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Cracks in Ductile Polymers Using Cohesive Zone Modeling[1] DEREK REDING, Texas A&M University, RAMESH TALREJA COLLABORATION[2] — Ductile polymer fracture is studied by using a relatively new technique in which cohesive elements are placed between elastic solid elements, along the mesh boundaries. Polymer chain elongation is described using cohesive model parameters that are calibrated to simulate the conical crack observed in a single fiber fragmentation experiment that uses a ductile polyester matrix. This approach limits the crack trajectory to align with the mesh, thus severely limiting the accuracy. We propose a new crack trajectory method to describe polymer chain elongation by incorporating both normal and shear traction contributions in a strictly cohesive zone model approach. Our formulation shows that local polymer chain orientation depends on the ratio of mode I and mode II stiffness penalty parameters and tractions. The corresponding stress state reaches a critical value that is represented by a material parameter. The new crack tip extends to a location where the critical stress is reached at a maximum distance from the existing crack tip. Implementation is performed by adding the proposed crack trajectory method to an extended finite element code (X-FEM) with cohesive element modeling.

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