MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialised Technologies, Including Nanotechnology (8)

Author: Dr. Shanshan ZHAO
China Academy of Launch Vehicle Technology (CALT), China, zss_buaa@163.com

DIMENSIONLESS DESIGN METHOD RESEARCH FOR ANNULUS-SHAPED FLEXURE STRUCTURE USING IN SPACE-PRECISION-SYSTEM

Abstract

With the rapid development of aerospace engineering and precision engineering, flexure structures are increasingly applied in several fields. There are advantages that reducing number of parts for special function, one-piece (monolithic) manufacturing, reduced weight, motion smoothness, virtually infinite resolution, zero backlash, low friction, and no lubrication. Flexure structures have been used in micro-solar-system and space mission by NASA and ESA. Beside the choice of the type of flexure element and material, the geometry itself determines the important properties of flexure structure such as stiffness and allowed rotation angle. Because there are several flexure elements in an annulus, the structure is complex and difficult to analyze capacity. Existing methods that balance method, energy method and principle of virtual work can analyze performance exactly and effectively, but designers cannot choose the type of annulus-shaped flexure structure and confirm key structural parameters in a fast way. In this paper, dimensionless design graphs of annulus-shaped flexure structure are established by a structure-interrelated dimensionless factor which is proposed in order to describe axial rigid property, radial rigid property, rotational rigid property and rotational stress property. Finite element calculations which can be assumed to be the 'truth' are used to construct dimensionless design graphs. The relationship between geometry and structure behavior are presented both numerically and graphically. Using the dimensionless design graph, design process can be reduced in both time and complexity.