

Flexible Loading Distributor Optimization Design for Tests of Thin-wall Stiffened Cylinder under Compression and Bend

***Bo Wang¹, Kaifan Du¹, Peng Hao¹, Bin Wang², Xi Zhang²**

¹ State Key Laboratory of Structural Analysis for Industrial Equipments, Department of Engineering Mechanics, Dalian University of Technology, Dalian, P. R. China,

² Beijing Institute of Astronautical Systems Engineering, Beijing, P. R. China

*Corresponding author: wangbo@dlut.edu.cn

Tests are a key link in launch vehicle design process. Generally, the inspected department is loaded by a distributor to test its mechanical properties. The real load is applied to the inspected department by its adjacent complicated segments, but the test load is applied by the strong stiffness, uniformity distributor. It results that the inspected department has strong constraint and uniform load. The load difference makes the accuracy of tests lower, especially in the large diameter thin-wall cylinder tests. This paper is aiming at the typical thin-walled cylindrical shell in launch vehicle through size optimization methods to design the overall stiffness of weaker distributor (flexible distributor), to reduce the load difference in the tests. First, the stiffness index of load difference is obtained by comparison of load distributing effects of adjacent segments and traditional distributors. Secondly, optimization problem is built based on traditional distributor structure, combined with stiffness index. Finally, the optimization problem is solved by the optimization algorithm (MIGA) and the target of reducing loads difference is achieved. A large number of numerical optimization is done aiming at stiffened cylinders under axial compression and bend load, and a general design method of flexible distributor for tests of thin-wall stiffened cylinders under compression and bend is obtained.

Keywords: Thin-walled Cylinders, Load Distributor, MIGA, Size Optimization