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Vibration and Parametric Instability Analysis of Delaminated Composite Beams

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Abstract : This paper revisits the free vibration problem of delaminated composite beams. It is shown that during the vibration of composite beams the delaminated parts are subjected to the parametric excitation. This can lead to the dynamic buckling during the motion of the structure. The equation of motion includes time-dependent stiffness and so it leads to a system of Mathieu-Hill differential equations. The free vibration analysis of beams is carried out in the usual way by using beam finite elements. The dynamic buckling problem is investigated locally, and the critical buckling forces are determined by the modified harmonic balance method by using an imposed time function of the motion. The stability diagrams are created, and the numerical predictions are compared to experimental results. The most important findings are the critical amplitudes at which delamination buckling takes place, the stability diagrams representing the instability of the system, and the realistic mode shape prediction in contrast with the unrealistic results of models available in the literature.

Keywords : delamination, free vibration, parametric excitation, sweep excitation
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