



## 28TH INTERNATIONAL CONFERENCE ON PROBLEMS OF COMPLEX SYSTEMS SECURITY CONTROL

In December 2020, the 28th International Conference on Problems of Complex Systems Security Control took place at Trapeznikov Institute of Control Sciences, Russian Academy of Sciences (RAS), Moscow. The conference organizers were the Ministry of Science and Higher Education of the Russian Federation, Trapeznikov Institute of Control Sciences RAS, Keldysh Institute of Applied Mathematics RAS, the RAS Scientific Council on the Theory of Controlled Processes and Automation, and the Ministry of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters.

The conference included the following sections:

- theoretical and methodological questions of security support;
- problems of economic and sociopolitical security support;
- problems of information security support;
- ecological and technogenic security;
- modeling and decision-making for complex systems security control;
- automatic systems and means of complex systems security support;
- legal aspects of complex systems security support.

At the conference, 130 authors from 42 organizations (Russia and some foreign countries) presented 91 papers.

According to the established tradition, the conference is held annually in the second half of December. The past 2020 will go down in history as the first year of the global fight against the COVID-19 coronavirus pandemic: its official date of appearance is November 17, 2019, when the first official diagnosis was made. The rapid spread of coronavirus around the world led to extremely serious consequences. (According to the World Health Organization data, by the end of 2020, the number of detected cases of this viral infection worldwide exceeded 80 million, and more than 1.6 million people infected with coronavirus died.) As a

result, several negative processes and phenomena of the universal character were observed. The deepening of the global political and economic crisis caused by the pandemic, the destruction of international economic ties, the decline in production, and the growing social tension in many countries (particularly due to the imposed restrictive measures) significantly increased various kinds of risks and the emergence of new threats. At the same time, despite the changes in the world agenda associated with the coronavirus, acute problems and hotbeds of external and internal contradictions have not disappeared anywhere, like their reasons. Rather, on the contrary, the pandemic acted as a catalyst for the further exacerbation of the existing problems of socio-economic development both globally and nationally. All these factors considerably toughened the requirements to the quality and efficiency of security control in the broadest meaning, reflected in the topics and content of the conference papers.

The conference-opening paper “Imperatives of a new reality. The fate of capitalism. Risks of information and biological space” by *G.G. Malinetskii, V.V. Kul’ba, T.S. Akhromeeva, and S.A. Posashkova* was devoted to the analysis of modern threats to the development of human civilization, as well as measures to counter them. At present, the authors stated, the world is at the stage of transition from the industrial to post-industrial phase of development. This stage—in fact, a global bifurcation point—is associated with extremely serious threats, uncertainty, instability, and, at the same time, many unexpected opening opportunities.

The paper thoroughly analyzed the development prospects for a human civilization based on *Come On!: Capitalism, Short-termism, Population and the Destruction of the Planet*, a recent report to the Club of Rome, prepared for its 50th Anniversary in 2018. (This organization is well known for research into world dynamics and currently unites more than a hundred prominent representatives of world political, financial, cultural, and scientific elites.) The problems



and prospects of the humanitarian and technological development of human civilization were considered in detail. The authors paid special attention to the extremely urgent problems of human society's fight against epidemics and pandemics.

The paper examined the reasons for the devastating response of most countries to the coronavirus pandemic, which led to a collapse of national economies, the destruction of a significant part of small and medium-sized businesses, an increase in unemployment, and social instability. Noting the tremendous successes of medical science in the last century, the authors emphasized the low level of readiness of most national health systems to deal with acute and large-scale epidemic problems. According to the authors, all these factors require recognizing healthcare as a priority sector of the economy and making carefully elaborated and radical changes in the management and financing of healthcare development, especially considering that by available forecasts, the coronavirus pandemic is far from the last on the foreseeable time horizon. (The consequences of the current pandemic have yet to be overcome.)

The paper "Pandemic, technologies, culture, and international stability" by V.V. Tsyganov considered a set of problems of civilizational development when reaching the global growth limits due to the bounded natural resources and the potential for their self-recovery, causing stagnation and social instability. Under these limits, the author emphasized, a significant part of the population of developed countries is in a state of depression. It is simultaneously strictly controlled by the global financial oligarchy, cultivating the consumer society values rigidly tied to its growth. The consequence is the strengthening of social instability in developed countries. Currently, a significant factor in reducing the level of consumption of the "golden billion" is the coronavirus pandemic and the associated restrictions on citizens' freedoms, a decrease in business activity, a drop in production, restrictions in the trade and service sector, etc. As noted in the paper, even the expected growth of the economy and, accordingly, consumption after the victory over the pandemic will be temporary: after a certain period, new global growth limits will be reached again and, accordingly, the period of the revival of the consumer society members will inevitably be replaced by the period of mass depression with all the ensuing consequences.

The author sees a fundamental way out of this situation in changing the value system of the "golden billion" (first of all, its middle class) from material to spiritual, which have no growth limits. However, note

that this problem is unlikely to be resolved in the foreseeable future. In this situation, it is possible to somewhat reduce the severity of the emerging problems, according to the author, by creating an information technology for public security control under growth limits based on the behavioral models of society members. The paper emphasized that with the development of neurosciences, it is now possible to build models of humans considering their rationality, sensuality, and emotionality. These models are based on modern neurophysiological studies of the relationship between human behavior and hormonal characteristics. Currently, models of a far-sighted human, controlled by his desires, have been developed and used in sociological research, the development of public security systems, and high humanitarian technologies.

The paper "Models of SARS-CoV-2 virus spread and security control problems" by N.G. Kereselidze was of much interest. It presented the results of mathematical modeling for the spread of coronavirus based on the epidemic control protocol adopted by the healthcare system of the Republic of Georgia. As noted therein, the choice of strategy and tactics for fighting the pandemic is significantly influenced by several factors, the most important of which is the economy: a lockdown may become too expensive for the country's budget, which it may not be able to cope with. In this situation, the problem of assessing the need for quarantine measures and determining their starting time, volume and content, became urgent for protecting the population from infection, avoiding overloads of the healthcare system and, at the same time, preventing the crisis of the national economy, which would inevitably decrease the level of life of citizens.

According to the paper, this problem can be solved using the methodology of optimal control of dynamic systems. The model proposed by the author involves the apparatus of differential calculus to justify the need to introduce a lockdown (or the ability to refrain from strict quarantine measures) based on the number of detected coronavirus cases. Note that this is the first step towards solving an extremely difficult multidisciplinary task—assessing the need to introduce restrictive measures to fight the spread of coronavirus—which requires considering many epidemiological, medical, psychological, social, economic, and other factors.

Many conference papers, diverse by the subject, were devoted to a wide range of methodological and applied problems of managing the socio-economic development of Russia, its regions, and individual

economic entities. Among them, we mention the following: “Experience and prospects of control of large-scale socio-economic projects development” by *N.I. Komkov*; “Fundamentals of a comprehensive assessment of risks of interstate integration entities” by *V.I. Medennikov*; “Tasks and specifics of organizing complex studies of the viability of rapidly changing Arctic systems” by *V.A. Putilov and A.V. Masloboev*; “Features of economic security control for the Arctic zone of the Russian Federation” by *R.V. Badylevich*; “Ensuring the reliability and security of information management systems for improving the survivability of the Russian energy system” by *E.P. Grabchak and E.L. Loginov*; “Crisis and security of socio-economic systems” by *A.Yu. Silant’eva, S.N. Grinyaeva, and I.V. Samarin*; “Systemic problems of public administration as a threat to national security” by *S.V. Zernov*; “Studying the security of control systems by analyzing their system parameters” by *D.A. Kononov*; “Decision support systems in the field of strategic planning and military security control. An approach to design and some features” by *Z.K. Avdeeva and S.V. Kovriga*; “Prospects for the development of domestic industrial companies” by *N.I. Komkov, A.A. Lazarev, and V.S. Romantsov*; “Multicriteria assessment of the economic security of an organization by criteria in quantitative and ordinal scales considering subjective probabilities” by *V.P. Korneenko*; “Applied issues of management in Russian integrated companies: risk factors and uncertainties” by *M.V. Krotova*; “Dividend policy of Russian companies as a factor in the development of the country’s economy” by *I.V. Cherenkov*; “Problems of calculating costs in the electric power industry in economic theory” by *V.I. Zhekov and N.V. Ivanov*; “A monitoring and security support system for natural resources” by *A.V. Golev*; “Optimal climatic models for ecological security support” by *V.G. Burlov, M.V. Mironova, A.I. Shershneva, and S.A. Shavurov*.

Traditionally, a large group of interesting papers was devoted to information security control and data protection from unauthorized access, relevant in the era of digitalization. Among them, we mention the following: “Assessment of information security under mixed uncertainty” by *G.S. Veresnikov and O.V. Ogorodnikov*; “Improving the efficiency of MANET mobile networks using data replication methods” by *S.K. Somov*; “A method for designing information security systems of complex objects” by *L.E. Mistrov*; “Analysis and assessment of information security risks of organizations” by *L.E. Sirotuk*; “A risk assessment model for information security based on fuzzy logic” by *A.D. Kozlov and N.L. Noga*; “The emergence of

dangerous situations when introducing digital twins at the objects of the fuel and energy complex and new development methods for special software to reduce these risks” by *A.V. Kryuchkov*; “On transferring information systems to domestic software” by *E.A. Kurako and V.L. Orlov*; “Communication problems in the digital information space” by *V.V. Muromtsev and A.V. Muromtseva*; “On control parameters in an information security monitoring model for complex systems” by *A.Yu. Maksimovskii*; “Modern issues of assessing data quality in the IT ecosystem” by *A.E. Mukhina*.

Following another tradition, the conference papers covered various topics on preventing and eliminating the consequences of man-made and natural emergencies and ensuring the secure (safe) and reliable operation of technological complexes and transport systems.

The paper “Methods for improving the safety of urban railways under centralized automatic control” by *L.A. Baranov and E.P. Balakina* was devoted to the problems of increasing the reliability and throughput of urban railway transport systems of a modern metropolis (subways and electric trains). The main attention was given to the development of schedule-interval algorithms for centralized control of urban train movements with a forecast of disturbances (e.g., exceeding the duration of station stops) considering the dependence of control constraints on the state of the transport system. Information about the forecasted disturbances (deviations of the durations of train stops from the planned ones) due to increased passenger traffic is generated at the output of an extrapolator developed by the authors based on Chebyshev polynomials. These algorithms minimize the number of restrictions imposed on the speed and duration of train stops.

Among the papers on the safe operation of transport systems, facilities, and their infrastructure, we mention the following: “Study of algorithms for optimizing the sequence and times of landing of aircrafts” by *E.L. Kulida and V.G. Lebedev*; “Advanced research and testing of swarms of air and ground vehicles for large-scale groups of joint autonomous systems in urban areas” by *M.V. Masyukov and S.A. Tyurin*; “Planning features for a safe transportation process on the Moscow Metro considering the operation of the Krasnaya Presnya depot of the Kol’tsevaya Line” by *A.I. Safronov*; “Modern challenges to the security of urban transport systems” by *V.G. Sidorenko*; “Choosing algorithms and parameters for an automatic speed control system of heavy long-haul



trains based on the criterion of traffic safety” by *O.E. Pudovikov*.

Several interesting papers, diverse by the subject, considered various methodological and applied aspects of technogenic and industrial security and the reliable operation of technological complexes and systems. Among them, we mention the following: “Application features for situational-contextual visualization in monitoring and control systems” by *V.S. Nesterov and Yu.K. Bezgubova*; “Organizing compact visualization of information parameters in monitoring and control systems” by *A.M. Anokhin*; “Improving the technical safety of complex systems with a nuclear reactor” by *V.V. Leshchenko*; “IIoT vibration monitoring systems to support decisions on power equipment protection” by *O.B. Skvortsov*; “Modeling elastic stress waves in a ten-story building with half-plane base under non-stationary seismic action” by *V.K. Musaev*; “Analysis of the direct causes of accidents in a transport packaging container with radioactive materials when working with a crane” by *A.L. Yandreev*; “Optimizing the placement of detectors using the gradient method” by *A.A. Galyaev, A.S. Samokhin, and M.A. Samokhina*; “The law of synergy in the security support of high-risk facilities” by *T.A. Piskureva, L.A. Chernyakova, and A.N. Makhov*; “Decision support algorithms and models for determining an optimal number of employees in the territorial departments of the EMERCOM of Russia in the investigation of fire accidents” by *S.Yu. Karpov*; “Analysis and study of technological process hazards using the HAZOP method” by *A.Yu. Marusina, A.F. Akhmadieva, and M.A. Polyukhovich*; “An action algorithm for emergency response operations at PAO “Khimprom” by *M.V. Govor and A.Yu. Tumanov*; “Assessing the impact of human behavior characteristics on the time of evacuation using simulation” by *M.O. Avdeeva and K.A. Danilova*; “Methods for analyzing the safety of gas cylinder equipment at the stage of operation” by *A.A. Evstifeev*; “Analyzing the efficiency and safety of systems of individual heat supply stations” by *A.G. Bagoutdinova and V.L. Vorontsova*; “Increasing the reliability of a vital unit through the timely detection of a sudden failure of a product’s structural element” by *S.A. Shilin*.

One of the distinguishing features of the conference was several interesting papers on the regulatory support of security control processes. Much attention of the participants was attracted to the paper “Web of Science and Scopus guarding the security of domestic science: the regulatory aspect” by *S.A. Bochkarev*. This paper presented the analysis of the requirements

stipulated by Part 2 of Article 3 of the Federal Law no. 127-FZ “On Science and State Scientific and Technical Policy” dated August 23, 1996, obliging the state to ensure competition in the field of scientific activity and protect subjects of science from unfair competition. In the paper, from the standpoint of the federal legislation requirements, some bylaws of the Ministry of Education and Science were criticized for introducing the foreign concepts “Web of Science” and “Scopus” into the sphere of state jurisdiction. Moreover, as stated in the paper, their compliance with the concepts used in the mentioned Federal Law was not checked. These concepts denote the corresponding databases used as a source of information for calculating the place of the Russian Federation by specific weight in the total number of articles in the areas determined by the priorities of scientific and technological development. As emphasized by the author, Web of Science and Scopus are business projects managed by foreign commercial organizations (Clarivate Analytics, located in Pennsylvania, USA, and Elsevier, a European publishing house, respectively). They were not checked for participation in the illegal “sanctions policy” of Western countries against Russian society and the state.

In this regard, the paper raised pressing issues on the validity of decisions to assess the success of scientific organizations and employees by counting the number of publications in journals indexed by these databases as well as rules for forming a list of scientific periodicals where the results of research of scientific degree applicants must be published. As noted in the paper, these decisions impose an extensive list of requirements to Russian journals. However, there are no requirements for foreign periodicals included in the Web of Science and Scopus databases, which puts them in obviously unequal conditions. The absence of mutual obligations and legal guarantees of compliance with Russian legislation on the part of the foreign organizations mentioned, their branches and representative offices located on the territory of Russia, forces researchers and applicants to work with them outside the scope of Russian legislation, i.e., within foreign jurisdiction in the absence of a regulator in corporate relations.

The problems addressed in the paper are undoubtedly debatable. At the same time, an active discussion in the domestic scientific and expert communities will surely contribute to the competitive advantages of Russian science, increasing the efficiency of managing its development and eliminating negative factors and trends that reduce its independence and endanger its security.



Among other papers related to the legislature, we mention the following: “Management of the judicial system: retrospective and prospective aspects” by A.A. Timoshenko; “Technological gap in the field of new technologies and peculiarities of intellectual property protection – systems with reliable signs of artificial intelligence” by A.V. Rozhnov; “Legal regulation of the creation, maintenance, and operation of protective structures of civil defense” by E.K. Chalovskaya, I.O. Klochikhin, L.A. Belotserkovskaya; “Security of transport systems of the EAEU countries: regulatory and legal aspects of the new Silk Road” by Zh.I. Ismailov; “Risk management in a complex network based on arbitration award”; “Security support for complex systems within consistent regulatory acts” by T.Kh. Usmanova.

Unfortunately, it seems impossible to reveal (or even review) the content of all conference papers, interesting and diverse by the subject, due to objective limitations of this publication. The papers can be found in the conference proceedings<sup>1</sup> or on the official conference website:  
URL: <https://iccss2020.ipu.ru/prcdngs>.

In his closing remarks, the Conference Chair, Dr. Sci. (Eng.), Prof. V.V. Kul’ba announced plans to hold the 29th International Conference on Problems of Complex Systems Security Control, according to the established tradition, in December 2021 at Trapeznikov Institute of Control Sciences RAS. Please contact the Organizing Committee via phone + 7 495 198-17-20 (ext. 1407) or e-mail [conf20@ipu.ru](mailto:conf20@ipu.ru). The Technical Secretary of the conference is *Alla Farissovna Ibragimova*.

*Academic Secretary of the Organizing Committee*  
*A.B. Shelkov*

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