

Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

Phase-field methods for predicting fracture in brittle and ductile materials

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ABSTRACT

In this presentation, we will describe recent developments in the application of phase-field methods to the prediction of dynamic fracture of brittle and ductile materials. We will review our study to achieve higher-order convergence rates and improved accuracy in fracture predictions. These improvements are the result of adding additional derivative terms to the phase-field model, thereby increasing the solution regularity. We will also introduce a modification to what we call the damage function which allows the method to more accurately capture material behavior prior to failure. We will also discuss our study to develop the constitutive theory for phase-field models of ductile fracture. We will present several numerical examples for both two- and three-dimensional problems with comparisons to experimental results. These examples will demonstrate the ability of phase-field models to accurately capture complex crack propagation patterns.