

Large deflection analysis of magneto-electro-elastic laminates

MILAZZO, A., Alaimo, A., Orlando, C.

Magneto-electro-elastic (MEE) composites containing piezoelectric and piezo-magnetic phases have recently emerged for many application smart structures technology. In this framework, the development of tools to analyze the MEE laminates is essential for their efficient design. In the present work, a model for the large deflection analysis of MEE laminated plates is proposed. The first order shear deformation theory and the von Karman stress function approach are employed to model the mechanical behavior whereas quasi-static behavior is assumed for the electro-magnetic quantities. First, the magneto-electric problem is solved in terms of the plate mechanical primary variables. In turn, this result is employed into the equations of motion and large displacement plate compatibility equation leading to a system of coupled partial differential equations involving the plate transverse displacement, rotations and a stress function. In this resolving system, the stiffness coefficients of the pure mechanical case are modified by the effects of the magneto-electro-mechanical couplings and new stiffness coefficients arise. The external magneto-electric inputs are modeled as applied equivalent forces and moments. Once the mechanical problem is solved the electro-magnetic quantities can be recovered. The presented results show the influence of large deflections on the plate response and can be useful in the analysis and design of layered MEE composite plates.