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Modelling and analysis of piezoelectric actuators with partially debonded adhesive layers.  
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Summary: In the modelling of thin-sheet piezoelectric actuators, the bonding condition between the actuator and the host structure can place a significant influence on the behaviour of the actuator. This paper provides a comprehensive theoretical study of the electromechanical behaviour of a thin-sheet piezoelectric actuator bonded to a host structure through a partially debonded adhesive layer under in-plane electric loading. The focus is on the coupled effect of the debonding and adhesive layer on the interfacial stress. The piezoelectric actuator is characterized by a general electro-elastic Euler-Bernoulli beam model featuring both axial and bending deformation. The theoretical solution of the problem is formulated by using singular integral equations, in terms of the interfacial shear and normal stresses, which are solved by using Chebyshev polynomials. The introduction of the adhesive layer in the model changes the singular behaviour of the problem. The current singular integral equations are shown to be effective in solving for both singular and non-singular stresses. Typical examples have been provided to show the effect of the geometry and the material property on the local stress field along the interface.

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74-XX Mechanics of deformable solids

Keywords: 
piezoelectric actuator; adhesive layer; debonding; bending; singularity

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