MS1I_10680

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Elastic Wave Propagation Development for Structural Health Monitoring

Wiesław M. Ostachowicz

Institute of Fluid Flow Machinery PAS, Gdańsk, Poland

This paper is a personal perspective of structural health monitoring technology and its applications as see from a current literature and projects. Recently, laminated composites with built-in piezoelectrics have attracted significant attention among researchers because of their potential application to controlling vibrations, suppressing noise, as well as monitoring the health of the structures. The investigated damage detection system is based on the known fact that material discontinuities affect the propagation of elastic waves in solids. The change in material characteristics, such as a local change in stiffness or inertia caused by a crack or material damage, will affect the propagation of elastic waves and will modify the received signals. Wave frequencies that are most sensitive to damage depend on the type of structure, the type of material, and the type of damage. Elastic waves are generated and sensed by an array of transducers either embedded in, or bonded to, the surface of the structure. Wave frequencies associated with the highest detection sensitivity depend, among others, on the type of the structure, the type of material, and the type of the damage. The proposed approach deals with the spectral finite element analysis method as a means of solving the wave propagation problems in structures. The change of the wave propagation process due to a damage appearance is examined by comparing the differences between the responses from damaged and undamaged structures. The influence of the damage growth for the wave propagation is also analysed. The differences in the propagating waves allow indicating the damage location and size in a very precise way. The proposed model can easily be used for detection of damage in complicated situations, i.e. multiple delaminations located in different places. The paper is not intended to be a comprehensive survey but merely to present a flavour of recent activity in this important subject.

View the extended summary