A meshfree method for dynamic analysis of rotating thick plates

with third-order shear deformation theory

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Abstract

A meshfree method based on radial point interpolation method (RPIM) is proposed for dynamic analysis of rotating thick plates. The RPIM is used to describe the deformation of the flexible plate and third-order shear deformation theory is used to model the plate. Considering the coupling deformation, the first-order approximate rigid-flexible coupled dynamic model is established via employing Lagrange's equations of the second kind. The effectiveness of RPIM with third-order shear deformation theory is first demonstrated in some static cases and then extended for dynamic analysis of a rectangular plate undergoing large overall motion. The simulation results are compared with those obtained by using first-order deformation theory and classic thin plate theory, which shows the results with third-order deformation theory are more accurate. Meanwhile, the influence of the radial basis shape parameters is discussed and the optimal parameters for plates are recommended. In addition, the method to overcome the shear locking issue is also provided.

Keywords: Meshfree method, Radial point interpolation method, Rotating thick plates, Third-order shear deformation theory, Rigid-flexible coupled dynamics