Dynamic Photoelastic Validation of Large Scale Fracture and Fragmentation Simulations

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Abstract

A detailed experimental and numerical investigation has been performed to validate large scale numerical simulations of dynamic crack propagation, branching, deflection, and penetration at interfaces in brittle homogeneous materials. High-speed photography in conjunction with the dynamic photoelasticity has been used to observe real-time failure mode transition mechanism at the interfaces. Wedge-loaded Homolite-100 plate specimens have been used to produce single, straight, mode-I propagating crack towards the interface. A modified Hopkinson bar setup has been used to accurately control initial and boundary conditions of crack face loading. Various interface angles and different bond strengths have been modeled using large scale computations which feature both bulk and interfacial cohesive element laws. The penetration/deflection behavior of incident mode-I cracks, crack branches and crack tip speed history for all these cases has also been investigated.