

On the Modelisation of the Piezoelectric Effect with Control System and some Applications

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Abstract

The conceptual approach to the modeling of the piezoelectric constitutive relation with MSC/NASTRAN in one-dimensional static and dynamic cases is discussed. The role of the Finite Element Model of the piezoelectric material is to represent the actuator and the sensor of an adaptive control system for the active damping of structural vibrations. Open and closed loop control systems, the amplifier and the piezo saturation functions are also modelled. For many piezoelectric materials the constitutive relation can be represented with a system of nine equations, composed by the six elasticity equations of the classic constitutive theory, coupled with three additional electrical equations. In this study, the reduction to a system of two second order differential equations is performed, keeping into account the coupling role of the electro-mechanical characteristics. Such procedure is applied to control models of simple structures with a distribution of piezoelectric micro-actuators for different applications.

Keywords

Piezoelectric, Nastran, Stability, Control