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A New Triangular Element for the Analysis of Composite Plates

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A triangular element based on the Mindlin's plate theory has been developed for the analysis of composite plates. The element has six nodes (at the vertices and mid-sides of the triangle) each containing five degrees of freedom – in-plane displacements u, v, transverse displacement w, and cross-sectional rotations θ_x $(= \frac{\partial w}{\partial x} + \gamma_x)$ and θ_y $(= \frac{\partial w}{\partial y} + \gamma_y)$. The key concept of assuming independent shear rotations γ_x and γ_y enables a high order of displacement to be modelled with relatively fewer degrees of freedom. Representing the field variables u, v, w, γ_x and γ_y with complete polynomials of suitable order maintain the proper hierarchy of deflection, rotation, moment and shear, and averts shear locking. C_1 compatibility required in the element is kept unsatisfied. On the other hand patch test is passed and the element is free from spurious modes. Numerical examples on deflection of composite plates prove the efficacy of the proposed element.

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