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COMPARATIVE ANALYSIS OF NEW SHEAR LOCKING-FREE FINITE ELEMENT WITH OTHER COMMONLY USED APPROACHES IN VIBRATION ANALYSIS OF MINDLIN PLATES

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Abstract. This paper is dedicated to validation of newly developed shear locking-free finite element (FE) for the vibration analysis of Mindlin plates. First, the state-of-the art in thick plate vibration theories and analysis methods is described and basic equations of the original and advanced Mindlin plate theories, respectively, are listed. Then, a detailed description of shear-locking free rectangular finite element is provided. Bending deflection is used as a potential function for the definition of total (bending and shear) deflection and angles of cross-section rotations. Extensive calculations are done by using developed in-house codes and standard commercial FE tools. Also, comparisons with analytical solutions and energy-based assumed mode method results are included. In addition, convergence of the developed finite element is checked. Natural vibration analyses of rectangular plates having different edge constraints, utilizing the proposed quadrilateral FE, show very good agreement with other commonly used methods.