Buckling of composite cross-ply sandwich panels using different finite element approximations

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ABSTRACT

The use of composite materials in different areas of engineering has grown markedly in recent years. Parallelly various techniques for modeling laminates macroscopically have been developed. In this paper the buckling loads of sandwich panels with cross-ply sandwich sections have been obtained numerically using finite elements based on different shell theories, i.e. classical lamination theory, first order transverse shear theory and refined zigzag theory. The elements considered are shell-type that have between 3 and 7 degrees of freedom per node and this does not depend on the number of layers or the characteristics of the section. In comparisons numerical models with solid elements, involving a quite larger computacional cost, are used as reference results. Examples discussed include flat panels subjected to in-plane loads and cylindrical panels subjected to in-plane loads or normal pressure. The study shows that buckling loads and the associated critical modes may vary significantly depending on the approximation used.