

## IN MEMORY OF PROFESSOR IGOR USHAKOV

**Mikhail Yastrebenetsky**  
Gnedenko Forum Vice President

•  
**Alexander Bochkov**  
Gnedenko Forum So-founder

On February 28, 2015, our colleague and dear friend Professor Igor Ushakov passed away. Igor was a famous scientist, and one of the key people in the theory of reliability over the past 50 years. He was the Editor-in-Chief of the e-Journal “Reliability: Theory and Application,” as well as founder and president of “Gnedenko e-Forum” – an informal International Association of professionals in the field of reliability.

Igor was a marvelous and uncommon example of the Renaissance man - he was not just a professor, but also a writer, a poet, a painter, and an evangelist of science. It seems that he knew all and could make all in the world.

Igor was born on January 22, 1935 in St. Petersburg, Russia to the family of a military electrical engineer. The most part of Igor life to 1989 was connected with Moscow. Igor graduated from school with a gold medal in 1952 and then from the Moscow Aviation University (Electronics School, Dept of Self-controlled surface-to-air missiles) in 1958. Igor worked as an engineer in Aviation Construction Bureau and participated in military projects and tests of the anti-aircraft warfare missiles.

His first step into the field of reliability took place in 1959 when he began working in the first USSR reliability department. This is when he published his first paper on reliability. (The word “first” was typical throughout Igor’s life!). This was also the beginning of his contacts with group of mathematics at the Moscow State University that was headed by academic Boris Gnedenko.

Igor earned a Candidate of Science in Reliability Engineering (PhD) in 1963, and after 5 years he became a Doctor of Science (Dr.Sc.) of System Analysis. In both cases, B. Gnedenko was his opponent. Igor was one of the youngest Dr.Sc. in USSR. A handbook of reliability evaluation, which Igor prepared together with B. Kozlov, was one of the first in the world - it was issued in 1966. This textbook was translated into different languages and published many times. To this day, it is a desktop reference for reliability specialists.



From 1963 to 1975, Igor served as Chief of Operations Research Dept. of Research and Design Institute. His area of interest included reliability & availability analysis of control systems for anti-aircraft system and control system for intercontinental ballistic missiles. From 1975 to 1989, Igor served as a Chair of Dept of Operations Research at the Computer Center of USSR



Academy of Science.

He was one of the founders and Deputy Chair of Central Consulting Center on Reliability (Moscow). Throughout the same time from 1968, he had been heading departments at such prestigious Russian educational centers as Moscow Energy Institute (MEI) and Moscow Institute of Physics and Technology (MFTI, a Russian analogue to Massachusetts Institute of Technology). Igor created his own scientific schools in all institutions where he worked. Igor was the head of 61 PhD theses of post-graduated students.

Igor's life changed in 1989 when he received a letter from George Washington University (Washington DC, USA) with an invitation to work there as an honorary invited professor. Then, in US he worked at:

- **SOTAS, Inc., Rockville, Maryland as *Chief Scientist*.** Directed modeling of telecommunication networks. Supervised a group of programmers and statisticians.
- **QUALCOMM, Inc., San Diego, California as *Principal Engineer and Senior Consultant*** **Availability analysis of telecommunication systems. Planning of spare stocks for Globalstar base stations.**
- **University of California San Diego as *Full Professor*.** Taught Courses on applied probability and statistics.
- **Hughes Network Systems, Bethesda, Maryland *Senior Consultant*.** Logistics, Inventory control, Maintenance scheduling, Reliability analysis, Quality Assurance problems.
- **ManTech International, Bethesda, Maryland *Senior Consultant*.** Cost-effectiveness analysis of system maintenance, optimization of spare supply for Na.

Areas of Igor's expertise included:

- Operations Research
- Cost-Effectiveness Analysis
- Logistics, Inventory Control
- Survivability & Safety Analysis
- Probabilistic Modeling
- Applied Statistics

Main results of Igor in reliability related to:

- Reliability optimization problems including optimal redundancy;



- Evaluation of systems effectiveness including systems effectiveness computation at design state;
- Highly reliable systems design;
- Analysis of complex network structure;
- Telecommunication reliability;
- Reliability analysis of computer systems and networks;
- Reliability of mechanical equipment;
- Reliability of big power systems.



A little bit more about the last item in the enumeration listed above. Acad. Yu. Rudenko and Siberian Energetic Institute allowed him to work on different tasks related to power system reliability. One of them was problem of survivability of these systems- their ability to resist deliberate impacts. The importance of this problem can scarcely be overestimated. The book by Yu.Rudenko and I. Ushakov “Reliability of Power Systems” received award of Russian Academy of Science in 1994.

He was a member of Editorial Board of Russian journal “Reliability and Quality Control” (since 2000 “Methods of Quality Management”); Executive Secretary of the journal of the Soviet Academy of Sciences “Engineering Cybernetics” (in USA it is published as “Soviet Journal of Computer and System Sciences”); Kybernetes (Great Britain); European Journal on Operational Research (USA); the journal of the Soviet Academy of Sciences “Informatics and its Applications”; International Journal of Performability Engineering; “Reliability” (Russia).



As editor and reviewer, he was always unbiased and held the strongest principles. Regardless of who wrote a book or an article, a famous scientist or even his good friend – he would always judge the work for its quality and merit and show on lacks. He was especially strict with criticizing articles in mathematic juggling that would not have any actionable application.

He was the author of about 30 monographs and over 300 scientific papers published in the prestigious National and International scientific and engineering journals. If Igor had not pursued the field of technology, he could have been a brilliant journalist. In fact, at some point, he was actually debating which one of these fields to pursue. His autobiography: “Notes of an uninteresting person,” is popular among many groups of people regardless of their profession. For specialists in applied mathematics, reliability, operations research – this book is perceived as the history of our areas of knowledge. One thing you just can’t do is agree with the title of the book – “uninteresting person,” as Igor is everything but that.

In 1976, Igor had a great misfortune of being in the Byelorussia and getting exposed to the nuclear cloud that was the result of the incident in the Chernobyl Nuclear Power Plant. He got very sick as a result. There is no doubt that healthcare in US did a lot to extend his life. But...

In his last 11 years, he worked on creating and developing an international project – an online forum where he tried to connect reliability professionals across the globe.

Representatives of the scientific schools of the USSR in Moscow, Leningrad, Kiev, Riga , Irkutsk, Tashkent , Gorky, Minsk , Tbilisi, Yerevan , Vladivostok and other cities after the tragic collapse of the country and due to the rapid development of globalization trends ( including in science ) in the world, appeared in various parts of the world. Of course, many leading experts continued scientific and personal contacts, but these personal contacts were sporadic and unsystematic character. How did he envision this project to be?



The Gnedenko Forum (the Forum) is to serve as an umbrella organization for fulfilling the professional needs of all individuals who have an interest in the scientific and technical aspects of reliability, risk analysis and safety, theoretical and applied.

The Forum will be virtual and internet - based, unencumbered by obligations to commercial and profit-making entities. It is designed to encompass all technical specialists interested in the topic of reliability, safety and risk analysis irrespective of their physical and organizational co-ordinates.

The Forum will also serve as an unbiased and neutral entity that disseminates scientific information to the press and the public on matters pertaining to the risk and reliability of complex technological systems. It will publish newsletters, technical papers, technical reports, and expository essays for timely dissemination of knowledge and information, but with a strong emphasis on scientific

credibility. It will also serve as a vehicle for disseminating information on scholarships, fellowships, and academic and professional positions in reliability, safety and risk analysis all over the world.



An informal international group of experts on reliability (International Group on Reliability, IGOR) organized in 2005 a worldwide network - Internet Forum website Gnedenko (GNEDENKO e-FORUM, [www.gnedenko-forum.org](http://www.gnedenko-forum.org)), named in honor of the outstanding Soviet mathematician , specialist probability theory, mathematical statistics, probability and statistical methods , Corresponding Member (1945) and academician (1948) Ukrainian Academy of Sciences Boris Vladimirovich Gnedenko (1912-1995) .

Gnedenko Forum - voluntary informal association, the main purpose of which - business discussion platform and establishing professional and personal contacts in the international community of experts on the theory of probability and statistics and their various applications , such as the theory of reliability, quality control, queuing theory, the theory of inventory management, risk analysis, etc.

The basic form of the Forum - the exchange of professional information via the website of the Forum participants and personal contacts. The Forum is a non-profit organization.

Areas of Interest Forum activities include (but are not limited to) the following models and their application :

- system reliability analysis;
- analysis model queues ;
- models to counter terrorism;
- operating efficiency;
- safety;
- survivability ( vulnerability) ;
- risk analysis ;
- cost-effectiveness analysis ;
- optimal distribution ;
- maintainability;

- optimum redundancy ;
- optimum inventory management ;
- reliability analysis;
- statistical process control ;
- quality assurance issues
- and other related topics .

The main objectives of Gnedenko Forum:

- establishing professional contacts among experts in the field of reliability theory in the world;
- sharing information on upcoming events in the activities of the Forum ;
- exchange of information on new publications in the field of activities of the Forum ;
- participation in international conferences and meetings;
- scientific publications in the electronic journal of the Forum;
- assistance in organizing the participation of members of the Forum for advice and grants.

The Forum can participate as personally (mostly) any expert in the theory of reliability and risk analysis, both individually and collectively (companies engaged in applied probability theory and statistics projects , the relevant departments of universities, etc.). There are no special requirements for membership except professional affiliation to the area of the Forum.

President of the Forum elected annually and has a casting vote in the decision-making process and the discussions at the Forum. The Vice President is elected annually and, accordingly, has a consultative voice. Under the rules of the Forum Vice President automatically becomes President for the second term of their activities.

Starting from January 2006 Gnedenko Forum began releasing its quarterly electronic magazine "Reliability: Theory and Practical Applications» («Reliability: Theory & Applications»). The journal is registered in the Library of Congress (ISSN 1932-2321). Over 8 years have passed since the publication of the first issue, in 31 issue of the journal published article 421. Articles undergo a compulsory stage of editing and are published in PDF format on the journal's website. The journal publishes articles, reviews, reviews, memories, information and bibliographies on theoretical and applied aspects of reliability and quality control, security, survivability, maintenance and methods of analysis and risk management. Preference is given to the editorial board materials, reflecting the practical application of these methods in the articles of a theoretical nature, must necessarily contain new problems designation practical application and should not



be excessive use of formal calculations.

In the editorial board of the journal includes scientists and experts who are recognized experts in their fields of activity and well versed in the essence of the problems discussed in the magazine.

Publication in the magazine is equivalent to publication in scientific journals. Articles recommended by the members of the editorial board for review are routed. The editors reserve the right to change the title of the article, as well as spend editing. The author retains full right to use their materials after publication in the journal of your choice (to send them to other publications, to submit to conferences, etc.)

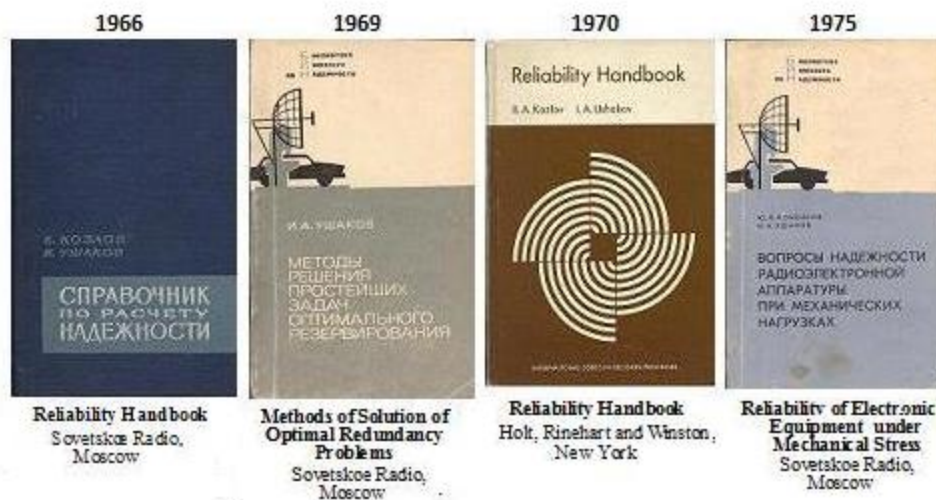
Forum regularly informs its members about upcoming conferences, seminars, when new monographs in the field of reliability theory and risk analysis.

Currently Forum brings together 347 participants from 47 countries. This is how this form exists today. I think that the best memory about Igor would be this forum.

Igor was the author of about 30 monographs and over 300 scientific papers published in prestigious National and International scientific and engineering journals. He also published eight books of prose, lyrics and poems (in Russian).

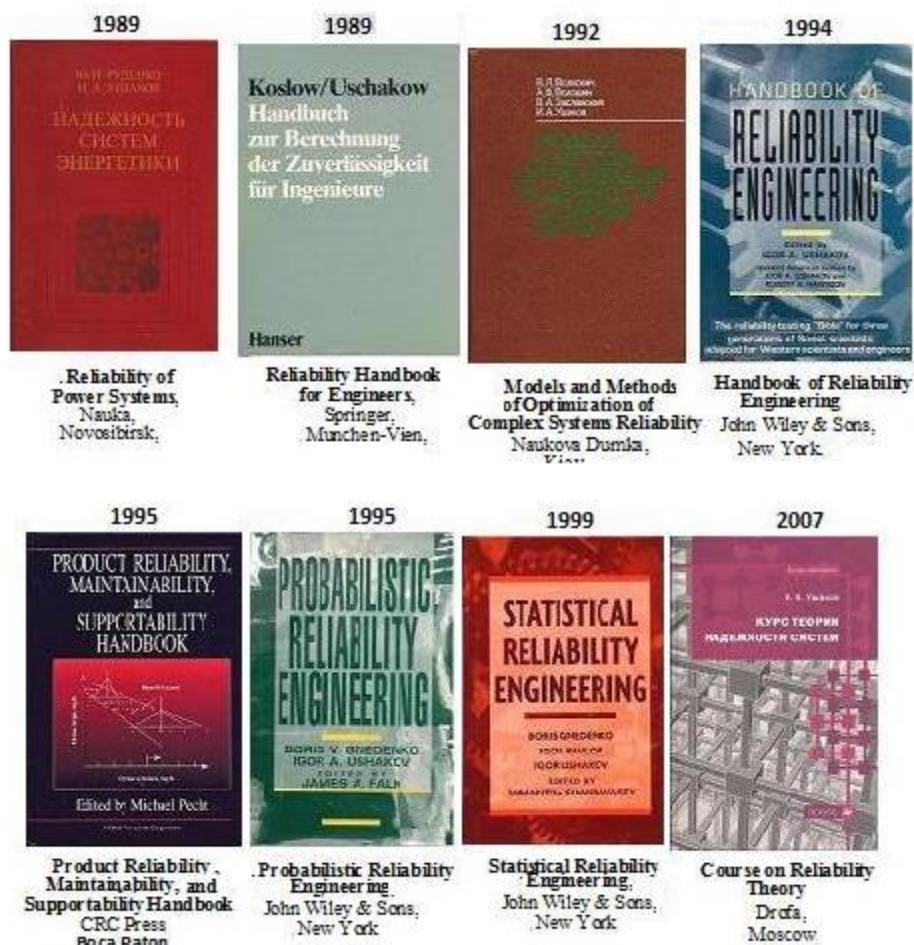


### *Dr. Ushakov's List of Publications*









### Books Edited (in English)

1. **Theory of Probability** by *B.V. Gnedenko*. Gordon and Breach Science Publishers, **1997**.

### Books Edited (in Russian)

18. **Reliability and Maintenance** by *F. Beihelt and P. Franken*. Radio i Svyaz, Moscow, **1988**
17. **Network Flow Programming** by *P. Jensen and J.W. Barnes*. Radio i Svyaz, Moscow, **1984**
16. **Statistical Methods of Reliability Evaluation of Complex Systems by Test Results** by *I. Pavlov*. Radio i Svyaz, Moscow, **1981**
15. **Problems of Optimal Failure Diagnosis in Electronic Equipment** by *G. Pashkovsky*. Radio i Svyaz, Moscow, **1981**
14. **Reliability in Engineering Design** by *K. Kapur and L. Lamberson*. Mir, Moscow, **1980**
13. **Fundamentals of Reliability Theory of Complex Systems** by *A. Raikin*. Sovetskoe Radio, Moscow, **1978**
12. **Reliability Evaluation for Systems with Time Redundancy** by *P. Kredentser*. Naukova Dumka, Kiev, **1978**
11. **Inventory control with random requests** by *G. Rubalsky*. Sovetskoe Radio, Moscow, **1977**

10. **Mathematical Models of Arms Control and Disarmament** by *T. Saaty*. Sovetskoe Radio, Moscow, **1977**
9. **Design of Reliable Electronic Circuits** by *P. Becker and F. Jensen*. Sovetskoe Radio, Moscow, **1977**
8. **Statistical Theory of Reliability and Life Testing** by *R.Barlow and F.Proschan*. Nauka, Moscow, **1975**
7. **English-Russian Dictionary on Reliability and Quality Assurance**. Moscow, **1975**
6. **Optimization in Integers and Related Extremal Problems** by *T. Saaty*. Mir, Moscow, **1973**
5. **Fundamentals in Operations Research** by *R. Ackoff and M. Sasieni*. Mir, Moscow, **1973**
4. **A concept of Corporate Planning** by *R. Ackoff*, Sovetskoe Radio, Moscow, **1972**
3. **On Purposeful Systems** by *R. Ackoff and F. Emery*. Sovetskoe Radio, Moscow, **1972**
2. **Mathematical Theory of Reliability** by *R.Barlow and F.Proschan*. Sovetskoe Radio, Moscow, **1969**
1. **Operations Research** by *P. Rivet and R.Ackoff*, Mir, Moscow, **1966**.

### Brochures

15. **Methods of Research in Telecommunications Reliability** (An Overview of Research in the Former Soviet Union), RTA, Springfield, Virginia, **1994**
14. **Reliability Analysis of Computer Systems and Networks** (*Russian*). Mashinostroenie, Moscow, **1989**
13. **Reliability Evaluation of Repairable Systems**, with Ya.G. Genis (*Russian*). Znanie, Moscow, **1986**
12. **Analysis of Complex Network Structures**, with E.I. Litvak (*Russian*). Znanie, Moscow, **1985**
11. **Evaluation of System Effectiveness** (*Russian*). Znanie, Moscow, **1985**
10. **System Effectiveness Computation at Design Stage** (*Russian*). Znanie, Moscow, **1983**
9. **Problems of Reliability Prediction** (*Russian*). Znanie, Moscow, **1981**
8. **Optimal Redundancy Problems** (*Russian*). Znanie, Moscow, **1979**
7. **Reliability of Complex Systems**, with V.A. Gadasin (*Russian*). Znanie, Moscow, **1978**
6. **Analysis of System Performance** (*Russian*). Znanie, Moscow, **1976**
5. **Highly Reliable System Design** (*Russian*). Znanie, Moscow, **1976**
4. **Reliability of Mechanical Equipment**, with Yu.K. Konyonkov (*Russian*). Znanie, Moscow, **1974**
3. **Reliability Estimation by Test Data**, with F.I. Fishbein (*Russian*). Znanie, Moscow, **1973**
2. **Reliability Optimization Problems** (*Russian*). Znanie, Moscow, **1971**
1. **Engineering Methods of Reliability Analysis** (*Russian*). Znanie, Moscow, **1970**

Igor was very ill, but any illness can't force him to leave off work. This is the list of his articles for last 15 years:

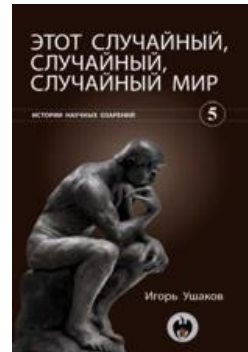
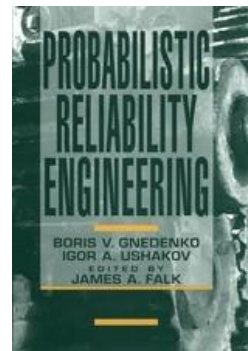
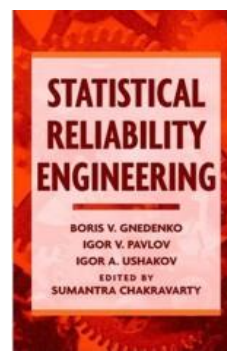
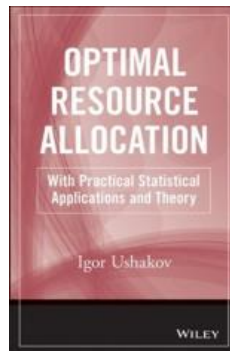
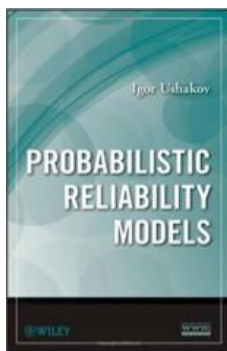
1. **Object Oriented Commonalities in Universal Generating Function for Reliability and in C++**, with S.Chakravarty. Reliability and Risk Analysis: Theory & Applications, No. 10, 2008, San Diego – Moscow.

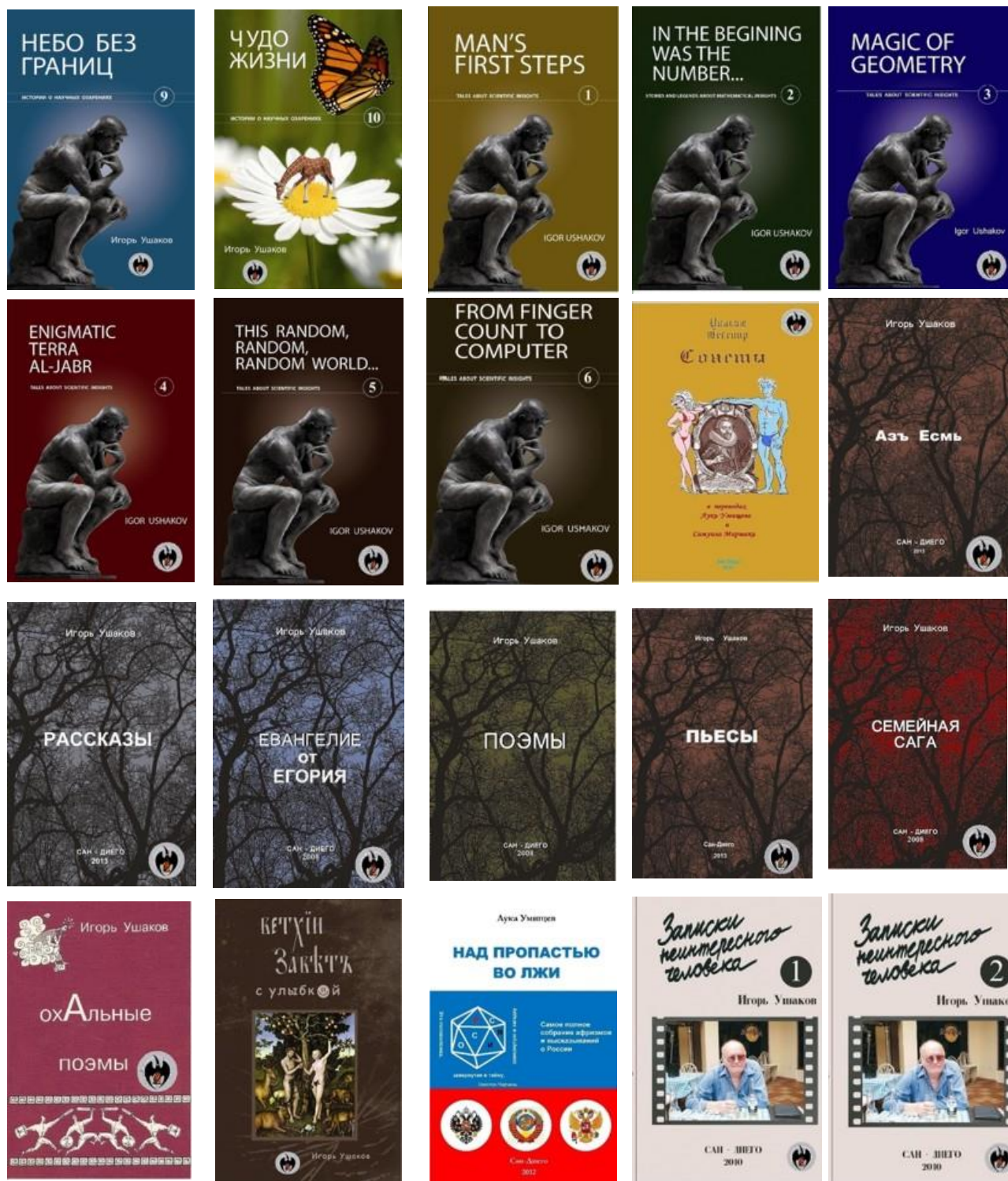
2. Spare Supply System For Worldwide Telecommunication System Globalstar, with S. Antonov, S. Chakravarty, A. Hamid, T. Keliinoi. Reliability and Risk Analysis: Theory & Applications, No. 10 , 2008, San Diego – Moscow.
3. Sensitivity analysis of optimal counter-terrorism resources allocation under subjective expert estimates, with A. Bochkov. Reliability: Theory & Applications, No. 6, 2007, San Diego – Moscow.
4. Is reliability theory still alive? Reliability: Theory & Applications, No. 5, 2007, San Diego – Moscow.
5. D'où venons-nous? Qui sommes-nous? Où allons-nous? Reliability: Theory & Applications, No. 1, 2006, San Diego – Moscow.
6. Counter-terrorism: Protection Resources Allocation. Reliability: Theory & Applications (No 2, 3, 4, 2006), San Diego – Moscow.
7. Terrestrial maintenance system for geographically distributed clients. Special Issue of The International Journal of Polish Academy of Sciences "Maintenance and Reliability", No. 2, 2006
8. Cost-effective approach to counter-terrorism. International Journal Communication in Dependability and Quality Management (vol.8, No.3), Serbia, 2005.
9. Terrestrial maintenance System for geographically distributed clients. The International Symposium on Stochastic Models in Reliability, Safety, Security and Logistics (book of abstracts), Beer-Sheva, 2005.
10. Cost-effective approach to counter-terrorism, with A. Muslimov. The International Symposium on Stochastic Models in Reliability, Safety, Security and Logistics (book of abstracts), Beer-Sheva, 2005.
11. At the origin. Methods of Quality Management, №1, 2004.
12. Model of a maintenance system with breaks of service at night time, with S. Antonov. In "Systems and Methods of Informatics", Moscow, Institute of Informatics of Russian Academy of Sciences, 2002.
13. Multi-state system reliability: from theory to practice, with G. Levitin and A. Lisnianski. Proc. of the 3rd International Conference on Mathematical Models in Reliability, Trondheim, Norway, June 2002..
14. Reliability measure based on average loss of capacity, with S. Chakravarty. International Transaction in Operational Research, №9, 2002.
15. Reliability influence on communication network capability, with S. Chakravarty. Methods of Quality Management, №7, 2002.
16. Calculation of nomenclature of spare parts for mobile repair station, with W. Puscher. Methods of Quality Management, №4, 2002.
17. Territorially dispersed system of technical maintenance, with W. Puscher. Methods of Quality Management, №2, 2002.
18. Few words about Great Man. Recollection about the teacher. Methods of Quality Management, №12, 2001.
19. Reliability: Past, present and future. Methods of Quality Management, №№5-6,2001.
20. Projection of return rate for mass production, with L. Guianulis and D. Hornback. Methods of Quality Management, № 11, 2000.

21. Estimation of component reliability by system testing, with S. Wise. *Methods of Quality Management*, №8, 2000.
22. Reliability: Past, Present, Future. Proc. of the 2nd Biennial Conference Mathematical Models in Reliability, Bordeaux, France, July 2000.
23. Effectiveness Analysis of Globalstar Gateways, with S. Chakravarty. Proc. of the 2nd Biennial Conference Mathematical Models in Reliability, Bordeaux, France, July 2000.
24. The Method of Generating Sequences. *European Journal of Operational Research*, Vol. 125/2, 2000

A width of his views and ability to work were amazing. Besides scientific books, his tireless nature found expressions in fiction, poems, humor stories.

The set of books «History of scientific inspirations» is unique event in modern popular- science literature. History of genius inspiration and invention is described so interesting that these books became as fascinating textbook for young people and friend for adult readers. Rather it isn't a textbook. It is a collection of stories about mathematical, scientist and engineering inspiration and about creators of new ideas in different areas of human activity. Read these books, present one to you children and grandchildren!





We understand what a serious loss it is to us and our Forum, caused by the passing away of Igor Ushakov. He was a remarkable person and great scientist and will always be remembered by all friends and acquaintances.

That he built up such a Forum from scratch speaks of the great talents and business acumen he had. He was the father of our Forum and the fountain-head of all progressive ideas. He was a source of strength and inspiration to many other scientists and researchers. Some of his pioneering work will go a long way in benefiting the future generations.



The gap left behind by the deceased is difficult to be filled. Please accept our sincerest sympathies on this sudden shock. We are pray for peace for the soul. We are express our heart-felt condolences on this sad occasion. May the departed soul rest in peace and be a driving force to all of us...