Evolution Equations of Translational-Rotational Motion of an Axisymmetric Satellite with Variable Oblateness

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The long-term evolution of translational-rotational motion of an axisymmetric satellite with variable oblate in the central gravitational field are obtained. Newton's interaction force is characterized by an approximate expression of the force function up to the second harmonic. The body masses vary isotropically at different rates. The axes of the own coordinate system of the nonstationary axisymmetric body are directed along the principal axes of inertia of the body and we assume that in the course of evolution their relative orientation remains unchanged. Doing necessary symbolic computations, we obtain the equations of motion of the satellite in terms of the canonical osculating Delaunay-Andoyer elements. Using the methods of canonical perturbation theory, a particular case of the problem is investigated in detail, when the reactive forces and additional torques are equal to zero. Equations of the translational-rotational motion of the satellite in osculating analogues of Delaunay-Andoyer elements are described. Equation of motion consists of twelve nonautonomous first-order equations that are canonical. In the case when there is no resonance, the evolutionary equation is obtained by double averaging according to the Gaussian scheme. The evolutionary equation decomposes into a system of four first-order differential equations with one first integral, the solution of which determines the evolution of the system. On the basis of these equations establish some qualitative analysis of motion. All necessary symbolic calculations are performed using the Wolfram Mathematica computer algebra system.

Keywords
translational-rotational motion, an axisymmetric satelite, evolution equation

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