EXPERIMENTAL IDENTIFICATION OF ELASTIC CONSTANTS OF AN ORTHOTROPIC COMPOSITE PLATE

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Conventional test methods for measuring elastic constants are often destructive and require multiple sophisticated tests to obtain all data. Non-destructive methods to determine the effective elastic constants of composite plates can be based on static measurements [1], vibration testing [2] or on the measurements of ultrasonic wave velocities. The last group of methods is most suitable to be used in guided wave non-destructive evaluation (NDE) system for the automated inspection of a component in a structure.

Lamb waves, dispersive by nature, are frequently used with an inverse procedure to determine the elastic constants of a homogenous anisotropic plate [3, 4]. Dispersion curves characterizing wave propagation in different directions are traced from experimental data obtained with an excitation of the glass-fiber composite plate by piezoelectric transducer and displacement measurements with laser interferometer. A sensitivity analysis of elastic constants to the phase velocity in orthotropic composite plate is carried out to choose better initial data. Hybrid optimization procedure consisting of genetic algorithm with simplex method is applied to the experimental dispersion curves to determine the effective elastic constants of an orthotropic composite plate.

The results of the procedure are compared to the experimental static traction measurement for mean elasticity moduli. Additional comparison is made to the results from vibration testing employing impulse technique and from finite element method modeling.

REFERENCES

