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Asymmetrical dynamic fracture model of bridging fiber pull-out of unidirectional composite materials. (English) Zbl 1427.74156

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Summary: An elastic analysis of an internal crack with bridging fibers parallel to the free surface in an infinite orthotropic anisotropic elastic plane is studied, and asymmetrical dynamic fracture model of bridging fiber pull-out of unidirectional composite materials is presented for analyzing the distributions of stress and displacement with the internal asymmetrical crack under the loading conditions of an applied non-homogenous stress and the traction forces on crack faces yielded by the bridging fiber pull-out model. Thus the fiber failure is ascertained by maximum tensile stress, the fiber ruptures and hence the crack propagation should also appear in the modality of self-similarity. The formulation involves the development of a Riemann-Hilbert problem. Analytical solution of an asymmetrical propagation crack of unidirectional composite materials under the conditions of two increasing loads given is obtained, respectively. In terms of correlative material properties, the variable rule of dynamic stress intensity factor was depicted very well. After those analytical solutions were utilized by superposition theorem, the solutions of arbitrary complex problems could be gained.

MSC:

74R10	Brittle fracture
74E30	Composite and mixture properties
74H10	Analytic approximation of solutions (perturbation methods, asymptotic methods, series, etc.) of dynamical problems in solid mechanics
74H35	Singularities, blow-up, stress concentrations for dynamical problems in solid mechanics

Keywords:

analytical solution; internal asymmetrical crack; maximum tensile stress; Riemann-Hilbert problem; dynamic stress intensity factor

Full Text: DOI

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