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Actuator and Sensor Modelling for Laminated Piezoelectric Plates

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We propose an accurate and efficient approach to laminated piezoelectric plate based on a refinement of elastic displacements and electric potential through the thickness co-ordinate of the plate. The model accounts for shearing function and a layerwise approximation for the electric potential. The equations of motion for the piezoelectric plate are deduced from a variational formulation taking into account the continuity conditions at the layer interfaces by using Lagrange multipliers. Different situations are investigated among them (i) bimorph and (ii) sandwich structures for two kinds of electromechanical loads (i) density of applied forces and (ii) applied electric potential and are compared to the finite element computations. A good agreement is observed for the local (field distributions) and global (deflection, induced electric potential) responses of the composite. The extension of the present approach to vibration of piezoelectric plates is studied. The prediction of the modal frequencies of vibration is obtained.

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