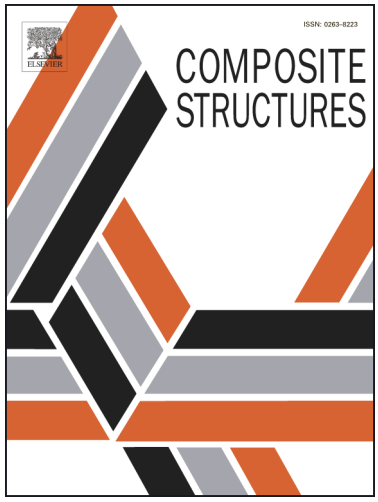

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Aeroelasticity of composite plates with curvilinear fibres in supersonic flow

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Abstract

The target of this investigation is to understand the aeroelastic (dynamic or static) instability of variable stiffness composite laminates (VSCLs) in the presence of supersonic airflow. The studied VSCLs have curvilinear fibre paths. Two different types of VSCLs are considered: the first type (already adopted in several previous researches) includes fibre path angles changing linearly from T_1 at right and left edges to T_0 at the centre, and the second type (not introduced before) includes fibre paths where their angles change linearly from T_0 at the left edge to T_1 at the right edge. Displacements and rotations in the plate are modelled by a Third-order Shear Deformation Theory (TSDT) and are discretised by a p-version finite element model. Aerodynamic forces due to supersonic airflow, in the steady or unsteady regime, are modelled using linear Piston theory and the equations of motion of the self-excited vibration system are formed using the principle of virtual work. Dynamic (flutter) and static (divergence) instabilities are identified using the eigenvalues of the linear system. Effects of different boundary conditions and various fibre angles as well as the influence of airflow direction on the flutter and divergence occurrence in VSCL plates are studied.

Keywords: Laminates, Variable stiffness, Curvilinear fibre, Flutter, Divergence

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