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RELATIVE MOTION BETWEEN HYPERBOLIC TRAJECTORIES

Abstract

Whereas relative motion between spacecraft in elliptical orbits has been widely studied, the case of hyperbolic trajectories has not received much attention and, in fact, is not found in the literature. Nevertheless, this problem could prove important for interplanetary missions involving two or more spacecraft on hyperbolic paths with respect to an object of interest. For example, sensor data from the vehicles could be combined to form a distributed sensor; analytical representations of the relative vehicle motion would be useful in the analysis and design of such a mission. This work employs a second-order solution for relative motion originally intended for application to elliptical orbits; however, the formulation is not limited to eccentricities less than unity. The results show that the solution gives accurate approximations, suitable for use in optimization studies where minimizing range-rate between spacecraft is required for a distributed-sensor mission.