

MATERIALS AND STRUCTURES SYMPOSIUM (C2)

Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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DYNAMICS ANALYSIS AND DESIGN OF COILABLE MAST

Abstract

Coilable mast is a linear deployable structures which has the characteristics of small compact volume, high compaction factor, high reliability, high stiffness, low cost, etc. So it can be used for deployment mechanism of solar array, detecting arm, antenna, magnetometer, etc. The coilable mast consists of longeron, diagonal and batten. The batten consists of components perpendicular to the longitudinal ones and diagonal members. It can be stowed into a tight helix with a diameter equal to the diameter of the deployed mast by coiling the longerons and deployed relying on the stored elastic energy in the coiled longerons. The design of the coilable mast, including configuration, deployment control and detail design is discussed. According to the detail design, the paper presents the mechanical properties formula when the mast is deployed, and the dynamics model while deploying and coiling. The deploying and coiling simulation model, constructed by the method of discrete flexible link, has the characteristics of no-linear, large deformation and rigid-flexible coupling. A demonstration prototype has been assembled for a student microsatellite as a detecting arm: when compacted, the mast length is 0.055-m while 2-meter when deployed. Results of testing validate the design, analysis and simulation model of component and assembly functional, strength, stiffness, shape, and dynamic behavior.