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Perturbations in the restricted three-body problem of variable mass

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Real space systems are nonstationary, their masses, sizes, shapes changes in the process of evolution [1-3], as a result their mathematical models become more difficult. Modern computer algebra allows new symbolic computation algorithms for obtaining evolutionary equations. The restricted three-body problem with non-isotropically varying masses in the presence of reactive forces was investigated. Astronomical observations determine the reactive forces in the orbital coordinate system, so the perturbation theory in the form of Newton's equation was used [4]. The expansion of perturbing forces needs time-consuming and very cumbersome analytical calculations. We obtained expansions of the perturbing function in the orbital coordinate system. In the nonresonant case, averaging over the mean longitude, we obtained the equations of secular perturbation of the restricted three-body problem with variable masses in the presence of reactive forces. All analytical calculations are done in Wolfram Mathematica [5].

Keywords
restricted three-body problem, variable mass, reactive forces, secular perturbations

References

[1] T. OMAROV (ED.), *Non-Stationary Dynamical Problems in Astronomy*. Nova Science Publ., New-York, 2002.
[2] M. MINGLIBAYEV, *Dynamics of gravitating bodies with variable masses and sizes*. LAMBERT Academic Publishing, Saarbrücken, 2012.
[3] A. PROKOPENYA; M. MINGLIBAYEV; S. SHOMSHEKOVA, Computing Perturbations in the Two-Planetary Three-Body Problem with Masses Varying Non-isotropically at Different Rates. *Mathematics in Computer Science* **14**(2), 241–251 (2020).
[4] M. MINGLIBAYEV; CH. OMAROV; A. IBRAIMOVA, New forms of the perturbed motion equation. *RNAS RK* **2**(330), 5–13 (2020).
[5] S. WOLFRAM , *An Elementary Introduction to the Wolfram Language*. Wolfram Media, New York, 2016.