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A Cohesive Zone Model Taking Account Of The Effect Of Through-Thickness Compression

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Experiments in the literature show that through-thickness compressive stress significantly enhances interfacial fracture resistance. Most existing cohesive zone and interface element models which consider the enhancement only introduce friction in the model. In this paper, a new method is proposed to include both friction and enhanced interfacial shear strength in a cohesive zone model. Contact and friction at micro/macro crack closure is added to the cohesive constitutive law. A traction-based failure function and an energy-based failure function are employed and combined to construct a damage surface. An enhancement of interfacial shear strength due to through-thickness compressive stress is introduced into the traction-based function which governs the damage initiation, while the energy-based function controls the damage growth. The damage surface shrinks in the traction space as damage develops and leads to a softening cohesive constitutive law. The model is employed to simulate shear failure of symmetric double notch specimens and delamination failure in specimens with cut- and dropped-plies. Numerical predictions are in good agreement with available experimental data in the literature. Parametric studies show that both the friction at crack closure and enhancement of the interfacial shear strength play an important role in enhancing fracture resistance.

KEY WORDS: Cohesive zone model; interface element; friction; damage; through-thickness compression.

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