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Effect of Root Flexibility on the Aeroelastic Analysis of a Composite Wing Box

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This paper discusses the effect of fibre orientations, skin lay-up, bending-torsion material coupling, and the root flexibility or stiffness of the rectangular composite wing box model on the free vibration and aeroelastic characteristics for the Circumferentially Uniform stiffness and Circumferentially Asymmetric stiffness configurations. The dynamic characteristics are in the form of natural frequency and associated mode shapes, where as for the aeroelastic is in the form of flutter and divergence speeds. All this work is conducted using the finite element codes FEMAP 8 and MSC/NASTRAN 70.5. An attempt is made to cover as extensive a field as possible and identify interesting areas. Interesting relations are obtained for both configurations, which could be helpful for aeroelastic analysis. These relations are in the form of stiffness ratio, EI/GJ, material coupling stiffness, K and frequency ratio, wb/wt versus fibre orientations for two skin laminates. The research showed that the root stiffness has a significant influence on the dynamic characteristics and on the flutter and divergence speeds of the composite wing models especially at root stiffness lower than thousand.

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