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FIFTH INTERNATIONAL SYMPOSIUM ON CLASSICAL AND CELESTIAL MECHANICS (23–28 August 2004, Velikiye Luki)

V. N. TKHAI

The symposium was organized by the Department of Power Engineering, Mechanical Engineering, Mechanics and Control Processes of the Russian Academy of Sciences, the A. A. Dorodnitsyn Computer Centre of the Russian Academy of Sciences, the M. V. Lomonosov Moscow State University and the Moscow Aviation Institute. The Chairman of the committee setting up and running the symposium was V. V. Rumyantsev; his deputies were P. S. Krasil'nikov, S. Ya. Stepanov and V. N. Tkhai, and the Scientific Secretary was I. I. Kosenko.

The symposium was held in a picturesque location close to the town of Velikiye Luki.

At the symposium, 133 papers were presented by 145 researchers in the field of mechanics from Russia, Georgia, Kazakhstan, the Ukraine, Uzbekistan, France, Germany, Great Britain, Italy, Mexico and Poland. The Moscow mechanics school was strongly represented. An appreciable number of the papers were given by young scientists, including postgraduates and students.

The scientific programme included plenary sessions (A), minisymposia at joint meetings of the three sections (B), minisymposia within the framework of the classical mechanics section (C), minisymposia within the framework of celestial mechanics (D), and minisymposia within the framework of the modelling of dynamics section (E). Common to all participants of the symposium were minisymposia B1 (Methods of Classical and Celestial Mechanics) and B2 (Applied problems of Classical and Celestial Mechanics).

Section C included minisymposia C1 (Analytical Mechanics), C2 (Stability of Motion), C3 (Regular and Chaotic Dynamics), C4 (Vibrations of Mechanical Systems), C5 (Solid-state Dynamics), C6 (Dynamics of Systems of Rigid and Deformable Bodies), and C7 (Non-holonomic Systems and Systems with Friction). Section D included minisymposia D1 (Three- and N-Body Problems), D2 (Studies on the Dynamics of Bodies of the Solar System), D3 (Dynamics of the Rotational and Relative Motion of Celestial Bodies), and D4 (Dynamics of the Orbital Motion of Satellite Systems). Section E included mini-symposia E1 (Modelling of the Dynamics of Systems of Rigid and Deformable Systems) and E2 (Various Problems of the Modelling of Dynamics).

We will give a brief outline of the papers delivered at the sessions of Sections A and B.

V. V. Beletskii and A. S. Kuleshov (Moscow). "The Dynamics of the rotational motion of a spacecraft in a light flux". The relative motion of a dynamically symmetrical satellite, when its centre of mass moves in a circular heliocentric orbit, is studied using averaged equations. The satellite is equipped with vanes skew-symmetrically installed in propeller form and with a symmetrical solar stabilizer.

A. V. Borisov and I. S. Mamayev (Izhevsk). "Tensor invariants and mechanisms of transfer into chaos in non-holonomic dynamical systems". The problem of the existence in non-holonomic systems of different tensor invariants such as integrals, fields of symmetries, an invariant pair, and a Poisson structure, is investigated.

A. A. Burov (Moscow). "Steady motions of systems restricted by unilateral constraints". The problem of extending Routh's theory on the existence and stability of steady motions to mechanical systems restricted by unilateral constraints is considered.

V. G. Vil'ke (Moscow). " The motion of a snake over a rough plane". The dynamics of the longitudinal motion of a flexible inextensible thread (a snake) along a prescribed curve described by a second-order differential equation with various restrictions on the moments of the internal forces and types of

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trajectory is investigated. It is assumed that the motive force is a maximum and independent of the position of the body of the snake on the trajectory.

Ye. A. Grebennikov and N. I. Zemtsova (Moscow). "The problem of the Lyapunov stability of new stationary in celestial mechanics". Algorithms are given for finding the stationary solutions of restricted n-body problems ($n=6, 7, 10, 14$). Estimates are obtained of the parameters of problems that guarantee stability (instability) of positions in relation to equilibrium.

A. M. Kovalev (Donetsk). "Hess's integral". The results are of an investigation of a Hess gyroscope, starting with the derivation of Hess's solution and ending with final work on chaos, non-integrability and the existence of a fourth integral, are described.

I. I. Kosenko (Moscow). "An objective model of the dynamics of systems of rigid bodies: rolling, impacts and friction". A procedure for presenting the dynamics of systems of rigid bodies in computer modelling is examined. Particular attention is paid to non-holonomic systems. Modelica language and a Dymola visual compiler are used.

P. S. Krasil'nikov (Moscow). "A. Poincaré and classical mechanics". A brief outline is given of Poincaré's main results in classical and celestial mechanics.

S. P. Kuznetsov (Saratov). "Renormalization group analysis of types of critical behaviour connected with quasi-periodic dynamics". The renormalization group method is applied to systems which allow of decomposition into two subsystems – a master subsystem with quasi-periodic dynamics and a slave subsystem capable of demonstrating transition to chaos.

A. Maciejewski and M. Przybilska (Zelena Gura, Sorhiya Antipolis). "All meromorphically integrable 2D Hamiltonian systems with homogeneous potential of 3 and 4." The necessary and sufficient conditions for the integrability of Hamiltonian systems with two degrees of freedom are given.

A. P. Markeyev (Moscow). "A design method for investigating the stability of Hamiltonian systems and its application in certain problems of classical and celestial mechanics". An algorithm is proposed for obtaining the conditions of stability of the equilibrium positions and periodic motions of Hamiltonian systems. The algorithm uses simplex mapping generated by differential equations of perturbed motion.

D. Yu. Pogorelov (Bryansk). "Problems of the computer modelling of the dynamics of systems of bodies: numerical methods and algorithms". Algorithms for the computer modelling of the dynamics of systems of absolutely rigid bodies with a large number of degrees of freedom, implemented in the "Universal Mechanism" software package are considered.

V. S. Sergeyev (Moscow). "The maximum periodic motions in systems with hysteresis, described by Volterra-type integral differential equations". In the dynamics of non-linear systems with hysteresis, subject to perturbations, the limit periodicity of every motion is proved (provided there is asymptotic stability of the linearized system). The limiting motion itself exponentially approaches periodic motion of a Volterra-type integrol differential equation.

J. J. Slawlanowski (Warsaw). "Classical and quantized dynamics of deformable bodies". Problems of the application of group methods to the dynamic of systems of bodies are discussed. A quantization procedure is proposed.

S. Ya. Stepanov (Moscow). "Conditions of equilibrium and stability of a satellite with a rotor and a load suspended from it on a tether in a circular orbit". Special symmetrized Silvester and Mann criteria of the sign-definite nature of symmetric quadratic forms are demonstrated. These results are applied to the satellite problem.

C. Tebaldi (Turin). "Low-dimensional analysis by proper orthogonal decomposition". A procedure is given in which the analysis of the system reduces to investigating a system of lower dimension. A proposed orthogonal decomposition is used. Applications of the method are given.

V. N. Tkhai (Moscow). "Periodic motions of a reversible mechanical second-order system. Application to Sitnikov's problem". A complete theory of the symmetric periodic motions of a reversible second-order system, covering both vibrations and rotations, is proposed. The theory is applied to Sitnikov's problem.

D. P. Chevallier (Paris). "Some mathematical aspects of the screw theory in mechanics (in memory of F. M. Dimentberg)". It is shown how the methods developed by F. M. Dimentberg can be summed up in "Euclidean module" theory over a ring of double numbers.

The symposium was supported financially by the Russian Foundation for Basic Research (04-01-10083-g). Every year, beginning with the first symposium in 1994, the symposium has been supported by two enterprises in Velikiye Luki – the 'ELVO' Chemical Combine Open Joint Stock Company (President B. N. Karakayev) and the 'ZETO' Closed Joint Stock Company (General Director N. N. Kozlovskii). With the facilities thus provided, the symposium was a fruitful and a very enjoyable experience for all those taking part.

Translated by P.S.C.