SM10L_10836

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Transient Dynamic Crack Analysis in FGMs Under Impact Loading

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Transient elastodynamic analysis of a two-dimensional (2-D) in-plane crack in functionally graded materials (FGMs) is performed by a time-domain boundary integral equation method (BIEM). An exponential law is applied to describe the material gradients of the FGMs. A finite crack in an unbounded solid of FGMs subjected to an impact crack-face loading is considered. The initial-boundary value problem is formulated as a set of hypersingualr time-domain traction boundary integral equations (BIEs) with the crack-opening-displacements (CODs) as unknown quantities. A time-stepping scheme is developed for solving the hypersingular time-domain BIEs. Both unidirectional and bidirectional FGMs with cracks are investigated. Numerical results are presented to show the effects of the material gradients and the crack orientation on the dynamic stress intensity factors (DSIFs) and their dynamic overshoot over the corresponding static values.

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