Conditions controlling kink crack nucleation out of, and delamination along, a mixed-mode interface crack

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Abstract

This paper analyzes the competition between kink nucleation and interface fracture for an interface crack (without a putative kink flaw) subject to mixed-mode loading. The simulations utilize a distributed cohesive zone approach that embeds cohesive elements throughout the entire mesh; dynamic crack path evolution occurs through a loss of cohesive traction associated with a critical separation between elements. The simulations identify mesh densities that lead to mesh-independent results for randomly oriented triangular meshes, and provide clear guidelines regarding parameters that recover toughness-controlled cracking (i.e. linear elastic fracture mechanics). The results demonstrate that, when the when the normalized bulk toughness is far from the transition between kinking and delamination, crack direction and critical loads are identical to those predicted by He and Hutchinson, who analyzed cracking from a putative flaw associated with the maximum energy

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