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Sandia Fracture Models for Mixed-Mode Brittle Fracture

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ABSTRACT

The ability to computationally model the initiation and propagation of cracks that originate from mixed-mode loading remains a compelling problem in the field of mechanical engineering. This problem is relevant to engineers in a wide variety of industries as well as at Sandia National Laboratories when modeling failure of brittle and ductile materials alike. In order to address this challenge, Sandia researchers have developed a wide range of modeling capabilities, including a phase-field fracture model and a geometric approach to crack propagation that couples Sandia's *Sierra* finite element code to *FRANC3D*, a commercial fracture mechanics tool. In this work, these approaches are applied to predict the crack path in a pre-notched polymethyl methacrylate (PMMA) sample under mixed-mode fracture conditions. Several key features of these models, such as the choice of crack driving energy and propagation criteria, and their implications will be discussed. These fracture modeling techniques demonstrate the capability to predict crack path and failure behavior in PMMA under mixed mode loading.

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