Ejection-collision orbits in some models of two degrees of freedom in Celestial Mechanics

Esther Barrabés, Universitat de Girona
E-mail address: esther.barrabes@udg.edu.

We study the mechanism that explain the birth of ejection-collision orbits in some models of two degrees of freedom in Celestial Mechanics. Ejection-collision orbits are solutions that start at (eject from) a total collision of the particles involved and go back to a total collision after some time. The models considered are planar, have two degrees of freedom, two equilibrium points, and the total collision manifold $\mathcal{C}$ is topologically equivalent to an sphere minus four points. For example, the Symmetric Collinear Four Body Problem (SC4BP) [2, 5], the Collinear Three Body Problem (C3BP) [4], the Rectangular Four Body Problem (R4BP) [5] or the Rhomboidal Four Body Problem (Rh4BP), [3]. In all of these problems, the knowledge of the dynamics on the total collision manifold is crucial to prove the existence of ejection-collision orbits. The main roles are played by two hyperbolic equilibrium points that live in $\mathcal{C}$, and their invariant manifolds. We review the ideas that lead the proof of the existence of the ejection-collision orbits, and in the case of the SC4BP we present a methodology to compute them numerically.

References

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