Eigenfrequency Analysis of Rectangular Composite Plates

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ABSTRACT

A numerical model for the analysis of the free vibration of multilayered rectangular plates is proposed. The model is based on a displacement field that assumes a non-linear distribution of the in-plane displacements with respect to the thickness coordinate and a transverse displacement that is constant through the plate thickness. The mathematical problem is solved by Ritz method, which relies on the minimization of the maximum Lagrangian functional, using a displacement field defined by beam functions in the form of finite series with undetermined parameters. By deleting the higher order terms of Reddy's displacement field or assuming Love-Kirchhoff hypothesis, the first order shear deformation and the classical plate theory models, respectively, are also obtained. The results will be presented for plates with different boundary conditions, and aspect ratio of 1 and 2, compared with other.

Keywords: composite plates, rectangular plates, Ritz method

References

1. **J. N. Reddy** – Mechanics of Laminated Composites Plates. London: CRC Press, 1997.
2. **James M. Whitney** – Structural Analysis of Laminated Anisotropic Plates.
3. **O.O. Ochoa, J.N. Reddy** – Finite Element Analysis of Composite Laminates. Dordrecht: Kluwer Academic Publishers.
4. **J.V. Aranjo dos Santos, Aurelio Lima Aranjo, C.M. Mota Soares** – Eigenfrequency Analysis of Completely Free Multilayered Rectangular Plates Using a Higher-order Model and Ritz Tehnique.
5. **A. Montanaro, Paolo Gardonio** - Natural in Plane-Vibration of Kirchoff-Love Plates. R.T. n. 83, Marzo 2001, Rapporti Tecnici, DMMSA, Universita di Padova, Italy.
6. **N.S. Bardell, R.S. Langley and J.M. Dunsdon** – On the Free In-Plane Vibration of Isotropic Rectangular Plates. Journal of Sound and Vibration (1996) 191 (3), 459-467
7. **K.M. Liew, C.M. Wang, Y. Xiang, S. Kitipornchai** – Vibration of Mindlin Plates – Programming the p-Version Ritz Method. Amsterdam: Elsevier, 1998.
8. **R. Szilard** – Theory and analysis of Plates. New Jersey: Prentince Hall, 1974.
9. **T. Mikami, J. Yoshimura** – Application of collocation method to vibration analysis of rectangular Mindlin plates. Computers & Structures, v.18, p. 425 – 431, 1984.
10. **T. Mizusawa** – Vibration of Rectangular Mindlin Plates by the Spline Strip Method. Journal of Sound and Vibration, v.163, n.2, p. 193-205, 1993.
11. **D.J. Dawe** – Finite Strips Models for Vibration of Mindlin Plates - Journal of Sound and Vibration, v.59, p. 441-452, 1978.
12. **A.W. Leissa** – The Free Vibration of Rectangular Plates. Journal of Sound and Vibration, v.31, p. 257-293, 1973.