IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IP)

Author: Dr. Wei Wang
China Aerospace Science & Industry Corporation (CASIC), China

Dr. Jianke Sha
Sichuan Institute of Aerospace System Engineering, China

GUIDANCE SYSTEM DESIGN AND VERIFICATION FOR THE SMALL COMMERCIAL ROCKET

Abstract

The rocket adopts the three-stage solid fuel and upper-stage liquid fuel to meet the commercial launch needs of micro-nano satellites. It has obvious advantages in response time, launch cost, maintenance, etc. However, the rocket also faces great challenges. This is because the solid motor inherently different in total mass, working time and thrust, and the multi-stage rocket is very complicated, and aerodynamic parameter is usually not accurate. For this reason, the rocket guidance strategy was first studied, and the guidance process was established. Subsequently, the energy management model for the aiming guidance section was developed, and the guidance system was improved. Finally, accurate evaluation was performed by single-impact factor and Monte Carlo calculations under the typical working conditions. The results show that: (1) the guidance strategy, which uses the program guidance in the first and second stages, the aiming guidance in the third stage, and the modified guidance in the final stage, can guarantee the orbit precise requirements of the micro-nano satellite;(2) the energy management model can identify and compensate the performance parameters of the solid motor, and meet the guidance requirements of the aiming guidance section; (3) the errors of the semi-major axis, eccentricity and orbital inclination of the micro-nano satellite are [50, 250]meters, [0, 0.0002] and [-0.001 , 0.001]degrees under the given conditions, respectively. The robustness and accuracy of the guidance method are ideal.