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Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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CONCEPT AND STRUCTURAL PROPERTIES OF DEPLOYABLE BOOM WITH CORRUGATED
CLOSED SECTION

Abstract

Several self-deployable booms have been developed for space antennas, solar sail deployment elements, as STEM boom, CTM boom, Omega shape boom, TRAC-boom, Bi-convex boom, and so on. To apply the boom for large deployable structures, the deployment length, deployment force, the stiffness, and buckling strength are requested for the structural properties.

In this research, we propose deployable booms to improve the structural properties by applying the corrugated closed section. To examine the structural properties, the deployment force was investigated by evaluate the stored strain energy theoretically, at first. Then, the finite element analyses have been performed to examine the structural stiffness and the buckling strength for numerical models with corrugated closed section. Moreover, we have examined the storable performance and deployment torque for the proposed booms experimentally.

The results indicated that the deployment force and torque of the proposed deployable booms with corrugated closed section become much higher than boom without corrugated closed section. Conversely, the maximum storable length of the proposed boom can be longer than the boom without corrugated closed section when the thickness of boom is reduced to have the equal deployment torque.

Finally, it has been shown that the proposed booms have advantages for designing deployable booms by considering the structural requirements of the deployment force/torque, the maximum storable length, the stiffness, and the buckling strength/mode to improve the structural performance.