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NASA TECH BRIEF

Stability of Structural Rings Under Uniformly Distributed Radial Loads

An energy-method analysis establishes the parameters governing the stability of circular rings acted upon by constant, uniformly distributed radial loads. The energy method was used so that the nonlinear behavior of the structure prior to buckling could be accounted for. In addition, this method affords a conceptually superior basis for analyzing the axisymmetric deviation mode. The analysis requires that the number of displacement variables used in the equation for the total strain energy in the ring be the smallest possible that will still lead to a realistic description of the expected behavior.

One example is a ring stiffener in a thin-walled shell of revolution subjected to external pressure. The displacements of the ring depend upon the relative stiffness of the shell in and out of the plane of the ring. The problem, then, is that of determining the stability of a ring acted upon by a uniform radial load and subjected to both in-plane and out-of-plane disturbances that may be constrained.

It is important that in-plane and out-of-plane displacements be given the same emphasis in a study of their interaction during buckling. For this reason, the displacements of the ring are described in terms of the displacements of its centroidal axis and the rotation (twist) of the cross section about that axis.

In general, the analysis shows that critical mode shapes are a combination of in-plane and out-of-plane displacements and that they occur at loads considerably below the classical (in-plane) critical load. For symmetrical cross sections, the critical load for the constrained ring is greater than that for the corresponding unconstrained ring.

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA-CR-107848 (N70-17318), The Stability of Circular Rings Under a Uniformly Distributed Radial Load

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