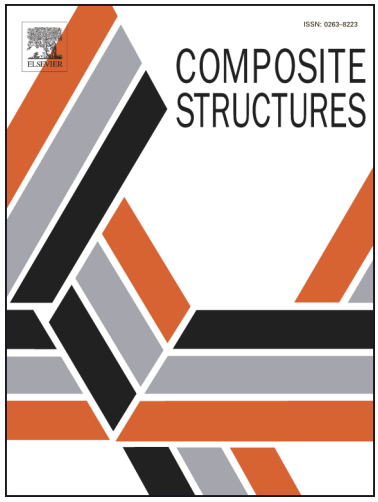

Buckling and post-buckling analysis of geometrically non-linear composite plates exhibiting large initial imperfections

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Buckling and post-buckling analysis of geometrically non-linear composite plates exhibiting large initial imperfections

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Abstract

This paper discusses the buckling and post-buckling of thick composite plates having large initial geometrical imperfections. Within the theory of large transformations, the proposed formulation uses generalised forces and deformations derived from the energy conjugacy of the second Piola-Kirchhoff and Green-Lagrange strain. In addition, it provides partial differential equations of equilibrium that are easy to solve using common techniques such as the Galerkin-Ritz method. Unlike existing contributions, which are (i) limited to imperfections that are proportional to current deformations, (ii) address small to moderate initial imperfections only, and/or (iii) require advanced and time consuming numerical methods, the present approach is based on analytical solution and takes into account large initial imperfections. Despite the complexity of the energy balance formulation, the resulting governing equations are simple and applicable to design practical composite structures. The proposed model was compared to numerical results obtained using the finite element method. Overall, good agreements have been obtained when the assumptions fall within the range of validity of the commercial software used for simulation.

Keywords: Composites, large deformations, energy conjugacy, initial imperfections, buckling, post-buckling.