Quasi-static Motions of Viscoelastic Satellites in the Gravitational Field. Problems of Stability and Nonlinear Oscillations

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We consider a motion of viscoelastic satellite. Assuming that the stiffness of the spacecraft is large and the dissipation parameter is small enough, we study the quasi-static motion, which is set after free elastic oscillations have damped. We describe an approach to construct and investigate the equations of quasi-static motion. The approach is a synthesis of the normal mode method and asymptotic methods. As an example we study planar quasi-static motions of a rigid body with a thin viscoelastic circular ring attached at some point of the body. In particular, the stability of the equilibrium positions in a circular orbit as well as the stability of eccentricity oscillations in a weakly elliptic orbit is investigated. Steady-state motions in the weakly elliptic orbit are also found and the conditions of their stability are given.