An edge-based smoothed three-node Mindlin plate element(ES-MIN3) for shell analysis

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Abstract

The edge-based smoothed finite element method (ES-FEM) was proposed recently to improve the accuracy of the standard finite element method for solid mechanics. In the present paper, the ES-FEM is incorporated with the three-node Mindlin plate element (MIN3) to give a novel edge-based smoothed MIN3 (ES-MIN3) for shell analysis. The system stiffness matrix is calculated by using the edge-based strain smoothing technique over the smoothing domains associated with edges of the elements. In order to avoid the transverse shear locking, the stabilized MIN3 element is performed to compute the strains in each element. From a series of selected numerical examples, it is observed that the present ES-MIN3 is free of shear locking and achieves high accuracy compared with the exact solutions and others existing shell elements.

Keywords: Numerical method, Edge-based smoothed finite element method (ES-FEM), MIN3, shell analysis