VIBRATIONS ANALYSIS OF LAMINATED COMPOSITE AND EULER BERNOULLI BEAMS USING DIFFERENTIAL TRANSFORMATION METHOD

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ABSTRACT

Differential Transformation Method is a technique that uses Taylor series for the solution of differential equations in the form of a polynomial. It is different from the high-order Taylor series method, which requires symbolic computation of the necessary derivatives of the data functions. The Differential Transformation Method leads to an iterative procedure for obtaining an analytic series solutions of functional equations.

Beams with abrupt changes of cross-section are used widely in engineering. It can be easily made in order to save weight or to satisfy various engineering requirements. Rectangular and circular shapes of the cross section are chosen because it often occurs in practice. In the first part of this thesis, the vibration problem of Euler-Bernoulli beams has been solved using Differential Transformation Method. The beam has variable cross sections and various end conditions.

In the second part of this thesis, an analogy is introduced for the governing differential equation of a beam subjected to moving load and resting on a viscoelastic foundation. The differential equation is solved using Differential Transformation Method and Galerkin Runge-Kutta.

The composite materials were well known by their excellent combination of high structural stiffness and low weight. The main feature of these anisotropic materials was their ability to be tailored for specific applications by optimizing design parameters such as stacking sequence, ply orientation and performance targets. In the third part of this thesis, Differential Transformation method for free vibration analysis of generally laminated composite beams is introduced on the basis of first order shear deformation theory. The dynamic stiffness matrix is defined based on the exact solutions of the differential equations of motion governing the free vibration of generally laminated composite beam.