
V.A. Trapeznikov
Institute of Control Sciences,
Russian Academy of Sciences

V.A. Trapeznikov

Institute of Control Sciences,

Russian Academy of Sciences

Brief references

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Reference book on the Institute of Control Sciences Today and Brief History

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CONTENTS

Introduction

V.A. Trapeznikov Institute of Control Sciences, Russian Academy of Sciences, was founded in 1939.

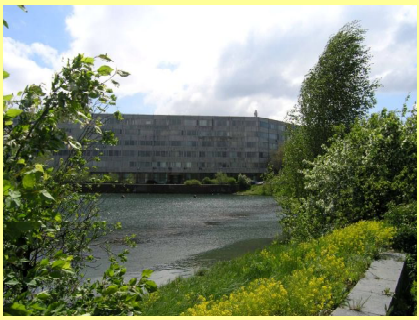
The Institute was named after Academician Vadim Alexandrovich Trapeznikov (1905 – 1994) and Institute Director in 1951 - 1987, in 1998.

The Institute's address is 117997, Moscow, 65, Profsoyuznaya St.

The Institute is at a five-minute walking distance from the Kaluzhskaya subway station on a hilltop in a picturesque part of Moscow.

Of the Institute's nearly 1,000 staff over 120 are doctors and over 250, candidates of sciences.

The Institute includes 53 laboratories and 4 research finding integration divisions.



A view of the Institute's area in late spring

The Institute is housed in two basic buildings:

- **A six-storey laboratory building deep inside the area that runs in parallel with the Profsoyuznaya Street; it houses laboratories, research finding integration divisions and certain services, in particular one of the cafes,**

  and

- **a three-storey general-purpose building that houses the director's office and other services, including a library, two conference halls, a large one and a small one, auditoriums, a diner and a second cafe**

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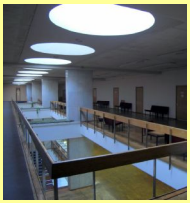
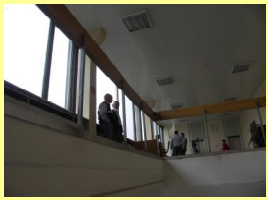
Department of Research	334-91-01	ontp@ipu.ru
Department of General Issues	334-89-20	office@ipu.ru



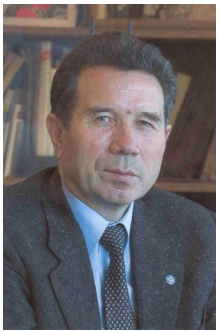
Third floor of the general-purpose building

Fall: the famous oak tree at a corner of the pond outside the Institute



Sixth floor of the laboratory

The Institute's Management



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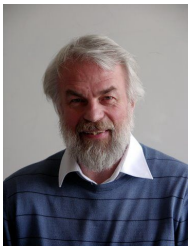

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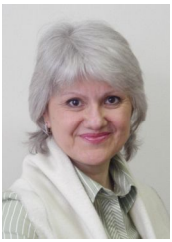

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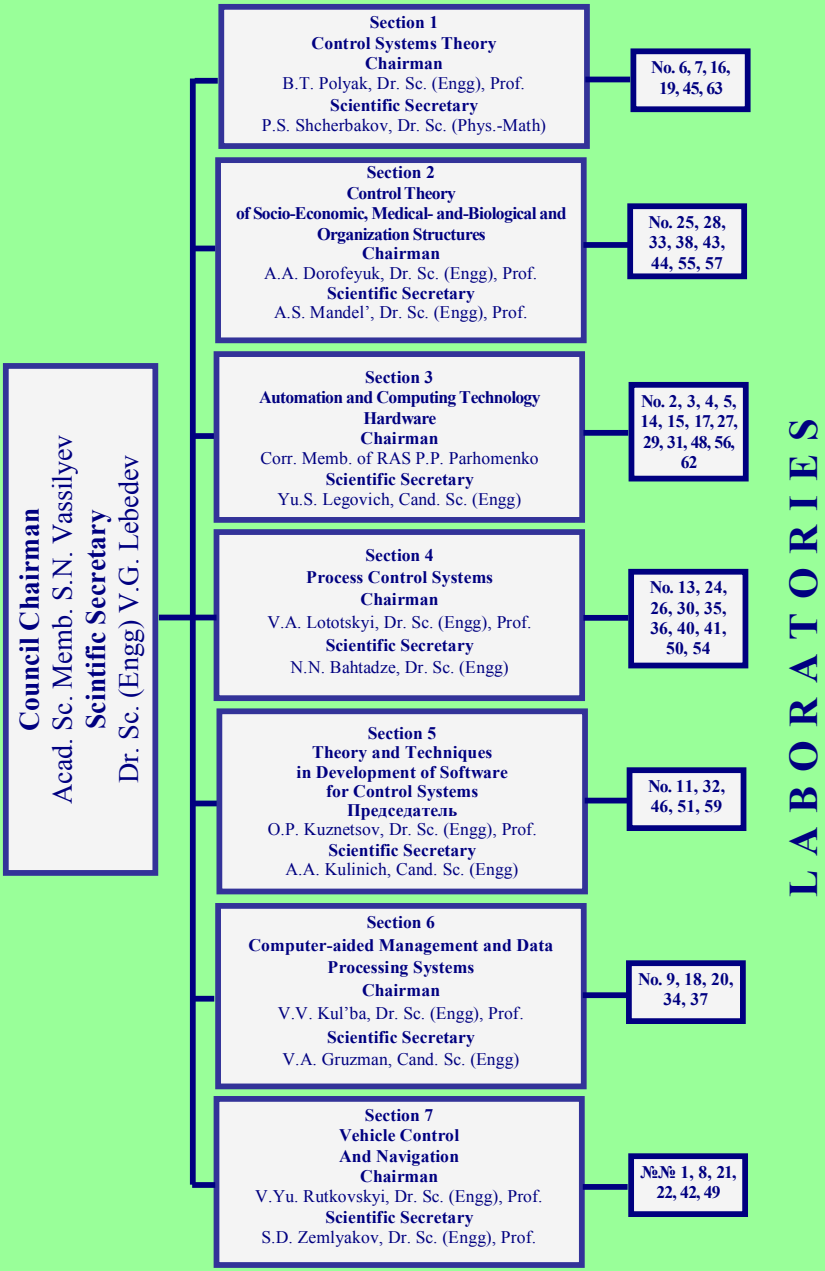
Basic Lines of Research

- **System Theory and General Control Theory;**
- **Techniques of Control in Complicated Engineering and Man-Machine Systems;**
- **Theory of Control in Inter-Disciplinary Models of Organizational, Social, Economic, Medical and Biological and Environment Protection Systems;**
- **Theory and Techniques in Development of Software-and-Hardware and Engineering Tools of Control and Complicated Data Processing and Control Systems;**
- **Scientific Fundamentals of Technologies in Vehicle Control and Navigation;**
- **Scientific Fundamentals of Integrated Control Systems and Automation of Technological Industrial Processes .**

The Scientific Council and its Sections provide guidance in basic research in these lines of research.

A meeting of the Scientific Council

Scientific Council and its Sections



As its basic "legislative" body, the Scientific Council has invariably played a tremendous part in the life of the Institute's personnel. It makes most important decisions in all kinds of the Institute's activities and structure, personnel and economic issues, awarding scientific titles, evaluating the activities of the entire Institute s and its divisions, awarding prizes named after outstanding researchers Academicians V.S. Kulebakin and B.N. Petrov; Academy of Sciences Corresponding Members M.A. Gavrilov, A.M. Letov and B.S. Sotskov and others. Its meetings discuss burning issues in today's control theory and applications.

At various times Scientific Council members were well-known researchers such as Academicians A.A. Andronov, A.I. Berg, N.A. Kuznetsov, V.S. Kulebakin, O.I. Larichev, A.A. Lebedev, N.N. Luzin, I.M. Makarov, B.N. Naumov, B.N. Petrov, I.V. Prangishvili, V.S. Pugachev, V.A. Trapeznikov, Ya.Z. Tsypkin, S.N. Vassilyev, A.A. Voronov and S.V. Yemel'yanov; Academy Corresponding Members O.I. Aven, M.A. Gavrilov, V.I. Kovalenkov, A.M. Letov, D.A. Novikov, P.P. Parkhomenko, Ye.S. Pyatnitsky and B.S. Sotskov; Professorss D.I. Ageikin, M.A. Aizerman, A.A. Bulgakov, V.N. Burkov, A.G. Butkovsky, A.A. Dorofeyuk, A.A. Feldbaum V.Yu. Kneller, B.Ya. Kogan, M.A. Krasnosel'sky, V.F. Krotov, V.V. Kul'ba, O.P. Kuznetsov, A.Ya. Lerner, V.L. Lossiyevsky, , B.T. Polyak, L.I. Rozonoer, V.Yu. Rutkovsky, V.V. Solodovnikov, N.P. Vasilyeva and numerous others.

At present there are 33 members of the Scientific Council. Because the Institute is engaged in research in numerous scientific fields, it has seven sections that are in charge of coordinating the activities of laboratories.

The Council's structure shown in the preceding page cannot represent all formal ties between the Council and laboratories, especially because quite a few laboratories do research in fields and lines of research covered by several Sections.

Section 1. Control System Theory: Labs. No. 6, 7, 16, 19, 45, 63

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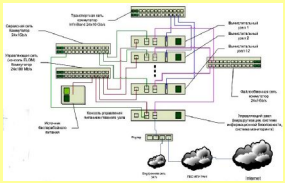
This Section employs well-known researchers Drs. Sc. Professors V.F. Krotov (deputy chairman), A.G. Butkovsky, L.B. Rapoport, and , V.P. Zhukovõ Cand. Sc. A.V. Akhmetzyanov and others.

Discussion of a "merry" problem (Lab. No. 7)

I.N. Barabanov at a workshop (Lab. No.16)



Structure of a today's multi-processor computing system and Lab. No. 19 headed by A.V. Akhmetzyanov (center) that uses it.

Section 2. Control Theory of Socio-Economic, Medical-and-Biological and Organization Structures: Labs. No 25, 28, 33, 38, 43, 44, 55, 57

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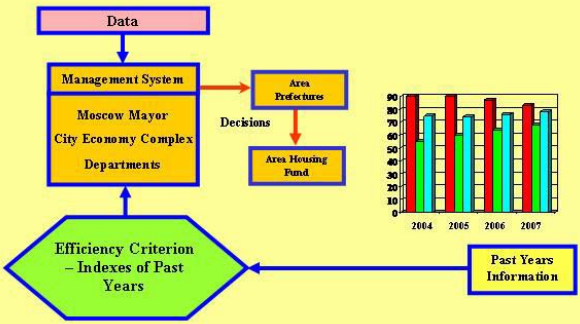
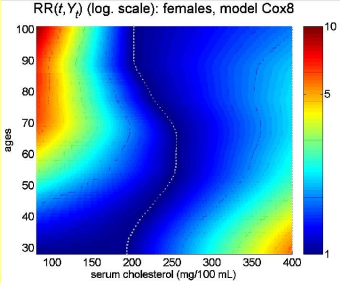
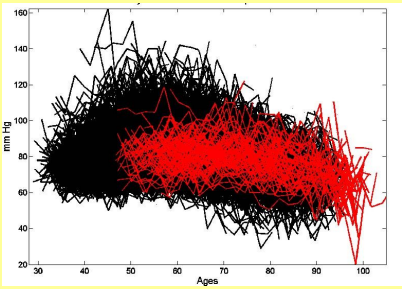
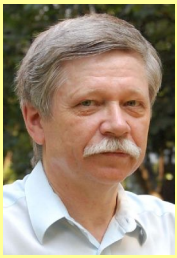


Evaluating operating efficiency of communal housing bodies in Moscow suggested by Labs No 44 and No.55







Graphs of gerontological research (death rate due to high blood pressure and excessive cholesterol content) and researchers in that field Anatoly Ivanovich Mikhalsky (left) and Vasily Nikolayevich Novosel'tsev (right), Lab. No. 38

Section 3. Automation and Computing Technology Hardware. Labs No. 2, 3, 4, 5, 14, 15, 17, 27, 29, 31, 48, 56, 62

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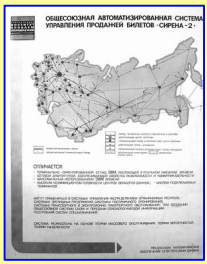
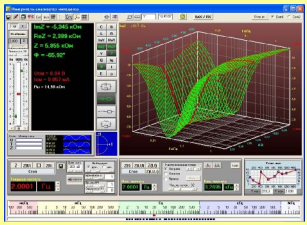
Multi-processor computing system PS-2000 (Lab. No. 31)

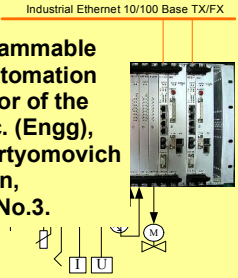


Flowchart of air ticket reservation and sale system Sirena-2 (Lab. No.17)

Fluid cc

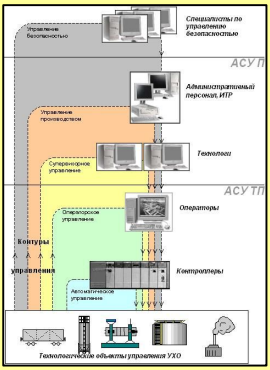


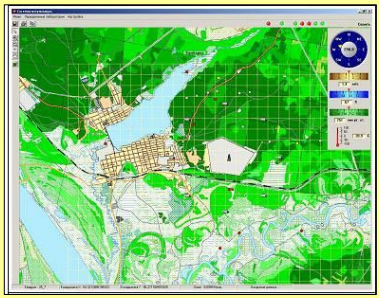
Front panel of a *virtual impedance meter* and analyzer for research and industrial control purposes (Lab. No. 62)

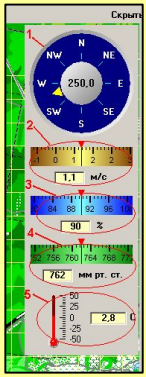


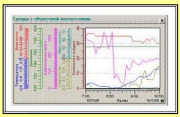
Flowchart of a programmable variable structure automation system and an author of the system's idea Dr. Sc. (Engg), Professor Alexander Artyomovich Ambartsumian, director of Lab. No.3.

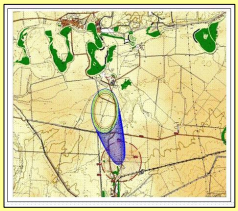
Pump plant of the Tyumen Oil Company that operates a control system developed in Lab. No. 3.





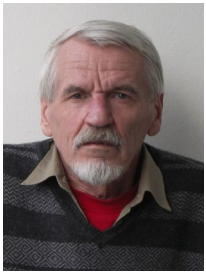






Lab. No. 29's Destruction of Chemical Weapons project that also involves Labs No.31, 46 and Research Finding Integration Division No. 75

Section 4. Process Control Systems. Labs No.№ 13, 24, 26, 30, 35, 36, 40, 41, 50, 54



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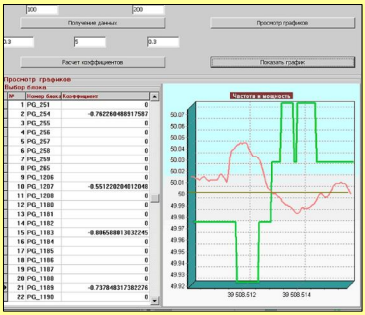
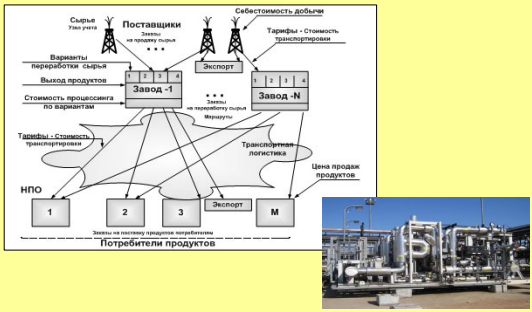


Action of power sources in general primary regulation of the frequency in emergencies (Lab. No. 41)



Multi-level Control System: Oil and Gas Recovery, Processing and Transportation (Lab. No. 30)

Section 5. Theory and Techniques in Development of Software for Control Systems. Labs No. 11, 32, 46, 51, 59

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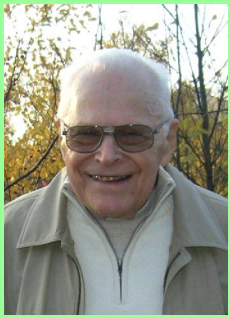
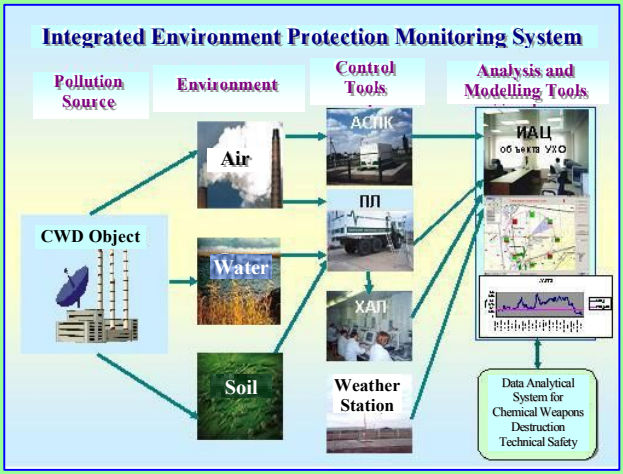
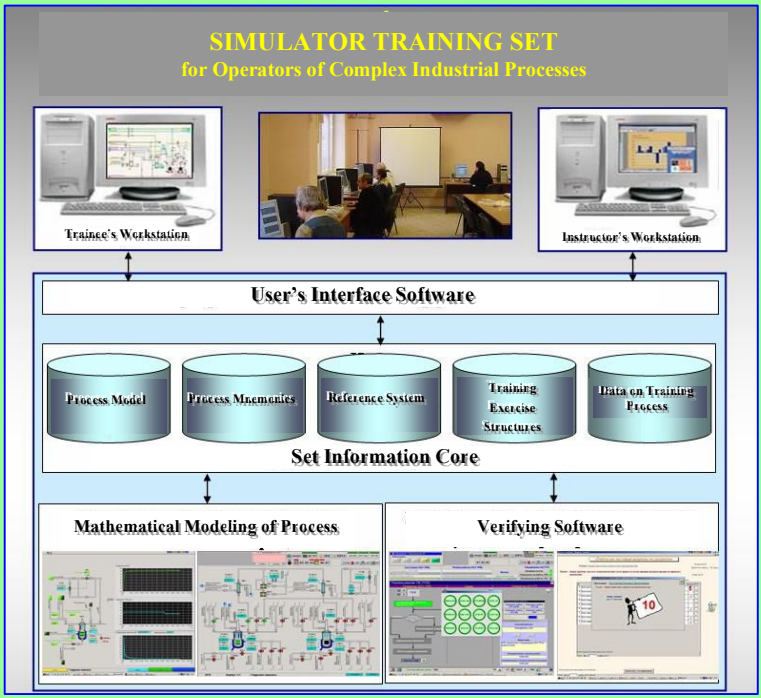


Professor Eduard Anatol'yevich Trakhtengerts and a small sample of his books



Environment Protection Monitoring System of the Chemical Weapons Destruction (CWD) Project (Lab. No. 46)



Lab. No 46-developed Simulator Training Set

Section 6. Computer-aided Management and Data Processing Systems. Labs No. № 9, 18, 20, 34, 37

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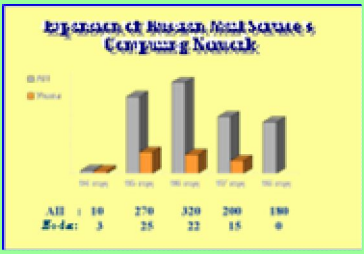
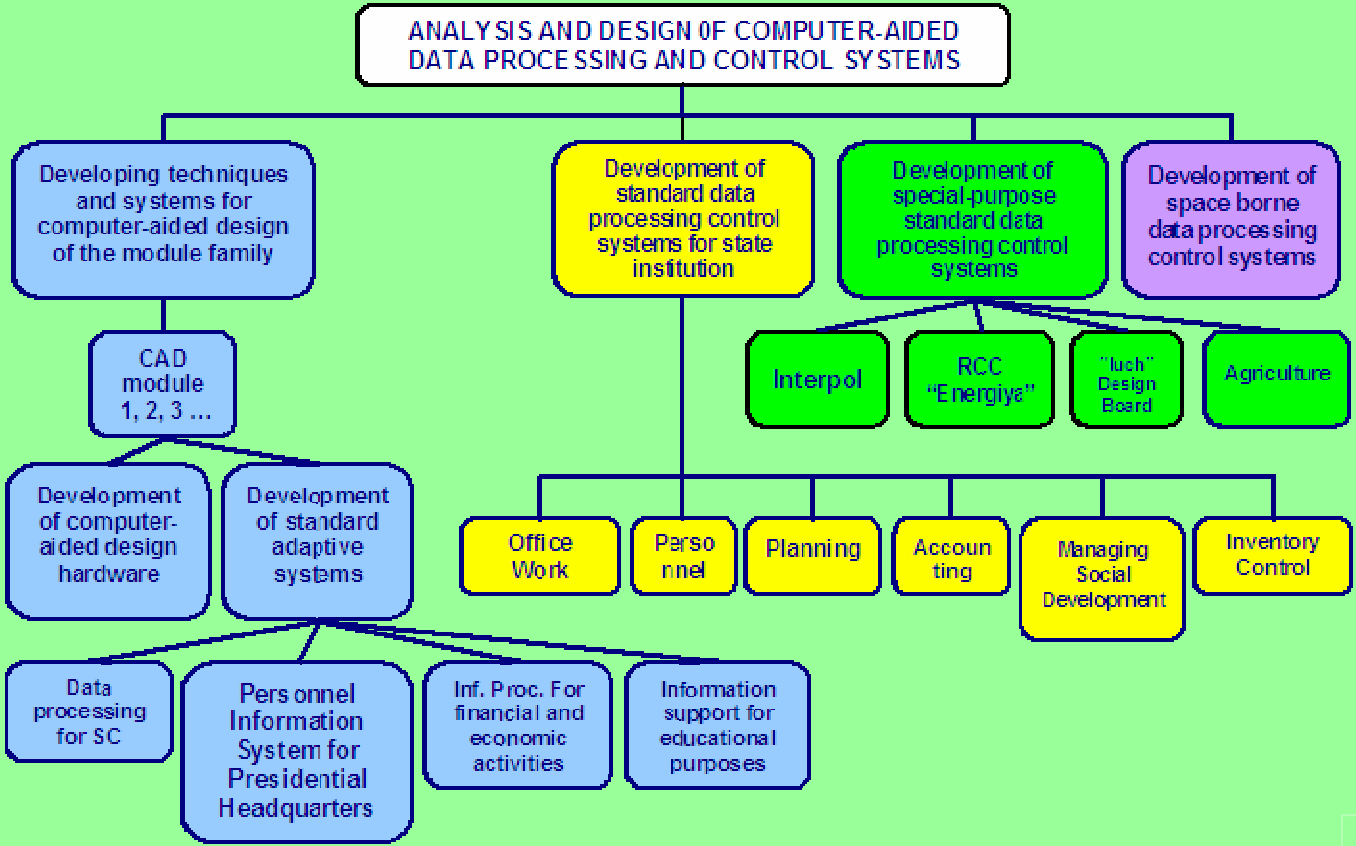
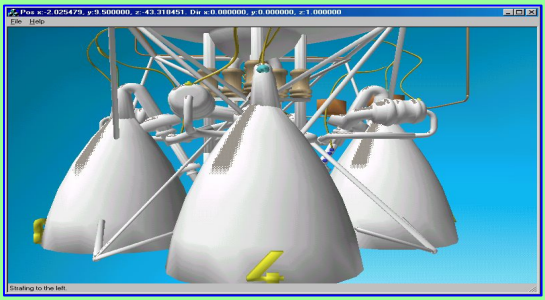
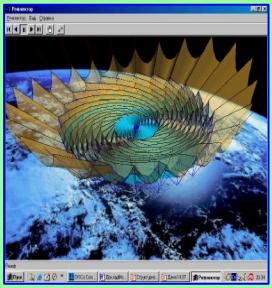


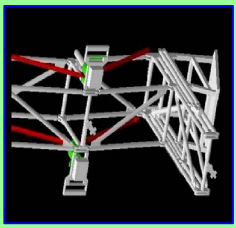
Computer-aided data processing system of the Russian Mail Service (Lab. No. 9).

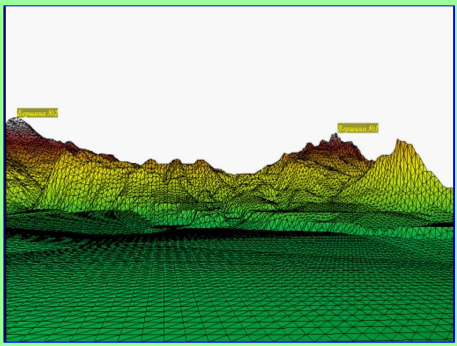
INTEGRATED RESEARCH FINDINGS OF LAB. No. 20

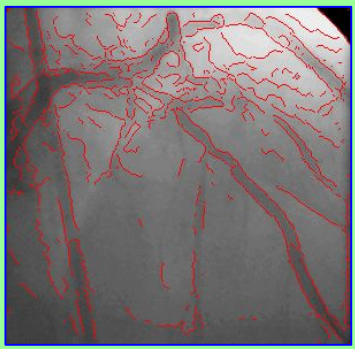












Examples of 3D graphics research and development of computer-aided dssign systems. (Lab. No. 18)

Section 7. Vehicle Control and Navigation: Lab. No. №№ 1, 8, 21, 22, 42, 49

Chairman:

Dr. Sc. (Engg), Professor

Vladislav Yul'yevich Rutkovsky

tel: (495) 334-87-30

E-mail: rutkov@ipu.ru

Scientific Secretary:

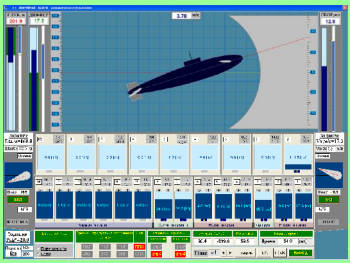
Dr. Sc., Professor

Stanislav Danilovich Zemlyakov

tel.: (495) 334-87-30

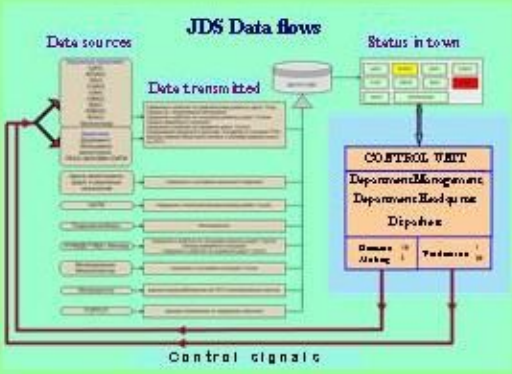
E-mail: zeml@ipu.ru

This Section employs well-known researchers Drs. Sc. (Engg) A.I. Alchinov, M.Kh. Dorri, A.P. Kurdyukov, Drs. Sc. (Engg) A.Ya. Andriyenko, B.V. Pavlov, Dr. Sc. (Phys.-Math) A.V. Dobrovidov and others.

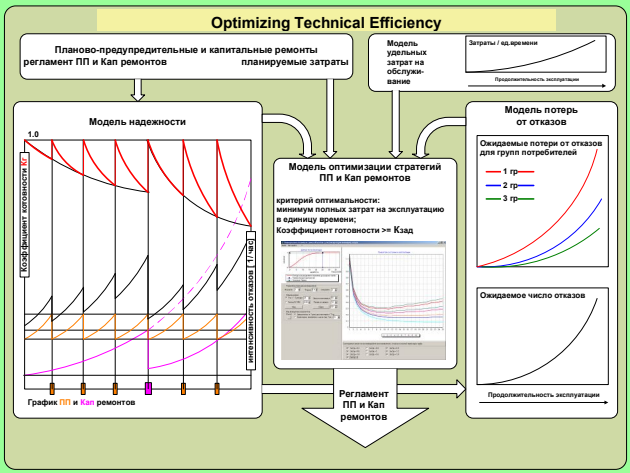


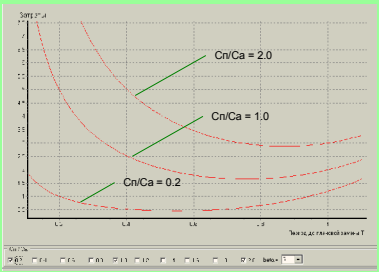
Project in design of comprehensive automation of a new class of nuclear-powered submarines (Project 705 carried out by Labs No. 2, 5, 10, 11, 27 and 49)

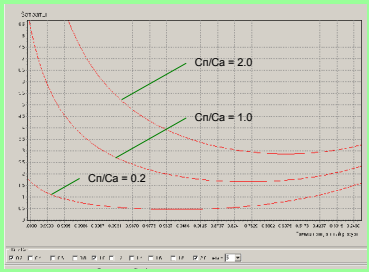
Systems developed in Labs No. 1, 6, 8, and 42 are used in numerous kinds of launching vehicles, in particular those sent to the Moon and those that inject earth satellites into orbits



Activities in setting up a joint dispatcher service (JDS) for the Moscow City Government's Housing Improvement Department (Labs No 49, 5, 11, 29, 41, 44, 46, 55, 59)

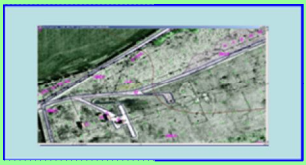


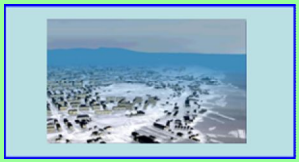




Evaluating technical efficiency and planning maintenance of heating networks by economic criterions (Labs No. 5, 49)

Integration Division No. 73





Activities in geographical information systems and digital cartography

Integration Division No. 75

Mobile air control laboratory of the sanitation-and-hygienic control system

Mobile air control laboratory

Thesis Councils

The Institute operates four thesis councils that award Dr. Sc. and Cand. Sc. (Engg and Phys.-Math) degrees in the following fields:

- **05.13.01 – Systems analysis, control and data processing in engineering and physical and mathematical sciences.**
- **05.13.05 – Computing technology and control systems elements and units.**
- **05.13.06 – Process automation and control.**
- **05.13.10 – Management in social and economic systems.**
- **05.13.11 – Computer, computing system and computer network software.**
- **05.13.12 – Computer-aided systems.**
- **05.13.15 – Computers and computing systems.**
- **05.13.18 – Mathematical modeling, numerical methods and software systems.**

Over 2,000 people have defended their doctoral and candidate theses at theses council sessions.

Technical secretary of thesis councils:

Tatiana Petrovna Syomkina

Tel.: (495) 334-93-29

E-mail: tps@ipu.ru

Conferences and Exhibitions

The Institute regularly holds scientific conferences on the following subjects:

- **All-Russian Youth Scientific Conference on Control Sciences;**
- **All-Russian Conference on Navigation of Ships and Special Vehicles;**
- **International Conference on System Identification and Control Problems (SICPRO);**
- **International Scientific and Practical Conference on Cognitive Analysis and Situation Development Control;**
- **International Conference on Parallel Computation and Control Problems (PACO);**
- **International Conference Outlook for Using New Technologies and Discoveries in the Aerospace Industry;**
- **International Conference on Control Sciences;**
- **International Conference "Issues in Regional and Municipal Management";**
- **International Conference "Issues in Safety Control of Complicated Systems";**
- **International Conference "Systems of Designing, Technological Preparation of Manufacturing and Control of Stages in the Life Cycle of Industrial CAD/CAM Products";**
- **International Scientific and Practical Conference on Theory of Active Systems;**
- **International Scientific-and-Practical Conference on " Management of Innovations";**

- **International Conference on Large-Scale System Development Control";**
- **International Conference and Exhibition "Digital Signal Processing";**
- **International Ye.S. Pyatnitsky Workshop on "Stability and Oscillations of Nonlinear Control Systems" (STAB);**
- **International Workshop-and-Presentation and Exhibition on Industrial Systems, Industrial Controllers, Process Control Hardware and Software, systems SCADA and Automation Instruments and Tools;**
- **All-Russian Workshop "Today's Navigation and Flight Control Techniques";**
- **Russian Conference with International Participation "Control, Supervision and Measurement System Hardware and Software".**

More detailed information on these conferences is available at the Institute's site http://www.ipu. ru.

Session of an All-Russian workshop on Today's Navigation and Flight Control Techniques (Small Conference Hall, April 2009)

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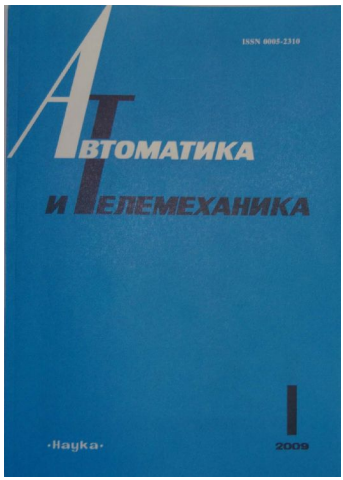
Periodicals

The Institute publishes and is the founder of six scientific journals.

Journal *Automation and Remote Control*



Published since 1936г.

Editor-in-chief: Academician S.N. Vassilyev.

Deputy editors-in-chief: Russian Academy of Sciences Corresponding Member A.P. Kuleshov; Russian Academy of Sciences Corresponding Member P.P. Parkhomenko; Dr. Sc., Professor B.T. Polyak.

Secretary: Russian Academy of Sciences Corresponding Member D.A. Novikov.

Editorial Board's tel.: (495) 334-87-70

E-mail: redacsia@ipu.ru

Site: http://www.mtas.ru/AiT/

Control Sciences

Published since 2002

Editor-in-chief: Russian Academy of Sciences Corresponding Member D.A. Novikov.

Deputy Editors-in-Chief: Cand. Sc. (Engg) L.P. Borovskikh; Dr. Sc. (Engg), Professor F.F. Pashchenko.

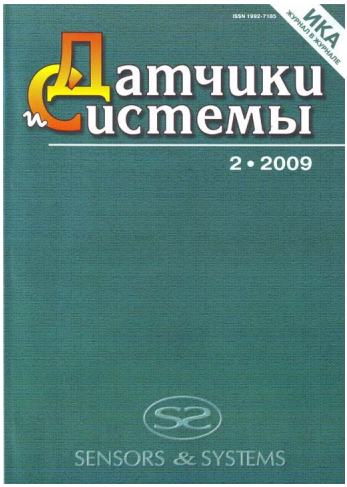
Editorial Board's tel.: (495) 334-92-00

E-mail: pu@ipu.ru

Site:

http://www.ipu.ru/period/pu

Journal *Sensors and Systems*



Published since 1999

Editor-in-chief:
Dr.Sc., Professor F.F. Pashchenko.

Deputy editor-in-chief:
N.N. Kuznetsova;
Editor-in-chief of IKA (journal inside journal):
Dr.Sc. (Engg), Professor V.Yu. Kneller.

Secretary:
G.M. Baranova.

Editorial Board's tel.: (495) 330-42-66

E-mail: datchik@ipu.ru
Site: http://www.datsys.ru

Journal *Automation in Industry*

Published since 2003 г.

Editor-in-chief:
Cand. Sc. (Engg) N. I. Aristova.

Editorial Board's tel.: (495) 334-91-30

E-mail: avtoprom@ipu.ru

Site: http://www.avtprom.ru

Journal *Control Systems and Data Processing Technologies*

Published since 2003

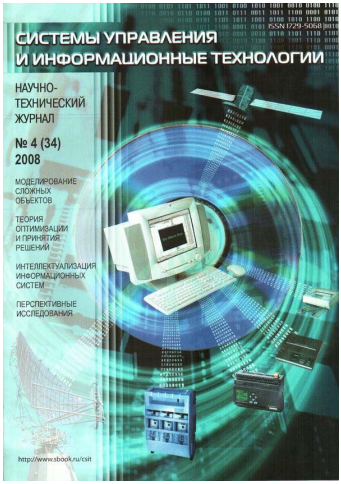
Editor-in-chief:
Dr.Sc. (Engg), Professor S.L. Podval'nyi.

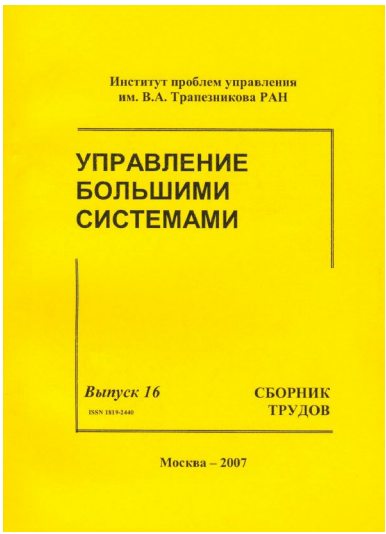
Secretary:
Dr.Sc. (Engg), Professor O.Ya. Kravets.

Editorial Board's tel.: (473-2) 43-77-18

E-mail: kravets@vsi.ru

Site: http://www.vsi.ru/~sbph/suit/





Electronic journal *Large system control*

Published since 1998

Editor-in-chief:
Russian Academy of Sciences
Correspon
ding Member
D.A. Novikov

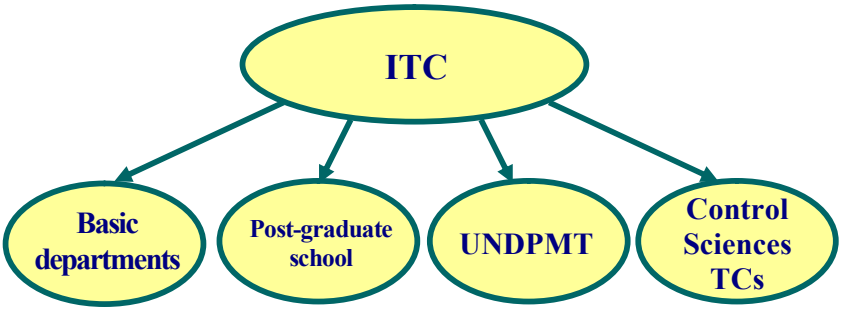
Secretary:
Cand. Sc. M.V. Gubko.

Site: http://ubs.mtas.ru

Institute's Training Center

The Institute's Training Center (ITC) incorporates today the following structures and is engaged in the following activities:

- **Basic departments and training centers (TCs) set up jointly with Moscow's leading institutes of learning whose students have diploma internship in the Institute;**
- **Post-graduate schools;**
- **Interaction with regional institutes of learning in the framework of joint training centers;**
- **University of new data processing and management technologies (UNDPMT).**



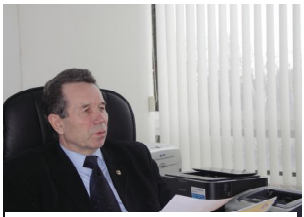
Учебно-научный комплекс Института

Basic Departments

The Control Sciences Department was set up in the Moscow Physico-Technical Institute in 1956 for the purpose of training broad specialists and covers the following main lines of research:

- **Theory of random processes, functional analysis and its applications to control problems;**
- **Algorithmical models in control processes;**
- **Mathematical methods of studying control processes in industrial systems**

- **Management in social and economic systems;**
- **Computation using today's computers and hardware.**



S.N. Vasilyev

Department head: Academician Stanislav Nikolayevich Vassilyev.

The department's staff includes Russian Academy of Sciences Correspondent Member D.A. Novikov, Dr. Sc. (Phys.-Math) V.I. Opoitsev and Drs Sc. (Engg) F.A. Aleskerov, V.N.Burkov, V.V. Ignatushchenko, Ye.Ya. Rubinovich and A.V. Shchepkin.

The Technical Control Engineering Department was set up at the Moscow Physico-Technical Institute in 2001 and provides fundamental training in the following fields:

- **Control theory (optimal control theory, identification of random control systems, control in random systems);**
- **Management of organizations, large-scale systems, in particular, vertically integrated oil companies;**
- **Development of ways to build man-machne systems , models of industrial processes (in particular, in oil processing and petrochemistry);**
- **Financial-and-economic analysis an investment studies; corporate and industrial planning; computer-based learning and industrial safety systems.**

Department head:
Dr. Sc., Professor Leonid Rafailovich Sorkin.

The department also employs as professors Dr. Sc. (Phys.-Math.) Yu.V. Mitrishkin and Drs Sc. (Engg) Ye.N. Khobotov, A.P.Kurdyukov, A.S. Mandel', and B.T. Polyak.

L.R. Sorkin

Pre- and Post-Graduate Training

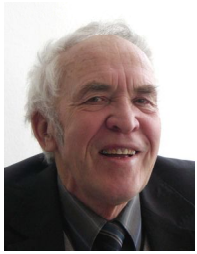
The Institute's post-graduate school provides training for candidates and doctors of science in the following engineering and physico-mathematical fields:

- **Control in industrial systems (05.13.01);**
- **Computing technology and control system elements and units (05.13.05);**
- **Automatic control systems (05.13.06);**
- **Management in social and economic systems (05.13.10);**
- **Software for computers, computing systems and networks (05.13.11);**
- **Design automation (for various fields) (05.13.12);**
- **Computing systems, their software and organization of computing processes (05.13.15);**
- **Mathematical modeling, numerical methods and software sets (05.13.18).**

The post-graduate school has recently started training in economic sciences such as:

- **Economy and economy management (08.00.05);**
- **Mathematical and instrumental methods in economy (08.00.13).**

Post-graduate school principal
Dr. Sc., Professor
Vladimir Dmitriyevich Malyugin
Tel.: (495) 334-90-19



Internet Projects

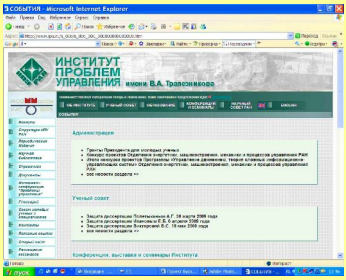
The following Internet projects have been implemented in recent years.

The Institute's site http://www.ipu.ru has significantly changed thanks to implementing the principle of dynamic and distributed formation of pages. It now includes new divisions such as:

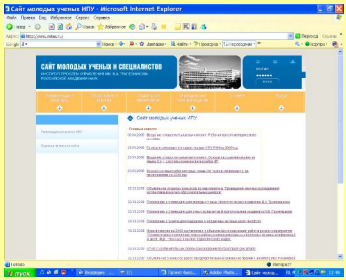
- **electronic passports of laboratories that are integrated with a system in which activities of laboratories are evaluated and with an information system of individual indexes of research activities;**
- **An electronic notice board (with interactive ways of reporting news) that reflects current information supplied by the Institute's administration, the Scientific Council and certain services and divisions (from notices of upcoming scientific events to orders, etc);**
- **Collection of regulations and forms;**
- **Data on the Scientific Council and thesis councils;**
- **an electronic telephone and postal directory etc.**
- **An Internet –conference (a generally accessible electronic journal) http://ubs.mtas.ru/forum is organized (in a forum mode) for fast and free (with minimal moderation) discussion of papers on control sciences**

A site of the Institute's Council of Young Researchers and Engineers (CYRE) http://new.mtas.ru.

An electronic glossary of terms in control sciences http://www.glossary-ipu.ru.



Institute's site



CYRE site

Council of Young Researchers and Engineers

The Institute's Council of Young Researchers and Engineers (CYRE) resumed its activities in 2007 and is active in organizing and running contests of research projects of young researchers and scientific youth conferences on the Institute's scope.

Council Chairperson
Cand. Sc. (Engg)
Zinaida Konstantinovna Avdeyeva
Tel.: (495) 334-78-00
E-mail: max@ipu.ru

Council Deputy Chairman:
Cand. Sc. (Engg)
Nikolai Andreyevich Korgin
Tel.: (495) 334-79-00
E-mail: kolyah@edunet.ru

The Institute's Youth Scientific Schools (YSS)

YSS in A.A. Ambartsumian's Lab. No. 3

YSS in N.A. Abramova's Lab. No. 51

Labs No. 1, 3, 11, 19, 31, 37 and 57 also run Youth Scientific Schools

V.A. Trapeznikov Institute of Control Scienes, Russian Academy of Sciences *

The Institute's first building, Maly Khariton'yevsky Pereulok

The Council of People's Commissars decided in 1939 that the Commission on Remote Control and Automation that had existed since 1934 had to be expanded into an Institute of Automation and Remote Control in the framework of the USSR Academy of Sciences' Division of Technical Sciences and one of the first Air Force pilots and by that time a famous researcher in aviation power engineering, Academician Viktor Sergeyevich Kulebakin was appointed director of the Institute.

V.S. Kulebakin

At the time of its setting up the Institute had a total of 22 personnel, in particular B.N. Petrov who would become a member of the Academy and its vice-president, M.A. Gavrilov who would become a correspondent member of the Academy, N.N. Shumilovsky who would become a member of the Kirghizian Academy of Sciences, Professors V.A. Lossiyevsky, G.V. Shchipanov, and others. Soon the Institute admitted Academician N.N. Luzin, an outstanding mathematician who, like Academician A.A. Andronov later trained an entire school of control theoreticians.

N.N. Luzin

G.V. Shchipanov

Pre-war years saw significant successes scored in description of control systems by differential equations and discussion of "compensation conditions" under which, as their author G.V. Shchipanov argued, the

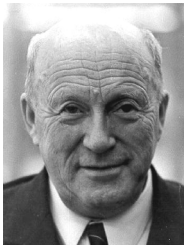
* The book Institute of Control Sciences Is Seventy published by the Institute in 2009 reports the Institute's history in more detail.

control system would not respond to perturbations.

That discussion spilled over from scientific publications to central periodicals controlled by the ruling Communist Party. Shchipanov's conditions were actually forerunners of what later became a theory of invariance advanced by V.S. Kulebakin, N.N. Luzin and B.N. Petrov. G.V. Shchipanov died in 1953 and his scientific vindication did not occur until 1960 when a commission that included Academicians A.A. Dorodnitsyn, A.Yu. Ishlinsky and B.N. Petrov confirmed the scientific value of his discovery (formally what was termed then "G.V. Shchipanov's compensation conditions" were recognized as a discovery in 1966 with a priority since April 1939).

The Institute's building during the war

During World War II the Institute worked for the war and the army while some of its future personnel like M.A. Aizerman, P.P. Parkhomenko, Ya.Z. Tsypkin and others fought the enemy arms in hand. The Institute's research in fighting non-contact torpedoes and mines carried out under the guidance of future Academy Corresponding Member B.S. Sotskov and automation of quality control in making cartridges under the guidance of future Academician and the Institute's Director V.A. Trapeznikov and B.N. Petrov were especially important.



B.S. Sotskov

Following the war Academician A.A. Andronov joined the Institute and launched a famous workshop attended by nearly every future scientific leader, in particular M.A. Aizerman, A.A. Fel'dbaum, A.Ya. Lerner, M.V. Meyerov, A.V. Mikhailov, V.V. Petrov, V.V. Solodovnikov, Ya.Z. Tsypkin and numerous others. In 1969 the Academy of Sciences Presidium introduced an A.A. Andronov Prize; A.G. Butkovsky, future

A.A. Andronov

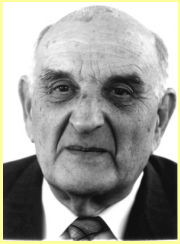
Academy Corresponding Member V.V. Petrov and Andronov's follower Dr. Sc. (Engg), Professor M.V. Meyerov were among its first winners.

The following were the highlights of the Institute's activities in 1940s and 1950s:

- **Development of the Boolean algebra tools for description, analysis and design of switching systems (M.A. Gavrilov);**
- **Development of a general theory of linear control systems (V.S. Kulebakin, B.N. Petrov, M.A. Aizerman, M.V. Meyerov, V.V. Solodovnikov, Ya.Z. Tsypkin and others);**
- **Development of a theory of nonlinear control systems, in particular a method of point-wise transformations, theory of absolute stability and theory of switching systems (M.A. Aizerman, V.V. Petrov, G.M. Ulanov, A.A. Fel'dbaum, Ya.Z. Tsypkin);**
- **Construction of a first Soviet family of analog computers (B.Ya. Kogan, V.A. Trapeznikov and others.);**
- **Development of general methods of studying digital control systems (Ya.Z. Tsykin);**
- **Development of fundamentals of an optimal control theory (A.A. Fel'dbaum, A. Ya. Lerner and at a later stage A.G. Butkovsky, V.F. Krotov);**

B.N. Petrov

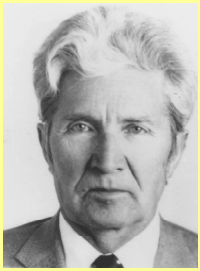
M.A. Gavrilov



M.A. Aizerman

The Institute's main building after the war (Kalanchyovskaya St.)

One of the Institute's building after the war (Leningradsky Prospekt)



A.M. Lyotov

A.G. Butkovsky

L.I. Rozonoer

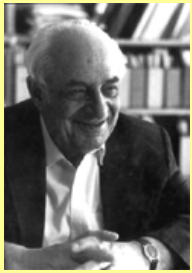
Development of a dual control theory (A.A. Fel'dbaum);

- **Development of essentially new sensitive elements, sensors and instruments (B.S. Sotskov, D.I. Ageikin, M.A. Rozenblat, Ye.K. Krug and others);**
- **Start of research in control of liquid propellant missile engines (B.N. Petrov);**
- **Theory of analytical regulator design (A.M. Lyotov).**

Vadim Alexandrovich Trapeznikov was appointed Institute director in 1951 and it was largely due to his efforts that by early 1960s conditions were in place for an upsurge of new ideas, creation of essentially new theories and development of control systems of an unprecedented scale and sophistication that were created in 1970s and 1980s and continue even now.

Research in aerospace control gained an unprecedented momentum (B.N. Petrov, Yu.P. Portnov-Sokolov, V.Yu. Rutkovky, G.M. Ulanov, L.G. Palevich, V.A. Viktorov and numerous others). In 1980 the Academy launched a B.N. Petrov Golden Medal and in 1993 a B.N. Petrov Prize to researchers for outstanding achievements in control theory and systems and for experiments in space exploration. It was V.Yu. Rutkovsky of the Institute of Control Sciences who obtained the first ever B.N. Petrov Golden Medal, in 1983 and in 2004 the Institute's Yu.P. Portnov-Sokolov, A.Ya. Andriyenko and V.P. Ivanov won a B.N. Petrov Prize in 2004 and V.V. Kulba and B.V. Pavlov in 2007.

A.A. Fel'dbaum



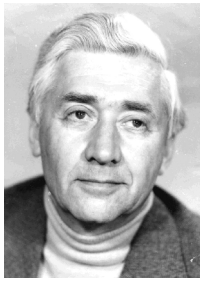
A.Ya. Lerner

S.V. Emel'yanov

A.A. Fel'dbaum and A.Ya. Lerner were the first to obtain striking results in optimal control theory. Young L.I. Rozonoer followed in their steps. Simultaneously A.G. Butkovsky developed a theory of control for systems with distributed parameters and extended to it Pontryagin's maximum principle and demonstrated the broadest application possibilities of that theory in solving numerous national economy problems.

Late in "fifties" and early "sixties saw the advent of fundamentals of a theory of variable structure systems (S.V. Yemel'yanov, now an Academician). At a later stage S.V. Yemel'yanov and his followers V.I. Utkin, A.M. Shubladze, S.K. Korovin and others extended that theory into a powerful tool for analysis and design of feedback control systems.

Also in those years B.N. Petrov, V.Yu. Rutkovsky, I.N. Krutova, S.D. Zemlyakov, V.V. Pavlov and others started working on a theory of adaptive systems with a model. At a later stage the findings of the theory were extended into a theory of adaptive coordinate parametric control that is being explored even today. This theory was integrated into control systems for numerous most important kinds of aerospace vehicles.



Ya.Z. Tsypkin

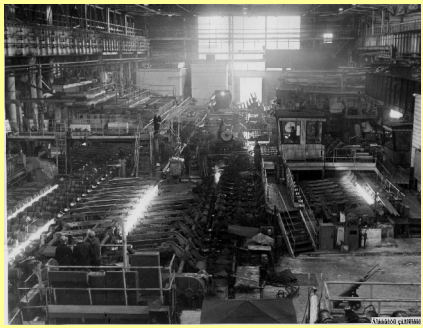
Future Academician Ya.Z. Tsypkin worked out a general theory of adaptive systems that became a natural extension of A.A. Fel'dbaum's dual control theory and at some later stage gave rise to a theory of robust systems whose fundamental were laid by Ya.Z. Tsypkin and is now extended in the laboratory named after Tsypkin and led now by B.T. Polyak.

In early 1960s A.A. Fel'dbaum and M.A. Aizerman took the lead in intensive research in theory of pattern recognition, automatic classification, learning systems and processing of data organized in a complex way. At that time fundamental research was underway in various laboratories: Ya.Z. Tsypkin and G.K. Kelmans (Lab. No. 7), M.A. Aizerman, E.M. Braverman, L.I. Rozonoer and B.M. Litvakov (Lab. No. 25), V.N. Vapnik and A.Ya. Chervonenkis (Lab. No. 38), A.A. Dorofeyuk, I.B. Muchnik and Ye.V. Bauman (Lab. No. 55)

Academician V.S. Pugachyov and his followers worked out a general system of control for random systems. N.S. Rajbman, a follower of V.S. Pugachyov, spared no efforts to have ways to build a mathematical model from experimental statistical data, identification theory, become an efficient tool for developers of control systems for various processes (V.M. Chadeyev, V.A. Lototsky, A.S. Mandel', and S.A. Vlasov).

V.A. Trapeznikov-led activities in Project 705, creation of the world's first comprehensively automated submarine, greatly contributed to having the Institute's personnel develop a taste in tackling complicated problems in control of most important industrial plants. At a later stage the findings of these activities proved useful in developing and improving control systems for nuclear-powered icebreakers and have significantly changed the ideas of seamen of requirements to reliability of the system's parts.

V.S. Pugachyov



An Adaptive Control System at a Tube Rolling Mill of the Pervouralsk Novotrubnyi Plant

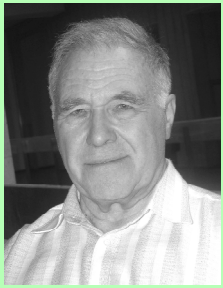
A nuclear-powered icebreaker *Sibir*

Vadim Alexandrovich Trapeznikov's plaque on the Institute's wall

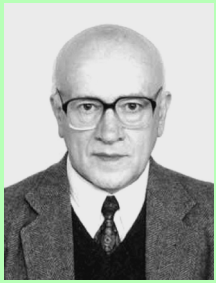
A Spare Parts project was designed assure supply of spares, in particular dual-purpose parts, to various industries. The project was run by a group headed by A.A. Dorofeyuk in 1971 – 75. Trapeznikov made a decisive contribution to the success of the project. As a first deputy chairman of the State Science and Technology Committee he succeeded in attracting the attention of Prime Minister A.N. Kosygin and his First Deputy D.S. Polyansky, top officials of several Union Republics and large regions of the Russian Soviet Federal Socialist Republic to that project. The Union Government and the Estonian Government carried out in 1973 – 75 an experiment in checking the efficiency of the Institute's R&D and proposals on that topic in which the overall savings were found to exceed eight billion rubles in 1975 prices.

Projects in development of computer-aided data processing and control systems such as Metal for control of metal product supplies, Morflot (merchant fleet), and Exchange for exchanges of apartments and rooms were launched in 1960s and are underway now. Outstanding researchers such as O.I. Aven, V.L. Epshtein, V.V. Kul'ba, A.G. Mamikonov, A.D. Tsvirkun and A.F. Volkov were involved in planning those projects.

V,Yu. Kneller



V,F. Krotov



O.I. Larichev

An air ticket reservation system developed late in 'sixties and early in 'seventies has played a major part in development of mass service systems. The USSR Council of Ministers appointed V.A. Zhozhikashvili general construction of the Sirena system and V.A. Kucheruk greatly contributed to integrating the automation methods developed in the Institute's Lab. No. 17.

Mid-1980s saw the start of the Institute's research in managing safety of complicated systems (A.Ya. Andriyenko, V.N. Burkov, V.V. Kulba,V.G. Lebedev, Yu.S. Legovich, and V.G. Volik). This research continues now. Most important results have to do with information safety and safety in emergencies. Since early 1990s the Institute holds annual international conferences on safety control of complicated systems. The Institute has scored impressive successes in fundamentals of reliability theory (I.Ye. Dekabrun, S.N. Domanitsky, B.P. Petrukhin, B.S. Sotskov and B.G. Volik) and technical diagnostics (M.F. Karavai, P.P. Parkhomenko, Ye.S. Sogomonian and others).

A variety of new hardware tools and automation systems have been developed in the Institute over decades. Institute Director Iveri Varlamovich Prangishvili who died on February 26, 2006 was deeply involved in that research.

B.S. Sotskov's idea moved forward in 1950s to standardize process automation hardware by building the latter of modules became the core of the State-run Instrument Systems GSP-1 of the 'sixties and 'seventies and FSP-2 of the 'eighties and 'nineties.

Great advances were made in development of a theory and new principles in construction of sensors and instruments (D.I. Ageikin, V.Yu. Kneller, Yu.R. Agamalov and others), magnetic and semi-conducting elements (M.A. Rozenblat, N.P. Vasilyeva, and others), automatic analysis hardware (system BARS) and relay units (M.A. Gavrilov,, P.P. Parkhomenko and others) and pneumatic elements (M.A. Aizerman, A.A. Tal', A.A. Tagayevskaya, T.K. Berends and T.K. Yefremova). Some of these research projects have extended to advanced magnetic elements with the use of nano-technologies (S.I. Kasatkin), micro- and nano-electronic elements and control units (R.R. Babaian), fluid technology hardware (A.M. Kasimov) and microwave technology hardware (B.V. Lunkin).

New generations of analog-and-digital hybrid computing systems, GVS-100 and a two-level GVS Rusalka were developed in 1970s (B.Ya. Kogan).

Back in 1960s a concept of uniform microelectronic logical and computing arrays was put forward by a group headed by I.V. Prangishvili. That concept materialized in multi-processor computing systems of the PS series, PS-2000 and PS-3000. In terms of their throughput PS systems were comparable with most powerful Soviet computing systems of associated classes and had the best throughput to price ratios.

I.V. Prangishvili

When it was entrusted with development of computer-aided control systems for future nuclear power stations, the Institute developed a system of parallel-structured programmable automation hardware. M.A. Gavrilov's followers A.A. Ambartsumian and others authored the concept of the hardware. M.A. Gavrilov's other followers such as O.P. Kuznetsov, A.K. Grigorian and others developed a programming language for logical units; that project led to development of numerically controlled machine tools that the industry manufactured in a series in 'eighties.

The Institute's research of properties of semi-conducting structures with specific volt-ampere characteristics (V.D. Zotov) resulted in development of essentially new semi-conducting multi-functional sensors, or Z-sensors. At present Russia is the sole owner of Z-sensor manufacture.

Z-sensors at an exhibition

Starting with 1970s, studies of the role played by man in the control loop and in the analysis and improvement of administrative and socio-economic systems became a very important line of research in the Institute. Pioneering research carried out by D.I. Ageikin and at a later stage extended by A.D. Tsvirkun and V.K. Akinfiyev (Lab. No. 33), F.F. Pashchenko (Lab. No. 40), A.M. Cherkashin, V.A. Glotov, V.B. Gusev and V.V. Pavel'yev (Lab. No. 43), A.S. Mandel' (Lab. No. 44), V.G. Lebedev and E.A. Trakhtengerts (Lab. No. 46), A.L. Chernyavsky and A.A. Dorofeyuk (Lab. No. 55), V.N. Burkov, D.A. Novikov, A.V. Shchepkin and A.K. Yenaleyev (Lab. No. 57).

Research in related fields, theory of choice, was carried out by M.A. Aizerman, A.V. Malishevsky and F.T. Aleskerov (Lab. No. 25) and ways to support managerial decisions, started in 'seventies by O.I. Larichev (a future Academician) and V.M. Ozernoi, is continued today by A.S. Mandel' (Lab. No. 44), A.A. Dorofeyuk and A.L. Chernyavsky (Lab. No. 55), V.N. Burkov, A.V.Shchepkin and A.Yu. Zalozhnev (Lab. No. 57).

Significant results have been obtained in control in biological and medical problems. This research started in laboratories headed by M.A. Aizerman, N.V. Pozin, A.M. Petrovsky and A.A. Fel'dbaum in 1960s. At present six laboratories do this research full-time. A.A. Desova of Lab. No. 15, a group headed by Ye.A. Andreyeva in Lab. No. 25, V.N. Novosel'tsev, A.i. Yashin and A.I. Mikhal'sky in Lab. No 38, and S.M. Borodkin, A.A. Dorofeyuk and I. B. Muchnik in Lab. No. 55 obtained challenging results in this field over the years.

In late 2006 Academician Stanislav Nikolayevich Vassilyev was elected director of Institute.

The Institute is developing by expanding and moving into new depths of basis research in control theory and applications. Cooperation with other Russian Academy of Sciences institutions goes from strength to strength. Joint projects are underway with the Ukrainian and Belarussian Academies of Sciences. The Institute's thirty five researchers presented their papers to the 17th IFAC Congress held in Seoul, Korea, in 2008. The Institute selected nine scientific youth schools run by leading scientists for financing. In cooperation with the Siberian Branch of the Russian Academy of Sciences' Institute of System Dynamics and Control Theory it set up a scientific school of stability and control in heterogeneous and certain other models of dynamic and intellectual systems.

A multi-processor computing complex in the Institute is used for high-speed computation while computer stands are used for modeling moving and other control systems and for training of operators. The Institute has signed large contracts with Russian and foreign companies.

The Institute carries out applied activities under contracts with:

- **The Russian Defense Ministry;**
- **The Russian Education and Science Ministry;**
- **The Russian Emergency Situation Ministry;**
- **The Russia Interior Ministry;**
- **The Russian Federal Security Service;**

- The Russian Federation Social Insurance Fund;
- The Russian National Central Office of the Interpol;
- The Gazprom company;
- The Russian Railroads company;
- Regional and municipal administrations (Moscow's Science and Industrial Policy Department and others);
- Yu.Ye. Sedakov Instrumentation Research Institute;
- M.V. Khrunichev Space Research and Exploration Center;
- The Electromechanical Research Institute company;
- The Kvant Research Institute federal unitary company;
- The Russian Interior Ministry's STiS Research and Manufacturing company;
- The Kursk Pribor (Instrument) company of the Aviaavtomatika (Aviation Automation) Design Board;
- Research Institute on Operation of Nuclear Power Stations;
- The Izhevsk Electromechanical Plant Kupol

and others

Lenin Prizes of the Institute's Researchers

Ya. Z. Tsypkin, Academician	–	Research in Theory of Switching Systems, 1960
M.A. Aizerman, Dr.Sc. (Engg), A.A. Tal, Dr. Sc. (Engg) T.K. Yefremova, Cand. Sc., A.A. Tagayevskaya, Cand Sc., T.K. Berends	–	Research and Development of the Universal System a Pneumatic Automation Element System, 1964 r.

B.N. Petrov, Academician	–	**Participation in Development and Manufacture of manned satellites Voskhod 1 and Voskhod-2, their launch and first ever human extra-vehicular activities, participation in development and manufacture of automatic Luna-9 and Luna-10 stations, their launch and soft landing on the moon, transmission of lunar panorama photographs and injection into a circum-lunar orbit of a first ever moon satellite, 1966**
S.V. Emel'yanov, Academician; V.I. Utkin, Dr. Sc. (Engg)	–	**Theory of variable structure systems, 1972.**
V.A. Trapeznikov, Academician	–	**Design of a comprehensive automation system for a new class of nuclear-powered submarines (Project 705), 1981**
A.A. Voronov, Academician	–	**Research in Automatic Control Theory and Synthesis of computer systems for program control, 1988**
V.S. Pugachyov, Academician	–	**Research in Stochastic Theory of Control Systems, 1990**

State Prizes of the Institute's Researchers

V.S. Pugachyov, Academician	–	Research in ballistics, 1948
A.B. Chelyustkin, Dr. Sc. (Engg)	–	Automation of sheet mills, 1948
V.A. Trapeznikov, Academician; B.Ya. Kogan, Dr. Sc. (Engg); D.E. Polonnikov, Dr. Sc. (Engg); V.V. Gurov	–	Development of an electronic modeling plant EMU-1, 1951
A.A. Fel'dbaum, Dr. Sc. (Engg); L.N. Fitsner, Dr. Sc. (Engg)	–	Development of analogue computers with nonlinear parts, 1953
Yu.P. Portnov-Sokolov, Dr. Sc. (Engg)	–	Participation in development of a carrier rocket, 1967
V.Yu. Rutkovsky, Dr. Sc. (Engg); V.I. Popov, Dr. Sc. (Engg)	–	Exploring a theory of and embedding gravitation-based satellite stabilization systems, 1970
V.V. Solodovnikov, Dr. Sc. (Engg); B.N. Petrov, A.M. Lyotov, Academy of Sciences Corresponding Member; V.V. Petrov, Academy of Sciences Corresponding Member; G.M. Ulanov, Dr. Sc. (Engg)	–	Books on Technical Cybernetics. Theory of Automatic Control, 1972
V.Yu. Kneller, Dr. Sc. (Engg); Yu.R. Agamalov, Dr. Sc. (Engg)	–	Promotion of a Theory of A/C unit meters and parameter converters, 1976

V.S. Pugachyov, Academician; N.S. Raibman, Dr. Sc. (Engg); V.M. Chadeev, Dr. Sc. (Engg); L.F. Isaikina	–	Development and operation of an adaptive 30-102 Pipe Rolling Mill in Pervouralsk Novotrubnyi Plant, 1976
D.I. Ageikin, Dr. Sc. (Engg)	–	Development of a new range of unified ship-based sensors, 1977
V.A. Victorov, Dr. Sc. (Engg); B.V. Lunkin, Cand. Sc. (Engg); В.И. Мишенин	–	Development of a high frequency resonance method for measuring non-electric quantities, 1977
G.M. Ulanov, Dr. Sc. (Engg)	–	Participation in automation of oil recovery processes, 1983
A.F. Volkov, Dr. Sc. (Engg)	–	Participation in building samples of nev ships, 1981
B.N. Petrov, Academician (posthumously); V.Yu. Rutkovsky, Dr. Sc. (Engg); S.D. Zemlyakov, Dr. Sc. (Engg); B.V. Pavlov, Dr. Sc. (Engg) I.N. Krutova, Dr. Sc. (Engg)	–	Development of structural principles, theory and design methods of adaptive systems and their serial production for classes of missiles, 1981
Yu.P. Portnov-Sokolov, Dr. Sc. (Engg); A.Ya. Andrienko, Dr. Sc. (Engg); V.P. Ivanov, Cand. Sc. (Engg); A.S. Poddubnyi, Cand. Sc. (Engg)	–	Development of space-borne terminal fuel flow control systems for carrier rockets, 1983

I.M. Makarov, Academician; O.I. Aven, Academy of Sciences Corresponding Member; A.G. Mamikonov, Dr. Sc. (Engg); V.L. Epshtein, Dr. Sc. (Engg)	–	Theory, Metholodgy and Implementartion of computer management control systems, 1984
S.N. Vassilyev, Academician	–	Development of a Lyapunov vector function method for analysis of stability and other dynamic properties of nonlinear systems, 1984
A.Ya. Chervonenkis, Cand. Sc. (Engg)	–	Application of pattern recognition methods to prospecting for gold fields, 1987
V.N. Burkov, Dr. Sc. (Engg)	–	Development of multivariable structure automatic systems, 1989
A.N. Raikov, Dr. Sc. (Engg)	–	Participation in development of a data processing system for monitoring e-mail in global communication networks, 2007

USSR Ministries Council Prizes

V.M. Baikovskyi, Cand.Sc (Engg), 1960

M.L. Linskyi, 1973

V.N. Burkov, Dr.Sc (Engg), 1981

S.V. Emel'yanov, RAS Member, 1981

V.N. Vapnik, Dr.Sc (Engg), 1986

Lenin Komsomol Prizes

B.A. Berezovskyi, RAS Corr. Memb., 1978

T.M. Vinogradskaya, Dr. Sc. (Engg), 1978

V.N. Yakimets, Dr. Sc. (Social), 1978

E.YA. Rubinovich, Dr. Sc. (Engg), 1980

A.P. Serebrovskyi, Cand.Sc (Phys.-Math), 1980
V.B. Tulepbaev, Cand.Sc (Engg), 1985
S.A.Kuz'min, Cand.Sc (Engg), 1985

Academy of Sciences Prizes and Awords

A.A. Andronov Prize

A.G. Butkovskyi, Dr. Sc. (Engg), 1974
M.V. Meerov, Dr. Sc. (Engg), 1977
M.A. Krasnosel'skyi, Dr.Sc (Phys.-Math), 1983
A.V. Pokrovskyi, Dr.Sc (Phys.-Math), 1983
Ya.Z. Tsypkinпкин, RAS Member, 1994
B.T. Polyak, Dr. Sc. (Engg), 1994
N.A. Bobylyov, Dr. Sc. (Phys.-Math), 2000
S.V. Emel'yanov, RAS Member, 2000
S.K. Korovin, RAS Member, 2000

B.N. Petrov Gold Medal

V.Yu. Rutkovsky, Dr. Sc. (Engg), 1983

B.N. Petrov Prize

A.YA. Andrienko, Dr. Sc. (Engg), 2004
V.P. Ivanov, Dr. Sc. (Engg), 2004
Yu.P. Portnov-Sokolov, Dr. Sc. (Engg), 2004
V.V. Kulba, Dr. Sc. (Engg), 2007
Павлов Б.В. Dr. Sc. (Engg), 2007

P.N. Yablochkov Prize

M.A. Gavrilov, Corr. Memb. of USSR AS 1958
V.S. Kulebakin, Memb. of USSR AS, 1962

Personnel Recreation Activities

The Institute and Its Interior

Some believe that hills outside Kaluzhskaya subway station and also the architecture and interior of the building and views fro the Institute of Control Sciences' windows are so nice that the Institute's personnel do not need to go somewhere for recreation. This view is illustrated by pictures below.

Stained glass panel
in the laboratory building

Holiday celebrated
in B.T. Polyak's laboratory

A fountain at the entrance
to the Large Conference Hall

A hall outside
the conference halls

The Trade Union Committee feels, however, that one should spend a leave on a move by engaging in sports, fishing or collecting mushrooms at the Tishkovo recreation camp, traveling inside or outside the country or engaging in creative activities, not necessarily in the Institute's line. The committee encourages this view in every way.

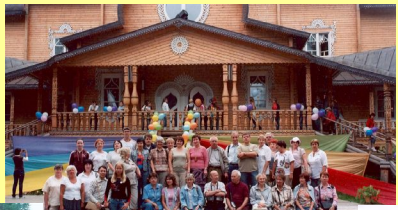
The Institute's sporting complex includes two lawn-tennis courts, a sporting hall in the general-purpose building and any place where a chess board can be nested.



The Institute's personnel are in love with the Tishkovo recreation center. Such breathtaking views!



Those who attend sightseeing tours share common impressions.



Everyone has his or her own hobby but the pleasure is shared by all!

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