Paper ID: 56075
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18th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Impact-Induced Mission Effects and Risk Assessments (3)

Author: Mrs. LIU MIN
China Academy of Space Technology (CAST), China

Dr. George.Z.H. Zhu
York University, Canada

SPACE DEBIRS RISK ASSESSMENT AND PROTECTION SCHEME DESIGN BASED ON SPACE STATION

Abstract

With gradual increase in the activities of human space exploration, it makes such rapid growth in the number of space debris, as the current debris mitigation measures cannot effectively reduce the amount of space debris, it leads to increasing deterioration of Near-Earth orbit environment day by day. And this will undoubtedly increase the risk of the operation of the manned space station, and even influence the astronaut's life safety. China's "Tiangong" manned space station(CSS) will launch in the near future.CSS will operate in low earth orbit for about 10 years,so it will suffer attacks of space debris inevitably, which is very dangerous for the manned space station.Therefore,to reduce the risk of the space debris on the space station and the astronauts,it must generally consider the space debris protection based on the space station itself from the space station configuration size and orbit environment characteristics. Firstly, through the ORDEM, space debris environment on the space station's orbit is predicted ,obtain the surface flux distributions of the three kinds of space debris.The impact risk assessment results of various types of space debris under different operating attitude of space station system are obtained. Secondly,establish the rendezvous and docking coordinates and coordinates conversion relationship between space stations and space debris, construct the probability density function of location of the space station and space debris.Based on the above work and combining the error ellipsoid model,calculate the collision between space debris and space station,and forecast the probability of collision that may occur between space station and space debris. Finally, according to the acquired surface flux, collision flux and disruptive flux of the three kinds of space debris,propose the risk assessment methods of collision between space station and space debris ,the passive protection scheme of space debris for space station is designed. The breakdown probability of space station is evaluated by simulation analysis and physical experiment, and the suitable for space station is put forward.