

Buckling driven delamination in uniaxially compressed composite panels

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Summary

A geometrically nonlinear plate model has been developed analytically in order to investigate the buckling behaviour of laminated composite panels containing a centrally located delaminated patch. The panels examined are rectangular and under uniaxial compression. Trigonometric out-of-plane displacement functions are employed in the Rayleigh–Ritz procedure where minimum energy principles are applied to solve for the mechanical behaviour of the plates. The in-plane deformations are determined via von Kármán’s compatibility equation by applying restrained edges at the boundary of the delaminated region. Different delamination configurations are investigated with the critical buckling loads and eigenvectors being determined using linear analysis and the results are related to the delamination parameters. Validation of the results is undertaken by comparing against previous work. An indication of residual capacity of the panels after the initial instability is assessed through the results in the postbuckling range. Furthermore, delamination propagation is incorporated via a discrete cohesive zone model which is formulated in order to investigate potential instabilities due to this important mechanism. Several different delamination configurations are studied around the transitional depth, which constitutes the boundary between global and local buckling.

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