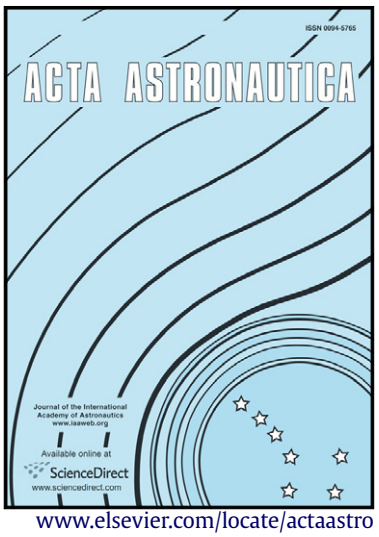

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Modeling Tether-Ballast Asteroid Diversion Systems, Including Tether Mass and Elasticity

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Abstract

The risk of an impact between a large asteroid and the Earth has been significant enough to attract the attention of many researchers. This paper focuses on a mitigation technique that involves the use of a long tether and ballast mass to divert an asteroid. When such a tether is modeled as massless and inelastic, results show that the method may be viable for diverting asteroids away from a collision with the Earth; the next step towards demonstrating the viability of the approach is to conduct a study which uses a more realistic tether model. This paper presents such a study, in which the tether models include tether mass and elasticity. These models verify that a tether-ballast system is capable of diverting Earth-threatening asteroids. Detailed parametric studies are presented which illustrate how system performance depends on tether mass and elasticity. Also, case studies are presented which show how more realistic models can aid in the design of tether-ballast asteroid mitigation systems. Key findings include the dangers imposed by periods during which the tether goes slack and ways to preclude this.

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