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Title: *"Study of the roto-translational dynamics using intermediaries: numerical experiments"*

Abstract. The present work deals with the roto-translational motion of an axisymmetric rigid body, considering this body under the influence of a central gravitational field. Following Ferrándiz and Sansaturio, a Hamiltonian formalism is considered based on the total angular momentum and the canonical variables associated, and the model is shaped as a perturbation of the Keplerian motion plus the free-rotation of a rigid body, where the elimination of the nodes is used to reduce two degrees of freedom of the problem. Despite this, the system of equations of motion is non-integrable. The concept of intermediary Hamiltonian is then used to propose a simplification of the system which is integrable in terms of elliptical integrals. An alternative procedure proposed by one of the authors may be followed identifying a second model, where now the canonical transformation known as elimination of the parallax is used before the process of building of a second intermediary Hamiltonian. This second intermediary becomes integrable in terms of elementary functions. As part of the full two-body dynamics, different values of the parameters: relative masses of the bodies and the shape of the rigid body, are considered to visualize possibilities of applications to problems such as binary asteroids and artificial satellite attitude propagation. Numerical experiments are made to compare the order of approximation of the two intermediary Hamiltonians with respect to the full model under the MacCullagh approximation. In all the cases considered in the numerical simulations, both models present good precision after hundreds of orbits for a system with a rigid body in an eccentric relative orbit, with some advantage for the model with elimination of the parallax.

Joint work with Sebastián Ferrer (Universidad de Murcia – Spain) and Daniel J. Scheeres (University of Colorado – USA).