

Rattanasuda Naewngerndee 2008: Generalized Least Squares Finite Element Methods for Timoshenko Beams. Master of Engineering (Mechanical Engineering),  
Major Field: Mechanical Engineering, Department of Mechanical Engineering.  
Thesis Advisor: Mr. Prapot Kunthong, Ph.D. 123 pages.

In this work, Galerkin finite element formulation for the steady-state vibration of Timoshenko beams is modified to reduce dispersion error. The residual of governing differential equation in gradient least-squares form is appended to the standard Galerkin finite element variational equation. The gradient least-squares parameters for linear and quadratic interpolations of the responses are selected such that the lower-order terms in Taylor series expansions of the finite element dispersion relations match the analytical dispersion relations. This technique provides a consistent variational framework for enhancing the accuracy of Timoshenko beam elements. Comparisons of finite element dispersion relations demonstrate the superiority of the Galerkin Generalized Least Squares methods over standard Galerkin method and Galerkin method with selective reduced integration. Numerical example for wave propagation in Timoshenko beams is presented to demonstrate the improved accuracy of the Galerkin Generalized Least Squares methods.

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