

**Ministry of Science and Higher Education  
of the Russian Federation**

**2021**

# **ANNUAL REPORT**



**St. Petersburg Federal Research Center  
of the Russian Academy of Sciences**

**St. Petersburg  
2021**

Ministry of Science and Higher Education  
of the Russian Federation

ST. PETERSBURG FEDERAL RESEARCH CENTER  
OF THE RUSSIAN ACADEMY OF SCIENCES  
(SPC RAS)

**ANNUAL REPORT**  
**2021**

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## **GENERAL INFORMATION**

The Federal State Institution of Science "St. Petersburg Federal Research Center of the Russian Academy of Sciences" (SPC RAS) is established in accordance with the orders of The Ministry of Science and Higher Education of the Russian Federation of December 18, 2019 No. 1399 and of July 08, 2020 No. 768 (information about the organization is entered in the Unified State Register of Legal Entities (USRLE) by the Federal Tax Service on July 17, 2020 No. 2207803466891) through the reorganization of Federal State Institution of Science "St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences" (SPIIRAS) in a form of joining:

The Federal State Research Institution "North-West Research Institute of Agricultural Economics and Rural Development" (IAERD);

The Federal State Research Institution "North-West Centre of Interdisciplinary Researches of Problems of Food Maintenance" (N-W CIRPFM);

The Federal State Institution of Science "St. Petersburg Scientific Research Centre for Ecological Safety of the Russian Academy of Sciences" (SRCES RAS);

The Federal State Institution of Science "Institute of Limnology of the Russian Academy of Sciences" (IL RAS);

The Federal State Research Institution "Novgorod Scientific Research Agriculture Institute" (NSRAI – Branch of SPC RAS).

According to the Charter the SPC RAS (the SPIIRAS successor) was founded as Leningrad Research Computer Center of the USSR Academy of Sciences by the Decree of the Council of Ministers of the USSR of December 19, 1977 No. 2643-p and the Decision of the Presidium of the USSR Academy of Sciences of January 19, 1978 No. 194.

The scientific and methodological management of the SPC RAS activities is performed by RAS through: Department of Nanotechnologies and Information Technologies of RAS, Department of Earth Sciences of RAS, Department of Agricultural Sciences of RAS.

SPC RAS is headed by the Director: Andrey L. Ronzhin, Doctor of Technical Sciences, Professor, Professor of RAS, appointed by the Order of The Ministry of Science and Higher Education of the Russian Federation of July 18, 2018 No. №20-3/114 п-о based on the Minutes of the labor collective General Meeting of March 23, 2018.

The Scientific Secretary of SPC RAS is Alexandra A. Zaitseva, Candidate of Technical Sciences.

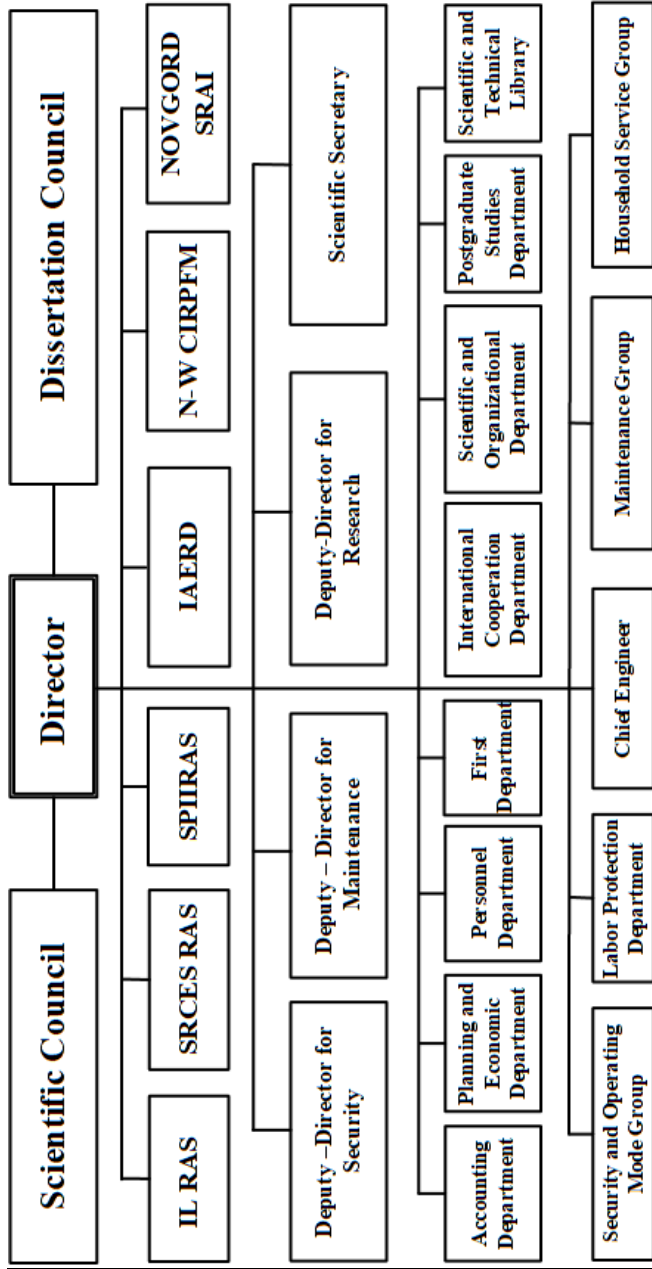
The Deputy Director for Research is Sergey V. Kuleshov, Doctor of Technical Sciences.

The purpose and subject of SPC RAS activities are basic, exploratory and applied research aimed at acquiring new knowledge in computer science and automation, management methods and information and communication technologies, environmental safety, environmental protection, food security, economy and organization of the agro-industrial complex, contributing to its technological, economic and social development, implementation of scientific advancements and best practices, training of highly qualified professionals.

### **Research activities**

Basic, exploratory and applied research and developments are done in the following areas in accordance with the SPC RAS Charter:

- fundamentals of information society development and the digital economy in Russia;
- fundamentals of complex modeling, automation of proactive monitoring and management of information processes in complex (info -, bio-, eco-, agro-, cogni-, socio-, geo-, aviation-space and transport) systems;
- fundamental and technological basics of artificial intelligence, big data, development of intelligent integrated decision support systems, multi-modal user interfaces in human-machine and robotic complexes;
- fundamentals and technological basics of information and cyber security, post-quantum cryptosystems;
- fundamentals of rational use of the territories' agricultural resources potential, conservation and reproduction of biological diversity of agricultural animals and crops to ensure food and environmental security of the Russian Federation;
- fundamental and technological basics for optimization of reclamation systems, construction and reconstruction of reclamation facilities that ensure the preservation of natural resources potential and increase the productivity of agro-landscapes;



- fundamentals and technological models aimed at effective management of the agroecosystems' production process based on adaptation, environment formation and biologization;
- fundamental and technological basics at cultivating economically expedient agricultural crops in order to create highly productive agro-phytocenoses;
- fundamental and applied technological basics of agricultural production that meet the needs of various population groups in a balanced high-quality agricultural raw materials for high-quality food supplies production;
- fundamental and applied basics of rational environmental management in the Arctic zone of the Russian Federation, given the first priority to production and consumption of locally produced food stuffs with a high level of environmental and biological safety;
- fundamentals of innovative and investment development of agricultural sectors and enterprises;
- fundamentals of integrative processes development in regional agro-industrial complexes;
- fundamentals of rural territories development, land relations and land use in the economy agrarian sector;
- fundamental ecology-economic and legal problems for ecological safety ensuring;
- fundamentals of ecosystem health assessment and maintenance, methods for their state diagnostics and prompt warning an occurrence of threats to ecological safety;
- fundamental and applied basics of transformation and migration of ecotoxicants in the environment;
- basic and applied research of life cycles of natural and economic systems and objects of past environmental damage, methods and processes of rehabilitation of disturbed and polluted ecosystems and man-made landscapes, waste management systems;
- basic research on the origin, evolution, functioning, sustainability, and lakes restoration in different physical and geographical zones;
- development of the theory of eutrophication and pollution of internal water basins, formation of their water quality and scientific forecast of these processes based on long-term studies, accounting for natural, climatic and anthropogenic factors;



- research fundamentals for assessing and forecasting trends in the natural resource potential of the Russian Lake Fund, its protection and rational use, accounting for the socio-economic regions' development ;
- basic and applied complex research of Lake Ladoga – the Neva river – the Gulf of Finland system as a geostrategic water object.

Within the Government Order approved by The Ministry of Science and Higher Education of the Russian Federation in 2021 SPC RAS worked on 18 State Budget tasks:

- State and prospects of the information society development and digital economy in Russia (SPIIRAS)
- Development of theoretic and technological basics of context - managed recommending servers and intelligent personified assistive decisions for socio-cyber systems (SPIIRAS).
- Theoretical and technological basics in development and joint use of the existing and prospective state and commercial information-management and telecommunication systems and networks at different stages of their life-cycle (SPIIRAS).
- Theoretic basics and algorithmic models of cognitive control, interaction and groups' state analysis of heterogeneous robotic complexes (SPIIRAS).
- Fundamentals and practical applications of information security. (SPIIRAS).
- Fundamentals and Big Data technologies for socio-cyber systems (SPIIRAS).
- Fundamentals and cyber-security technologies in critical infrastructures and in developing post-quantum cryptosystems (SPIIRAS).
- Theoretical and methodological basics of rural development accounting for the diversification of the rural economy, innovative and investment development of the agro-industrial complex and regulation of the agricultural land market in the North-West of the Russian Federation (IAERD).
- Development of scientific basics for quality and safety management of crop and livestock products in the Russian Federation North-West and Arctic Zone, with due account for the agroclimatic and agroecological risks' limitations (N-W CIRPFM).

- Scientific support of technological updating of agriculture in the Novgorod Region in order to preserve the natural and resource potential and enhance the production efficiency (NSRAI - Branch of SPC RAS).
- Identification of new and insufficiently studied natural and anthropogenic ecotoxicants in environmental objects, study of their transformation mechanisms and impact on biota (SRCES RAS).
- Systematization, identification and methods for assessing the objects of past environmental damage in some private basin of the Gulf of Finland (SRCES RAS).
- Ecological and economic mechanism for minimizing transboundary environmental pollutions in the Baltic Sea region through the method of prevented environmental damage (SRCES RAS).
- Development of methods for early diagnostics and preventing threats to the ecological safety of ecosystems in the North-West of Russia (SRCES RAS).
- Complex assessing of the ecosystems' dynamics of Lake Ladoga and its basin reservoirs under the impact of natural and anthropogenic factors (IL RAS).
- Innovative approaches to the use and management of water ecosystem resources (IL RAS).
- Development of complex methods for exploring and evaluating the characteristics of solid particles in the nanoscale size range in water bodies with different degrees of anthropogenic load (IL RAS).
- Patterns of lakes' distribution across Eurasia and assessment of their water resources (IL RAS).

Research done in 2021 on 119 projects included: 7 projects - on the grants of the Russian Science Foundation, 36- on the grants of the Russian Foundation for Basic Research; 8 - on the projects of Federal target programs and programs of the Russian ministries and services; 2- on the project of MIC; 50 - on the projects of industrial enterprises; 16 - on the contracts with international partners.

The following organizations acted as customers:

"SRI SS named after A.A. Maximov" – branch of FSUE "Khronichev State Research and Production Space Center"; FSUE "Arsenal Design Bureau" named after M.V. Frunze; JSC The Railway Research Institute (JSC VNIIZhT); PJSC "Gazprom Neft"; FSAEIHE "Southern

Federal University" (SFedU); LLC "HUAWEI TECHNOLOGIES Co. LTD"; Festo SE & Co. KG; LLC "Mobile Video Analytics"; LLC "ACM Decisions", Moscow; LLC "Transoil"; LLC "SIRIUS"; LLC AP "Disso"; JSC "Lengiprotrans"; LLC "SPRUT"; SUE "Lengiproinzhpoeekt"; LLC "SPb Project-Geology"; LLC "BALTMOR-project"; LLC "EC Prospector", LLC "EMS-engineering"; FSBI RosNIIVH; LLC "ESG: Labor Protection"; Secretariat of the IPA CIS Council; LLC "Vodokanal Nevsky", SPSUACE; European Regional Development Fund (ERDF), Hendrikson&Ko; Committee for Nature Use, Environmental Protection and Ecological Safety; SGUE "State Company Mineral"; LLC "Russalt"; Center for Forest Ecology and Productivity of the Russian Academy of Sciences (CFEP RAS).

During 2021 213 SPC RAS professionals took part in 244 conferences, published over 1050 papers like:

- 97 publications indexed in the WoS systems (72 articles out of them in scientific journals, including 16 articles in the Q1 journals);
- 227 publications indexed in the Scopus system (80 articles out of them in scientific journals, including 17 articles in the Q1 journals);
- 728 publications indexed in the RSCI system (245 articles out of them in scientific journals from the current list of the Higher Attestation Commission (VAK) and 133 articles in scientific journals from the RSCI list).

2021 contributed to the SPC RAS intellectual activity results by obtaining seven patents for inventions, six utility model patents, three Data Base and 41 certificates of state registration of computer programs.

In 2021 SPC RAS made arrangements for twelve international scientific conferences, proceedings of six of them were indexed in the international Data Bases like WoS/Scopus.

Currently SPC RAS counts over 500 staff members, among them eight Honored Scientists of the Russian Federation, three Academicians, three Corresponding Members of RAS, one Professor of RAS, 69 doctors of sciences and 126 candidates of sciences.

### **Educational activity**

SPC RAS is authorized to run educational activities under the programs of scientific and pedagogical personnel training through the postgraduate course in compliance with a perpetual license issued by The Federal Service for Supervision in Education and Science on September 02,

2020 No. 2918; the entity also has state accreditation for educational activities until May 18, 2022 in the following directions of postgraduate students' training:

09.06.01 Computer Science and Engineering:

– direction "System analysis, control and information processing" (05.13.01);

– direction "Mathematic- and soft –ware of computers, computer complexes and computer networks" (05.13.11);

10.06.01 Information Security:

– direction "Methods and systems of information security, information assurance" (05.13.19).

– 38.06.01 Economics:

○ direction (speciality according to the VAK list) "Economics and national economy management" (08.00.05);

○ training profile - economy, organization and management of industries, complexes – agro-industrial complex and agriculture;

○ training profile – regional economy.

As of December 31, 2021, the post - graduate course counts 42 post graduate students.

The doctoral dissertation Council functions in specialities: 2.3.1 (previously 05.13.01) – "System analysis, control and information processing"; 2.3.5 (previously 05.13.11) – "Mathematic- and soft –ware of computers, computer complexes and computer networks"; 2.3.6 (previously 05.13.19) – "Methods and systems of information security, information assurance".

In 2021 four candidate and one doctoral theses in technical sciences have been defended.

SPC RAS administers five basic departments in the leading St. Petersburg universities as well as six joint research laboratories.

Basic Departments:

- Research Automation at *The St. Petersburg State Electrical Engineering University, established in 1979.*
- Distributed Intelligent Automation Systems at *The St. Petersburg State Polytechnic University, established in 2009.*
- Information Security at *The St. Petersburg State University of Transport Communications, established in 2010.*

- Information Systems and Technologies in Economics at *The St. Petersburg University of Economics, established in 2017.*
  - Information Technologies in Logistics at *The St. Petersburg School of Economics and Management NRU HSE, established in 2018.*
- Joint Research Laboratories:
- R&D Laboratory of Information Technologies in Transport Systems, Power Engineering, Automation and Modeling Systems at *Mari State Technical University, established in 2012.*
  - Virtual Joint Laboratory at *The Military Teaching and Research Center of the RF Air Force "Military Air Force Academy", Voronezh, established in 2015.*
  - Joint Research Laboratory for Robotic Systems' Design and Programming at *The St. Petersburg State University of Aerospace Instrumentation, established in 2016.*

Sessions of the city seminar on "Informatics and Automation" at the Scientific Council for Informatization of St. Petersburg are regularly held by the Center under the leadership of Corresponding Member of RAS Yusupov, R.M. and Professor Osipov, V.Yu.

At the Center the SPIIRAS History Museum is established and maintained; the presented exhibits show the main directions of computer technologies development over preceding years. The history of Museum collection is inextricably linked with the history of establishing in 1974 the Computer Engineering Department at the Joffe Physical and Technical Institute (further LRCC, LIAN, SPIIRAN and SPC RAS). The Center occupies the building that used to be the Carl May School premises with the current museum of the same name. Among the Carl May School alumni: 40 members of the Russian Academy of Sciences and the Academy of Fine Arts, 156 Full Professors, two ministers, seven governors, four members of the State Council, twenty generals and admirals, three Heroes of Socialist Labor, two pilot-cosmonauts (G.M. Grechko and A.I. Borisenko).

Using the Museums' factual database the SPC RAS staff members run enlightenment and educational activities at the secondary and higher schools of St. Petersburg promoting, at that, the best scientific, pedagogic, cultural and ethical traditions of the Russian education and science.

## **Publication activity**

SPC RAS is a developer of an electronic editorial platform that provides automation of routine operations of publishers and editorial offices of scientific journals, transparency of the editorial process, generation of citation statistics and import/export of data to global indexes and aggregators of scientific information. In 2021, the platform hosted 5 journals: Notes of the Mining Institute; Information and Control systems; Bulletin of Plant Protection; Intelligent Technologies in Transport, Proceedings of SPIIRAN. After the reorganization of SPIIRAN, SPC RAS became the legal successor of the co-founding agreements for the journals "Izvestiya Russkogo Geograficheskogo Obshchestva" and "Regional Ecology". The journal "Trudy SPIIRAN" was renamed to "Informatics and Automation" and reregistered in the state registers and indexing systems.

### **Scientific Journal "Informatics and Automation" (Proceedings of SPIIRAS)**

Print media and online media - The journal "Informatics and Automation" (Proceedings of SPIIRAS) has been published since 2002, since 2016 is in the international database Scopus (CiteScoreTracker 2019: 1,3 SJR: 0,24), in the List of the Higher Attestation Commission since 2011 ISSN: 2713-3192, E-ISSN: 2713-3206. Subscription Index (Catalogue "Post of Russia"): P5513. Languages: Russian, English. Publication Frequency: 6 issues a year.

The journal main categories:

- Mathematical Modeling and Applied Mathematics.
- Artificial Intelligence, Data and Knowledge Engineering.
- Digital Information and Telecommunication Technologies.
- Robotics, Automation and Control Systems.
- Information Security.

Starting December 2018 г. the journal publishes articles on eight specialities:

01.01.02 – Differential equations, dynamic systems and optimal control (physical and mathematical sciences),

01.01.05 – Probability theory and mathematical statistics (physical and mathematical sciences),

01.01.09 – Discrete mathematics and mathematical cybernetics (physical and mathematical sciences),

05.13.01 – System analysis, management and information processing (by industry) (technical sciences),

05.13.11 – Mathematical and software support of computers, complexes and computer networks (technical sciences),

05.13.15 – Computing machines, complexes and computer networks (technical sciences),

05.13.17 – Theoretic basics of computer science (technical sciences),

05.13.19 – Methods and systems of information protection, information security (technical sciences).

In the rating of the RSCI for 2021: the journal ranks 17th in the overall rating; 1st place on the topic "Automation. Computer Engineering"; 1st place on the topic "Cybernetics"; 2nd place on the topic "Mathematics".

Full-text versions of the articles are available on the journal's website: <http://ia.spcras.ru>.

Profile of the journal Informatics and Automation in Scopus: <https://www.scopus.com/sourceid/21100793186>.

### **Scientific journal "Russian Geographical Society News"**

Print media and electronic media - Journal "Izvestiya Russkogo Geograficheskogo Obshchestva" is published since 1865, in the List of the Higher Attestation Commission (VAK), indexed in the core of RSCI, ISSN: 2079-9705, E-ISSN: 2079-9713. Language: Russian. Publication frequency: 6 issues per year. The journal publishes articles on the speciality: 39.00.00 Geography.

The journal articles are available on the website of the Russian Geographical Society: <https://www.rgo.ru/ru/obshchestvo/periodicheskie-izdaniya-rgo/zhurnal-izvestiya-rgo>

### **Conferences organized in 2021**

- 29-th Euromicro International Conference on Parallel, Distributed and Network-Based Processing (PDP' 2021); Special Session: "Security in Parallel, Distributed and Network – Based Computing (SPDNS 2021)". <https://www.pdp2021.org/specialsessions/snds/snds.php>, Valladolid (Spain), March 10-12, 2021 (papers are indexed in WoS, Scopus). (Kotenko, I.V.).

- XVI All-Russian Scientific and Practical Conference "Prospective Systems and Management Tasks", Dombaj (Russia), April 5-9, 2021. (*Yusupov, R.M., Ronzhin, A.L.*)
- XVI International Conference on Electromechanics and Robotics "Zavalishin's Readings" (ER (ZR)-2021), <http://confs.guap.ru/zav-read>, St. Petersburg (Russia), April 14-17, 2021 (Springer, SIST: papers are indexed in WoS, Scopus Q3). (*Ronzhin, A.L.*)
- First International Conference on Agriculture Digitalization and Organic Production (ADOP – 2021), <http://adop.nw.ru>, St. Petersburg (Russia), June 07-09, 2021 (Springer, SIST: papers are indexed in WoS, Scopus Q3). (*Kostyaev, A.I., Surovisev, V.N., Ronzhin, A.L.*)
- 6-th International Theoretical and Practical Conference "Simulation and Complex Modeling in Marine Technology and Maritime Transport Systems" (SCM MTMTS-2021), <http://simulation.su/static/ru-ikm-mtmts-2021.html>. Within the X International Marine Defence Show (IMDS 2021), St. Petersburg (Russia), June 23, 2021 (papers are indexed in RSCI). (*Sokolov, B.V.*)
- VI Interregional Theoretical and Practical Conference: "Advanced Lines of Development in National Information Technologies", <http://pnroit.code-bit.com>. Sevastopol (Crimea), September 21-25, 2021. (*Yusupov, R.M., Kasatkin, V.V., Sokolov, B.V.*)
- 23-rd International Conference "Speech and Computer" SPECOM-2021, <http://www.specom.nw.ru/20201>. St. Petersburg (Russia), September 27-30, 2021 (Springer, LNCS: papers are indexed in WoS, Scopus Q3, **in a list of top conferences A\***). (*Karpov, A.A.*)
- VI International Conference "Interactive Collaborative Robotics" (ICR-2021), <http://specom.nw.ru/icr2021>, St. Petersburg (Russia), September 27-30, 2020 (Springer, LNCS: papers are indexed in WoS, Scopus Q3). (*Ronzhin, A.L.*)
- XIV Conference "Robotics and Mechatronics (R&M - 2021) within 14-th All Russian Multi-Conference on Control Problems (MCPU-2021), <http://www.conf.mvs.sfedu.ru>. Divnomorskoe, Gelendzhik, Krasnodar Krai, (Russia), September 27- October 02, 2021. (*Ronzhin, A.L.*)



- 7-th International Scientific School "Incident Management and Countering Targeted Cyber-Physical Attacks in Distributed Large-Scale Critical Systems" (IM&CTCPA 2021), <http://www.comsec.spb.ru/en/conferences> St. Petersburg (Russia), October 12-14, 2021. Journal: "Systems of Control, Communication and Security" (papers are indexed in Scopus, RSCI). (*Kotenko, I.V.*)
- 10-th All-Russian Theoretical and Practical Conference "Simulation. The Theory and Practice" IMMOD-2021, <http://simulation.su/static/ru-immod-2021.html>. St. Petersburg (Russia), October 20-22, 2021. (*Sokolov B.V.*)
- XII St. Petersburg Interregional Conference "Information Security of the Russian Regions (ISRR-2021)". St. Petersburg (Russia), October 27-29, 2021 (*Yusupov, R.M.*)

### **Conferences to be organized in 2022**

- XVII All-Russian Scientific and Practical Conference "Prospective Systems and Management Tasks". Dombaj (Russia), April 4-8, 2022. (*Yusupov, R. M., Ronzhin, A.L.*)
- III All-Russian Conference "Advanced Tendencies in Development of Chemical Technology, Industrial Ecology and Ecological Safety". St. Petersburg (Russia), April 7-8, 2022. (*Tronin, A.A.*)
- Second International Conference on Agriculture Digitalization and Organic Production (ADOP – 2022), <http://adop.nw.ru>. St. Petersburg (Russia), June 06-08, 2022 (Springer, SIST, Q4). (*Kostyaev, A.I., Surovtsev, V.N., Ronzhin, A.L.*)
- 24-th International Conference "Speech and Computer" SPECOM-2022, <http://www.specom.nw.ru/>. St. Petersburg (Russia), October 03-06, 2022 (Springer, LNCS: Q3, **in a list of top conferences A\***). (*Karpov, A.A.*)
- VII International Conference "Interactive Collaborative Robotics" (ICR-2022), <http://specom.nw.ru/icr2022>. St. Petersburg (Russia), October 03-06, 2022 (Springer, LNCS/LNAI, Q3). (*Ronzhin, A.L.*)
- 12-th Conference "Information Technologies in Control (ITC-2022)" within the 14-th Russian Multiconference on Control Problems (RMCCP-2022). St. Petersburg (Russia), October 04-06, 2022. (*Yusupov, R.M., Fedorchenko, L.N.*)

## **International cooperation**

In 2021 were continued and somewhat extended the engagements with international research community by strengthening the existing interactions and international scientific cooperation through international contracts, agreements, grants, the R&D contacts, information exchange; it is worth noting that on-line format even broadened the availability of many events internationally. As for personal communications, in St. Petersburg at the premises of SPC RAS two groups of HUAWEI Technologies Co. Ltd (8 persons); two representatives of Russian-German House in Moscow, two young scientists from Syrian Arab Republic; one young scientists from Republic of Kazakhstan were received; six SPC RAS researchers paid visits with Belarus and Estonia organizations. 164 on-line international events (conferences, seminars and other meetings) were attended by SPC RAS staff members.

Professional contacts were maintained with the following institutions:

- University of Informatics and Radioelectronics (Republic of Belarus);
- Institute of Experimental Botany of the National Academy of Sciences of Belarus (Republic of Belarus);
- Joint Institute of Computer Science Problems of the National Academy of Sciences of Belarus (Republic of Belarus);
- Bulgarian Academy of Sciences (Bulgaria);
- Center for Environmental Research of the Hungarian Academy of Sciences (Hungary);
- Danube Research Institute (Hungary);
- Institute of Information Technologies, VAST (Vietnam);
- Hellenic Mediterranean University (Greece);
- Dresden University of Technology (Germany);
- Karlsruhe Institute of Technology (Germany);
- Technical University of Kaiserslautern (Germany);
- Leipzig University of Telecommunications (Germany);
- University of Rostock (Germany);
- Ulm University (Germany);
- University of Cologne, Institute for Geology and Mineralogy (Germany);
- Festo SE & Co. KG (Germany);

- Fraunhofer Institute for Secure Information Technology (Germany);
- Centre for Water Resources Development and Management (CWRDM), Kerala (India);
- Karnataka Environment Research Foundation (KERF), Bangalore, (India)
- Almaty University of Energy and Communications (Kazakhstan);
- L. N. Gumilyov Eurasian National University (ENU) (Kazakhstan);
- KATU named after S. Seifullin (Kazakhstan);
- Cyprus University of Technology (Cyprus);
- Liaoning University (China);
- HUAWEI TECHNOLOGIES Co. Ltd (China);
- Harbin Polytechnic Institute (China);
- Mexican National Autonomous University - UNAM (Mexico);
- Institute of Mathematics and Informatics of the Academy of Sciences of Moldova (Moldova);
- Institute of Geography and Geoecology of the Mongolian Academy of Sciences (Mongolia);
- University of Novi Sad (Serbia);
- Ford Motor Company (USA);
- Center for Arctic Research at the University of Northern Iowa (USA);
- Bogazici University (Turkey);
- Erzurum Technical University (Turkey);
- Finnish Environment Institute SYKE (Finland);
- Institute for Atmospheric and Earth System Research (INAR) (Finland);
- Natural Resources Institute of Finland in Punkaharju (Finland);
- University of Helsinki (Finland);
- Open Innovations Association FRUCT (Finland);
- Paul Sabatier University (Toulouse III) (France);
- University of West Bohemia (Czech Republic);
- Institute for Global Change, the Czech Academy of Sciences (Czech Republic);
- Thomas Bata University in Zlin (Czech Republic);
- Blekinge Institute of Technology (Sweden);

- Swedish Institute of Agricultural Sciences (Uppsala, Sweden);
- Riga Technical University (Latvia);
- Tallinn University of Technology (Estonia);
- Hendrikson&Ko (Finland).

The research and contractual works were done on orders by the Secretariat of the CIS Interparliamentary Assembly; University of West Bohemia in Plzen (Czech Republic); Festo SE & Co. KG (Germany); Swedish University of Agricultural Sciences (Sweden); HUAWEI TECHNOLOGIES Co. Ltd (China); Nord Consult OY (Finland); Hellenic Mediterranean University (Greece); Finnish Environment Institute SYKE (Finland) and other; totally on 16 agreements and contracts including 7 concerning the EC Cross-Border Cooperation Programs (CBC).

### **Expeditions**

In 2021 SPC RAS researchers took part in 32 expeditions, including:

- one research tour to reindeer herding farms of Kamchatka, the Yamalo-Nenets and Nenets Autonomous Districts to collect biological material;
- one exploratory tour to the coastal zone of the Gulf of Finland Eastern part under the Russian-Estonian Cross-Border Cooperation Program;
- one expedition to take samples of water, phyto- and zooplankton in the water area of LLC Transoil Port in Primorsk;
- one expedition to explore the coastal and deep-water zone of the Eastern part of the Gulf of Finland;
- 18 expeditions in Lake Ladoga and the reservoirs of its basin;
- 9 field trips to the Limnological station on the lake. Krasnoe (Karelian Isthmus, Leningrad region);
- one expedition along the Volga River within the Yaroslavl - Astrakhan regions.

### **Monographs**

1. Geyda, A.S. Fundamentals of Potential's Theory of Complex Technical Systems. Moscow: RAS. 2021. 408 p. ISBN 978-5-907366-25-1.

2. Doynikova, E.V., Kotenko, I.V. Security Assessment and Selection of Countermeasures for Cybersecurity Management. Moscow: RAS, 2021. 184 p. ISBN 978-5-907366-23.

3. Current State and Problems of Anthropogenic Transformation of Lake Ladoga Ecosystem in a Changing Climate / Ed. Kondratyev, S.A., Rumyantsev, V.A., Pozdnyakov, Sh. R. Moscow: RAS, 2021. 637 p. ISBN 978-5-907366-50-3.

4. Ronzhin, A., Vu Q., Nguyen, V., Ngo, T. Ground and Air Robotic Manipulation Systems in Agriculture. Intelligent Systems Reference Library. Springer, Cham. 2022. vol. 214. 294 p. <https://doi.org/10.1007/978-3-030-86826-0>. ISBN: 978-3-030-86825-3.

### **Honors and awards**

- Teslya, N.N. – Medal of the Russian Academy of Sciences with a Prize for young scientists of Russia by results of the 2020 contest in the field of computer science, computer engineering and automation;

- Abramov, M.V., Egorova, A.B. – Breastplate "Young Scientist" of the Ministry of Science and Higher Education of the Russian Federation;

- Bakina, L.G., Ronzhin, A.L., Salukhov, V.I. – Medal "For Contribution to Implementation of State Policy in Scientific and Technological Development" of the Ministry of Science and Higher Education of the Russian Federation;

- Pavlova, O.A. – Third Class Medal "For Impeccable Work and Distinction" awarded by the Ministry of Science and Higher Education of the Russian Federation;

- Sukhorukova, N.T. - Honorary Certificate of the Ministry of Science and Higher Education of the Russian Federation;

- Balun, O.V., Kurashov, E.A., Chernova, E.N., Chechulin, A.A. – Gratitude of the Ministry of Science and Higher Education of the Russian Federation for a significant contribution to the development of science and conscientious work, Order No. 21 k/p of February 6, 2020;

- Tulupyeva, T.V., Pavlov, A.N. – Honorary Title "Honorary Worker of Education of the Russian Federation";

- Kulakov, A.Yu. – 2020 scholarship for specialists and young staff members of organizations – contractors of the state defense order for a significant contribution to developing the breakthrough technologies and the advanced prototypes of VVST to ensure the state defense and security

- Mikoni, S.V. – Alexander Nevsky Prize : "For Merits in Strengthening National Unity, Preserving Cultural and Historical Heritage" in the nomination "Patriotism";

- Lytaev, S.A., Borisova, A.V., Mikoni, S.V., Guzivaty, V.V., Mityukov, A.S., Trifonova, I.S., Petukhov, V.V., Yuzhakov, A.A., Yakovleva, V.A., Pogodina, O.V., Smrtyukh, T.B., Sokolov, B.V., Latypov, I.Sh., Morozova, N.G., Kotenko, I.V., Moldovyan, A.A., Arkhipov, M.V., Kuzikova, I.L., Lyubimtsev, V.A., Pitulykov, V.M., Rodionov, V.Z., Rymsha, V.A., Barbashova, M.A., Kapustina, L.L., Kondratyev, S.A. – Honorary Diplomas of the Russian Academy of Sciences for many years of conscientious work for the benefit of Russian Science, a great contribution to the development of fundamental and applied research;

- Abramov, M.V., Tulupyeva, T.V., Tulupyev, A.L. — Gratitude on behalf of the Organizing Committee for Arranging and Holding the BRICS International Municipal Forum for delivering a presentation at the BRICS IMF;

- Korepanova, A.A. — Winner of the contest for a receipt of the Scholarship of the Russian Federation President for supporting the individuals who have revealed outstanding abilities and demonstrated high advances in a certain field of activity, enrolled in master's degree programs;

- Ivanko, D.V., Ryumin, D.A. – Winners' Diplomas of the 2021 St. Petersburg Grants' Contest for young candidates of sciences from the St. Petersburg Government;

- Markitantov, M.V. – Winner's Diploma of the 2021 St. Petersburg Grants' Contest for young scientists from the St. Petersburg Government;

- Kuzikova, I.L. – Winner's Diploma of the 2021 St. Petersburg Grants' Contest in scientific and scientific-technical activities;

- Fedorchenko, E.V., Chechulin, A.A. – Gratitude for assistance in ensuring the activities of the St. Petersburg Academy of the Investigative Committee as aimed at enhancing the professional level of officers of the Investigative Committee of the Russian Federation;

- Fedorchenko, E.V. – Winner of the contest for the right to apply for the St. Petersburg Government Award "The Best youth Project of St. Petersburg" for 2021;

- Levshun, D.S. – Winner of the competitive selection for the scholarship of the President of the Russian Federation from 01.09.2020 to 31.08.2021;
- Krestovnikov, K.D. – Scholarship of the Government of the Russian Federation for the 2021/22 academic year;
- Guyfuina, D.A., Kozyr, P.S., Kuznetsov, L.D. – Winners of the competitive selection for a scholarship of the Government of the Russian Federation for students in the areas of training corresponding to the priority areas of modernization and technological development of the Russian economy and training directions in higher education approved by the Government of the Russian Federation. 2020-2021;
- Novikova, E.S., Murenin, I.N. – The best paper award the 14th International Symposium on Intelligent Distributed Computing (IDC 2021), Italy, September 16-18, 2021;
- Karpov, A.A. – The best research paper and presentation at the 28th International Telecommunications Forum TELFOR (The Ilija Stojanović Prize);
- Zhernova, K.N. - Winner of the competitive selection for a grant under the program "SMART GUY" within the national program "Digital Economy of the Russian Federation"; program "Digital Economy of the Russian Federation";
- Kostyaev, A.I., Nikonova, G.N. – I Degree Diploma for the best scientific presentation at the Ufa Humanitarian Scientific Forum; I Degree Diploma for the best scientific presentation at the international scientific and practical conference "Food Security: State, Problems and Solutions";
- Nikonova, N.A. – Winner's Diploma of the All-Russian contest for the best scientific book of 2020. Foundation for the Development of Domestic Education;
- Mityukov, A.S. – "Silver Medal" and diploma of the AgroRus - 2021 exhibition for the development of technology and methods for the use of sapropel suspensions in animal husbandry and crop production.