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Shallow Spherical Caps Under External Pressure

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The present study addresses the static stability of shallow spherical caps subjected to uniform and static external pressure. A series of six, carefully machined, mild steel spherical caps were chosen to complement the existing experimental data. The shallowness parameter, lambda, was chosen to be between 3.5 and 5.5. Caps were CNC-machined from 245 mm diameter solid billet. Shells had a heavy edge ring being integral with the wall. It was aimed here to model the fully clamped boundary conditions. The height-to-wall thickness ratio varied from 1.5 to 4.5 and the radius-to-thickness ratio varied from 300 to 1800. The above models were buckled through the application of quasi-static external pressure. All caps failed suddenly through a snap-through mechanism. Comparison of experimental failure pressures with numerical predictions was found to be good. The trend of experimental data on load versus the slenderness parameter, lambda, confirms a sudden dip in the load carrying capacity around lambda = 4.0 (i.e. contrary to some of the existing data which has been published on this controversy).

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