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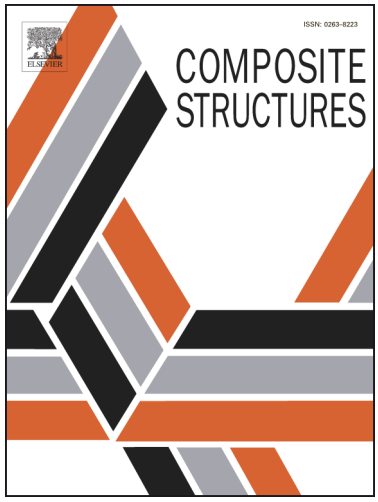

Investigation on mixed-mode dynamic stress intensity factors of an interface crack in bi-materials with an inclusion

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Investigation on mixed-mode dynamic stress intensity factors of an interface crack in bi-materials with an inclusion

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Abstract: Particle-reinforced composites (PRCs) have been widely used in numerous engineering applications; however, reliability issues related to interfacial fracture still remain major factors preventing their further development. By combining the extended finite element method (XFEM), a domain-independent interaction integral (DII-integral) method is developed to effectively evaluate the mixed-mode dynamic stress intensity factors (DSIFs) of an interface crack in bi-materials with an inclusion close to the crack tip under an impact loading. With the existence of the inclusion in the integral domain, the DII-integral is rigorously and numerically proved to be still domain-independent. The results demonstrate that the DSIFs is more sensitive to the elastic modulus than the mass density of the inclusion. The critical distance from the inclusion to the crack tip and the critical size of the inclusion are determined. The present study is of central significance for the fracture analysis and safety design of particle-reinforced composites.

Keywords: Domain-independent interaction integral; Mixed-mode dynamic stress intensity factors; Interface crack; Inclusion

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