

# Transfer from the Earth to a Lissajous Orbit around the Collinear Libration Point by Lunar Swingby

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**Abstract:** Collinear libration points of the restricted three body problem (RTBP) play a key role in deep space exploration, due to the fact that they're ideal locations for the spacecraft (such as SOHO) with special purposes. The nominal orbit of the spacecraft is conditionally stable but virtually unstable, and will exponentially diverge from the nominal orbit under small perturbations. If the spacecraft is inserted to the stable manifold associated with the collinear libration points, it will approach the nominal orbit without any more propulsion, and the total  $\Delta v$  will be reduced. For the nominal orbit of small amplitude, the manifold could not approach the Earth, in this case direct transfer from the parking orbit (such as LEO) around the vicinity of the Earth to the manifold will be impossible. Nevertheless, in the real solar system, Lunar bends some manifolds, so makes them approach the Earth. Based on this consideration, this paper takes the transfer of a spacecraft around L1 of the Sun-Earth system as an example and study the Lunar effect in the transfer of the spacecraft. We give out some numerical simulations, and acquire some useful results.

**Key words:** Collinear libration point, stable manifold, Lunar swingby