The motion of a gyrostat in a central gravitational field: phase portraits of an integrable case

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In this paper we describe the Hamiltonian dynamics, in some invariant manifolds of the motion of a gyrostat in Newtonian interaction with a spherical rigid body.

Considering the first integrable approximation of this roto-translatory problem, by means of Liouville-Arnold theorem and some specifics techniques, we obtained a complete topological classification of the phase flow associated to this system.

The action-angle variables regions are obtained. These variables allow us to calculate the modified Keplerian elements of this problem useful to elaborate a perturbation theory.

The results of this work have a direct application to the study of two body roto-translatory problems where the rotation of one of them influences strongly in the orbital motion of the system. In particular, we can apply these results to binary asteroids.