

Computing and validating collisions, ejections, and homoclinics for the three body problem

Shane Kepley

Abstract

Understanding connecting and collision/ejection orbits is central to the study of transport in Celestial Mechanics. We present an collection of algorithms combining the Parameterization Method with rigorous numerical techniques for solving initial boundary value problems in order to find and validate connecting orbits. These parameterizations are ill-conditioned when parameterizing orbits passing near a singularity such as “near miss” homoclinics or ejection/collision orbits. In this talk we present a method of overcoming this obstacle based on rigorous Levi-Civita regularization which desingularizes the vector field near the primaries. This regularization is performed dynamically allowing invariant manifolds to be parameterized globally, even near singularities.