Shoot the Moon

Wang Sang Koon, Martin W. Lo, Jerrold E. Marsden, Shane D. Ross

In 1991, the Japanese Hiten mission used a low energy transfer with a ballistic capture at the Moon which required less $\triangle V$ than a standard Hohmann transfer to the Moon. In this paper, we apply the same dynamical systems techniques used to produce the "Petit Grand Tour" of Jovian moons to reproduce a Hiten-like mission. We decouple the Sun-Earth-Moon-Spacecraft 4-body problem into two 3-body problems. Using the invariant manifold theory of the Lagrange points of the 3-body systems, we are able to construct low energy transfer trajectories from the Earth and ballistic capture trajectories at the Moon. The techniques used in the design and construction of this trajectory may be applied in many situations.