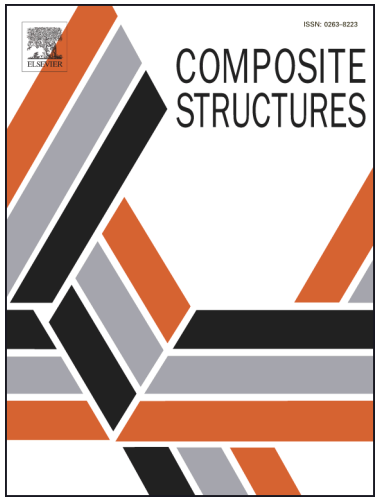

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A linear smoothed quadratic finite element for the analysis of laminated composite Reissner–Mindlin plates

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Abstract:

It is well known that the high-order elements have significantly improved the accuracy of solutions in the traditional finite element analysis, but the performance of high-order elements is restricted by the shear-locking and distorted meshes for the plate problems. In this paper, a linear smoothed eight-node Reissner-Mindlin plate element (Q8 plate element) based on the first order shear deformation theory is developed for the static and free vibration analysis of laminated composite plates, the computation of the interior derivatives of shape function and isoparametric mapping can be removed. The strain matrices are modified with a linear smoothing technique by using the divergence theorem between the nodal shape functions and their derivatives in Taylor's expansion. Moreover, the first order Taylor's expansion is also employed for the construction of stiffness matrix to satisfy the linear strain distribution. Several numerical examples indicate that the novel Q8 plate element has good performance to alleviate the shear-locking phenomenon and improve the quality of the solutions with distorted meshes.

Keywords: laminated composite plate; linear smoothing technique; Taylor's expansion; shear-locking; distorted meshes.