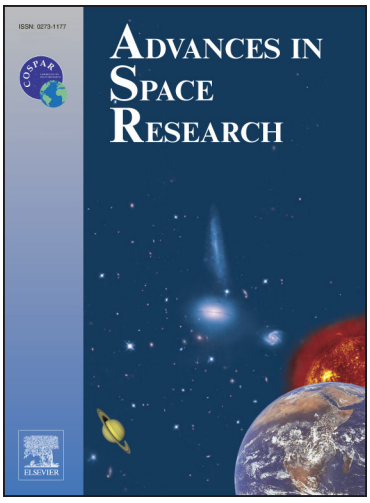

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Two-Phase Shaping Approach to Low-Thrust Trajectories Design Between Coplanar Orbits

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Abstract

To rapidly design low-thrust trajectories between coplanar orbits for the orbit transfer and rendezvous problems, an analytic shape-based approach is proposed. Unlike all of the existing analytic shape-based approaches, the trajectory is divided into two phases. The finite Fourier series functions are employed to shape each phase of the trajectories. As a result, the fitting performance for the transfer and rendezvous trajectories by using the proposed method is improved. Consequently, the proposed approach can provide solutions with less fuel consumption and smaller maximum thrust acceleration. In addition, the trajectory safety is also ensured by the proposed method. The effectiveness of the proposed approach is validated by extensive numerical simulations.

Keywords: Rapid trajectory design; Shape-based method; low-thrust trajectory; Transfer and rendezvous problems

1. Introduction

Due to the advantages of high specific impulse, long lifetime and high control precision Gondelach & Noomen (2015) of low-thrust engines, low-thrust orbit transfer and rendezvous is getting more and more attention Di Carlo et al.

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