

Evgenii Alekseevich Barbashin (on the occasion of his 50th birthday)

Authors:

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Abstract

Full Text

Preamble

DIFFERENTIAL EQUATIONS, DECEMBER 1957, VOLUME III, NO. 12 SOVIET SCIENCE: EVGENY ALEKSEEVICH BARBASHIN (On his 50th Birthday)

January 17, 1968, marks the 50th birthday of Academician of the Academy of Sciences of the BSSR, Evgeny Alekseevich Barbashin. Born into a civil servant's family in the village of Uinsk, Perm Region, Barbashin was orphaned at the age of six and was raised in an orphanage from 1927. After graduating from high school in 1935, he enrolled in the Faculty of Physics and Mathematics at Ural University. In 1940, he began his postgraduate studies at Moscow State University under the supervision of V. V. Nemytskii. Barbashin immediately became an active participant in the renowned seminar on qualitative theory led by V. V. Stepanov and V. V. Nemytskii, where he was the first to develop the theory of dynamical systems without the assumption of uniqueness.

Following the defense of his candidate dissertation in 1943, Barbashin was appointed Associate Professor in the Department of Higher Mathematics at the Ural Polytechnic Institute. In 1948, he entered the doctoral program at the V. A. Steklov Mathematical Institute of the USSR Academy of Sciences, successfully defending his doctoral dissertation, "The Method of Sections in the Theory of Dynamical Systems," in 1951. In this work, he was the first to link the qualitative study of dynamical systems as a whole with problems of motion stability. This connection led to several new results in Lyapunov stability theory, including the proof of the existence of a smooth Lyapunov function in the domain of attraction of an asymptotically stable singular point.

In 1952, Barbashin returned to Sverdlovsk to the Department of Higher Mathematics at the Ural Polytechnic Institute. There, he began extensive scientific and organizational work to establish the now well-known Sverdlovsk school of differential equations. Under his leadership, a large and capable collective of Sverdlovsk mathematicians emerged, conducting significant research across a broad spectrum of problems, including the theory of differential equations, stability theory, oscillation theory, and the theory of optimal control. This group consistently balanced the investigation of fundamental theoretical questions with the solution of important applied problems.

During this period, Barbashin's own scientific interests focused primarily on two major areas: the global stability of substantially nonlinear systems and the stability of nonlinear systems based on first approximations. His work resulted in the proof of critical theorems justifying the Lyapunov function method for new classes of problems. He developed methods for the effective construction of Lyapunov functions for specific types of nonlinear systems and established general methods for proving stability theorems by first approximation. These methods proved applicable not only to ordinary differential equations but also to more general systems, such as integro-differential equations. The Sverdlovsk seminar and the research groups that grew from it maintained close ties and collaborated extensively with other scientific centers across the country, including Leningrad University, the Institute of Problems in Mechanics of the USSR Academy of Sciences, and the Minsk mathematical community.

From 1961 to 1966, Barbashin served as a staff member of the Sverdlovsk Branch of the Mathematical Institute of the USSR Academy of Sciences, where he headed the Department of Mathematical Analysis. He played a leading role in establishing and strengthening this major new mathematical center in the Urals. During this time, his research shifted significantly toward the theory of automatic control. He published a series of works on program control, providing a comprehensive look at the relationship between programmed motion tasks, general stability theory, optimal process theory, and function approximation theory. Furthermore, he developed original and effective methods for stabilizing automatic control systems, including dynamic systems with irregular or discontinuous characteristics, which are critical for applications but difficult to study mathematically.

Most recently, Barbashin developed a new conceptual framework for the fundamental definitions of motion stability, treating stability in relation to a system's reaction to various classes of external perturbations. This approach allowed for the application of the apparatus of generalized functions to stability problems. Many of his significant results from this period were compiled in his monograph, *Introduction to the Theory of Stability* (Nauka Publishing, 1967). Throughout his career, Barbashin has mentored a large number of researchers, including more than 25 Candidates of Sciences.

In 1966, Barbashin was elected an Academician of the Academy of Sciences of the BSSR and moved to Minsk. He currently serves on the editorial board of

the journal *Differential Equations*, heads the Laboratory of Applied Mathematics and Mechanics at the Institute of Mathematics of the BSSR Academy of Sciences, and chairs the Department of Applied Mathematics at the V. I. Lenin Belarusian State University. In 1967, he was awarded the Order of the Red Banner of Labour for his scientific achievements. Evgeny Alekseevich Barbashin remains in the prime of his career, and he and his students will undoubtedly continue to produce profound research in the theory of differential equations.

—N. P. ERUGIN, N. N. KRASOVSKII

List of Published Works by E. A. Barbashin

1. On certain features arising in a dynamical system upon violation of uniqueness. *DAN SSSR*, 1943.
2. Local features of ordinary points of a system of differential equations. *DAN SSSR*, 41, No. 5, 183-186.
3. On the behavior of points under homeomorphic transformations of space. *DAN SSSR*, 51, No. 1, 3-6.
4. On σ -coverings of space. *Matem. Sb.*, 18 (60), No. 3, 423-428.
5. On the classification of integral manifolds of a system of equations in total differentials. *DAN SSSR*, 55, No. 4, 283-286.
6. Toward a theory of generalized dynamical systems. *Uch. Zap. Moskovskogo Un-ta*.
7. On dynamical systems possessing a velocity potential. *DAN SSSR*, 61, No. 2, 185-187.
8. On homomorphisms of dynamical systems. *DAN SSSR*, 61, No. 3, 429-432.
9. Toward a theory of systems of multi-valued mappings of a topological space. *Uch. Zap. Ural'skogo Un-ta*, 7, 54-60.
10. Dispersive dynamical systems. *UMN*, 5:4 (38), 138-139.
11. On homomorphisms of dynamical systems. *Matem. Sb.*, 27 (69), No. 3, 455-470.
12. On a condition for the existence of a secant surface. *DAN SSSR*, 70, No. 3.
13. On the existence of smooth solutions for certain linear partial differential equations. *DAN SSSR*, 72, No. 3, 445-447.
14. The method of sections in the theory of dynamical systems. *Matem. Sb.*, 29 (71), No. 2, 233-280.
15. On homomorphisms of dynamical systems. II. *Matem. Sb.*, 29 (71), No. 3, 501-518.
16. On the stability of the solution of a certain third-order nonlinear equation. *PMM*, 16, Iss. 5, 629-632.
17. On the stability of motion as a whole. *DAN SSSR*, 453-456 (with N. N. Krasovskii).
18. On the behavior of points under homeomorphic transformations of space (generalization of Birkhoff's theorem). *Trudy Ural'skogo Politekhniceskogo In-ta*, 51, 4-11.

19. On the existence of Lyapunov functions in the case of asymptotic stability as a whole. *PMM*, 18, Iss. 3, 345 (with N. N. Krasovskii).
20. On the question of stability by first approximation. *PMM*, 19, Iss. 5 (with M. A. Skalkina).
21. On two schemes for proving stability theorems by first approximation. *DAN SSSR*, No. 1, 9-11.
22. On conditions for preserving the stability property of solutions to integro-differential equations. *Izv. Vuzov. Matematika*, No. 1, 25-34.
23. On the works of members of the Sverdlovsk seminar on qualitative methods in the theory of differential equations. *Trudy Vsesoyuznogo Matematicheskogo S'ezda*, 31-36; AN SSSR.
24. Toward a topological definition of integral invariants. *Izv. Vuzov. Matematika*, No. 3 (4), 8-12 (with V. A. Baidosov).
25. On the stability of solutions to a system of integro-differential equations. *Nauchn. Dokl. Vysshei Shkoly. Fiz. Matem.*, No. 3, 18-22 (with L. Kh. Liberman).
26. On the stability of solutions to integro-differential equations. *Trudy Ural'skogo Politekhnicheskogo In-ta*, Sb.
27. On conditions for the existence of limit cycles. *PMM*, 23, Iss. 5, 826-835 (with V. A. Tabueva).
28. On the oscillations of a pendulum in the presence of dry friction. *Izv. Vuzov. Matematika*, No. 5 (12), 48-57 (with V. A. Tabueva).
29. On a problem in the theory of dynamic programming. *PMM*, Iss. 6.
30. On the mapping of a dynamical system into a dynamical system analytic with respect to time. *Izv. Vuzov. Matematika*, No. 1 (14), 11-15 (with F. A. Sholokhovich).
31. On estimating the mean-square deviation of a given trajectory. *Avtomatika i Telemekhanika*, No. 7, 941-950.
32. On estimating the maximum deviation from a given trajectory. *Avtomatika i Telemekhanika*, No. 10, 1341-1351.
33. On conditions for the uniqueness of limit cycles. *Izv. Vuzov. Matematika*, No. 3 (16), 43-47 (with E. V. Vdovina).
34. Toward a theory of dynamical systems with multi-valued and discontinuous characteristics. *DAN SSSR*, No. 1, 9-11 (with Yu. I. Alimov).
35. Qualitative study of equations describing the motion of interacting points on a circle. *Izv. Vuzov. Matematika*, No. 2 (21), 137-146 (with V. S. Serebryakova).
36. On circular motions of coupled pendulums. *Izv. Vuzov. Matematika*, 4 (23), 111-118 (with V. S. Serebryakova).
37. On the construction of periodic motions. *PMM*, Iss. 2, 276-283.
38. On the construction of Lyapunov functions for nonlinear systems. *Trudy Mezhdunarodnogo Kongressa Mezhd. Federatsii po Avtomaticheskomu Upravleniyu*. Theory of Continuous Systems. Special Math Problems. AN SSSR.
39. On the approximate realization of motion along a given trajectory. *Avtomatika i Telemekhanika*, No. 6, 681-687.

40. Program control of systems with random parameters. *PMM*, Iss. 5.
41. Toward a theory of relay differential equations. *Izv. Vuzov. Matematika*, No. 1 (26), 3-13 (with Yu. I. Alimov).
42. On a method for stabilizing a third-order control system with a high gain coefficient. *Avtomatika i Telemekhanika*, No. 10 (with V. A. Tabueva).
43. On a method for stabilizing third-order control systems with a high gain coefficient. *Avtomatika i Telemekhanika*, No. 5, 608-614 (with V. A. Tabueva).
44. On the stability of a variable-structure control system upon violation of sliding conditions. *Avtomatika i Telemekhanika*, No. 7, 882-890 (with V. A. Tabueva and R. M. Eidinov).
45. On the stability of solutions to integro-differential equations. *Izv. Vuzov. Matematika*, No. 3 (34), 7-14 (with L. P. Bisyarina).
46. Construction of periodic motion as a problem in program control theory. *Trudy Mezhdunar. Simpoziuma po Nelineinym Kolebaniyam*, Vol. III. Kiev.
47. Application of variable-structure automatic control systems for the regulation of a class of linear static objects. *Avtomatika i Telemekhanika*, No. 1, 27-32 (with I. N. Pechorina and R. M. Eidinov).
48. A theorem on the stability of the solution of a third-order differential equation with a discontinuous characteristic. *PMM*, Iss. 4, 664-671 (with V. A. Tabueva).
49. On a method for stabilizing a control system with limited permissible values of regulator parameters. *Izv. AN SSSR. Tekhnicheskaya Kibernetika*, No. 2, 121-128 (with V. M. Badkov).
50. Realization of processes and construction of signals at the system output. *Trudy 4 Vsesoyuznogo Matem. S' ezda*, Vol. II, Section Reports. Nauka Publishing, 410-415.
51. Seminar on the theory of variable-structure control systems. *UMN*, No. 6.
52. Theory of variable-structure control systems. *Vestnik AN SSSR*.
53. On the stabilization of control systems. *PMM*, Iss. 4, 761-765 (with E. I. Gerashchenko).
54. Theorems on the asymptotic stability of solutions to certain third-order differential equations with discontinuous characteristics. *PMM*, Iss. 3, 528 (with V. A. Tabueva).
55. On a principle for constructing stabilization systems. *Avtomatika i Telemekhanika*, No. 6, 995-1003 (with E. I. Gerashchenko).
56. On periodic motions of a double pendulum. *Izv. Vuzov. Matematika*, (48), 19-26 (with M. D. Kocheva).
57. On forcing sliding modes in automatic control systems. *Differentsial nye Uravneniya*, 1, No. 11, 25-32 (with E. I. Gerashchenko).
58. Program control and the theory of optimal systems. *Trudy II Mezhdunarodnogo Kongressa Mezhdunarodnoi Federatsii po Avtomaticheskomu Upravleniyu*. Optimal Systems. Statistical Methods. Nauka Publishing.
59. Stability of variable-structure control systems. *Trudy II Vsesoyuznogo S' ezda po Teoreticheskoi i Prikladnoi Mekhanike*, Iss. II. Nauka Publishing,

- 7-14 (with V. A. Tabueva and R. M. Eidinov).
60. On stability with respect to impulsive actions. *Differentsial' nye Uravneniya*.
 61. Certain questions in the synthesis of variable-structure automatic control systems. *Trudy III Vsesoyuznogo Soveshchaniya po Avtomaticheskomu Upravleniyu*. Nauka (with E. I. Gerashchenko, V. A. Tabueva, R. M. Eidinov).
 62. *Introduction to the Theory of Stability*. Monograph. Nauka Publishing.
 63. Methods for analyzing the stability of variable-structure automatic control systems. *Trudy III Mezhdunarodnogo Kongressa Mezhdunarodnoi Federatsii po Avtomaticheskomu Upravleniyu*. Nauka (with E. I. Gerashchenko, V. A. Tabueva, R. M. Eidinov).
 64. On a class of pendulum motion in a medium with high resistance. *Differentsial' nye Uravneniya*, No. 3, 371-379 (with V. A. Tabueva).
 65. On a method for stabilizing control systems. *Differentsial' nye Uravneniya*, No. 5, 733-741 (with N. G. Yarov).
 66. Conditions for the existence of recurrent trajectories in dynamical systems with a cylindrical phase space. *Differentsial' nye Uravneniya*, No. 10, 1627-1633.
 67. Classification of trajectories of a dynamical system with a cylindrical phase space. *Differentsial' nye Uravneniya*, No. 12.
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Figures

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PEOPLE OF SOVIET SCIENCE

EVGENII ALEKSEEVICH BARBASHIN

(for his 50th birthday)

January 17, 1968, marks the 50th birthday of the Academician of the Academy of Sciences of the BSSR, Evgenii Alekseevich Barbashin.

E. A. Barbashin was born into the family of an employee in the village of Uinske, Perm Region. At the age of six, he was left a complete orphan and from 1927 was raised in an orphanage. Upon graduating from high school in 1935, E. A. Barbashin entered the Faculty of Physics and Mathematics of Ural University and in 1940 the graduate school of Moscow State University. E. A. Barbashin's supervisor was V. V. Nemytskii. Evgenii Alekseevich immediately became an active participant in the well-known seminar on the qualitative theory, which was led by V. V. Stepanov and V. V. Nemytskii. He first developed the theory of dynamical systems without the assumption of uniqueness. After defending his PhD thesis in 1943, E. A. Barbashin was appointed associate professor of the Department of Higher Mathematics of the Ural Polytechnic Institute. In 1948, Evgenii Alekseevich entered the doctoral program of the Steklov Mathematical Institute of the USSR Academy of Sciences and in 1951 successfully defended his doctoral dissertation on the topic "Method of sections in the theory of dynamical systems. In this work, in particular, the questions of the qualitative study of dynamical systems in the large were linked for the first time with the problems of stability of motion. This made it possible to obtain a number of new results in the theory of stability according to Lyapunov and, in particular, to prove the existence of a smooth Lyapunov function in the domain of attraction of an asymptotically stable singular point.

In 1952, Evgenii Alekseevich returned to Sverdlovsk to the Department of Higher Mathematics of the Ural Polytechnic Institute. Here his great scientific and organizational work began on creating the now well-known Sverdlovsk school of differential equations. At the seminar of E. A. Barbashin, a large and strong team of Sverdlovsk mathematicians was formed, who carried out and are carrying out interesting research on a wide range of problems from the theory of differential equations, the theory of stability, the theory of oscillations, the theory of optimal control and regulation. This team, alongside the study of fundamental theoretical questions, always



Figure 1: Figure 1

devoted much attention to solving important applied problems. The scientific interests of E. A. Barbashin himself at that time were focused mainly on two major problems. He studied the stability of substantially nonlinear systems as a whole and problems of stability of motion of nonlinear systems in the first approximation. As a result, important theorems were proven by him, substantiating the method of Lyapunov functions in application to a new class of problems, methods for effective construction of Lyapunov functions for specific types of nonlinear systems were developed, and general methods were developed for proving stability theorems in the first approximation, working not only in the field of ordinary differential equations, but also in the field of systems of a more general type (integro-differential equations, etc.). Note that the Sverdlovsk seminar of E. A. Barbashin and the research teams of Sverdlovsk mathematicians and mechanics that grew up on its basis are in great friendship and work in close contact with many scientific teams in our country. We are speaking here primarily about mathematicians from Leningrad university, about the Institute of Problems of mechanics of the CCCP Academy of Sciences, about the collective of Minsk mathematicians, etc.

In the period 1961–1966 E. A. Barbashin was an employee of the Mathematical Institute of the UCCR Academy of Sciences (Sverdlovsk Branch), headed the department of mathematical analysis of this institute.

Evgeniy Alekseevich played one of the leading roles in the creation and strengthening of this new major mathematical centre in the Urals. At that time, problems of automatic control theory occupied a particularly large place in his research. He published a series of papers on programme regulation, in which the connection, problem of implementing programme motions with the general theory of stability of motion, with the theory of optimal processes and with the theory of approximation of function was comprehensive. Furthermore, he developed new original and effective methods for stabilizing automatic control systems, covering, in particular, we systems, very important for applications and difficult to mathematically study dynamic systems with irregular, discontinuous characteristics. Finally, recently by E. A. Barbashin was developed a new concept of the main condition of stability of motion, interpreting this condition in connection with the reaction of the system to an external disturbance of one or another class. This concept allowed, in particular, application of generalized functions to the study of stability of motion. A number of interesting results obtained by E. A. Barbashin in this period entered into his monograph «Introduction to the Theory of Stability». Publishing House «Nauka», 1967.

Evgeniy Alekseevich trained a large number of scientific workers, including over 25 candidates of science.

In 1966, Evgeniy Alekseevich was elected an academician of the Academy of Sciences of the BSSR and moved to work in Minsk. He is a member of the editorial board of the All-Union journal «Differential Equations», heads the laboratory of applied mathematics and mechanics of the Institute of mathematics of the Academy of the BSSR and the department of applied mathematics of the Belorussian State University named after V. I. Lenin.

In 1967, for his scientific work, Evgeniy Alekseevich was awarded the Order of the Red Banner of Labour.

Evgeniy Alekseevich Barbashin is in his prime. He and his students, undoubtedly, will carry out many more deep studies on various issues of the theory of differential equations.

N. P. ERUGIN, N. N. KRASOVSKII

Figure 2: Figure 2

LIST OF PUBLISHED WORKS BY E. A. BARBASHIN

1943 yr.

1. On certain peculiarities arising in a dynamical system upon violation of uniqueness. DAN SSSR, 41, No. 4, 139–141.
2. Local peculiarities of ordinary points for a system of differential equations. DAN SSSR, 41, No. 5, 183–186.

1946 yr.

3. On the behavior of points under homeomorphic transformations of space. DAN SSSR, 51, No. 1, 3–6.
4. On σ -covering of space. Matem. Collection, 18 (60), No. 3, 423–428.

1947 yr.

5. On the classification of integral manifolds of a system of equations in total differentials. DAN SSSR, 55, No. 4, 283–286.

1948 yr.

6. Towards the theory of generalized dynamical systems. Uch. zap. Scientific Notes of U.S.S.R., 110–133.
7. On dynamical systems, possessing a velocity potential. DAN SSSR, 61, No. 2, 185–187.
8. On homomorphisms of dynamical systems. DAN SSSR, 61, No. 3, 429–432.

1950 yr.

9. Towards the theory of systems of non-unique mappings of a topological space. Uch. zap. Scientific Notes, 7, 54–40.
10. Dispersive dynamical systems. UMN, 5, 4 (38), 138–139.
11. On homomorphisms of dynamical systems. Matem. sb., 27 (69), No. 3, 455–470.
12. On one condition for the existence of a secant surface. DAN SSSR, 70, No. 3, 365–368.
13. On the existence of smooth solutions of certain linear equations in partial derivatives. DAN SSSR, 72, No. 3, 445–447.

1951 yr.

14. Method of sections in the theory of dynamical systems. Matem. sb., 29 (71), No. 2, 223–280.
15. On homomorphisms of dynamical systems. II. Matem. sb., 29 (71), No. 3, 501–518.

1952 yr.

16. On the stability of the solution of a single nonlinear equation of the third order. PMM, 16, no. 5, 629–632.
17. On stability of motion in the large. DAN SSSR, 86, No. 3, 453–456 (with N. N. Krasovskiy).

1954 yr.

18. On the behavior of points under homeomorphic transformations of space (generalization of theorem Birkhoff). Trudy Uralskogo politeknicheskogo in-*ta*, 51, 4–11.
19. On the existence of Lyapunov Functions in the case of asymptotic stability in the large. PMM, 16, no. 3, 345 (with N. N. Krasovskiy).

1955 yr.

20. Towards the question of stability in the first approximation. PMM, 19, no. 5, 623–624 (with M. A. Skalkina).

1956 yr.

21. On two schemes of proof of theorems on stability in the first approximation. DAN SSSR, 111, No. 1, 9–11.

Figure 3: Figure 3

44. On the stability of one control system with variable structure under the violation of sliding conditions. *Automation and Remote Control*, 24, No. 7, 882–890 (jointly with Tabueva V. A., Eydinov R. M.).
45. On the stability of the control system, under from the variable analysis of *Automation and Remote Control*, 21, (jointly with Tabueva V. I., M.I., 1964).
46. On the stability of the control system with variable structures under the violat of sliding conditions. *Automation and Remote Control*, 24, No. 7, 882–890 (jointly with Tabueva V. A., 1964).
47. On the stability of stability of the most numbers of θ nonlinear this, nonlinear differential equations with incurrent system sonto: Ar-tion'ist. *dst.* Tabuev, V. M., Eydinov M. No. 11, e, 523–530 (jointly with interme nele catesaities and ratinoreasy, v. kop. Ilacyh A. V. A., Valoz., 1965).
48. On the asymptotic set stability of control structure under this differential s sliding conditions. *Automation and Remote Control*, 24, No. 7, v. 3, 882–890 (jointly with Tabueva V. A.).
49. Analytis stability of como satority and contion in practice senone formed characteristics. *Automation and Remote Control*, 24, No. 29, v. A., 1965.
50. The mad of proceeding of Index. T. A.A. and A.S. and M. -gara-acteristics. *Automation and Remote Control*, 24, No. 7, 882–890 (jointly with Tabueva V. I., Ront., 1965).
51. Theorems on the asymptotic stability of solutions of certain non-linear differential equations of the third order with disc characteristics. *PMM*, 28, v. 3, 523–528 (jointly with Tabueva V. A.).
52. Theorems on the asymptotic stability of solutions of certain non-linear differential equations of the third order with discontinuous characteristics. *PMM*, 28, v. 123, (jointly with via, 1965).
53. Theorems on the asymptotic stability of solutions of certain non-linear differential equations of the third order with discontinuous characteristics. *PM*, 8, v. 523–528 (jointly with Tabueva V. A.).
54. On the stability of anongal system with thire order under the violation of sliding conations. *Automation and Remote Control*, *PMM*, 28, v. 3, 882–890 (jointly with Tabueva V. A.).
54. Theorems on the asymptotic stability of solutions of certain nonlinear differential equations of the third order with discontinuous characteristics. *PMM*, 28, v. 3, 523–528 (jointly with Tabueva V. A.).
55. Theorems on the asymptotic stability of solutions of certain nonlinear differential equations of the third order with discontinuous characteristics. *PMM*, 28, v. 3, 523–528 (Tabueva V. A.). [Wnt-two l. more with smpus. "Mnograph", 1966.
56. Theorems on the asyemic imagorization for first continenent differential equations of the third nemers. *Automation and Remote Control*, 24, MM, 28, v. 3 Tabuevi V. A., 1966.
57. Theorems on the asymptotic stability of solutions of certain nonlinear differential equations of the third order with discontinuous characteristics. *PMM*, 28, v. 3, 523–528 (jointly with Tabueva V. 1965.
58. Deamniyovoments in the theory of stability and certain quick ert stabilices. In a. statistic semanters. *PMM*, 28, v. 56–528 (jointly with Tabueva V. A., 1966.
60. Introduction to the theory of stability. Monograph. Publ. "Nauka". Honter on tiec hxis. *PMM*, 28, v. 1. (jointly with Paninov enoey. 1967.
61. Introduction to the theory of stability. Monograph. Publ. "Nauka et. v. *et*kl. Fietreeva, R. Bamarin, 1967.
62. Introduction to the theory of stability. Monograph. Publ. "Nauka"
63. "Nauka, J. A. Garbasa, in the sead of Menoroni, Publ., Monograph. c. 546–641. (jointly with Tabueva, 1967.
64. Conference proceeding, theory of the Squjo. English new Conference Differential Rogacesomatngs of the equitions. *Automation and Remote Control*, 24, No. 7, 1967.
65. Conference in a asymptotic stability of the contracting thirh order with discontinuous characteristics. *PMM*, 28, 527–623 (jointly with Tabueva V. A., 1967.
66. Unags: to the theory of stability, the origit of cpnveception and function detaalase. Monograph Publ. Itasia, 1967.
67. Conference and theory of stability. Monograph. Publ. "Nauka" 4, No. 10., 180–557 Tabueva V., 1967.

Figure 4: Figure 4