IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM (IP)

Author: Dr. Xiao Xiao
University of South China, China, brightxiao@163.com

Mr. Zhang Qiao
University of South China, China, 2282351154@qq.com

DISTRIBUTION OF ENERGY AND STRESS FOR WRINKLING AEROSPACE LAMINATED MEMBRANE STRUCTURES

Abstract

Mylar and Kapton membrane are the most common laminated membranes which widely used in large aerospace structures. When the laminated membranes are pressurized, wrinkles emerge, which have an important effect on the performance of the structures during operation. This paper describes the numerical investigation of wrinkles in laminated membranes. Firstly a comparative study on wrinkles of laminated membranes with the two membrane materials by nonlinear buckling method, direct interference method and dynamic display method respectively. Based on laminated thin-shell elements, these methods were used to simulate the onset, growth, and final configuration of wrinkles when laminated membranes are subjected to external loads. Compared with the experiment results, the most suitable method is proposed. Secondly the simulations are conducted with the proposed method and ABAQUS finite element package to rectangular and toroidal membrane models. For local regions and whole membrane, distribution of energy and stress concentration regions of two kinds of membranes under different grid densities and different loads are investigated. Changing regularities of number, wavelength, and range for the wrinkles during the onset and growth processes are also investigated. By comparing the results of numerical analysis and experimental results, the accuracy of the numerical analysis method was verified. This study work is expected to inform wrinkling simulation and shape control of aerospace laminated membrane structures.