ASTRODYNAMICS SYMPOSIUM (C1)
Guidance, Navigation and Control - Part 1 (7)

Author: Mr. Ren Xianhai
College of Aerospace and Materials Engineering, National University of Defense Technology, China, rxh1205@hotmail.com

Prof. Yang Leping
National University of Defense Technology, China, z9812030@hotmail.com
Mr. ZHANG Yuanwen
China, zhangyuanwen1983@163.com

OPTIMAL TRAJECTORY FOR GEO SATELLITE PROXIMITY INSPECTION BASED ON HP-ADAPTIVE PSEUDOSPECTRAL METHOD

Abstract

Proximity inspection significantly contributes to improving GEO satellite cataloging ability and verifying GEO satellite failures. A simple and single purpose nanosatellite usually serves as the inspection spacecraft, whose relative orbit and attitude control systems are performed by thrusters. Considering the requirements of sensor-targeted spacecraft alignment, trajectory constraints and imaging quality, this involves the problem of coupled control of relative orbit and attitude, which is difficult to resolve due to the non-convex and nonlinear attitude dynamics. Proceeding from this problem and the objective of minimal maneuver energy consumption, this paper firstly sets an optimal continuous control model, which takes into consideration six constraints of attitude, concealment, safe, control, resolution and pixel smear. Secondly, the paper adopts hp-adaptive pseudospectral method to suggest a prompt coping strategy of dynamics constraint and trajectory constraint, transform the continuous control problem to discrete nonlinear design problem for solution and make a comparison with global pseudospectral method. Simulation results show that the optimal solutions concluded by the two pseudospectral methods are close, indicating the effectiveness of this algorithm to address the problem of coupled control of relative orbit and attitude and its higher computing efficiency, which serves as a testament to the applicability and efficiency of hp-adaptive pseudospectral method to solve multi-constraint problems.