

Simulation of Piezoelectric Laminated Smart Structure under Strong Electric Field

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Abstract : Piezoelectric materials usually behave very significant material nonlinear effects under strong electric fields. In order to give a precise prediction of piezolaminated smart structures under large electric field, this paper develops a finite element (FE) model accounting for material nonlinearity (piezoelectric part) based on the first order shear deformation (FSOD) hypothesis. The proposed FE model is first validated by both experimental and numerical examples from the literature. Afterwards, it is applied to simulate for plate and shell structures with multiple piezoelectric patches under strong applied electric field. From the simulation results, it shows that large discrepancies occur between linear and material nonlinear predictions for piezoelectric laminated structures driving at strong electric field. Therefore, material nonlinearity should be taken into account for piezoelectric structures under strong electric.

Keywords : smart structures, piezolaminates, material nonlinearity, strong electric field

Conference Title : ICSSA 2017 : 19th International Conference on Smart Structures and Applications

Conference Location : Istanbul, Turkey

Conference Dates : September 28-29, 2017