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Buckling of Reversible-Spherical Shells: The Retraction Affected By the Shape of Aperture

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Abstract

The buckling and its related phenomenon are frequently observed on surface of soft matter, which has caught the attention of many scholars. In this paper the performance under external pressure of a spherical shell perforated by various shapes were compared. The complex shapes of apertures were generated via Superformula and projected on the spherical shell. The numerical simulation was achieved in Abaqus, where velocity-controlled loads and proper geometric imperfection were used to control the volume of buckled shell. It can be concluded that buckling patterns were response to the aperture shapes and the shell with the rounded –square aperture has the value for further topological optimization as it had the maximal volume retraction ratio as well as the lowest energy consumption. The strain energy densities were represented to explore the relationship between the buckling manners and energy consumptions. The material properties had been tested and the simulation results were verified by physical experiment employed 3D printing technique.