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MICROMECHANICAL INVESTIGATIONS OF CROSS-OVER FIBER BRIDGING

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Fibers that bridge the fracture surfaces in the wake of the crack tip can significantly enhance the delamination resistance for some polymer composite laminates [1-3]. In the current study, both detailed finite element analyses and a novel semi-analytical micromechanical model are employed to investigate the effects of fiber, matrix and interface properties on the macroscopic bridging law (traction-separation law), see Figure 1.

The semi-analytical model includes debonding between fiber and matrix, large deflections of the bridging fibers as well as buckling of fibers in compression. The predictions made by the proposed semi-analytical micromechanical model are shown to be in excellent agreement with those made by detailed finite element models.

The most important model prediction is that increasing the fiber/matrix interface may not be the best way to increase the delamination resistance of the laminate.

References