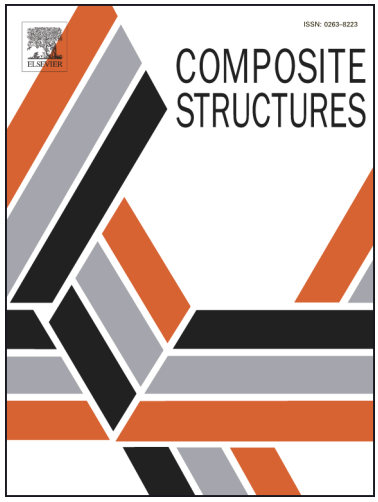

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Shear deformable dynamic stiffness elements for a free vibration analysis of composite plate assemblies - Part I: Theory

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Abstract

A procedure for developing the dynamic stiffness matrix of a completely free laminated composite plate based on the first-order (FSDT) and higher-order shear deformation theory (HSDT) is presented. The proposed method allows the computational analysis of free transverse vibrations of the individual rectangular laminated composite plates, as well as the composite plate assemblies, without any restrictions regarding the boundary conditions or frequency limitations. The general solution of the governing differential equations of the HSDT and FSDT is established using the superposition method. Continuous boundary conditions are discretized by using the projection method. The dynamic stiffness matrices of plate elements are than formulated from the assembly of the four dynamic stiffness matrices (four symmetry contributions). The validation of the theory and its application are provided in the Part II of this two-part paper.

Keywords: dynamic stiffness method; HSDT; FSDT; laminated composite plate; free vibrations