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Hohmann Transfer and Bi-Elliptic Hohmann Transfer in TRAPPIST-1 System

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Abstract : In orbital mechanics, an active research topic is the calculation of interplanetary trajectories efficient in terms of energy and time. In this sense, this work concerns the calculation of the orbital elements for sending interplanetary probes in the extrasolar system TRAPPIST-1. Specifically, using the mathematical expressions of the circular and elliptical trajectory parameters, expressions for the flight time and the orbital transfer rate increase between orbits, the orbital parameters and the graphs of the trajectories of Hohmann and Hohmann bi-elliptic for sending a probe from the innermost planet to all the other planets of the studied system, are obtained. The relationship between the orbital transfer rate increments and the relationship between the flight times for the two transfer types is found. The results show that, for all cases under consideration, the Hohmann transfer results to be the least energy and temporary cost, a result according to the theory associated with Hohmann and Hohmann bi-elliptic transfers. Saving in the increase of the speed reaches up to 87% was found, and it happens for the transference between the two innermost planets, whereas the time of flight increases by a factor of up to 6.6 if one makes use of the bi-elliptic transfer, this for the case of sending a probe from the innermost planet to the outermost.

Keywords : bi-elliptic Hohmann transfer, exoplanet, extrasolar system, Hohmann transfer, TRAPPIST-1
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