Pergamon

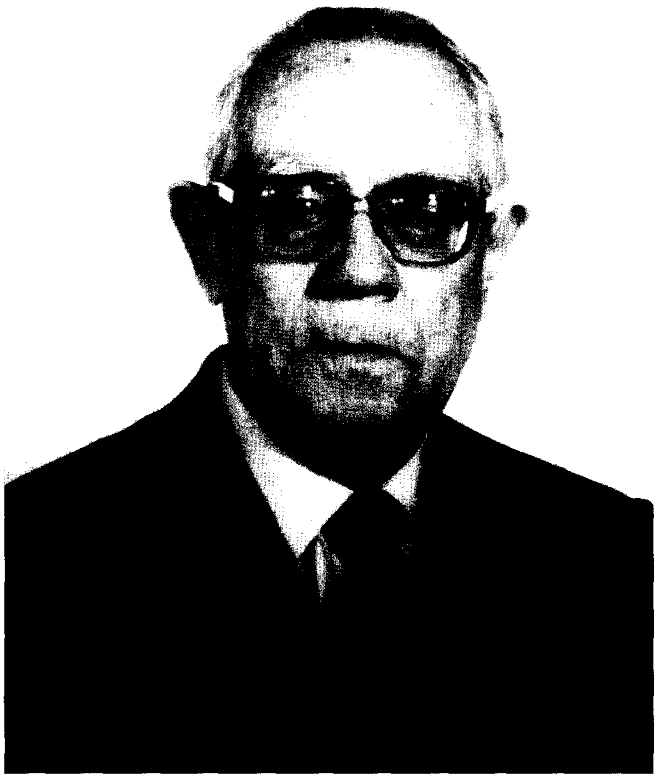
www.elsevier.com/locate/jappmathmech

J. Appl. Maths Mechs, Vol. 65, No. 4, pp. 531–541, 2001

0021-8928/01/$—see front matter

PII: S0021-8928(01)00059-4

VALENTIN VITAL'YEVICH RUMYANTSEV (80TH BIRTHDAY TRIBUTE)†



On 19 July 2001, Valentin Vital'yevich Rumyantsev, an outstanding scientist of his time, member of the Russian Academy of Sciences, Head of the Department of Mechanics of the Computing Centre of the Russian Academy of Sciences, Honorary Professor of Moscow State University, and Editor-in-Chief of the journal Prikladnaya Matematika i Mekhanika, celebrated his 80th birthday.

Professor Rumyantsev is recognized world-wide as a leader in the field of analytical mechanics and the theory of stability of motion. His name is primarily associated with the development of the theory of stability of motion of bodies with cavities containing liquid, and the theory of stability with respect to a part of the variables. Many fundamental results in the field of analytical mechanics and the dynamics of rigid bodies were also obtained by him.

The key influence in shaping his scientific interests and his entire future destiny can be attributed to his teacher, an outstanding scientist and pedagogue Nikolai Gur'yevich Chetayev. Rumyantsev became not only a worthy scientific successor to his unforgettable teacher but also actively continued his work.

Rumyantsev's scientific results and the methods he developed have been widely used in various fields of science and engineering. His monographs 'The Dynamics of Rigid Bodies with Cavities Containing Liquid' (1965, coauthor with N. N. Moiseyev), 'The Stability of the Steady Motions of Satellites' (1967), 'The Dynamics and Stability of Rigid Bodies' (1972), 'The Stability of Conservative and Dissipative Systems' (1983, coauthor with A. V. Karapetyan) and 'The Stability and Stabilization of Motion with Respect to a Part of Variables' (1987, coauthor with A. S. Oziraner), many of which have long been a bibliographic rarity, are reference books for many Russian and foreign specialists on theoretical and applied mechanics, the stability theory and rigid body dynamics.

†*Prikl. Mat. Mekh.* Vol. 65, No. 4, pp. 547–556, 2001.

His contributions have been recognised by many awards. In 1950 he was awarded the Prize of the Presidium of the Academy of Sciences of the USSR for developments in new technology, and in 1958 he was awarded the Chaplygin Prize of the Academy of Sciences of the USSR for his work on rigid body dynamics. In 1980 he was the winner of the State Prize of the USSR for his work on the dynamics of rigid bodies with cavities containing liquid, and in 1996 he was the winner of the State Prize of the Russian Federation for his work on the dynamics of rigid bodies on a string and related problems. In 1970, he was elected a corresponding member of the Academy of Sciences of the USSR and in 1992 he was elected a full member of the Russian Academy of Sciences.

His scientific activity has received international recognition. In 1995 he was elected a corresponding member of the International Astronautical Academy, and then in 2000 a full member of this academy. In 1996 he was honoured with the Humboldt Prize. In 1997 he was elected a foreign member of the Serbian Academy of Sciences and Arts and was honoured with the International K. and A. G. Agostinelli Prize for Theoretical and Applied Mechanics and for Mathematical Physics of the Italian Accademia Nazionale dei Lincei.

In the difficult years of Perestroika, his scientific standing and also his purposefulness and focus on the final result enabled him to gather around him a group of leading specialists on theoretical and celestial mechanics, who worked with him on various scientific and training projects. He has taken an active part in the implementation of many projects within the framework of different competitions run by national and international scientific trusts, and has headed a number of these projects. They include projects of the International Science Foundation, INTAS, the Russian Foundation for Basic Research, the Federal Special-Purpose "Integration" programme, the "Leading Scientific Schools" programme of the Russian Foundation for Basic Research (a grant from the President and Government of the Russian Federation). As a result, he managed not only to retain but also to double the strength of the scientific team he headed at the Computing Centre of the Russian Academy of Sciences, recruiting new talented young people interested in science.

The school of analytical mechanics and stability theory that he has set up includes a group of brilliant specialists and is at the leading edge of these fields of research. Among his numerous pupils, both in Russia and abroad, over 60 have presented dissertations, almost one-third of them doctoral dissertations. Many of his pupils hold leading scientific positions in their countries.

Professor Rumyantsev is now concentrating his efforts on the further development of general methods of analytical mechanics. In a published group of papers, Chetayev's theory, based on Poincaré's remarkable idea concerning the use of Lie groups for describing the motion of holonomic systems, has been considerably developed. Poincaré's and Chetayev's original equations are based on groups of Lie operators of virtual and real displacements of holonomic systems. A generalization of these equations is given for closed systems of operators, the commutator of which is determined by variable structural coefficients, unlike Lie groups for which the coefficients are constant. The relation between the generalized Poincaré and Chetayev equations and the basic equations of analytical dynamics was demonstrated, and it was shown that Chetayev's canonical equations are Hamilton equations in non-canonical variables. The Poincaré equations can be used for non-holonomic systems, for which, however, the system of operators of virtual displacements is not closed, whereas for holonomic systems it is. The generalized equations obtained describe both holonomic and non-holonomic systems in generalized coordinates and in quasi-coordinates, including in redundant variables, and in this sense they are general equations of dynamics.

It was proved that systems of generalized Lagrange and Hamilton equations in redundant coordinates and also Boltzmann–Hamel equations in redundant quasi-coordinates are special cases of the Poincaré–Chetayev equations, the theory of which is thereby extended to the systems named. It was shown that, under conditions when an energy integral can exist, the operator $\partial/\partial t$ satisfies the Chetayev cyclic displacement conditions. Using the energy integral, the order of the system of equations is reduced, generalized Jacobi equations are derived from Poincaré's equations, and Whittaker's equations are derived from Chetayev's equations. The equivalence to generalized Poincaré–Chetayev equations of all known equations of motion of holonomic and non-holonomic systems, that is, the Voronets, Hamilton, Appel, Maggi, Volterra, Kane, etc. equations was shown.

The equations of motion of rigid bodies in Rodrigues–Hamilton variables were also derived in the form of Poincaré–Chetayev equations, and the applicability of the latter to relative motion was shown. The equations of motions of an axisymmetric gyrostat over a rough surface were derived in the form of Poincaré equations and, in particular, it was shown that these equations reflect, in projections onto the axes of a stereonodal system of coordinates, the theorem of the angular momentum about a moving point of contact of a gyrostat with a plane.

Various forms of the Hamilton principle for non-holonomic systems, proposed for linear relations of Hölder, Voronets and Suslov, were investigated. In the general case of non-linear relations, it was shown that these forms are equivalent and transform into one another; an expression was given for these forms in quasi-coordinates, and their expressions corresponding to canonical equations were also given.

Professor Rumyantsev continues to manage active organizing work in science. He is a member of the National Committee of the Russian Federation on Theoretical and Applied Mechanics, Deputy Chairman of the Scientific Council of the Russian Academy of Sciences on the Problem of "General Mechanics", Editor-in-chief of the journal *Prikladnaya Matematika i Mekhanika* and a member of the Department of Problems of Mechanical Engineering, Mechanics and Control Processes of the Russian Academy of Sciences. He also continues to teach in the Department of Mechanics and Mathematics of Moscow State University, is running a special course, supervising post-graduate students and, together with V. V. Beletskii and A. V. Karapetyan, holds a scientific seminar on analytical mechanics and stability theory.

He plays an active part in the organization of practically all national and many international scientific forums on mechanics and the stability of motion. In particular, he has been Chairman or a member of the Scientific Committee of all Chetayev Conferences on "Problems of Analytical Mechanics and Motion Control" which are held every five years, Chairman of the "Analytical Mechanics and Stability of Motion" Section of All-Union congresses on theoretical and applied mechanics, a coordinator and lecturer at the International Scientific School at the International Centre for Research on Mechanics in Udine (Italy), an invited speaker at three World Congresses of Non-Linear Analysts (1992, 1996, 2000), and so on.

His scientific teaching and social activity has been recognized by numerous government awards – orders and medals.

The scientific community, his pupils, and the editorial board and editorial staff of the journal *Prikladnaya Matematika i Mekhanika* send their sincere best wishes to Valentin Vital'yevich Rumyantsev on his birthday and wish him health and continued success in his many productive activities.

A LIST OF THE MAIN SCIENTIFIC PUBLICATIONS OF V. V. RUMYANTSEV

1949

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1954

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1955

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1956

The stability of permanent rotations of a heavy rigid body. *Prikl. Mat. Mekh.*, 1956, **20**, 1, 51–66.

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1961

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The motion of certain systems with non-ideal constraints. *Vestn. MGU. Ser. Matematika, Mekhanika*, 1961, 5, 67–75.

On systems with friction. *Prikl. Mat. Mekh.*, 1961, **25**, 6, 969–977.

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Translated by P.S.C.