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RESEARCH ON ATTITUDE CONTROL OF LOW-ORBIT SATELLITE BASE ON AERODYNAMIC DRAG

Abstract

With the development of rapid response technology and space technology, in response to sudden natural disasters on the demand for rapid high resolution imaging, low-orbit spacecraft, especially low-orbit satellite have been used increasingly widely, aerodynamics is a main force in low-orbit space environment, but it has been seen as disturbing torque usually. In this dissertation, I have studied the attitude control method based on the aerodynamics of low-orbit spacecraft. The main contents of this dissertation are consisted of the following parts.First, for the need of using aerodynamics to control the attitude of low-orbit spacecraft, the structure of the spacecraft with atmospheric drag is designed. The kinematics and dynamics model of attitude is established base on profile parameters which has been chosen. The model of aerodynamics is analyzed quantitatively. The aerodynamic torque model is established base on the structure which has been designed. And the model is validated by simulate with simulink.Secondly, for the need of using linear aerodynamic model to study the attitude control, the attitude kinematics and dynamics model and the aerodynamic torque model that have been established is simplified and linearized. The linear dynamics model is derived by combining the simplified attitude kinematics and dynamics model and the linear aerodynamic torque model. a appropriate controller of PID is designed, the linear dynamics model is simulated with simulink. The simulation results show that the impact of orbital altitude is a major factor in aerodynamic torque and there is a scope of orbital altitude for the attitude control.Thirdly, for the need of using nonlinear aerodynamic model to study the attitude control, the system block diagram is designed and the simulation module is designed base on the system block diagram. The disturbances of the space environment are considered, a appropriate controller is designed and the model is simulated. The simulation results show that using aerodynamic torque to control attitude of low-orbit spacecraft at an appropriate orbit is feasible.