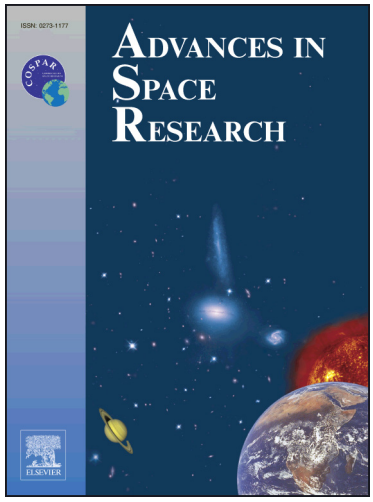

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Solar Sail Equilibria with Albedo Radiation Pressure in the Circular Restricted Three-Body Problem

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Abstract

Solar Radiation Pressure (SRP) and albedo effects are investigated in the circular restricted three-body problem for a system consisting of the Sun, a reflective minor body and a solar sail. As an approximation of albedo radiation pressure (ARP), the minor body is treated as Lambertian with reflected flux scattered by the bidirectional reflectance distribution function. Incorporating the ARP, which is inherently a function of SRP, into solar sail equations of motion renders additional artificial equilibrium points in a volume between the L_1 and L_2 points which is defined as the region of influence. Based on the model, characterization of the findings are provided that are theoretically applicable to any body with discernible albedo such as for instance Earth, Mars or an asteroid. Example results are presented for a Sun-Vesta system which show that inclusion of ARP generates artificial equilibrium points requiring solar sail designs with very low mass-to-area ratio. In general the equilibrium points are found to be unstable but asymptotic stability may be enforced with sail attitude feedback control.

Keywords: Solar sail; Restricted three-body problem; Albedo; Lambertian; Region of influence

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