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Author: Mr. Marcel Becker
TU Braunschweig, Germany, marcel.becker@tu-braunschweig.de

Dr. Ingo Retat
EADS Astrium Space Transportation GmbH, Germany, ingo.retat@airbus.com
Prof. Enrico Stoll
TU Braunschweig, Germany, e.stoll@tu-braunschweig.de

TETHER ORBITAL PERTURBATIONS INFLUENCE DETERMINATOR

Abstract

This paper specifies the determination and the influence of the ballistic coefficient for tethered space systems, e.g. for active debris removal missions in low Earth orbit (LEO). Using a flexible (tethered) connection between the chaser satellite and a debris object it is possible to perform an active debris removal (ADR) mission. For a successful mission, a stabilisation and control of the tethered system is necessary. Therefore the development of control laws and equations of motion for the tethered system is indispensable. Due to the non negligible influence of the atmospheric drag, especially in lower LEO regimes, it is necessary to know the ballistic coefficient for the calculation to estimate applying drag forces. The ballistic coefficient of a tether can be described as a function o the tether length, its diameter, attitude and altitude. The calculation process is adapted from the Simplified General Perturbation Model 4 (SGP4) routines, so it can be assured to use SGP4 routines for following orbit determinations. To demonstrate the effect of the atmospheric drag on the tether, comparative calculations on the basis of an example mission are performed. The physical model of the example mission system consists of two idealized mass points (MChaser and MTarget) which are connected by a flexible tether. The combined ballistic coefficient of the mass points results from the geometry of a small satellite platform (e.g. Alphabus) and by selected values of high priority objects for an ADR mission. Through the comparative calculations, the influence of atmospheric drag, induced by a tether, during an ADR mission can be presented. Also a useful method for an estimation of expectable drag coefficients is given.