Other

The variational approach to fracture: recent developments and extensions

Blaise Bourdin

Associate Professor, LSU Department of Mathematics and Center for Computation & Technology

Lockett 285
September 24, 2013 - 03:30 pm

Abstract:

Most models for the fracture of brittle materials rely on an energetic argument, the celebrated Griffith criterion, combined with ad-hoc branching criteria. In addition, such models rely heavily on smoothness and regularity assumptions whose validity is debatable.

The variational approach to fracture was developed as an extension of Griffith criterion preserving its essence, competition between surface and volume energy, while avoiding any ad-hoc branching criterion or regularity hypothesis of fracture sets, in space or time. It is formulated as a sequence of unilateral global minimization problems of a free discontinuity energy.

I will first recall some elements of the mathematical analysis of this approach. I will then describe its numerical implementation, focussing on methods based on elliptic regularization. I will finally show how this approach can be used in many applications, including transverse fracture and debonding of thin films, drying of colloidal suspension, thermal shocks of glass and ceramics, dynamic fracture and hydraulic stimulation. I will describe the mathematical and algorithmic tools developed for each specific problem, and present validation and verification experiments.

Refreshments in the Keisler lounge (3rd floor, Lockett) at 3pm.

Speaker's Bio:

Blaise Bourdin is an associate professor in the LSU Department of Mathematics and adjunct professor in the LSU Center for Computation & Technology.

Bourdin's primary research interest lies in the analysis and numerical implementation of the variational approach to fracture. Throughout this work, he became increasingly interested in large scale high performance computing. In particular, he is deeply indebted to the PETSc, TAO, and Cubit projects which play an instrumental role in this project.

In recent years, Bourdin has become interested in the predictive understanding of reservoir stimulation for Enhanced Geothermal Systems, a clean and renewable source of energy. With several colleagues from the departments of Geology and Petroleum Engineering,he is involved in the Geothermal Interest Group at LSU which is “what I thought academia was about before I knew what academia really is”...

This lecture has refreshments @ 03:00 pm

Center for Computation & Technology
2003 Digital Media Center • Telephone: +1 225/578-5890 • Fax: +1 225/578-8957