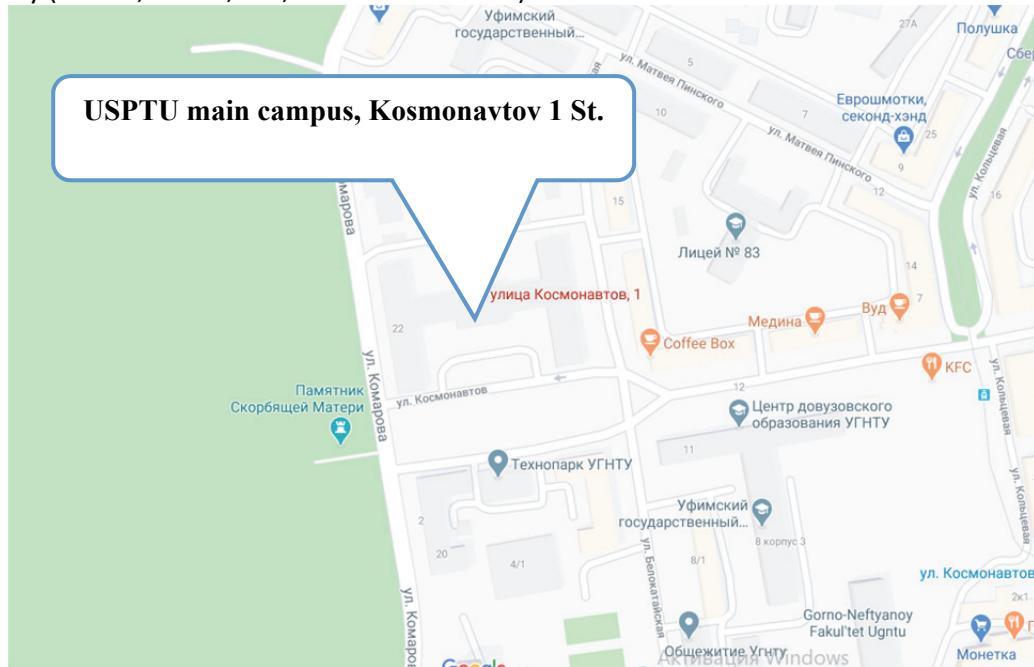
Please take a bus № 272, 298, 51, 51a to get to the University from Azimut Hotel
(the trip takes about 25 minutes).
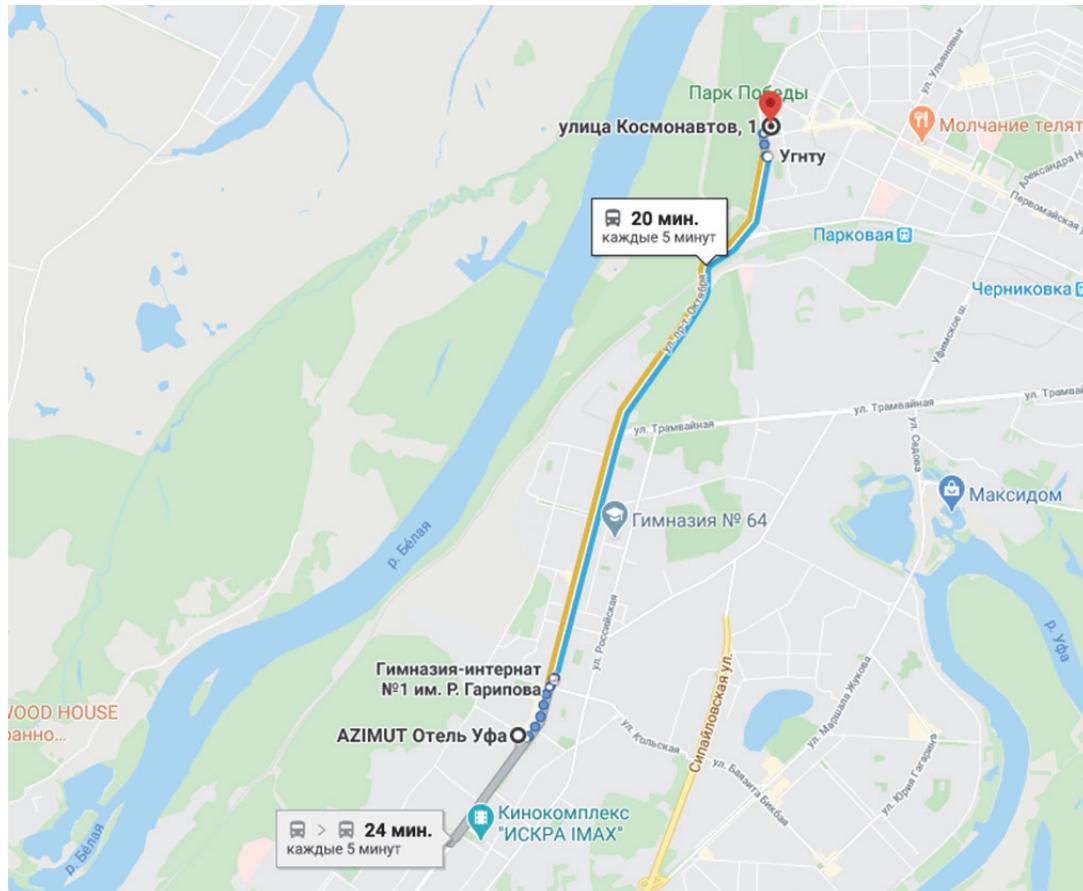
Please take a taxi to get to the University from the Ufa airport (the trip takes about 50 minutes) or use the transfer provided by the organizers for a trip to USPTU
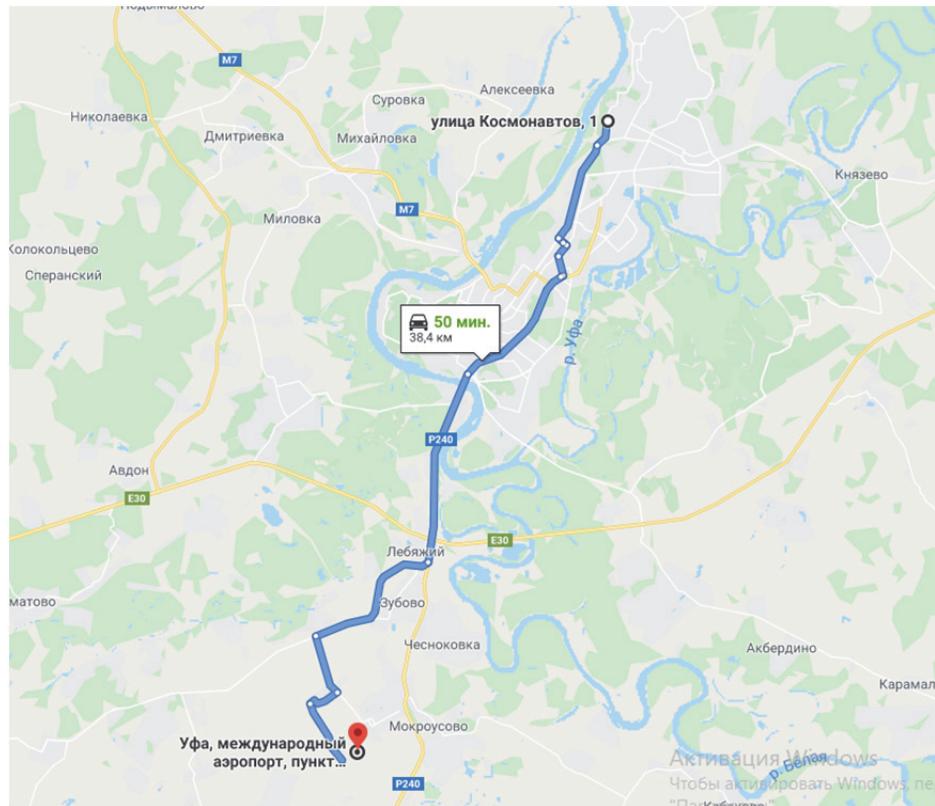

Please take a bus № 277 to get to the University from the Ufa train station
(the trip takes about 51 minutes).
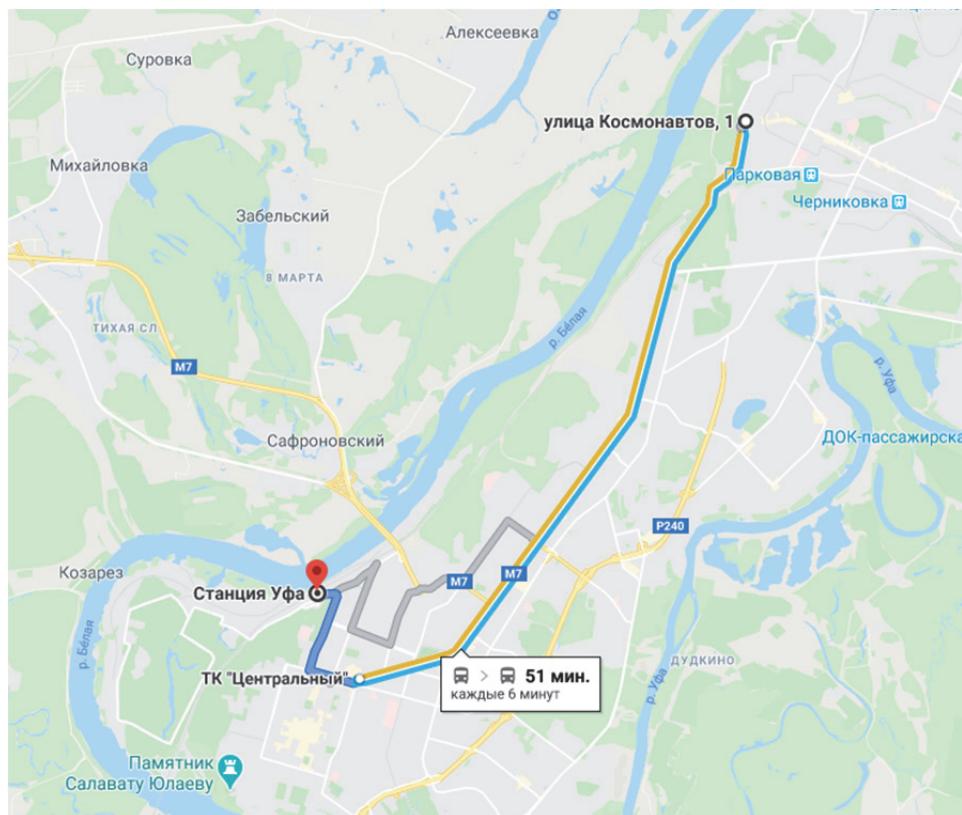
Please take a taxi to get to the Azimut Hotel from the Ufa airport (the trip takes about 31 minutes) or use the transfer provided by the organizers for a trip to Azimut Hotel
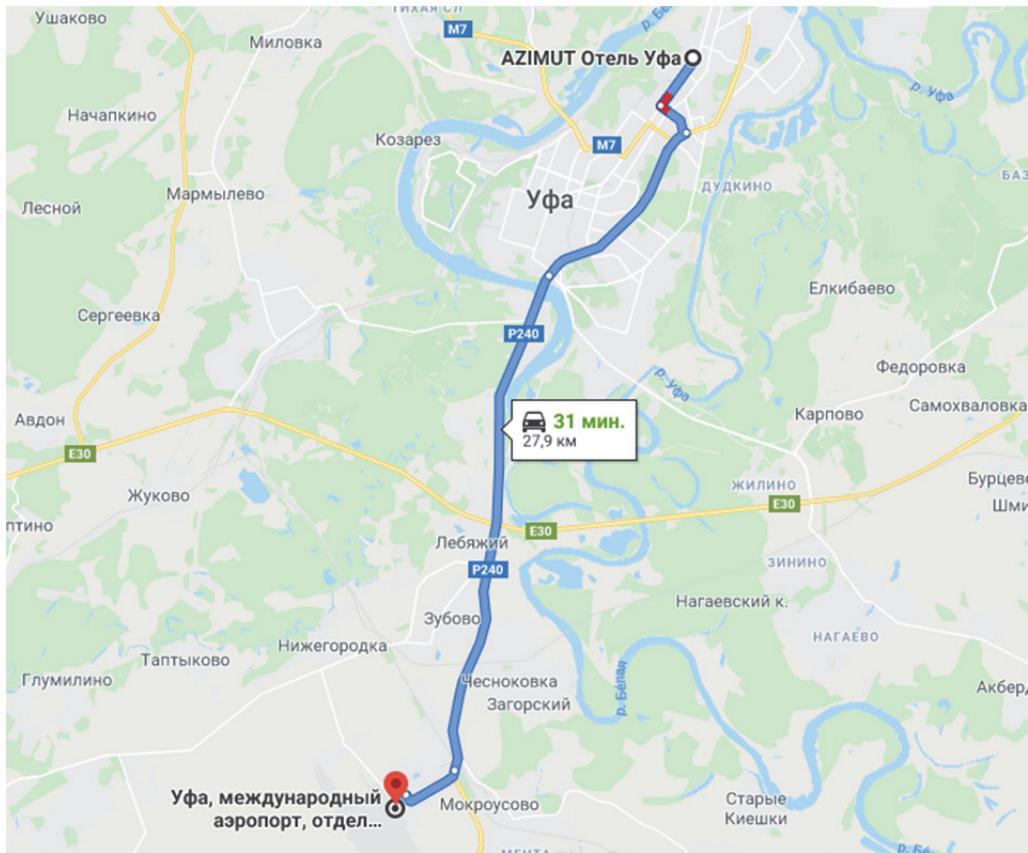
Please take a bus № 277 to get to the Azimut Hotel from the Ufa train station
(the trip takes about 15 minutes).
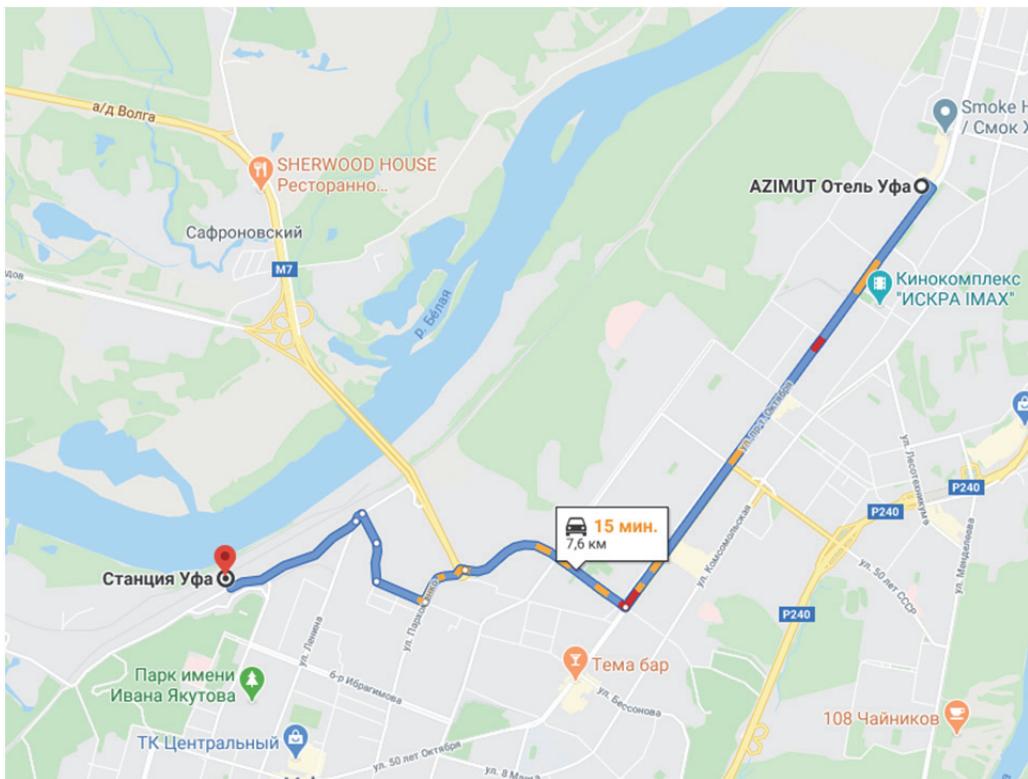
Ufa sights

Ufa was founded as the oldest Russian fortress on the territory of Bashkortostan.

The main symbol of Ufa (and the whole Republic of Bashkortostan) is a monument to Salavat Yulaev, the national Bashkir hero, sung in Soviet times. It was installed in 1967 on the highest point above the Belaya River - on Cherkalikhin Hill. The author of the sculpture is S.D. Tavasiev. The sculpture weighs 40 tons and was claimed to be the largest at that time in the USSR. Salavat Yulaev is shown on a rising horse rushing forward. Dynamism is enhanced by a high pedestal and a well-chosen installation location. It is especially beautiful here at sunset.
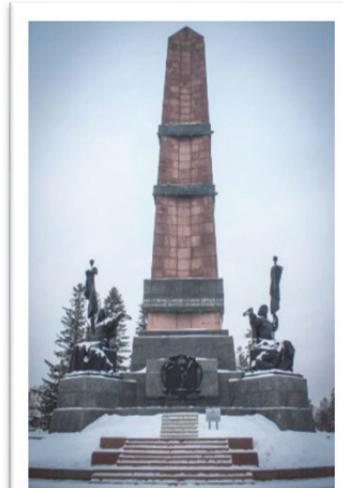
Another attraction of the city of Ufa is the Friendship Monument. It was founded in 1957 and opened in 1965 in honor of the 400th anniversary of the voluntary entry of Bashkiria into Russia. The monument looks like a composition of two female figures who sit half-turned to each other and hold laurel wreaths - a symbol of peace. The figures represent Bashkortostan and Russia. Between them on a bas-relief shows a meeting of the Bashkirs and the Russians, the exchange of letters. At the foot of the monument the words "Glory to the great fraternal friendship of the Russian and Bashkir peoples" are inscribed.

Contacts

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