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# SOME RECENT PROGRESS ON PHASE-FIELD MODELING: FATIGUE, R-CURVES, AND LARGE STRUCTURES

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## ABSTRACT

Over the last few decades, the phase-field approach to fracture has been shown to be a useful tool for modeling complex crack path evolution. Features including the nucleation, turning, branching, and merging of cracks as a result of quasi-static mechanical and dynamic loadings are captured without the need for extra constitutive rules for these phenomena. This presentation will touch on our recent work on the phase-field modeling approach for fatigue crack growth, R-curve behavior for brittle fracture in the presence of plastic flow, and modifications for large-scale structures will be discussed. For fatigue, a modified J-integral will be developed to demonstrate how the phase-field approach can be used to generate Paris-Law type crack growth rates. A steady-state finite element method is then applied to generate fits of the phase-field theory to measured crack growth rate data. Full transient simulations are performed and compared to experimental measurements on samples where crack turning is induced by the presence of a hole in the vicinity of the crack. To model R-curve behavior plasticity is introduced into the formulation and adaptive refinement is used to capture different length scales. Finally, modifications to the damage functions are introduced to allow for the analysis of large- scale structures and some issues are identified and discussed.