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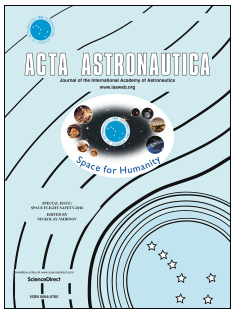

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Effect of Mass Variation on Dynamics of Tethered System in Orbital Maneuvering

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Abstract

In orbital maneuvering, the mass variation due to fuel consumption has an obvious impact on the dynamics of tethered system, which cannot be neglected. The contributions of the work are mainly shown in two aspects: 1) the improvement of the model; 2) the analysis of dynamics characteristics. As the mass is variable, and the derivative of the mass is directly considered in the traditional Lagrange equation, the expression of generalized force is complicated. To solve this problem, the coagulated derivative is adopted in the paper; besides, the attitude dynamics equations derived in this paper take into account the effect of mass variation and the drift of orbital trajectory at the same time. The bifurcation phenomenon, the pendular motion angular frequency, and amplitudes of tether vibration revealed in this paper can provide a reference for the parameters and controller design in practical engineering. In the article, a dumbbell model is adopted to analyze the dynamics of tethered system, in which the mass variation of base satellite is fully considered. Considering the practical application, the case of orbital transfer under a transversal thrust is mainly studied. Besides, compared with the analytical solutions of librational angles, the effects of mass variation on stability and librational characteristic are studied. Finally, in order to make an analysis of the effect on vibrational

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