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Topological Existence of Periodic Orbits in a Two-Center Symmetric Pair Problem

The Two-Center Symmetric Pair Problem, derived from the Rhomboidal Symmetric-Mass problem by fixing one symmetric pair, limits, as the mass of the non-fixed symmetric pair goes to zero, to the integrable Euler Two-Center Problem (with the centers having equal mass). Standard KAM Theory indicates that many of the quasi-periodic orbits found in the integrable limit case persist for small values of the mass of the non-fixed symmetric pair. Through topological methods, we investigate the existence of several periodic orbits in the Two-Center Symmetric Pair Problem with and without collisions when the mass of the symmetric pair is not necessarily close to zero.