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Coorbital motion in the co-planar RTBP: family of Quasi-satellite periodic orbits

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Abstract

In the framework of the Restricted Three-body Problem (RTBP), we consider a primary whose mass is equal to one, a secondary on circular or eccentric motion with a mass ϵ and a massless third body. The three bodies are in coplanar motion and in co-orbital resonance. We actually know three classes of regular co-orbital motions: in rotating frame with the secondary, the tadpole orbits (TP) librate around Lagrangian equilibria L_4 or L_5; the horseshoe orbits (HS) encompass the three equilibrium points L_3, L_4 and L_5; the quasi-satellite orbits (QS) are remote retrograde satellite around the secondary, but outside of its Hill sphere.

Contrarily to TP orbits which emerge from a fixed point in rotating frame, QS orbits emanate from a one-parameter family of periodic orbits, denoted family-f by Henon (1969). In the averaged problem, this family can be understood as a family of fixed points. However, the eccentricity of these orbits can reach high values. Consequently a development in eccentricity will not be efficient. Using the method developed by Nesvorny et al. (2002) which is valid for every values of eccentricity, we study the QS periodic orbits family with a numerical averaging.

In the circular case, I will present the validity domain of the average approximation and a particular orbit. Then, I will highlight an unexpected result for very high eccentricity on families of periodic orbits that originate from L_3, L_4 and L_5. Finally, I will sketch out an analytic method adapted to QS motion and exhibit associated results in the eccentric case.