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A new composite beam element based on higher-order shear deformation theory and assumed strain field for static and dynamic analysis of composite beams

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An efficient, accurate and reliable beam element is presented for the static and dynamic analysis of laminated beams. The element formulation is based on the quasi-conforming element technique and a new accurate higher-order beam theory proposed by the authors in which the interlaminar continuity of laminated beams is taken into account. The element stiffness matrix of the resulting composite beam element is given explicitly, consequently it is very computationally efficient. Furthermore, this new composite beam element possesses a linear bending strain field although only two nodal parameters associated with bending deformation at each node. Therefore, this new beam element has higher accuracy than the conventional beam elements. Both static and dynamic analyses of laminated composite beams with different aspect ratios and boundary conditions are solved. The numerical results clearly demonstrate that the composite beam element presented in this work is not only efficient and locking free but also very accurate indeed.

Keywords: Composite beam element, Higher-order beam theory, Quasi-conforming element technique, Laminated composite beam, Interlaminar stress continuity, Higher mode flexural vibration