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NUMERICAL SIMULATIONS OF LAMB WAVES FOR OPTIMIZATION OF SENSOR PLACEMENT IN SHM SYSTEM

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Lamb waves are a type of waves propagating in thin-walled structures which have found many applications in aerospace and automotive industry. Due to the distribution of displacements in the whole cross-section and high sensitivity to material discontinuity, Lamb waves are often utilized for Structural Health Monitoring (SHM). In such systems, Lamb waves are usually excited and registered by a network of piezoelectric transducers. The algorithms for damage detection and localization are based on Lamb wave signals corresponding to all combinations of actuator-sensor pairs. It is very important to place piezoelectric transducer so that it is possible to inspect largest possible area without blind spots. This is an enormous optimization problem which requires a large database of Lamb wave signals. Hence, in the proposed method analytical solutions were utilized along with genetic algorithms for finding optimal sensor configuration. However, the analytical solution has many limitations as it does not take into account mass of piezoelectric transducers as well as the bonding layer.

This research work aims to provide a database of full wavefield data of propagating Lamb waves for the final configuration of piezoelectric transducers in order to verify the methodology based on the analytic solution. The simulations consider realistic 3D plate model with or without physically bonded piezoelectric transducers. The in-house code of time domain spectral element method is used for the simulations. In order to speed up computation, parallel implementation on Graphics Processing Unit (GPU) was applied [1].

REFERENCES

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