MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

Author: Mr. Zhicheng Zhou
China Academy of Space Technology (CAST), China

Dr. Fuxiang Dong
China Academy of Space Technology (CAST), China
Mr. guangji qu
China

DEPLOYMENT DYNAMICS OF A LARGE DEPLOYABLE MESH ANTENNA CONSIDERING ANTI-ENTANGLEMENT TECHNIQUES

Abstract

The reliable deployment in orbit of a Large Deployable Mesh Antenna (LDMA) is the key of the success of space mission. The entanglement of truss and cable nets has become an important factor which induces the deployment failure of the large truss antenna. The proper measure of anti-entanglement of cable nets will help to insure the reliable deployment of the antenna. The gravity effects of cable nets in ground experiments are not eliminated during the LDMA's deployment process, thus the anti-entanglement technique of truss and cable nets will not be validated before the launch of satellite, so the venture of the entanglement between cable nets and truss is difficult to be evaluated. Since the in-orbit dynamic behavior of cable nets of LDMA's can't be exposed through ground experiments, it is necessary to prevent the coupling dynamic behavior of truss and cable nets during the in-orbit deployment of antenna by the numerical simulation. There are many challenges to simulate the in-orbit deployment behavior of LDMA accurately. The large deployable mesh antenna is a complex mechanism with numerous moveable parts, joints, the nonlinear flexible cable nets. During the deployment of LDMA, the interaction between the truss and cable nets such as their contact, impact and entanglement is complex, which brings a series of problems on the establishment and numerical simulation of dynamic equations. According to the deployment principle of LDMA, the coupling dynamics equations of truss and cable nets considering their contact and entanglement interactions are established, which is based on the recursive approach and absolute coordinate frame, and the corresponding numerical algorithm and software are also developed. The entanglement mechanism of cable nets is analyzed, and the corresponding factors which induce the entanglement between the cable nets and truss are concluded, finally some design suggestions on the anti-entanglement of cable nets of large space mesh antenna are given.