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Abstract

General similitude requirements and the scaling laws for nonlinear buckling of stiffened orthotropic shallow spherical shells are presented by applying similitude transformation to the total energy of the structural system. In the absence of the experimental data, structural similitude is completed by numerical experiments. The predicted values of the prototype, obtained by substituting the model results into the scaling laws, are compared with those values of the prototype. In practical engineering, it may be hard to fulfill the complete similarity requirements. Thus, several cases of partial similitude are mainly investigated, including models distorted in material properties of ribs, in material properties and in material properties and geometry. By using specific formulas of stiffness parameters and the displacement scale factor, distorted models can predict geometric nonlinear buckling behavior of the prototypes of the stiffened orthotropic shallow spherical shell under external pressure with good accuracy.

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