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TWO SPHERICAL BODIES WITH NON-ISOTROPICALLY VARYING MASSES IN THE PRESENCE OF REACTIVE FORCES

M.Zh. Minglibayev[1], A.T. Ibraimova[2,*]

[1]Al-Farabi Kazakh National University, Almaty, Kazakhstan
[2]Fesenkov Astrophysical Institute, Almaty, Kazakhstan
* ibraimova@aphi.kz

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Real celestial bodies are unsteady, their masses, sizes, shapes and structures change in the process of evolution. The consequences of the variable masses of celestial bodies, especially during the nonstationary stage of the gravitational system are poorly studied [1, 2].

We considered gravitational system consisting of two spherical celestial bodies with variable masses in the relative coordinate system with the origin in the center of the more massive body. The masses of the bodies decreases due to the separating particles and increases due to the joining (sticking) particles. In this case, in general, the relative velocity of separating particles from the body differs from the relative velocity of joining (sticking) particles to the body. The general case where the body masses do not change isotropically at different rates, in the presence of reactive forces, was studied.

The derived equations of motion of the two-body problem with variable masses in the presence of reactive forces are generally very complicated. Therefore, we investigated the problem by perturbation theory based on aperiodic motion along the quasi-conic section developed for such nonstationary gravitating systems [2, 3]. To study our problem of two bodies with variable masses varying non-isotropically at different rates in the presence of reactive forces in the relative coordinate system, we used the perturbed motion equations in Newton form [4]. In the dynamics of gravitationally-bound systems, during the evolution, the perturbed analogue of the eccentricity of aperiodic motion along the quasi-conic section remains less than unity $e(t)<1$ for a long time. In this case it is convenient to use the following system of oscillatory elements *a, e, i,* π , Ω , λ . Here *a, e, i,* π , Ω , λ are analogs of Keplerian dynamic elements, *a* - analog of the semi-major axis, *e* - analog of eccentricity, *i* - analog of orbit inclination to the plane, π - analog of pericenter longitude, Ω - analog of ascending node longitude, $\lambda = M + \pi$ - analog of mean longitude in the orbit. The obtained equations of perturbed motion, in the form of Newton's equations, in various systems of osculating variables can be effectively used in the study of the dynamics of nonstationary gravitational systems.

Averaging over the mean longitude, we obtained evolution equations of the two-body problem with variable masses in the presence of reactive forces, which are quite simple, easy to calculate.

From the equations for the analogue of the semi-major axis and eccentricity we obtained the exact analytic integral, which has a very simple form $a^3e^4 = const$.

The derived evolution equations of the two-body problem with variable masses in the presence of reactive forces will be used to study binary systems with variable masses.

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