MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

Author: Prof.Dr. Changguo Wang
Harbin Institute of Technology, China, wangcg1221@163.com

Dr. Zhenmeng Xia
Harbin Institute of Technology, China, xiazhenmeng@126.com
Prof. Huifeng Tan
Harbin Institute of Technology, China, tanhf@hit.edu.cn

BUCKLING AND WRINKLING OF INFLATABLE SUPPORT STRUCTURE OF DEPLOYABLE ANTENNA

Abstract

The inflatable support structure is the major load-carrying component for deployable antenna to resist the external loads. One of the keys to design a precision deployable antenna is to accurately evaluate the buckling characteristics of inflatable support structure. In this paper, the nonlinear buckling characteristics of inflatable support structure are evaluated using a proposed pseudo beam model. The local wrinkles are obviously observed in the buckling modes of inflatable support structure. A thin shell model is then used to predict the critical wrinkling load of an inflated beam. According to the wrinkling evolution, the bending-wrinkling mechanism of inflated beam is elucidated subsequently. The relationships of bending stiffness factor and bending-wrinkling factor versus wrinkling angle are also determined and evaluated. In the end, a bending-wrinkling experiment of inflated beam is performed to verify and elucidate the global and local buckling characteristics of inflatable support structure. Our results reveal that the global buckling results from the local wrinkles which may be considered as the critical case to design the load-carrying ability of inflatable support structure. For a wrinkled inflated beam under bending, the inflated pressure, the offset from central axis, the large deformation and the beam stiffness contribute to the total bending-wrinkling moments, which also reveal the bending resistance mechanism of inflated beam in bending. The results obtained in this paper are good references to the design of inflatable support structure of deployable antenna.