Fracture propagation in Indiana Limestone interpreted via a cohesive fracture model

Presenter (Theme Affiliation), Research Team

Joe Bishop (Theme 1), Alex Rinehart (now graduated), Tom Dewers, postdoc (TBD)

Objectives of Research

- Understand the underlying assumptions of cohesive fracture models and their applicability to modeling fracture processes in geomaterials.
- Formulate and validate a **subcritical** cohesive fracture model.
- Compare/contrast a cohesive fracture model with continuum-damage or phase field methods.

Conclusions

We have taken a first step in validating a cohesive fracture model. Subsequent research will focus on extending the model to include subcritical phenomena.

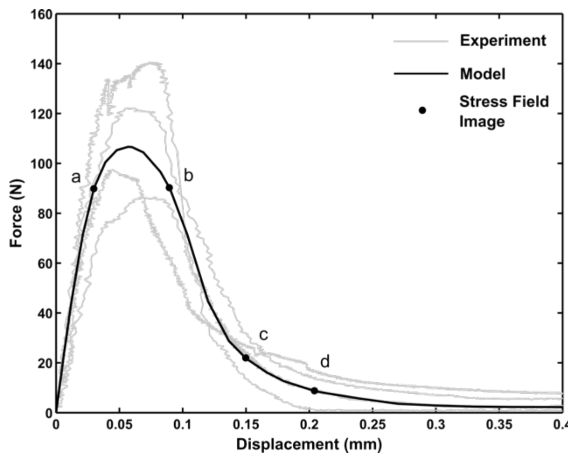
Impact on Specific Challenges

Challenge 1: (Sustaining large storage rates)

Injection rates are limited by pore-pressure induced fracture. Thus, understanding the mechanics and physics of fracture is critical to maximizing injection rates.

Challenge 3: (Controlling undesired emergent behavior)

Subcritical fracture is a type of emergent behavior. Understanding the mechanics and physics of subcritical fracture growth is a first step in controlling it.



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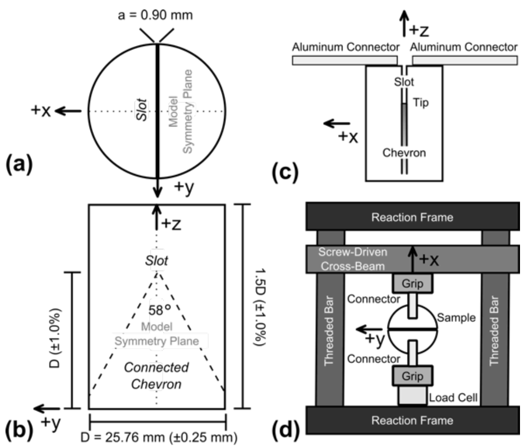
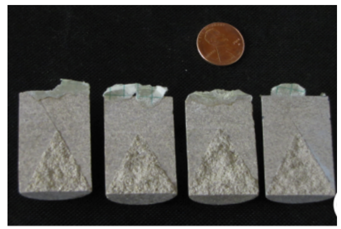
(A. Rinehart, J. Bishop, T. Dewers, 2015, “Fracture Propagation in Indiana Limestone Interpreted via Linear Softening Cohesive Fracture Model,” JGR, DOI: 10.1002/2014JB011624)

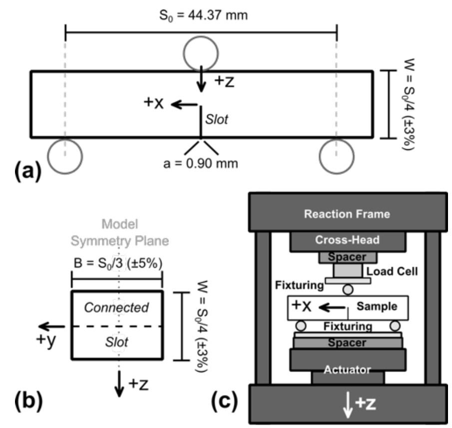
short-rod fracture experiment



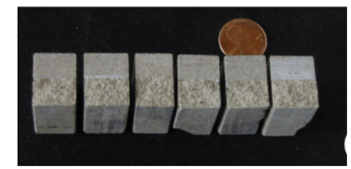
fractured short-rod specimens



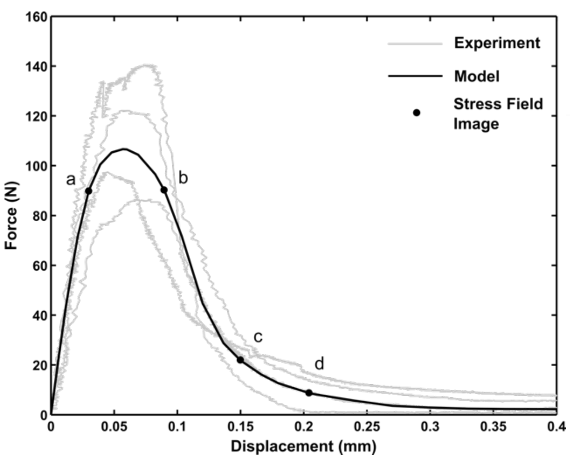
3-point bend fracture experiment



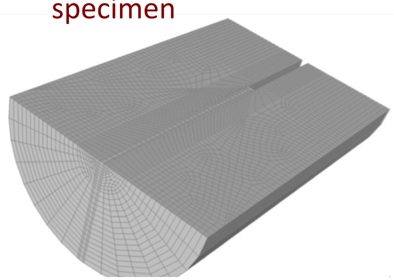
fractured 3-point bend specimens



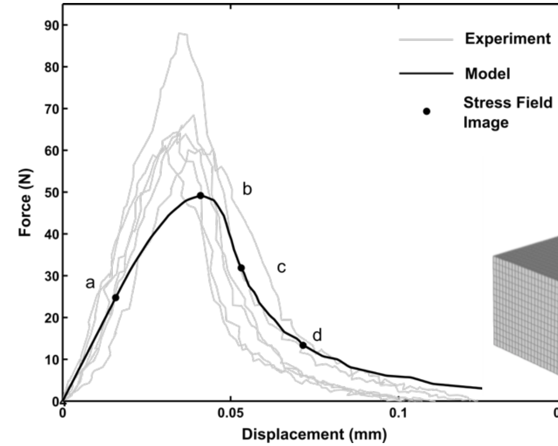
Applied Force vs. Displacement



finite-element model of short-rod specimen



Applied Force vs. Displacement



finite-element model of 3-point bend specimen