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Electro-Mechanical Admittance-Based Damage Identification Using Box-Behnken Design of Experiment

Summary

Piezoceramic transducers have emerged as new tools for the health monitoring of large-scale structures due to their advantages of active sensing, low cost, quick response, availability in different shapes, and simplicity for implementations. In the present paper, a statistical metamodeling utilization of electro-mechanical (E/M) admittance approach by applying piezoelectric materials to the damage identification is investigated. A response surface metamodel is constructed by empirically fitting a model to a set of design points chosen using a Box-Behnken design of experiment (simulation) technique. This empirical fit allows polynomial models to be produced for relating damage parameter such that stiffness reduction to the electromechanical admittance signature generated at piezoelectric sensors at specific frequency ranges. Then, an analytical study based on finite element models is carried out to verify the validity of the present numerical metamodeling technique.

keywords: Damage identification, Structural health monitoring, Electromechanical admittance, FEM, Box-Behnken design of experiment, Response surface metamodels.