

Dr. Vladimir Kitov

Russian Plekhanov university of economics

USSR: First Computers and Evaluation of Cybernetics

Points of this papers

Part 1.

- **USSR: First Computers and Evaluation of Cybernetics.**

Part 2.

- **Several key moments of the Soviet informatics.**

Part 1.

USSR: First Computers and Evaluation of Cybernetics.

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- 1.2. The most important seven organizations of the USSR, where the first serial computers "Strela" were established.
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Part 2.

Several key moments of the Soviet informatics.

- 2.1. About the following computers after "MESM", "M-1" and "Strela.
- 2.2 The first in the world project of The Nationwide computer network for the control of Economy and Military Forces of the USSR.
- 2.3 The application of computers for the economy and the creation of automated management systems (AMS) for different levels and purposes.
- 2.4 Soviet computers “ES EVM” are the clones of IBM/360 computers . The beginning of the end of Soviet computers.

1.1. The first soviet computers "MESM", "M-1" and "Strela".

- *The first official step in computer industry in the USSR was patent number 10475 for the invention of "Automatic digital computer" registered on December 4, 1948 by prominent Soviet scientists Isaak Bruk and Bashir Rameev. It was the USSR first officially registered invention in the field of electronic digital computers.*
- *At the same time in parallel with them another computer pioneer Sergey Lebedev also pondered the architecture of his computer.*
- *In the USSR, creating the first Soviet computers "MESM" and "M-1" began in 1949 by teams led by Sergei Lebedev in Kiev and Isaac Bruk in Moscow.*
- *The two computers were created in academic laboratories and were completed at the same time in the end of 1951.*

Computer "MESM"

- *Since the end of 1948 S.A. Lebedev in Kiev started working on "MESM" computer.*
- *During the next two years under his leadership there were developed principles of "MESM", its individual modules and implementation of their union as a holistic computer.*
- *"MESM" included about six thousand vacuum tubes and used hexadecimal binary system with a fixed point. The memory device was made on trigger cells using a magnetic drum. In its three-address commands system basic operations were addition, subtraction, multiplication, division, shift, comparison with sign, comparison of the absolute value.*
- *"MESM" speed was about 50 operations per second. Initial data input used either punch cards or dialing codes on the plug-in switch. Output of data was performed using electromechanical printer.*
- *Computer used room of 60 square meters, power consumption - 25 kW. On December 25, 1951 MESM was approved by the Commission of the Academy of Sciences of the USSR.*

Sergey Lebedev (1902-1974)



Computer “MESM”



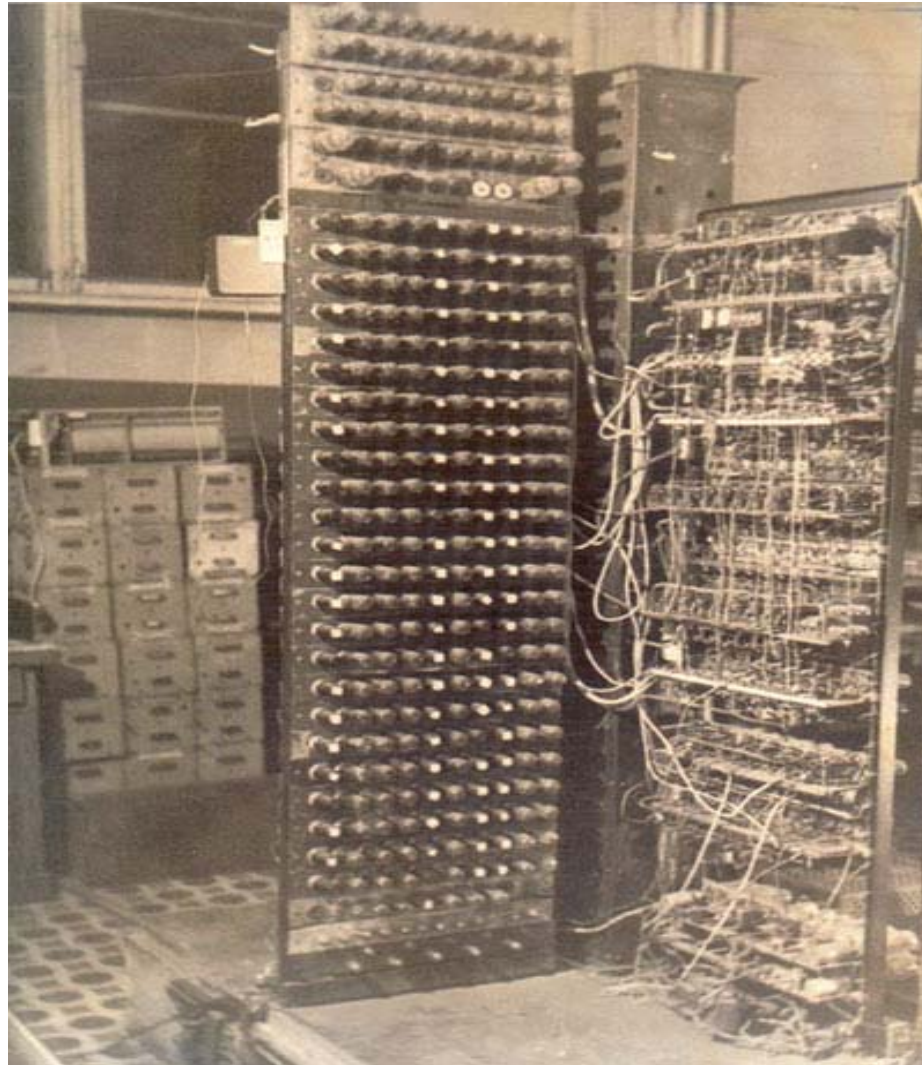
Computer "M-1"

- *The I.S. Bruk's computer "M -1" had several thousand semiconductor devices and only 730 vacuum tubes. This significantly reduced size of the computer, which occupied a room as small as 15 square meters.*
- *It used two-address command system , electronic memory electrostatic tubes memory on a magnetic drum , widescreen TTY output and transmitter for their input from a punched tape. Number of bits - 24 . internal memory on the tubes of electrostatic and magnetic drum - 256 25-digit numbers.*
- *It's performance was 20 transactions per second. Operations: addition, subtraction, multiplication , division, and a number of auxiliary operations. Power consumption - 8 kW.*
- *During the first two years of computer "M-1" operation it was used to calculate operation mode of electrical networks in Moscow, heating of ballistic missiles during the motion in the atmosphere for a number of projects of the Institute of Atomic Energy.*

Isaak Bruk (1902-1974)



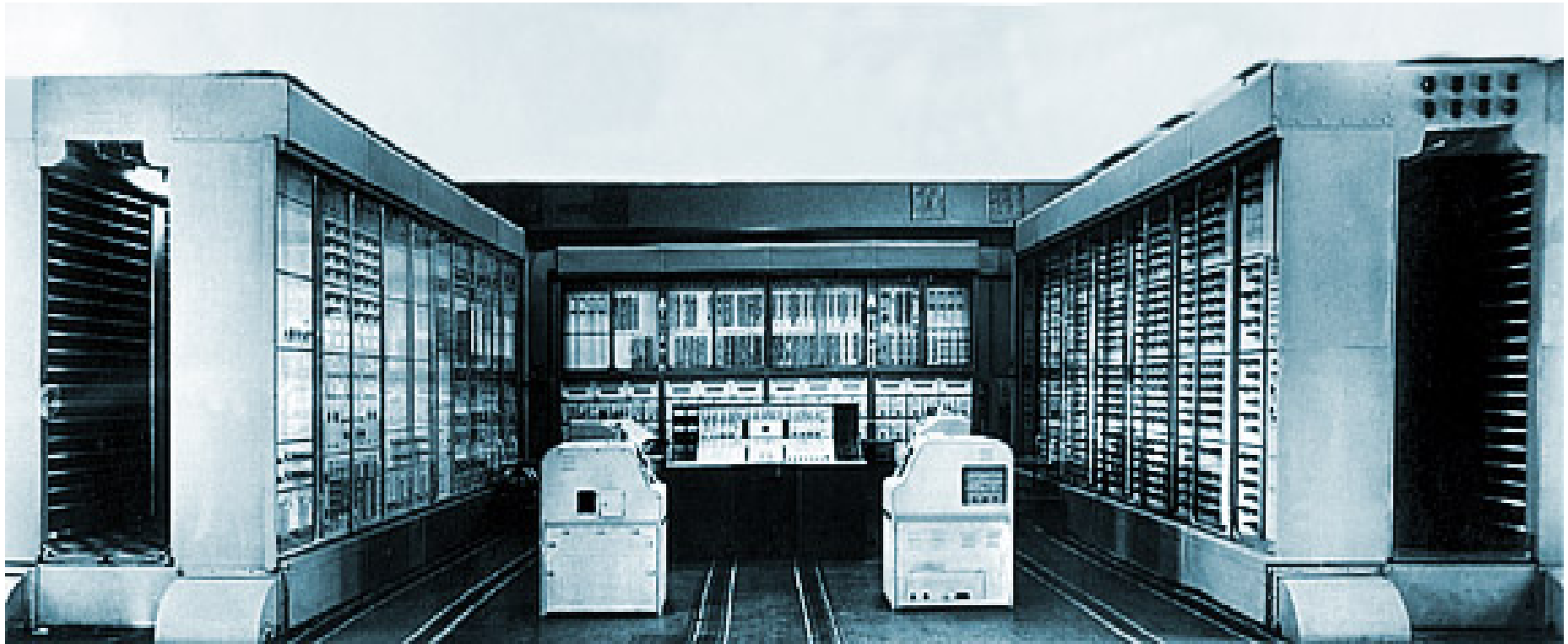
Computer “M-1”



Computer "Strela"

- *Computer "Strela" had performance of 2000 operations per second.*
- *In the random access memory (RAM) it had 43 cathode-ray tubes - one tube for each digit. It operated numbers with floating point, which corresponded to almost 10⁻¹¹ -bit decimal numbers.*
- *External hard drive had two units with tape width of 125 mm and length up to 100 m. Data on the tape housed in groups of zones. In the last modification computer had a magnetic drum storage with capacity of 4096 words, having a speed of 6000 rev./Min .*
- *The computer used about 6,000 vacuum tubes and tens of thousands semiconductors.*
- *It used computer room area over 400 square meters.*
- *Total power consumption - 150 kW: the computer itself consumed 75 kW; 25 kW - for the ventilation unit and 50 kW - for refrigeration unit.*
- *It is worth to mention that computer "Strela" implemented many modern ideas. In particular, it had co-processors for fast execution of short programs.*

Computer "Strela"



Bashir Rameev (1918-1994)



Computer "Strela"

- Less than two years after the creation of "MESM " and "M -1" Soviet industry produced and began to use computer "Strela".
- Computer "Strela" became the first Soviet serial computer.
- Seven copies of □□computer "Strela" were made.
- Unlike their predecessors, which operated in the same scientific institutes where they had been created, computer "Strela" was a serial one.
- It was used in the seven major state organizations of the USSR.

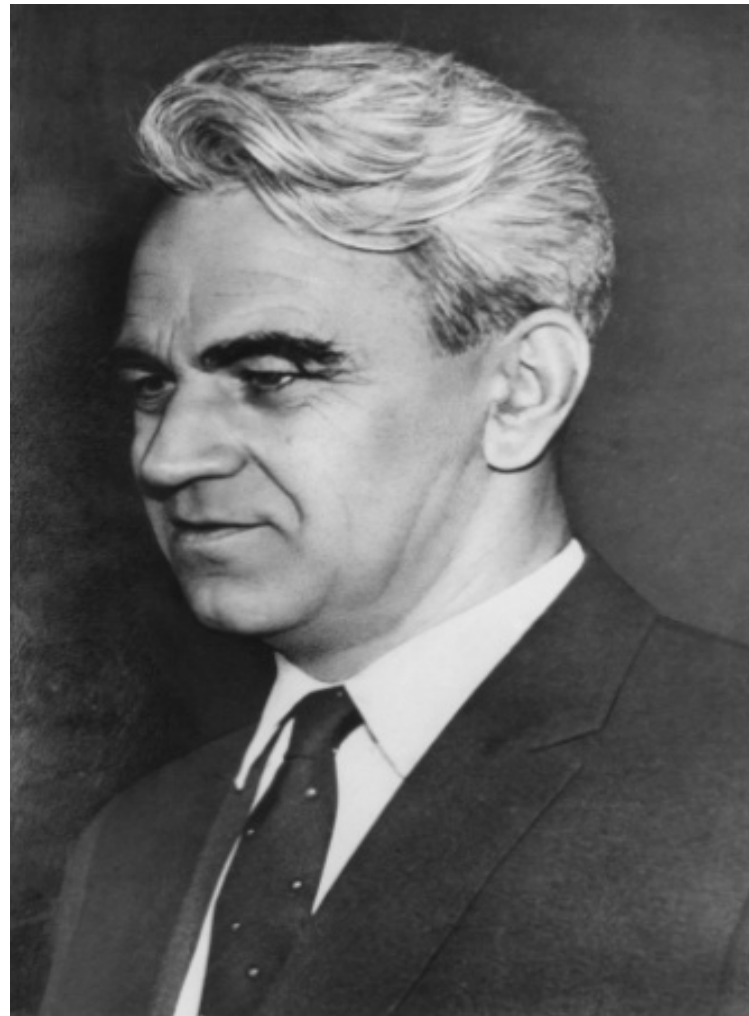
7 organizations of the USSR, where computer "Strela" was established.

1. *The Institute of Applied Mathematics (IAM),*
2. *Computing Center №1 of the Ministry of Defense (CC №1),*
3. *Research Institute "Almaz",*
4. *Computing Center of the USSR Academy of Sciences,*
5. *Research Computing Center of The Moscow State Lomonosov University,*
6. *Nuclear Center "Arzamas-16"*
7. *Nuclear Center "Chelyabinsk-70."*

The Institute of Applied Mathematics (IAM)

- *In the Soviet Union the IAM was the main center for the nuclear calculations.*
- *It was one of the world's leading centers of computational mathematics.*
- *Until 1954, a huge amount of computations for the Federal Nuclear Center "Arzamas-16" was carried out in large groups of employees (teams) on electromechanical machines "Mercedes" and "Rheinmetall". These teams followed one another, passing each other special notebooks with a lot of numbers. It was a real "factory of accounts".*
- *This factory operated effectively until the commissioning of the computer "Strela". Setting up of the computer "Strela" began in the Keldysh Institute in 1954.*

Mstislav Keldysh (1911-1978) - founder and director of the Institute of Applied Mathematics



Nuclear weapons

- *Specific results from the use of this computer was the implementation at 22d of November, 1955 in the Semipalatinsk test site of the explosion of new type of nuclear weapons.*
- *This nuclear weapons were created on the base of previously developed mathematical models of physical nuclear processes.*
- *Then great physicist Andrei Sakharov in his scientific report on the hydrogen bomb wrote about a big role in his project of mathematical calculations.*
- *At that date these calculations were carried out under the leadership of Mstislav Keldysh and Andrei Tikhonov.*

Computing Centre №1 of the Ministry of Defense of the USSR.

- *Important installation of computer "Strela" was in Computing Centre № 1 of the Ministry of Defense of the USSR (CC №1) created in 1954 by Second World War veteran engineer-colonel Anatoly Kitov [5].*
- *Computer "Strela" in the CC №1 was the first computer installed in the organization of the Soviet Ministry of Defense.*
- *In 1950s the Computing Centre №1 of the Ministry of Defense carried out a lot of different works: it calculated orbits of artificial satellites and interplanetary space stations; developed new types of specialized computers; conducted extensive work on mathematical modeling of various combat situations, calculations were carried out for the General Staff and the various departments of the Ministry of Defense (intelligence, logistics, ground troops, artillery and others);*
- *It created software and hardware for missile defense systems and processing information from radar stations, etc.*

**Anatoly Kitov (1920-2005) - founder and scientific director
of the Computing Center №1 Ministry of Defense**



CC №1 of the Ministry of Defense was the most powerful computing centre in the USSR

- *At 1950s years, CC №1 solved a large number of military problems of national importance.*
- *Several hundred highly qualified scientists and engineers worked in its various departments.*
- *CC №1 of the Ministry of Defense was the most powerful computing centre in the USSR and one of the most powerful computer centers in the world.*
- *CC №1 executed many important projects for Soviet defense and space programs including creation one of the most powerful computer “M-100” (1958, one hundred thousand operations per second) and launch of the first artificial satellite in 1956 and Yury Gagarin flight in 1961.*

Research Institute "Almaz"

- *Computer "Strela" was installed in a secret research institute called "Almaz".*
- *Almaz was created in the late 1940s as a Special Office № 1 of Ministry of Armaments, its core competence was the development of air defense missile systems (ADMS).*
- *Over the years, this top-secret research institute has successfully completed a major cycle of works on creation of missile defense.*
- *For many years, the director and chief designer of a number of ADMS was Alexander Raspletin - founder of the national school of managed anti-aircraft missile systems developers.*
- *In 1950 - 60s A.A. Raspletin provided scientific and technical guidance on development and modernization of air defense missile systems S-25, S-75, S-125, S-200 as well as on creating space defense system.*

**Alexander Raspletin (1908-1967) - the
director and chief designer of ADMS.**



Secret Research Institute "Almaz"



Computing Center of the Academy of Sciences of the USSR (CC AS)

- *Computer "Strela" was installed in the Computing Center of the Academy of Sciences of the USSR (CC AS), which was founded in 1955 by Anatoly Dorodnitsyn.*
- *Literally within a few years after its founding, CC AS became the country 's leading institute in the field of computational methods, mathematical modeling, mathematical and computer software, as well as in a variety of applications, primarily in the area of □□military applications, such as aviation, shipbuilding, ballistic calculations and etc.*
- *The main lines of its research was computational hydroaerodynamics, computational mathematics and mathematical physics; design automation; space dynamics; development of computer software systems, etc.*

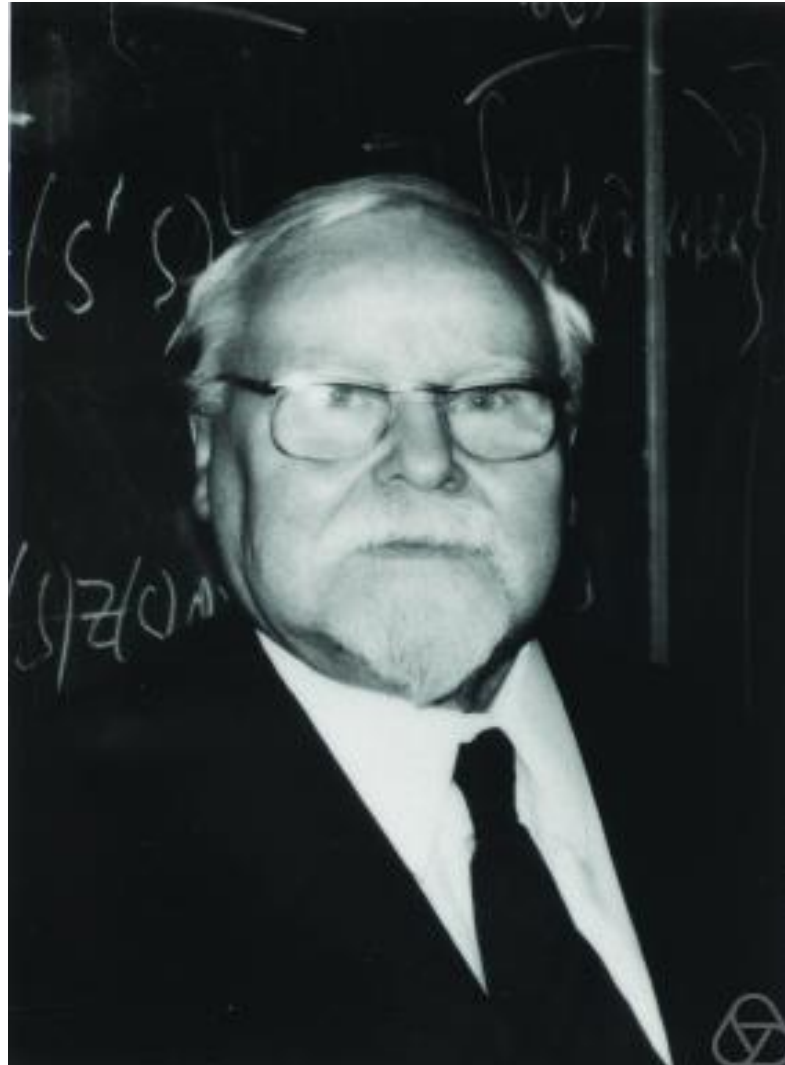
**Anatoly Dorodnitsyn (1910-1994) - founder and
director of the Computing Center
of the Academy of Sciences of the USSR**



Scientific Research Computing Center of The Moscow State Lomonosov University (SRCC MSU)

- *Scientific Research Computing Center of The Lomonosov Moscow State University (SRCC MSU) was founded in 1955.*
- *It was the first computer center in the educational institution and one of the first in the country at all.*
- *In December 1956, SRCC MSU got computer "Strela".*
- *During nearly 25 years scientific director of SRCC MSU had been an outstanding mathematician Andrei Tikhonov, the head of the Moscow State University department of computational mathematics. Andrei Tikhonov well known as the author of one of the world's most famous books on mathematics "Equations of mathematical physics" (co-authored with Alexander Samarsky).*
- *In addition to scientific and educational purposes, "Strela" in SRCC MSU was used to solve important for the country complex secret tasks.*

**Andrey Tikhonov (1906-1993) - founder
and scientific director of the SRCC MSU**



Federal Nuclear center " Arzamas-16"

- *For atomic project in 1946 the first top-secret Soviet Federal Nuclear center "Arzamas-16" was created.*
- *Initially, the necessary calculations for nuclear projects were carried out on adding machines.*
- *In the first half of 1950s these calculations were performed on computer "Strela" in IAM (Director Keldysh).*
- *The first Soviet atomic and hydrogen bombs were developed in the nuclear center "Arzamas-16".*
- *Prominent physicists of the 20th century Julius Hariton and Andrei Sakharov worked in "Arzamas-16".*
- *At the end of 1956 computer "Strela" was installed in "Arzamas-16".*
- *Currently, 24 000 employees work in the nuclear center "Arzamas-16". In 2011 there was installed modern supercomputer - to date, the most powerful supercomputer in Russia.*

Federal nuclear center "Chelyabinsk-70"

- *The last seventh computer "Strela" was installed in 1957 in the nuclear center "Chelyabinsk-70".*
- *It was organized in 1955 as the second Federal Nuclear center after "Arzamas-16".*
- *Nuclear center "Chelyabinsk-70" is located on the eastern foothills of the Middle Urals, midway between the cities of Yekaterinburg and Chelyabinsk.*
- *In the Nuclear Center "Chelyabinsk-70" there were created the majority of peak nuclear weapons, most of them have no analogues in the world. There was created the world's smallest nuclear charge for artillery shells of 152 mm.*
- *Since the beginning the Nuclear Center "Chelyabinsk-70" had a strong team of theoretical physicists, specialists on mathematical modeling, computer programming. Its scientists obtained unique scientific results in the field of nuclear physics processes through their computer simulations.*

**One of the first atomic bomb called "Tsar Bomb"
at the
Museum of the Federal Nuclear Center
"Arzamas-16"**



Andrei Sakharov (1921-1993) - prominent physicists of the 20th century



Julius Hariton (1904-1996) - prominent physicists of the 20th century



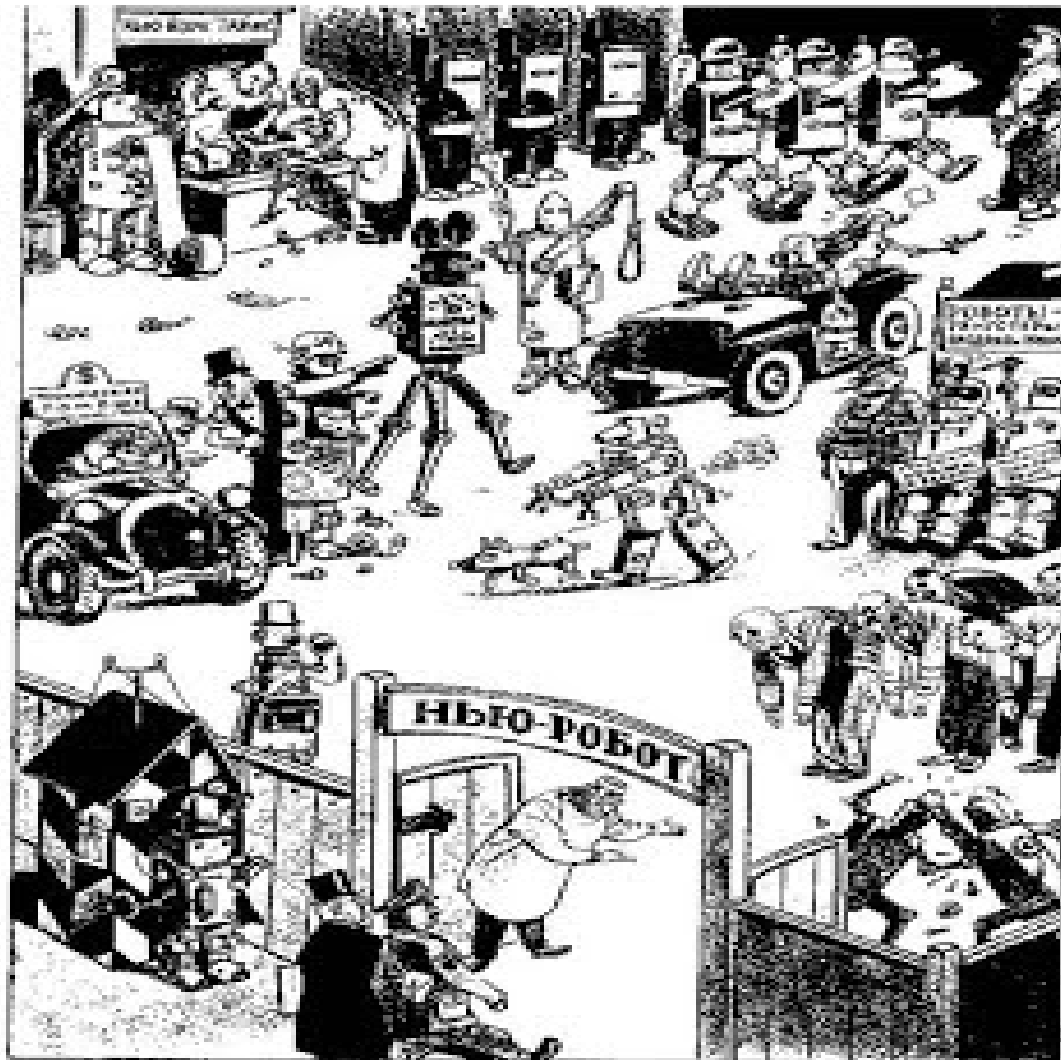
Prominent role of "Strela"

- *The first Soviet serial computer "Strela" played a prominent role in strengthening the military might of the USSR.*
- *In the years 1950-1960, the period of "the cold war" with the West, the Soviet priority in using computers in the USSR was to provide calculations and solving various problems of mathematical modeling for the nuclear program , missile and space programs and military command.*

1.3. Difficult fate of cybernetics in the USSR.

- *In 1948, the eminent American scientist Norbert Wiener proclaimed a new science, "cybernetics".*
- *In the USSR, during the first seven years after that people in the central ideological press cursed her as a bourgeois pseudoscience.*
- *Published in 1948, a book by Norbert Wiener "Cybernetics or Control and Communication in the Animal and the Machine" in the Soviet Union came to the shelves of secret libraries.*
- *In Soviet science, along with genetics and a number of other sciences, cybernetics was a typical victim of the Stalinist regime.*
- *Set of labels for cybernetics (empty shell, pseudoscience, ideological weapon of imperialist reaction, causing the lackeys of imperialism, etc.), as if meant for granted that no representative of the Soviet science can not deal with such a vile, according to the author, science.*

**One of the article against cybernetics -
"Cybernetics means longing for mechanical
soldiers"**



The struggle for cybernetics in the USSR

- *In recognition cybernetics (computer science) in the USSR as a science a great role was of a small group of courageous military scientists, who only few years ago took part in the Second World War.*
- *Anatoly Kitov had to have an enviable scientific foresight to appreciate the depth and usefulness of the new science just after reading the Wiener's book «CYBERNETICS» (which was marked "Top Secret" and to needed a special permit to access). In addition, it was necessary to have an enviable courage in Stalin years to write, contrary to the official doctrine, the first in the USSR positive article "The main features of cybernetics."*
- *In the co-authors of this fundamental article Kitov invited professor A.A.Lyapunov and academician S.L. Sobolev.*
- *If there were no active position, headed by Anatoly Kitov and Alexei Lyapunov, the ideological concepts, protected by the conservative philosophy of the communists, would prevent for many years to develop computer methods of cybernetics and its applications to management and economics.*

1955. The article

"The main features of cybernetics"

- *Since spring of 1953, Kitov and Lyapunov during the one and half a year have organized a series of lectures in several major public institutions, famous research centers and universities.*
- *In 1955, as a result of successful lectures made by Kitov, Lyapunov with their several associates, the Ideological Department of the CPSU Central Committee gave permission to publish the article "The main features of cybernetics".*
- *Publication of the article "The main features of cybernetics" became solid point in the struggle for cybernetics.*
- *According to the President of the Academy of Sciences of the USSR in the years 1986-1991 Gury Marchuk: "This article was of the great importance for the understanding of the new field of knowledge and implemented change in the minds of people who have received a solid foundation of the new nascent science. The value of this article for the science can hardly be overestimated. "*

1.4. The first courses of lectures on computers and informatics in three Soviet universities.

In 1951, in the Soviet Union three courses on computer and programming had been organized:

- *Sergei Lebedev made the lectures about computers to the students of Moscow Power Engineering Institute (MEI in Russian). For it Lebedev especially once a week came from Kiev to Moscow. MEI was the first university in the Soviet Union where was created the Chair on Computer science.*
- *Anatoly Kitov had made series of lectures on computers and programming in Moscow in Artillery Engineering Academy for cannon and missile officers.*
- *Bashir Rameev lectured on computers for the students of The Moscow Engineering Physics Institute (MEPHI in Russian).*

1.5. The first Soviet books on programming, computers and applications and their significant role in several foreign countries.

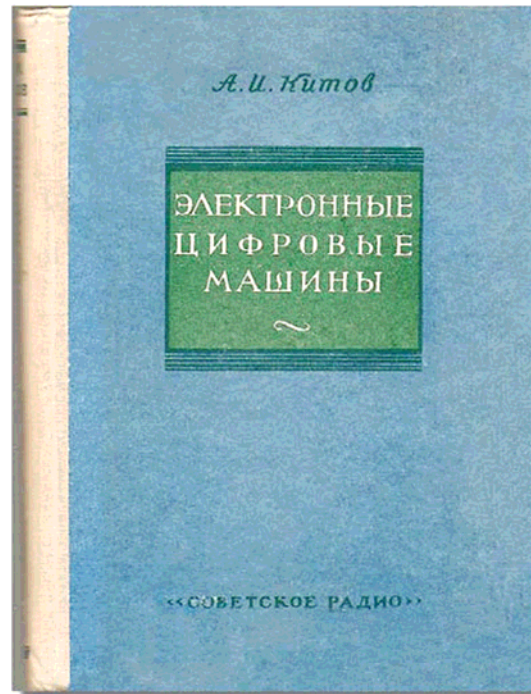
Until 1956 in the Soviet Union were published only a few Soviet and Western publications on separate aspects of computers.

Among them, there were two pioneer publications:

- **"Solving mathematical problems in automatic digital computers"** (L.Lyusternik, V.Abramov, V.Shestakov, M.Shura-Bura, 1952) and
- **"Computer Applications"** (A.Kitov, 1953).

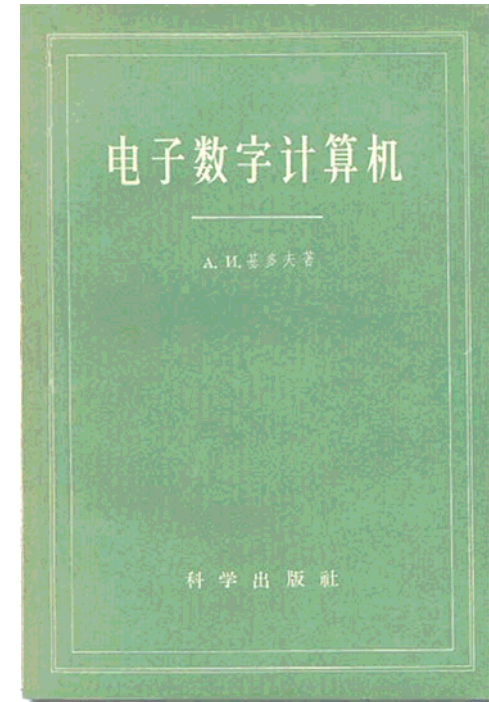
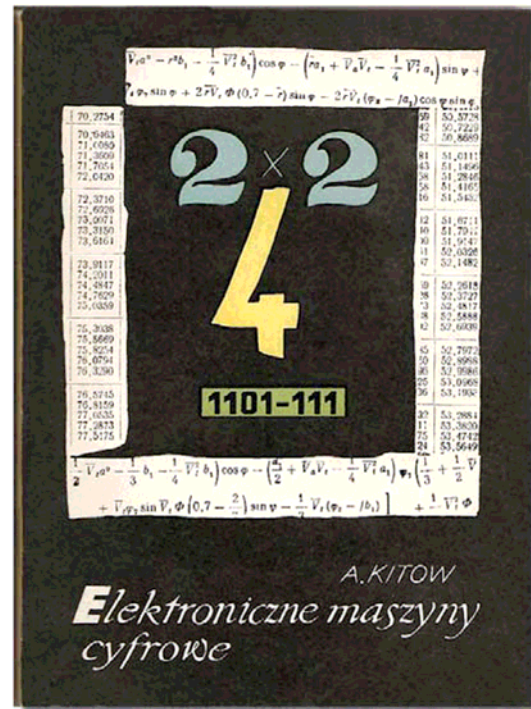
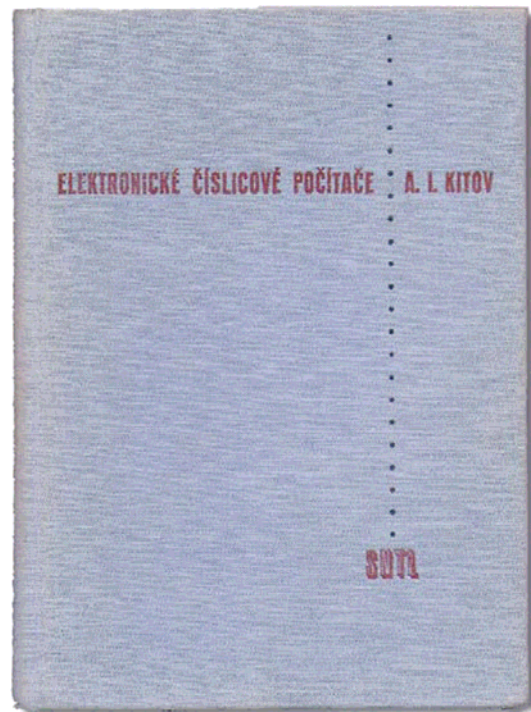
1956.

A.Kitov. "Electronic digital computers"



- *The first Soviet publicly available book on programming, computers and their applications.*
- *In 1958 University of Michigan professor John Carr, in his book "Lectures on Programming" wrote that at present the most complete presentation of the manual and automatic programming for computers (with detailed examples and analysis) is given in the Kitov's book. Some sections of this book translated into English and may be obtained from the American Association of Computers".*

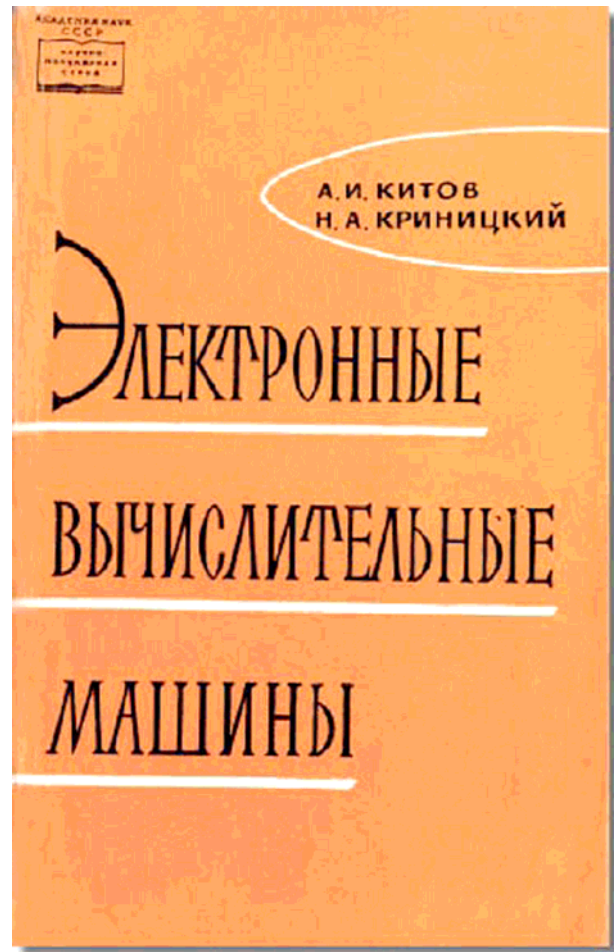
These book was published in Poland,
Czechoslovakia and China.



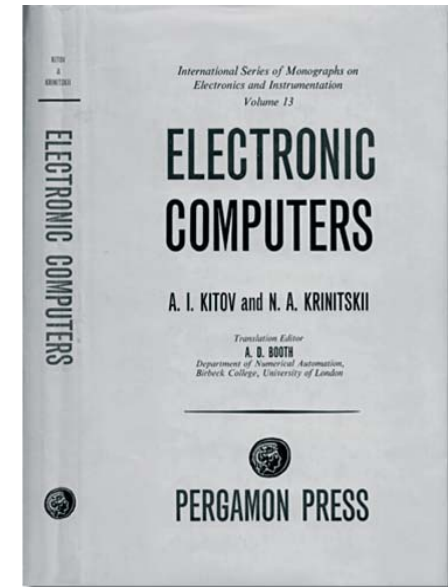
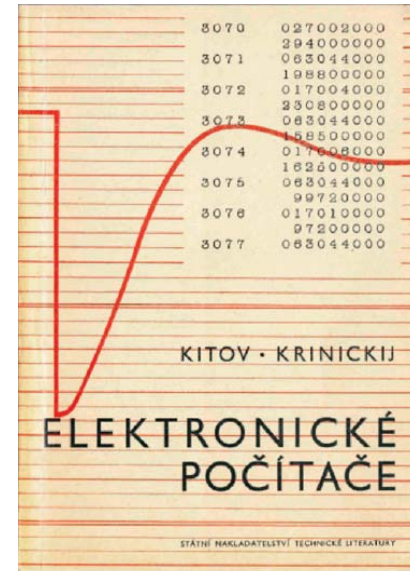
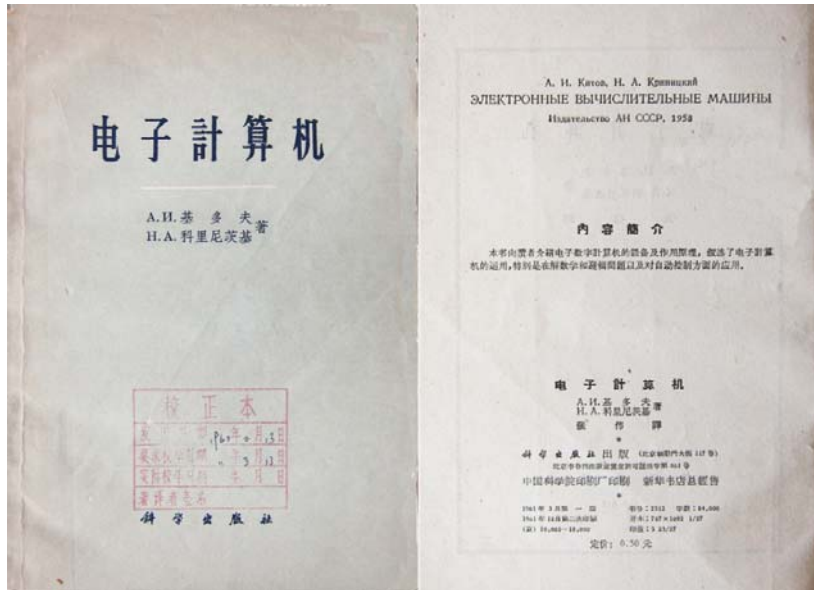
1958.

A.Kitov and N.Krinitzsky

The book "Electronic computers"



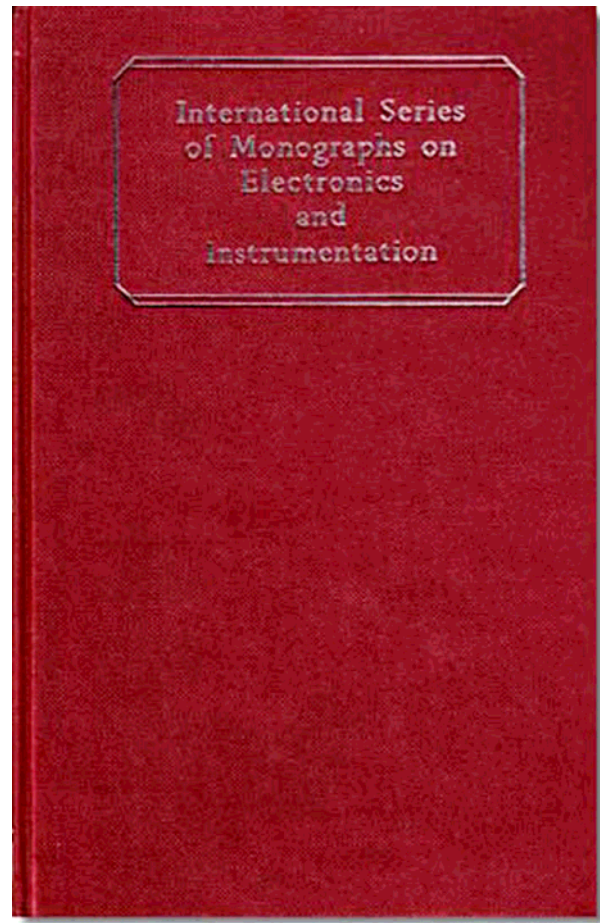
These book was published in China,
Czechoslovakia and Great Britain.



1959.
Collection of articles "Computer technics and its applications".
Editor is Sergey Lebedev.
Publication in China at 1962.



**The book of A.Kitov and N.Krinitzky and the book of S.Lebedev
were published abroad
in the famous series of books "International Series of Monographs
on Electronics and Instrumentation".**



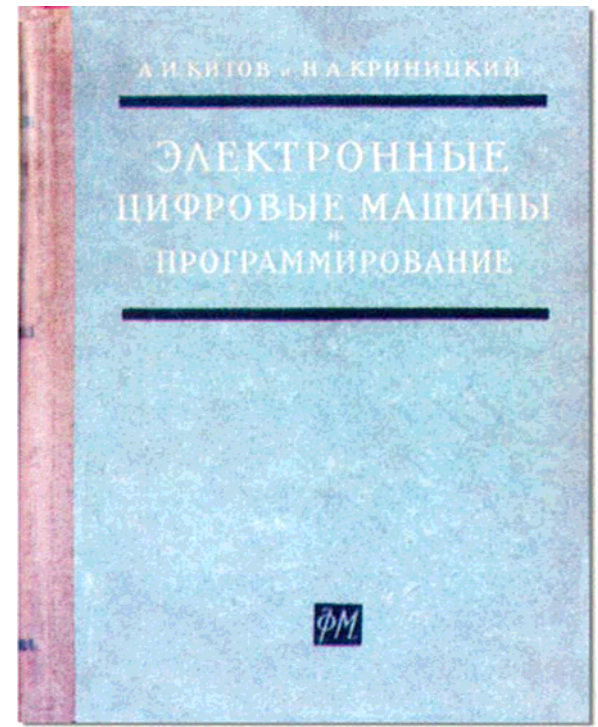
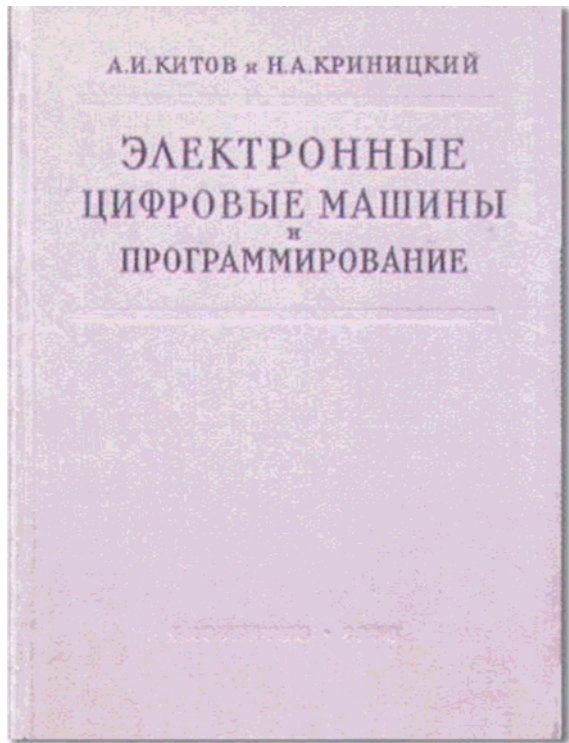
1959 and the second edition in 1961.

A.Kitov and N.Krinitsky *"Electronic digital computers and programming"*.

The first Soviet official tutorial textbook (computer encyclopedia). About 600 pages.

The total circulation of this computer encyclopedia is about 100 000 books.

Two generations of computer specialists in the USSR and several foreign countries were trained of this textbook.





- **We will be very grateful to all colleagues who have informed us about the other first books on programming, computers and their applications published in different countries.**

Part 2.

Several key moments of the Soviet informatics.

- 2.1. About the following computers after "MESM", "M-1" and "Strela.
- 2.2 The first in the world project of The Nationwide computer network for the control of Economy and Military Forces of the USSR.
- 2.3 The application of computers for the economy and the creation of automated management systems (AMS) for different levels and purposes.
- 2.4 Soviet computers “ES EVM” are the clones of IBM/360 computers . The beginning of the end of Soviet computers.

2.1. About the following computers after "MESM", "M-1" and "Strela".

- **2.1.1. Lebedev's scientific school after "MESM" computer.**
- **2.1.2. Bruk's scientific school after "M-1" computer.**
- **2.1.3. Rameev's computer school after computer "Strela".**
- **2.1.4. Computers «Minsk-22» and «Minsk-32». Computers created in Kiev, Erevan and others.**

2.1.1. Lebedev's scientific school after "MESM" computer.

- *After creating MESM Sergey Lebedev moved from Kiev to Moscow. Under Lebedev's leadership in Moscow there was created computer "BESM" (1953), which served as a prototype for the first computers in China (maybe in Asia as well).*
- *That time it was the most powerful computer in the USSR and in Europe. About this computer "BESM-1" Lebedev made □□ the report of the International Conference in Darmstadt in October, 1953. It was fastest computer in Europe. But BESM-1 was inferior in speed and memory capacity of the American computer IBM 701.*
- *Then in the second part of the 1950's the computers "BESM-2" and "M-20" were created under his leadership. In 1959 computer "M-20" was put into production. Compared with previously created computers "BESM" the performance of computer "M-20" was 4 times higher.*
- *In 1964, Lebedev created the computer BESM-4 - one of the first Soviet universal computers of the second generation.*

Computer «BESM-2»



Computers "BESM-4" and BESM-6"

- *In 1964, Lebedev created the computer BESM-4 - one of the first Soviet universal computers of the second generation.*
- *The top of Lebedev's computer line was the creation of second-generation mainframe computer "BESM-6". That time it was the most powerful computer in the Soviet Union and one of the most powerful computers in the world with performance equal to 1 million operations per second. Since 1967 during about 15 years the computer "BESM-6" was installed in many Soviet scientific centers.*
- *In the Soviet Union Lebedev's computers "M-20", "BESM-3M", "BESM-4", BESM-6 " and others became very famous.*

Computer «BESM-6» and its main developers with Lebedev



Bruk's scientific school after "M-1" computer.

- *In addition to the computer "M-1" under the leadership of Isaak Bruk a series of computers was created.*
- *Computer "M-2" was developed in 1952. Computer "M-2" has been held for the calculations of the Institute of Atomic Energy, the design bureau led by Sergey Korolev and other scientific institutions.*
- *In the mid-1950s, the computer "M-2" has been improved by introducing the device memory on ferrite cores.*
- *In 1955-1956 Bruk created the concept of small computers based on experience in the creation of machines "M-1" and "M-2".*
- *After a while the computer "M-3" was created, which operated 30-bit binary numbers with fixed point, had two-address instruction format, the memory capacity of 2048 numbers on a magnetic drum, and had an initial average capacity of 30 operations per second.*

Computer "M-4" and "M-5"

- *In 1957, Bruk began to work on the creation of a computer "M-4" for processing data received from the radar.*
- *This computer had shared internal memory and program ROM and constants used special processors for input-output.*
- *Computer "M-4" was one of the first computers that was made on the basis of more advanced components - semiconductor transistors.*
- *Soon Bruk developed a multiprogramming, multiterminal computer "M-5", which could work with several programs. Its performance was 50 thousand operations per second.*

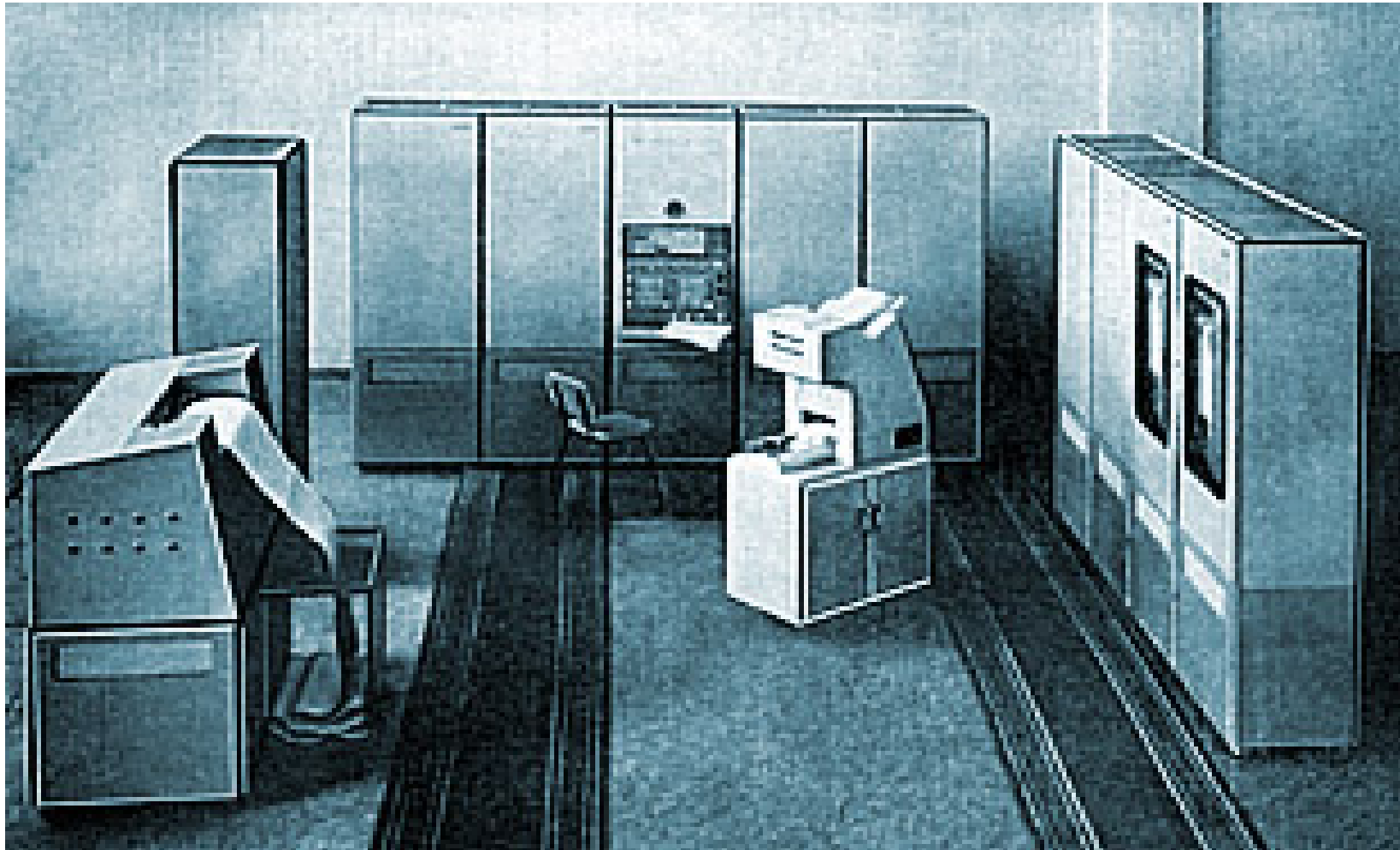
Computer «M-4»



2.1.3. Rameev's computer school after computer "Strela".

- *After computer "Strela" Bashir Rameev created the family of computers "Ural". This family included the famous in the USSR computers "Ural-1, 2, 3,4, 11, 14, 16".*
- *Application field of this family of computers "Ural" was solving of broad range of mathematical and engineering computations in computing centers of scientific research institutes, design bureaus and industrial enterprises.*

Computer “Ural-14”



2.1.4. Computers «Minsk-22» and «Minsk-32»

- *Computer «Minsk-22» and computer «Minsk-32» were one of the most mass Soviet computers for the time of second part of 1960s and first years of 1970s.*
- *These computers were produced in Minsk and had the greatest use in the USSR.*
- *They were designed to solve the economic problems, problems of statistics and planning, production management, information retrieval.*
- *There were produced 734 computer "Minsk-22" and 2889 computers "Minsk-32".*
- *That time computer "Minsk-32" was the most common in the USSR between general purpose computers.*
- *Computer "Minsk-32" was manufactured from 1968 to 1975.*

**Computer «Minsk-22» was produced by series from
1965 till 1970.**

One of the most mass Soviet computers of that time.



Computer “Minsk-22” and “Minsk-32” designer Victor Przyjalkowski



2.2 The first in the world project of The Nationwide computer network for the management and control of Economy and Military Forces of the USSR.

- *The scientist which formulated in 1959 the proposals for complex automation of information processing and state administrative management on the base of Unified State Network of Computer Centers (USNCC, EGSVC in Russian) was Anatoly Kitov.*

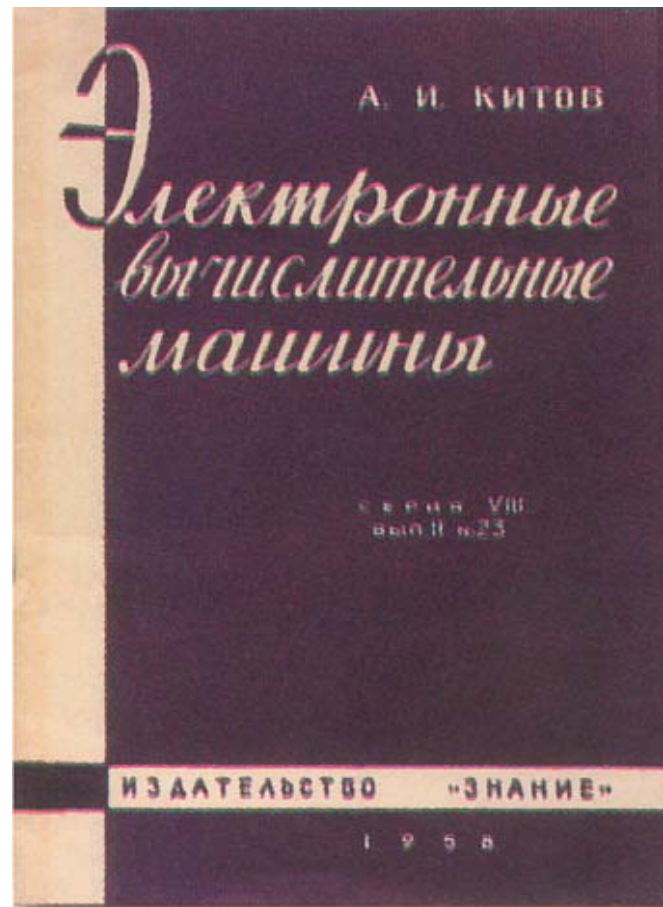
Since 1955

- *Since 1955 in his articles and presentations A.Kitov paid considerable attention to prospects of economic and management applications of computers which could become feasible after the full amount of economic data was collected and processed.*
- *As a necessary tool for that he proposed to create a Unified nationwide network of computers, which would collect all economic data in the country including the information of different enterprises, material supplies, data of financings, labor force data and operatively process this information for planning and management of economics of the USSR.*

1958

- *In particularly at 1958, in his publication "**Electronic computers**" Kitov offered to create such The Common state computer network for the whole country. His suggestions were particularly risky at that time as Soviet Party ideologists continued to consider applications of mathematics in economics like “the instruments of capitalist apologetics”. Such indictment could have particularly serious consequences for supporters of the use computers and mathematics in the economy.*

**Publication of A.Kitov, in which he raised the
question of the creation in the USSR The
Unified State Network of Computer Centers
(USNCC, EGSVC- in Russian).**



Two letters to the head of the USSR Nikita Khrushchev.

- *The proposals of Kitov, considering computer applications, were introduced in his two letters to the head of the USSR Nikita Khrushchev.*

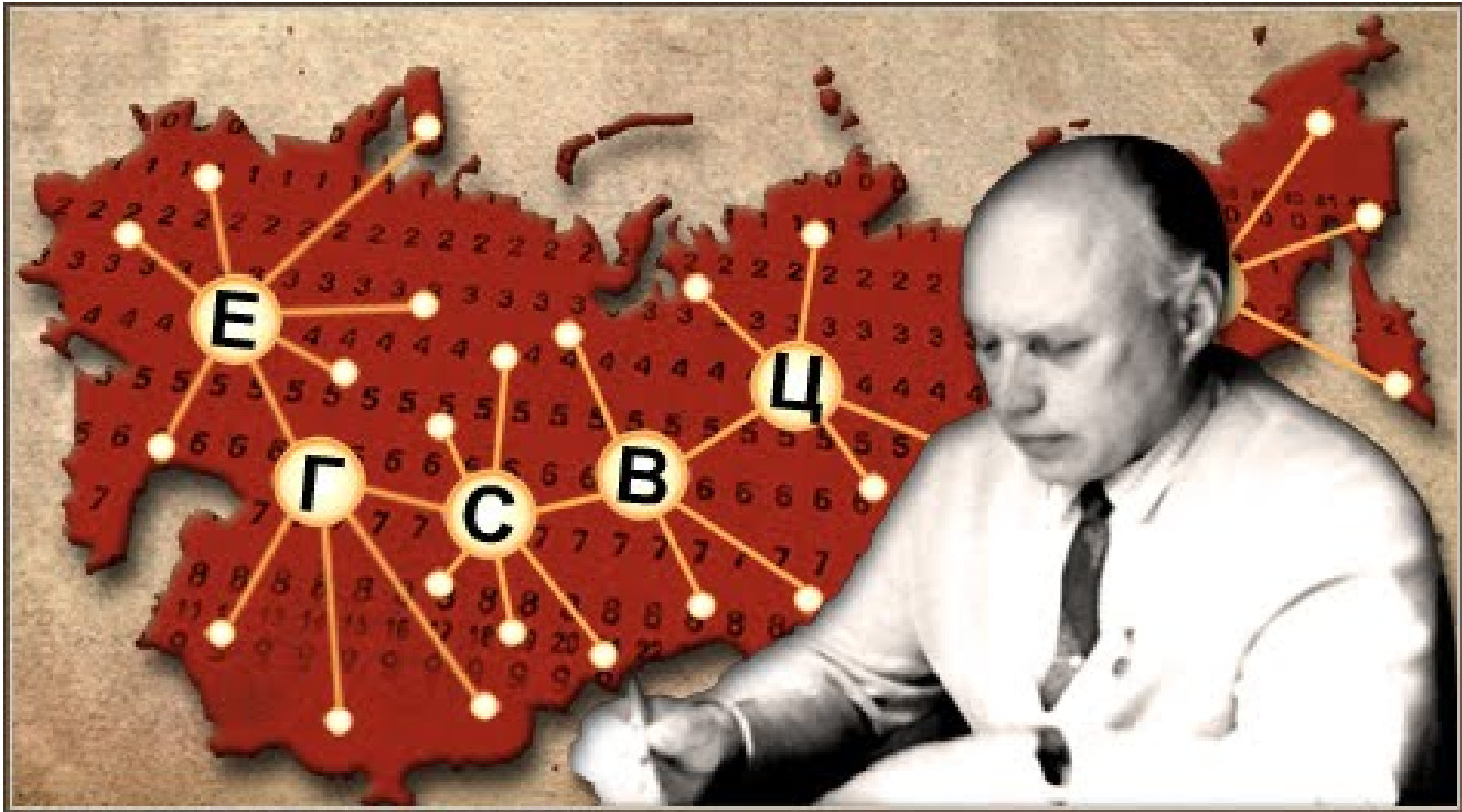
First letter to Khrushchev.

- *Kitov sent his first letter on January 7th 1959 and received understanding in the soviet political circles and some of the proposed by him measures were implemented. However, his main proposal – the creation of The Nationwide Computer Network for effective and timely economic management of the USSR - was not accepted.*

The second letter to Khrushchev (project “Red Book”)

- *The second letter to Khrushchev Kitov sent in autumn 1959. His this letter contained even more radical project (named “Red Book”) with double functionality - Universal computerization of the management for national economy and military forces based on The Unified Nationwide Computer Network. Creation of such network, according to Kitov, could bring management of national economy and military forces on a qualitatively new level and to liquidate outlined backlog from the USA in use of computers (as A.Kitov wrote, «to overtake the USA without catching up of them»).*

Anatoly Kitov and his project USNCC (EGSVC)



The project “Red Book” and Communist Party

- *The project “Red Book” caused anger of influential Communist Party and military officials since realization of its ideas seriously limited power of the Communist Party in the country. The project was rejected, and its author was excluded from the Communist Party (which actually meant civilian death), dismissed from the prestige job with prohibition to occupy command positions.*

Political monopoly power

- *It is indicative that Anatoly Kitov's persecution followed the campaign against writer Boris Pasternak awarded in 1958 the Nobel Prize in literature, and chronologically preceded persecution of general Petr Grigorenko. These three campaigns revealed that Soviet communist party, wishing to preserve its political monopoly power, toughened its control over arts, science and politics.*

2.3 The application of computers for the economy and the creation of automated management systems (AMS) for different levels and purposes.

- *Isaak Bruk proposed the idea of using small computers.*
- *1960th - 1970th – twenty years of the Soviet age of Automated enterprise management systems (AEMSs). Victor Glushkov.*
- *Algorithmics Language for the Programming of Economycal and Mathematical tasks ALGEM.*
- *Several words about Soviet Medical Cybernetics.*

Isaak Bruk proposed the idea of using small computers.

- *Isaac Bruk developed the idea of using small computers for control of industry production and technological processes.*
- *In 1957 there was created the Institute of Electronic Control Machines (INEUM) for development and design of small control computers. I. Bruk was appointed as its director.*
- *Offers of Bruk on the use of computers in the economy met with sharp objections from officials from the State Planning Ministry of the USSR (Gosplan).*
- *In 1964 Bruk was forced to resign as director of INEUM.*

**1960th - 1970th – twenty years of the Soviet age of
Automated enterprise management systems (AEMSs).
Victor Glushkov.**

- *In 1960th and 1970th during twenty years the director of Kiev Institute of Cybernetics Victor Glushkov was the unformal leader of the direction “Soviet Automated enterprise management systems (AEMSs)” (ASU in Russian).*
- *In this direction several hundred thousands of Soviet programmers, analytics, engineers, etc. worked.*

Computers Dnepr, Kiev, Promin and MIR

- *Director of Kiev Institute of Cybernetics Victor Glushkov applied his theory of automata to enhance construction of computers Dnepr, Kiev, Promin and MIR.*
- *These computers were designed in Kiev under his leadership and produced in 1960s-1970s.*

Computer «Dnepr»



Computer for engineering calculations

«Mir»



**Director of Kiev Institute of Cybernetics
Victor Glushkov (1923 – 1982).**



EGSVC again

- *In the 1960s V. Glushkov tried to promote the idea of EGSVC.*
- *In the 1970s, Glushkov continued to promote the idea of this project under new name “OGAS”.*
- *This ambitious project received the opposition from many senior Communist Party leaders who felt the system threatened Party control of the economy.*
- *By the 1970s official interest for this project ended.*

Algorithmics Language for the Programming of Economical and Mathematical tasks ALGEM.

- *ALGEM (Algorithmics Language for the Programming of Economy and Mathematics) was designed for the programming of the economical, mathematical, logical and control (including the real time control of the technical systems) tasks.*
- *The creator of ALGEM was Anatoly Kitov.*
- *In particular ALGEM was the language for the programs for processing the large (super large at that time) information arrays of complex but determined structure .*

ALGEM realization and usage

- *In 1965 the first version of ALGEM was developed .
In 1967 A. Kitov published the monograph «The programming of informational logical tasks» in which ALGEM was described*
- *This language was realized in the system of computer programming ALGEM ST-3 (ST-3 □ Syntax-directed Translator, the 3rd version)*
- *The system ALGEM ST-3 was realized on the base of the second generation computer «Minsk-22»*
- *ALGEM ST-3 included in «Minsk-22» software had several hundred of installations in the USSR and was widely used during the development of various applied systems*

ALGEM specifics

- *ALGEM was the procedure-oriented programming language -that is why Algol-60 was selected as a base for it.*
- *ALGEM mainly was designed for practical purposes of industrial programming while Algol is a classical language for algorithms presenting.*
- *Practical orientation of ALGEM determined the deep modification of the basic language and introduction of serious alterations: new block nesting mechanism, new variable types and also the special advanced instruments for the work with the values densely packed in computer memory cells.*
- *In ALGEM there is a possibility to describe the structure of variables by means of declarator shape. It points the quantity and type of symbols contained in variable value:*
- *Variables in ALGEM language may be simple and composite. Composite variable contains other variables including composite as well and in fact it is a record type. Composite arrays are also provided in the language.*
- *All these means make it possible for ALGEM to solve specific economical and management tasks of any level (they are also attributable to the systems of real time, in particular to air defense systems).*
- *There are also compound operators in the language except blocks. It provides unlimited nesting of blocks and composite operators as well. The operators are the same as in Algol: assignment operator, go to operator, conditional jump, loop operator. Instead of procedure operator it was introduced procedure-code operator.*

2.4. Soviet computers “ES EVM” are the clones of IBM/360 computers.

The beginning of the end of Soviet computers.

- *In late 1966, the Soviet Government decided to set up new computers ES EVM (Unified Series Computers) by copying the architecture of computers IBM-360 and borrowing system software of these american computers.*
- *However, these scientists were in the minority. Under this ambitious program to create ES EVM was allocated the bulk of state money. This was done by reducing the funding of Lebedev's and Rameev's computer research centers, Kiev Institute of Cybernetics and others.*
- *Many Soviet research centers and factories were reoriented. Many professionals had to relearn. In university programs mainly architecture and software IBM / 360 and IBM / 370 computers were included. Other directions of Soviet computers began to decline due to lack of funding, customers, young professionals.*
- *Creating computers or copying computers are two completely different things. Established Soviet scientific schools building computers began to decline.*
- *Thus, the Soviet Union began to produce ES EVM. In this case, used borrowed from IBM's system software. In the program codings their names just replaced the letters common in Latin and Russian alphabet only. So IBM multiterminal monitor CICS became Soviet multiterminal monitor KAMA. Database management system IMS became Soviet similar system OKA. And so on ...*
- *Create ES EVM showed inflexibility of the Soviet socialist system. It absent, real incentives for working and competition. But there was a monopoly on decision-making. Subsequent years have shown the fallacy of this chosen path of the computers “ES EVM” development of the Soviet government. As a result the soviet computer schools were destroyed.*