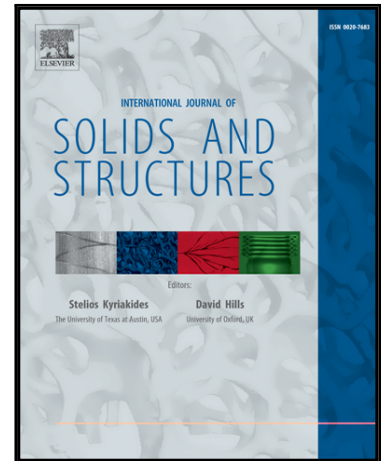


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## Wrinkling of Transversely Loaded Spinning Membranes

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### Abstract

Spinning membrane structures provide a mass-efficient solution for large space apertures. This paper presents a detailed study of the wrinkling of spinning circular membranes loaded by transverse, uniform loads. Experimental measurements of the angular velocities at which different membranes become wrinkled, and of the wrinkling mode transitions that occur upon spin down of the membrane, are presented. A theoretical formulation of the problem is presented, from which pairs of critical angular velocities and critical transverse loads are determined. A general stability chart is presented, which identifies the stability limits in terms of only two dimensionless parameters, for any membrane. The transition between bending dominated behavior and in-plane dominated behavior is identified, and it is shown that in the bending-dominated case the critical non-dimensional transverse load is independent from the non-dimensional angular velocity.

*Keywords:* buckling, wrinkled membranes, von Kármán plate theory, nonlinear dynamical systems

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