On the structure of the sets of heteroclinic connections between libration points and some applications

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Abstract: Heteroclinic connections in the spatial circular restricted three-body problem are well recognized for their significance role in astrodynamics. These connections, which occur at the intersections between hyperbolic manifolds of invariant sets, offer zero-propellant transfer opportunities, making them crucial not only for mission design but also for understanding the system's global dynamical behavior. Some previous work in computing systematically these solutions for the spatial problem can be found in [**?**, **?**].

Our work is based on the results presented in [**?**], where heteroclinic connections between the center manifolds of the libration points L_1 and L_2 are computed using a semianalytical strategy. These connections, when intersected with a surface of section, are found to be a two-sphere topologically. Our work focuses on assessing the accessibility of these spheres from the tori of the center manifolds of both libration points. We provide results on the specific connectivity of each torus and show global connection diagrams of the isoenergetic slices of the center manifolds. Sample connections performing inclination changes of quasi-periodic orbits around L_2 are also provided.

References:

[1] G. Gómez, W. S. Koon, M. W. Lo, J. E. Marsden, J. Masdemont, and S. D. Ross. Connecting orbits and invariant manifolds in the spatial restricted three-body problem. *Nonlinearity, 17(5):1571–1606.* (2004)

[2] L. Arona and J. J. Masdemont. Computation of heteroclinic orbits between normally hyperbolic invariant 3-spheres foliated by 2-dimensional invariant tori in Hill's problem. *Discrete Contin. Dyn. Syst., (Dynamical Systems and Differential Equations. Proceedings of the 6th AIMS International Conference, suppl.):64–74.* (2007)

[3] Barcelona, M., Haro, A., Mondelo, J. M. Semianalytical computation of heteroclinic connections between center manifolds with the parameterization method. *SIAM Journal on Applied Dynamical Systems, 23(1): 98–126.* (2024)