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Author: Mr. Shi Li
Aerospace System Engineering Shanghai, China, China, shilihit@163.com

A FEM-BASED METHOD RESEARCHING OF ORBIT PROPAGATION

Abstract

High precision orbit propagation is an important research area in aerospace. As the developments of space activities, such as rendezvous and docking, on orbit service, and formation flight, higher requirements are raised. On restriction to improve orbit propagation precision is the disturbances calculation precision. Equivalent areas and aerodynamic centers identifications are the difficulties in the disturbances calculation. In tradition, simplifications and omissions are always used of complex components to calculate the equivalent area and the aerodynamic center, which will reduce the precision. As a result, one way to improve orbit propagation precision is to reduce the disturbances calculation error. Some methods, which using beam or pixel, are researched. These two ways can calculate the equivalent area, while will be dealing with the across area calculation between triangular or quadrangle, resulting in a long computation time. To satisfy the real time requirement, a fast calculation method is raised. By this method, the less computation time is needed and the aerodynamic center can also be calculated. The calculation has six steps (Figure. 1): 1. Step 1: Building a 3-D aerospace model based on Pro/E or other CAD tools. 2. Step 2: Creating a STL file of the 3-D aerospace model. 3. Step 3: Reading the data of the STL file. 4. Step 4: Calculating projection points of the data in the disturbance plane. 5. Step 5: Calculating the contour line of projection points. 6. Step6: Calculating the equivalent area and the aerodynamic center. After calculating the equivalent area and the aerodynamic center, orbit propagation can be done then.