Ladevèze, P.; **Qian, Z.**; **Simmonds, J. G.**

Computing exact, elastodynamic linear three-dimensional solutions for plates from classical two-dimensional solutions. (English) Zbl 0995.74039

Int. J. Solids Struct. 37, No. 46-47, 7029-7042 (2000).

Summary: Given an approximate time-dependent distribution of midplane vertical displacement and three-dimensional transverse shear and normal stresses in a platelike elastic body undergoing flexure – the quantities delivered by the Kirchhoff (classical) theory – we construct exact solutions of the equations of motion of linear three-dimensional elasticity. This is accomplished by (1) solving an auxiliary spatially hyperbolic system of partial differential equations (in which time enters only parametrically), and (2) choosing residual body and surface forces and initial conditions to ensure the satisfaction of all three-dimensional field equations, boundary, and initial conditions. The residual quantities which, in general, are significant only near the edges of the plate, serve as meaningful physical measures of errors in classical plate theory. Special difficulties posed by plates with sharp corners are mentioned, but are left for future treatment.

MSC:

74K20 Plates
74H05 Explicit solutions of dynamical problems in solid mechanics
74B05 Classical linear elasticity

Keywords:

Kirchhoff theory; midplane vertical displacement; three-dimensional transverse shear; normal stresses; exact solutions; linear three-dimensional elasticity; spatially hyperbolic system; residual body

Full Text: DOI