

Effect of Skin Local Buckling on the Axial Compressive Load-Carrying Capacity of Stiffened Cylindrical Shells (Postprint)

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Date: 2025-04-21T15:22:41+00:00

Abstract

Early design guidelines for grid-stiffened cylindrical shells, such as NASA SP-8007, recommended avoiding skin local buckling by employing sufficient stringers and skin thickness. However, this design requirement lacks strong supporting evidence and may potentially increase manufacturing costs and structural weight. To clarify the influence of skin local buckling on the axial compressive load-carrying capacity of structural components, detailed computational and comparative analyses were conducted on a typical grid-stiffened cylindrical shell and its stiffness-equivalent modified structure using linear analytical method, nonlinear finite element method, and single perturbation load approach. The results indicate that for perfect, defect-free structures, skin local buckling significantly reduces their structural load-carrying capacity, whereas for actual structures with initial imperfections, skin local buckling has no effect on their structural load-carrying capacity. Therefore, it is unnecessary to deliberately avoid skin local buckling in structural design.

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