

Studying the Stability of Equilibrium Solutions in the Planar Restricted Rour-Body Problem

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In the present paper we consider an autonomous Hamiltonian system of the fourth order and study stability of its equilibrium solutions. It should be noted that this problem can be solved only in a strict nonlinear formulation on the basis of Arnold-Moser theorem. Besides, in the case of the third or fourth order resonance the corresponding Markeev's theorem should be applied. In both cases it is assumed that the Hamiltonian has been preliminarily reduced to the normal form up to the fourth order in perturbations. As an example we consider a planar restricted four-body problem formulated on the basis of the Lagrange triangular solutions of the three-body problem. We have developed an algorithm for constructing a real-valued canonical transformation normalizing the Hamiltonian and implemented it with the computer algebra system Mathematica. We have shown that there is a curve in a plane of the system parameters along which conditions of Arnold-Moser theorem are not fulfilled and to prove stability of equilibrium solutions we had to normalize the Hamiltonian up to the sixth order in perturbations.