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Author: Dr. Liang Sun
Beihang University, China

Dr. Guowei Zhao
Beihang University, China
Mr. Guanglie Yang
Beihang University, China
Prof. Hai Huang
Beihang University, China

MODELING AND DYNAMICS OF VARIABLE MASS TETHERED SYSTEM WITH CHEMICAL PROPULSION

Abstract

The tether satellite with chemical propulsion has broad application prospects in the disposal of abandoned satellite, the orbital rescue of spacecrafts, and the transportation of space supplies. Compared with the traditional applications of tethered satellites, the mass of tethered system is time varying due to fuel consumption; then correspondingly, the position of the mass center gradually removes, which leads to complex dynamic characteristics of tethered system. Hence, the research on the modeling and dynamics of variable mass tethered system has an important theoretical and practical significance. In this paper, based on the discrete element method and the Lagrange equation of variable mass system, dynamics equations of tethered system with chemical propulsion are established. Then, according to the propulsive coefficients, analytical solutions of the equilibrium position for librational angles are derived during orbital transfer. Meanwhile, the effects of the change of mass, the thrust acceleration and the tether length on librational stability are analyzed. Furthermore, the coupling effects between the tether librational and vibration characteristics are studied.