Aleksandr Andreevich Shestakov

(A tribute in honor of his 80th birthday)

On January 19, 2000, Aleksandr Andreevich Shestakov, a distinguished specialist in qualitative theory and stability theory of differential equations, Doctor of Sciences in physics and mathematics, Professor, celebrated his 80th birthday.

Shestakov was born in the village of Kis'va, Ryazan region in a peasant family. He left secondary school with excellence in the town of Shuya in 1936 and graduated from the Department of Physics and Mathematics of the Kazan University in 1941. In 1944–5 he served in the Soviet Army as a sergeant of the antiaircraft artillery. In 1945–7 he was a postgraduate student at M. V. Lomonosov Moscow State University. Since 1947 till 1949 Shestakov was a senior researcher at the Central Construction Bureau "Research Institute-88" of the Armament Ministry of the USSR and a junior researcher at the Mathematical Division of the Geophysical Institute of the Academy of Sciences of the USSR.

Since 1948 Shestakov has been working in higher education institutes (Moscow Institute of Railway Transport in 1948–54, Moscow Cooperative Institute in 1959–74, and the Russian State Open Technical University of Railway Transport from 1951 until now). In 1951–90 he was in charge of the Chair of Higher Mathematics at Russian State Open Technical University of Railway Transport, where now he is a Professor.

Shestakov's scientific activity began in the Kazan University, where, supervised by N. G. Chebotarev, he wrote two works on number theory. During his postgraduate studies, he wrote a series of papers on qualitative theory of differential equations, and in December, 1947 he defended the Ph.D. thesis "The Behavior of Integral Curves of a System of Ordinary Differential Equations near a Complex Singular Point" under the supervision of V. V. Nemytskii. Shestakov's scientific activity in 1948–68 was summarized in his D.Sc. thesis "Some Problems of the Qualitative Theory of Many-Dimensional Systems of Ordinary Differential Equations."

In his scientific papers, Shestakov developed the following promising directions of qualitative theory and stability theory of differential equations:

(1) the decomposition of a complex analytic singular point into simple singular points for a many-dimensional autonomous differential system in a real or complex domain;

(2) the development of the first Lyapunov method for systems without linear terms with the use of generalized Lyapunov numbers and the related study of asymptotic properties of solutions of homogeneous and quasihomogeneous systems in a neighborhood of elementary solutions;

(3) the development of the second Lyapunov method for the investigation of stability-like properties of solutions of a nonautonomous differential system and abstract dynamical processes; in particular, the analysis of the orbital stability of a noncompact set with respect to a nonautonomous differential system;

(4) the localization of positive limit sets with the help of Lyapunov functions and functionals in systems with lumped and distributed parameters;

(5) the classification of possible types of dynamic flows in the phase space near an invariant set;

(6) the development of methods of orbital stability and rigidity theory of trajectories of general dynamical and celestial-mechanical systems;

(7) the extraction of stable motions and rigid trajectories with the use of variational principles of mechanics.

In these directions, Shestakov obtained important results, which are a substantial contribution to qualitative theory and stability theory of dynamical systems. His ideas have been developed

by V. I. Zubov, L. A. Beklemisheva, Sh. R. Sharipov, Yu. N. Merenkov, V. N. Shchennikov, Yu. V. Malyshev, O. V. Dunaeva, N. A. Pan'kin, E. P. Korol'kov, and others. In particular, the Newton polyhedron construction suggested by Shestakov and related to the extraction of polynomials homogeneous in the extended sense became a foundation of further research in the resolution of complex singular points of polynomial and analytic differential systems.

Shestakov is the author of more than two hundred scientific publications, including four monographs in stability theory of motion, and seven textbooks in mathematical sciences.

Shestakov pays great attention to and puts much effort into mathematical education and the preparation of highly qualified scientists. He is an active member of several scientific councils; for many years he was a member of the scientific-methodological council in mathematics at the State Committee of Education of the USSR. Since 1968 Shestakov has been in charge of a scientific seminar in stability theory and qualitative theory of dynamical processes, where many theses have been certificated. Shestakov supervised seven doctors of sciences and more than 30 philosophy doctors in differential equations and theoretical mechanics.

Aleksandr Andreevich takes an active part in social and scientific life; he is Editor-in-Chief of inter-institute collections of scientific papers on problems of qualitative theory and stability and rigidity theory of trajectories of dynamical systems and problems in the dynamics of railway trains.

Shestakov's scientific results in the field of differential equations are widely recognized by Russian and foreign scientists.

Shestakov has numerous government awards.

We wish Aleksandr Andreevich Shestakov good health and further success.

V. A. Il'in, V. V. Rumyantsev, and A. A. Samarskii

LIST[1] OF SHESTAKOV'S PUBLICATIONS

1990

Obobshchennyi pryamoi metod Lyapunova dlya sistem s raspredelennymi parametrami (The Generalized Direct Lyapunov Method for Systems with Distributed Parameters), Moscow: Nauka.

Asymptotic Properties of Solutions of Nonautonomous Functional-Differential Equations (together with Merenkov, Yu.M. and Shatokhin, M.M.), *Differents. Uravn.*, vol. 26, no. 8, pp. 1351–1358.

Ustoichivost' dvizheniya: metod predel'nykh uravnenii (Stability of Motion: the Method of Limit Equations) (together with Kato, D. and Martynyuk, A.A.), Kiev: Naukova dumka.

The Construction of Lyapunov Functionals for Systems of Partial Differential Equations (together with Nekhai, S.N.), *Problemy dinamiki podvizhnogo sostava i ustoichivosti dvizheniya dinamicheskikh sistem* (Problems of Dynamics of Railway Trains and Stability of Motion of Dynamical Systems), Collection of Scientific Works, Moscow: VZIIT, pp. 79–83.

The Semigroup Approach to the Investigation of Stability of Some Classes of Partial Differential Equations (together with Lisovskii, E.V.), *Ibid*, pp. 120–125.

Generalizations of La Salle and Marachkov Theorems (together with Golechkov, Yu.I.), *Ibid*, pp. 128–132.

Stabilization of Motion of an Evolution Control Equation in a Hilbert Space (together with Novikova, O.G.), *Ibid*, pp. 139–142.

1991

Teoriya ustoichivosti: pryamoi metod Lyapunova dlya beskonechnomernykh dinamicheskikh protsessov: Kurs lektsii (Stability Theory: Direct Lyapunov Method for Infinite-Dimensional Dynamic Processes. Course of Lectures), Saransk: Mordovian University.

---

[1] For the beginning of the list, see *Differentsial'nye Uravneniya*, 1980, vol. 16, no. 3 and 1990, vol. 26, no. 7.

State of the Art of the Generalized Direct Lyapunov Method for Deterministic and Nondeterministic Distributed Systems (together with Merenkov, Yu.N.), *Sovremennye problemy upravleniya, ustoichivosti i kolebanii nelineinykh mekhanicheskikh sistem zh.d. transporta* (Modern Problems of Control, Stability, and Oscillations of Nonlinear Mechanical Systems of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: VZIIT, part 1, pp. 4–12.

The Stability of Linear Differential Equations with an Unbounded Operator in a Hilbert Space (together with Lisovskii, E.V.), *Ibid*, pp. 49–54.

The Localization Method for the σ-Limit Set of a Fuzzy Semidynamical System on the Basis of Upper Semicontinuous Lyapunov Functionals (together with Malysheva, I.A.), *Ibid*, pp. 101–104.

The Localization of the Limit Set of an Asymptotically Autonomous D^+-Process (together with Karpukhin, V.B.), *Sovremennye problemy upravleniya, ustoichivosti i kolebanii nelineinykh mekhanicheskikh sistem zh.d. transporta* (Modern Problems of Control, Stability, and Oscillations of Nonlinear Mechanical Systems of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: VZIIT, part 2, pp. 15–18.

The Stability of Equilibrium of a Fuzzy Semidynamical System on the Basis of Continuously Differentiable Lyapunov Functionals (together with Blistanova, L.D.), *Ibid*, pp. 18–21.

A Theorem on the Localization of the Limit Set of Solutions of a Monotone D^+-System with the Use of the Lyapunov Operator (together with Novikova, O.G.), *Ibid*, pp. 41–45.

1992

The Asymptotic Stability of Motion for a Certain Class of Partial Differential Equations (together with Merenkov, Yu.N.), *Tez. dokl. VIII konf. "Kachestvennaya teoriya differentsial'nykh uravnenii"* (Abstr. VIII Conf. "Qual. Theory of Diff. Eqs."), Samarkand: Samarkand University.

Asymptotic Properties of a Functional-Differential Equation (together with Novikova, O.G.), *Problemy mat. obespecheniya sovershenstvovaniya tekhn. sredstv zh.d. transporta* (Problems of Mathematical Support for Developing Technical Equipment of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: VZIIT, part 1, pp. 33–36.

Lyapunov Functionals for Functional-Differential Equations (together with Shchennikov, V.N.), *Ibid*, pp. 55–59.

The Asymptotic Stability of a Functional–Differential Equation (together with Golechkov, Yu.I.), *Ibid*, pp. 69–73.

Periodic Solutions of Ordinary Nonlinear Differential Equations (together with Karpukhin, V.B.), *Ibid*, pp. 74–79.

Lyapunov Exponents of Motions of a Dynamical System in a Hilbert Space (together with Merenkov, Yu.N.), *Problemy mat. obespecheniya sovershenstvovaniya tekhn. sredstv zh.d. transporta* (Problems of Mathematical Support for Developing Technical Equipment of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: VZIIT, part 2, pp. 33–37.

A Refinement of the Theorems of the Classical Lyapunov Direct Method for Functional-Differential Equations (together with Shchennikov, V.N.), *Ibid*, pp. 43–46.

1993

Stabilization Problems for Dynamical Systems, *Problemy mat. obespecheniya ustoichivosti, stabiliziruemosti i dolgovechnosti zh.d. ustroistv* (Problems of Mathematical Support for the Stability, Stabilization, and Longevity of Railway Equipment), Inter-Institute Collection of Scientific Works), Moscow: VZIIT, pp. 11–13.

The Structure of a Neighborhood of a Simple Singular Point of a System of Differential Equations, *Ibid*, pp. 3–5.

The Asymptotic Stability of a Singularly Perturbed System with a Homogeneous Principal Part (together with Shchennikov, V.N.), *Ibid*, pp. 13–16.

Stability Types of an Equilibrium and Decay Degrees of Solutions of an Infinite-Dimensional Linear Equation with an Unbounded Operator (together with Merenkov, Yu.N. and Dunaeva, O.V.), *Ibid*, pp. 28–31.

Stability Criteria for a Homogeneous Linear Differential Equation in Banach Space (together with Dunaeva, O.V.), *Ibid*, pp. 48–49.

Generalized Petrovskii–Nemytskii Theorem (together with Merenkov, Yu.N.), *Ibid*, pp. 51–53.

The Measure of the Robust Stability Region for Linear Equations in a Banach Space (together with Dunaeva, O.V.), *Ibid*, pp. 77–80.

The Limit Sets of Solutions of a Functional-Differential Equation and Their Localization with the Use of Lyapunov Functionals (together with Shchennikov, V.N.), *Dinamica sistem i upravlenie* (Dynamics of Systems and Control), Inter-Institute Collection of Scientific Papers, Saransk: N. P. Ogarev Mordoviya State University, pp. 5–8.

The Boundedness of Solutions of a Functional-Differential Equation on the Basis of Lyapunov–Razumikhin Functions (together with Blistanova, L.D.), *Ibid*, pp. 8–12.

Attainability of the Maximal Exponent of a Dissipative System with Infinitely Many Degrees of Freedom, *Tez. dokl. XXIX nauch. konf. f-ta fiz.-mat. i est. nauk* (Abstr. XXIX Sci. Conf. of Department of Phys.-Math. and Nat. Sciences), Moscow: RUNF.

Matematicheskoe modelirovanie: Uchebn. posobie (Mathematical Modeling. Textbook) (together with Golechkov, Yu.I.), Moscow: VZIIT, part 1.

Matematicheskoe modelirovanie: Uchebn. posobie (Mathematical Modeling. Textbook) (together with Golechkov, Yu.I.), Moscow: VZIIT, part 2.

1994

A Variational Property of Solutions of a Linear Nonhomogeneous Equation in a Banach Space, *Tez. dokl. XXX nauch. konf. f-ta fiz.-mat. i est. nauk; Ch. 2. "Mat. sektsii"* (Abstr. XXX Sci. Conf. of Department of Phys.-Math. and Nat. Sciences. Part 2: Mathematical Sessions), Moscow: RUNF, p. 28.

On the Method of Center Manifold in Bifurcation Theory of Differential Equations in a Banach Space, *Ibid*, p. 29.

The Stability of Motion of a Mass System with Distributed Parameters (together with Dunaeva, O.V.), *Ibid*, p. 64.

A Remark to the Theory of Boundedness of Solutions with Respect to Some of the Variables for Nonlinear Systems of Differential Equations (together with Shchennikova, E.V.), *Tez. dokl. mezhdunar. konf. "Differentsial'nye uravneniya i ikh prilozheniya"* (Abstr. Int. Conf. "Diff. Eqs. and Their Applications"), Saransk, p. 16.

On Program Control Problem Solution (together with Shchennikova, E.V.), *Abstracts Int. Conf. on Interval and Computer Algebraic Methods in Science and Engineering* (Interval March 7–10, 1994), St.-Petersburg, p. 217.

The Localization of the Positive Limit Set of Solutions of Functional-Differential Equations with the Use of Lyapunov Functionals (together with Golechkov, Yu.I.), *Metody teorii differentsial'nykh uravnenii* (Methods of the Theory of Differential Equations), Collection of Scientific Works, Deposited in VINITI 12.01.94, no. 108–V94, pp. 2–6.

The Stability of a Homogeneous Linear Differential Equation with an Unbounded Operator in Banach Space (together with Shchennikov, V.N.), *Ibid*, pp. 7–12.

The Boundedness of Solutions of Functional-Differential Equations on the Basis of Lyapunov–Krasovskii Functionals (together with Blistanova, L.D.), *Ibid*, pp. 15–19.

A Sufficient Condition for the Absence of Asymptotic Stability for a Differential Equation in the Complex Domain (together with Stepanov, A.N.), *Ibid*, pp. 29–31.

<center>1995</center>

Variational Properties of Solutions of Linear Equations in a Banach Space, *Vestn. RUNF. Ser. Matematika*, no. 2, pp. 90–95.

C^1-Preservation of Attraction Domain of Asymptotic Stability of an Equilibrium for a Nonlinear Dynamical System Under Small Perturbations (together with Dunaeva, O.V.), *Tez. dokl. XXXI nauch. konf. f-ta fiz.-mat. i est. nauk, posvyashch. 35-letiyu RUNF. Ch. 1: "Mat. sektsii"* (Abstr. XXXI Sci. Conf. of Department of Phys.-Math. and Nat. Sci. dedicated to the 35th anniversary of RUNF. Part 1: "Math. Sessions"), Moscow: RUNF, p. 41.

Bifurcations of Stationary Solutions of a Nonlinear Evolution Equation in a Banach Space, *Ibid*, p. 52.

Variational Methods for the Investigation of Stability of Motion in Problems of Mechanics and Physics, *Ibid*, p. 53.

The Stability of a Soliton for the Nonlinear "Long-Wave" Equation, *Tez. dokl. XXXI nauch. konf. f-ta fiz.-mat. i est. nauk, posvyashch. 35-letiyu RUNF. Ch. 2: "Fiz. sektsii"* (Abstr. XXXI Sci. Conf. of Department of Phys.-Math. and Nat. Sci. dedicated to the 35th anniversary of RUNF. Part 2: "Phys. Sessions"), Moscow: RUNF, p. 62.

The Instability of Solitons for Two Classes of Nonlinear Wave Equations (together with Dunaeva, O.V.), *Ibid*, p. 63.

Types of Motion Stability of Mechanical Systems (together with Dunaeva, O.V.), *Tez. dokl. nauchno-metod. konf. "Sovremennye nauchnye aspekty funktsionirovaniya transportnogo compleksa i razvitie ego kadrovogo potentsiala"* (Abstr. Scientific-Methodological Conf. "Modern Scientific Aspects of Operation of Transport System and Development of Its Personnel Possibilities"), Moscow: RSOTUCM, pp. 69–70.

On Motion Rigidity in the Zhukovskii Sense (together with Dunaeva, O.V.), *Ibid*, p. 70.

Controllability, Observability, and Stabilization of Complex Systems in Fuzzy Media, *Ibid*, p. 74.

The Boundedness of Solutions with Respect to Some of the Variables (together with Shchennikova, E.V.), *Ibid*, p. 75.

In Memory of Nikolai Andreevich Pan'kin (together with Demchenko, A.T.), *Matematicheskie metody i zadachi funktsionirovaniya sistem zh.d. transporta* (Mathematical Methods and Problems of Operation of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, pp. 3–4.

The Structural Stability and Instability of a Nonlinear Dynamical System (together with Dunaeva, O.V.), *Ibid*, pp. 19–22.

Lyapunov Stability and Instability Preservation for an Equilibrium of a Nonlinear Dynamical System (together with Dunaeva, O.V.), *Ibid*, pp. 73–75.

A Remark to the Theory of Boundedness of Solutions to Nonlinear Systems of Differential Equations with Respect to Some of the Variables (together with Shchennikova, E.V.), *Mat. Modelirovanie*, vol. 5, no. 5, p. 84.

Stability-Like Properties of an Autonomous Functional-Differential Equation on the Basis of Lyapunov Functions (together with Shchennikov, V.N.), *Vestn. Mord. Un-ta*, no. 3, pp. 61–63.

Numerical Methods (together with Golechkov, Yu.I.), *Programma, metodicheskie ukazaniya i kontrol'nye zadaniya dlya studentov spetsial'nosti 071900. Informatsionnye sistemy v ékonomike* (Program, Methodological Recommendations, and Test Exercises for Students of the Speciality 071900 "Information Systems in Economics"), Moscow: VZIIT.

1996

Stability of Motion and Variational Principles of Dynamics (together with Galiullin, A.S.), *Vestn. RUNF. Prikl. Matematika i Informatika*, no. 2, pp. 20–28.

Asymptotic Properties of Motions of a Dynamical System (together with Galiullin, A.S.), *Optimal'noe funktsionirovanie, sokhranenie ustoichivosti i nadezhnost' sistem zh.d. transporta* (Optimal Operation, Stability Preservation, and Reliability of Railway Transport Systems), Inter-Institute Collection of Scientific Works, M: RSOTURT, pp. 72–74.

The Relationship between the Lyapunov Stability and the Poincaré Stability for Motions of a Stationary Dynamical System (together with Dunaeva, O.V.), *Dokl. RAN*, vol. 351, no. 1, pp. 48–51.

Phase Asymptotic Stability of the Omega-Limit Set of a Lyapunov Stable Motion of a Nonlinear Stationary Dynamical System (together with Dunaeva, O.V.), *Dokl. RAN*, vol. 351, no. 3, pp. 332–334.

Stability of Motion of Nonautonomous Systems (Method of Limiting Equations) (together with Kato, J. and Martynyuk, A.A.), Gordon and Breach Publishers, Stability & Control: Theory, Methods & Applications Series, vol. 3.

Criteria for the Asymptotic Zhukovskii Rigidity and Nonrigidity of Motion (together with Dunaeva, O.V.), *Tez. dokl. II mezhdunar. konf. "Aktual'nye problemy razvitiya zh.d. transporta"* (Abstr. II Int. Sci.-Tech. Conf. "Topical Problems of the Development of Railway Transport"), Moscow: MITE, vol. 2, pp. 56–57.

Criterion for the Two-Sided Lyapunov Stability of an Everywhere Dense Motion of a Dynamical System (together with Dunaeva, O.V.), *Ibid*, pp. 65–66.

Conservation of the Critical and Critically Repelling Manifolds Under Bounded Perturbations of a Linear Equation (together with Dunaeva, O.V.), *Tez. dokl. pervoi mezhvuz. nauchno-metod. konf. "Aktual'nye problemy i perspektivy razvitiya zh.d. transporta"* (Abstr. I Inter-Institute Sci.-Methodological Conf. "Topical problems and Perspectives of the Development of Railway Transport"), Moscow: RSOTURT, part 1, pp. 141–145.

A Criterion for the Existence of Zhukovskii Rigid Periodic Motion of a Nonstationary Differential Equation (together with Dunaeva, O.V.), *Ibid*, pp. 146–149.

Prochnost' dvizheniya mekhanicheskikh sistem (Rigidity of Motion of Mechanical Systems) (together with Dunaeva, O.V.), Moscow: PAIMS-RUNF.

On Definitions of Stability of Mechanical Systems (together with Galiullin, A.S.), *Tez. dokl. XXXII nauch. konf. f-ta fiz.-mat. i est. nauk; Ch. 2. "Mat. sektsii"* (Abstr. XXXII Sci. Conf. of Department of Phys.-Math. and Nat. Sciences. Part 2: Mathematical Sessions), Moscow: RUNF, pp. 15–16.

The Existence of an Exponentially Rigid Periodic Motion of a Dynamical System (together with Dunaeva, O.V.), *Ibid*, pp. 21–22.

Theory of Zhukovskii Rigidity of Motion and the Jacobi Variational Principle (together with Dunaeva, O.V.), *Ibid*, pp. 33–34.

Averaging on an Infinite Interval on the Basis of the Zhukovskii Asymptotic Rigidity of Motion (together with Dunaeva, O.V.), *Ibid*, pp. 34–35.

Variational Principles of Dynamics and Motion Stability (together with Galiullin, A.S.), *Ibid*, pp. 35–36.

Sufficient Condition for the Asymptotic Rigidity of an Unbounded Motion of a Dynamical System (together with Dunaeva, O.V.), *Tez. dokl. mat. konf. "Eruginskie Chteniya-III"* (Abstr. Math. Conf. "Erugin Readings-III"), Brest, Belarus, p. 72.

Chaotic Nonrigidity of Trajectories in Deterministic Mechanical Systems (together with Dunaeva, O.V.), *Ibid*, p. 73.

Stability Types and Rigidity of Motion of Dynamical Systems in a Riemann Space (together with Dunaeva, O.V.), *Optimal'noe funktsionirovanie, sokhranenie ustoichivosti i nadezhnost' sistem zh.d. transporta* (Optimal Operation, Stability Preservation, and Reliability of Railway Transport Systems), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, pp. 63–66.

Diskretnaya matematika: Rabochaya programma i kontrol'naya rabota dlya studentov-zaochnikov spetsial'-nosti 220100. Vychislitel'nye mashiny, kompleksy, sistemy i seti (Discrete Mathematics: Work Program and Test for Correspondence Students of the Speciality 220100 "Computers, Their Complexes, Systems and Networks"), Moscow: RSOTURT.

1997

Extremal Criteria for the Poincaré Stability (together with Galiullin, A.S.), *Tez. dokl. XXXIII nauch. konf. f-ta fiz.-mat. i est. nauk; Ch. 2. "Mat. sektsii"* (Abstr. XXXIII Sci. Conf. of Department of Phys.-Math. and Nat. Sciences. Part 2: Mathematical Sessions), Moscow: RUNF, p. 22.

State of the Art of the Theory of Zhukovskii Rigidity (together with Galiullin, A.S.), *Ibid*, p. 23.

A Theorem on the Rigidity of Motion on the Basis of Concavity (together with Dunaeva, O.V.), *Ibid*, p. 33.

On the Notions of Orbital Stability and Phase Stability of a Motion of a Dynamical System (together with Dunaeva, O.V.), *Dokl. RAN*, vol. 355, no. 3, pp. 339–341.

Criteria for the Zhukovskii Rigidity and Asymptotic Strength of a Motion (together with Dunaeva, O.V.), *Tez. dokl. mezhdunar. mat. konf. "Eruginskie Chteniya-IV"* (Abstr. Int. Math. Conf. "Erugin Readings-IV"), Vitebsk, Belarus, pp. 97–98.

Nekotorye voprosy teorii prochnosti dvizheniya po Zhukovskomu (Some Problems of the Theory of Zhukovsii Rigidity of Motion) (together with Dunaeva, O.V. and Bochkarev, P.M.), Textbook, Saransk: Saransk Cooperative Institute of Moscow University of Customer Cooperation.

Vysshaya matematika. Mnozhestva i prostranstva (Higher Mathematics. Sets and Spaces) (together with Sindalovskii, G.Kh.), Textbook, Moscow: RSOTURT.

1998

The Notions of Orbital Stability and Rigidity of Trajectories of Dynamical Systems, *Kolebaniya, prochnost' i ustoichivost' dvizheniya v zadachakh mekhaniki transportnykh sistem* (Oscillations, Strength, and Motion Stability in Problems of Mechanics of Transport Systems), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, pp. 4–8.

The Method of Exponents for the Investigation of the Dynamic Rigidity of an Invariant Set (together with Dunaeva, O.V.), *Ibid*, pp. 27–32.

Estimates for Solutions of an Ordinary Differential Equation (together with Matvienko, A.M.), *Ibid*, pp. 104–105.

The Rigidity of the Set of Permanent Rotations of a Gyrostat (together with Dunaeva, O.V.), *Tez. dokl. XXXIV nauch. konf. f-ta fiz.-mat. i est. nauk. "Mat. sektsii"* (Abstr. XXXIV Sci. Conf. of Department of Phys.-Math. and Nat. Sciences. "Mathematical Sessions"), Moscow: RUNF, p. 22–23.

The Rigidity of the Set of Equilibria of a Moving Ball (together with Dunaeva, O.V.), *Ibid*, pp. 23–24.

Rigidity Exponents of an Invariant Set of a Nonstationary Differential Equation (together with Duna-eva, O.V.), *Tez. dokl. mezhdunar. mat. konf. "Eruginskie Chteniya-V"* (Abstr. Int. Math. Conf. "Erugin Readings-V"), Mogilev, Belarus, p. 25.

The method of the Family of Zubov–Lyapunov Functions for the Rigidity Analysis of the Invariant Set of a Dynamical System (together with Dunaeva, O.V.), *Sovremennye problemy sovershenstvovaniya raboty zh.d. transporta* (Modern Problems of Improvement of Railway Transport Operation), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, part 1, pp. 54–58.

On the Construction of Rigidity Zones in Problems of Celestial Mechanics (together with Dunaeva, O.V.), *Sovremennye problemy sovershenstvovaniya raboty zh.d. transporta* (Modern Problems of Improvement of Railway Transport Operation), Inter-Institute Collection of Scientific Works, Moscow: RSOTUCM, part 2, pp. 36–39.

Development of the Method of Topographic Surfaces for the Investigation of the Global Structure of the Neighborhood of an Equilibrium (together with Dunaeva, O.V.), *Ibid*, pp. 39–43.

Diskretnaya matematika. Ch. 1. Chetkie i nechetkie mnozhestva. Algebraicheskie struktury i kody (Discrete Mathematics. Part 1. Fuzzy and Unfuzzy Sets. Algebraic Structures and Codes) (together with Duna-eva, O.V.), Teaching Book, Moscow: RSOTURT.

1999

The Instability of an Equilibrium by the First Approximation for a Stationary Nonlinear Equation in a Hilbert Space (together with Druzhinina, O.V.), *Differents. Uravn.*, vol. 35, no. 6, p. 840.

Conservation of Stability for Conditionally Periodic Motions Under Small Perturbations of the Hamiltonian (together with Dunaeva, O.V.), *Tez. dokl. XXXV Vseros. nauch. konf. po problemam fiziki, khimii, matematiki, informatiki i metodiki prepodavaniya* (Abstr. XXXV Russian Sci. Conf. on Problems of Physics, Chemistry, Mathematics, Computer Science, and Teaching Methods), Moscow: RSOTURT, pp. 28–29.

The Poisson Stability of Gravitation Systems (together with Dunaeva, O.V.), *Tez. dokl. chetvertoi mezhvuz. nauchno-metod. konf. "Aktual'nye problemy i perspektivy razvitiya zh.d. transporta"*, (Abstr. 4th Inter-Institute Sci.-Methodol. Conf. "Topical Problems and Perspectives of Railway Transport Development"), Moscow: RSOTURT, part 2, pp. 91–92.

The Generalized Lyapunov Direct Method for Ordinary Differential Equations (together with Meren-kov, Yu.N.), *Ibid*, pp. 92–94.

Diskretnaya matematika. Ch. 2. Nechetkie grafy i nechetkie otnosheniya (Discrete Mathematics. Part 2. Fuzzy Graphs and Fuzzy Relations) (together with Dunaeva, O.V.), Teaching Book, Moscow: RSOTURT.

Vysshaya matematika. Topologicheskie struktury (Higher Mathematics. Topological Structures) (together with Dunaeva, O.V.), Teaching Book, Moscow: RSOTURT.

The Stability of Invariant Compact Sets (together with Merenkov, Yu.N.), *Ustoichivost', prochnost' i nadezh-nost' sistem podvizhnogo sostava zh.d. transporta* (Stability, Strength, and Reliability of Moving Systems of Railway Transport), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, pp. 4–7.

The Investigation of Asymptotic Properties with the Use of Generalized Lyapunov Direct Method (together with Druzhinina, O.V.), *Ibid*, pp. 14–16.

The Growth Character of Solutions of a Second-Order Differential Equation (together with Zakharova, M.V.), *Ibid*, pp. 36–38.

The Strengthening Method for Solutions of Differential Equations and Its Applications (together with Druzhinina, O.V.), *Sovremennye problemy sovershenstvovaniya raboty zh.d. transporta* (Modern Problems of Improvement of Railway Transport Operation), Inter-Institute Collection of Scientific Works, Moscow: RSOTURT, pp. 144–146.

Svoistva ogranichennosti i ustoichivosti nekotorykh klassov dinamicheskikh sistem (Boundedness and Stability Properties of Some Classes of Dynamical Systems) (together with Shchennikov, V.N. and Shchennikova, E.V.), Deposited in VINITI 26.04.99, no. 1315–V99, Moscow.

Ustoichivost' i stabilizatsiya nelineinykh upravlyaemykh dinamicheskikh protsessov (Stability and Controllability of Nonlinear Control Dynamical Processes) (together with Bashmakov, I.G. and Shchennikov, V.N.), Deposited in VINITI 04.10.99, no. 2988–V99, Moscow.

Diskretnaya matematika. Ch. 3. Vvedenie v nechetkuyu arifmetiku (Discrete Mathematics. Part 3. Introduction to Fuzzy Arithmetic) (together with Druzhinina, O.V.), Teaching Book, Moscow: RSOTURT.