STRESS INTENSITY FACTORS FOR SURFACE CRACKS IN FUNCTIONALLY GRADED MATERIALS UNDER MODE I THERMOMECHANICAL LOADING

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This congress presentation describes the development and application of a general domain integral method to obtain *J*-values along crack fronts in three-dimensional configurations of isotropic, functionally graded materials (FGMs). The present work considers Mode I, linear-elastic response of cracked specimens subjected to thermo-mechanical loading, although the domain integral formulation accommodates elastic-plastic behavior in FGMs. Finite element solutions and domain integral *J*-values for a two-dimensional (2-D) edge crack show good agreement with available analytical solutions for both tension loading and temperature gradients. A displacement correlation technique provides pointwise stress-intensity values along semi-elliptical surface cracks in FGMs for comparison with values derived from the proposed domain integral. Numerical implementation and mesh refinement issues to maintain path independent *J*-values are explored. A parametric study that provides a set of stress-intensity factors for semi-elliptical surface cracks covering a practical range of crack sizes, aspect ratios and material property gradations under tension, bending and spatially-varying temperature loads is given.

Our ongoing work considers applications of the proposed domain integral to compute *J*-values in surface cracks for metal-ceramic FGMs that undergo elastic-plastic deformations. The preliminary results again show good path independence of the *J*-values. Such *J*-values may prove useful to characterize the intensity of elastic-plastic crack-front fields in FGM specimens.

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