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AN APPROACH OF COMPACTION ANALYSIS AND DESIGN FOR MODULAR SATELLITE

Abstract

A modular satellite consists of various functional modules, and the threaded rods are used to connect all modules together, with the rods going through the bottom module to the top one. Therefore, the compaction design by the aid of the threaded rods is important to guarantee the stiffness of the modular satellite and enable the satellite to endure external dynamic loads. However, an applicable and efficient analytical method in compaction parameter design has not been developed for the modular satellite. The correct and optimal quantity, size and screw torque of the threaded rods are difficult to determine.

To solve the above problems, the article conducted the fraction and superimposition force-deform analyses for the modular satellite, and thus proposed a computation and design method for compaction stiffness of modular satellite. For the longitudinal loading, according to the superimposition rationale of mechanics, the coordinated deforms for the satellite structure and the threaded rods have been analyzed, in which the stiffness matrix was computed. Then the relations between the parameters of the threaded rods, and the external load were obtained, with the modules being kept intact under the external load. For the lateral loading, the friction and lateral shear forces between modules were computed, and the relations between the rod parameters and external load can be derived.

Using the proposed method, the compaction analysis and design for a modular satellite were carried out. The results show that under the combined external loadings, 5 threaded rods (diameter of M6) with the pre-tension of 6250N are optimal solutions for the modular satellite.