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NASA TECH BRIEF

Manned Spacecraft Center

Structural Behavior of Tapered Inflated Fabric Cylinders under Various Loading Conditons

In developing structural analysis methods for inflatable structures, it was found that classical methods long used for rigid structures did not apply. The material from which an inflatable structure is ordinarily fabricated is neither isotropic nor orthotropic but is anistropic in behavior. Furthermore, when non-metallic materials are used, the large deflection behavior of the structure must be accounted for as a result of large strains at the design stress level. Thus, an analytical method for predicting structural behavior of linearly variable (tapered) cross sections under various loadings was required.

This innovation is the first method of analysis for such members and considers axial loads (tension, compression, Euler effect), torsional moment and internal pressure. The behavior is dependent on the anistropic nature and the large deflection stress-strain characteristics of the fabric material. The equations of behavior for a pressurized cylinder loaded in torsion are developed. The limiting torsional moment (including the influence of nonlinearity, permanent set and history of loading), and other loading conditions such as bending and axial load are considered.

This material may be of interest to architects, civil engineers and the fabric industry.

Note:

Requests for further information may be directed to:

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No patent action contemplated by NASA.

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