

Buckling delamination of a PZT/Metal/PZT sandwich rectangular thick plate containing interface inner band cracks

ABSTRACT

This work studies the 3D buckling delamination problem around the interface band cracks which are in the PZT/Metal/PZT sandwich rectangular thick plate within the scope of the piecewise homogeneous body model by utilizing the so-called 3D linearized theory of stability loss for piezoelectric materials. It is assumed that the plate is simply supported with respect to mechanical quantities and short-circuit conditions with respect to the electric potential along all its lateral edge-surfaces. On the face planes of the PZT layers, the open-circuit condition with respect to the electrical displacement is satisfied. It is also assumed that on the opposite two ends of the plate which are parallel to the band cracks' front, uniformly distributed normal compressive mechanical forces act. The critical values of these forces under which the buckling delamination of the plate around the band crack occurs, are determined by employing an initial imperfection criterion. For solution of the corresponding boundary value problems the 3D FEM is utilized and numerical results on the critical forces and on the influence of the problem parameters on these forces are presented and discussed. In particular, it is established that the piezoelectricity of the face layers and the three dimensionality of the problem cause to increase the values of the critical forces.

Keywords: Piezoelectric material, band crack, critical force, buckling delamination, sandwich rectangular plate