MAE Seminar Series

Application of Peridynamics to Fracture in Solids and Granular Media

THURSDAY,
OCTOBER 22
4:00 PM
Zoom Information
Meeting ID: 983 6137 4638
PASSWORD: MAE

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ABSTRACT

In this talk, we will present our recent work on peridynamics and its application. We consider a bond-based peridynamics with a nonlinear constitutive law relating the bond-strain to the pairwise force. For the model considered, we can show well-posedness and existence in the Hölder and Hilbert H2 space under appropriate conditions and obtain apriori bounds on the finite-difference and finite-element discretization. We will present the application of the model to mode-I and mixed-mode fracture problems. One particular topic of interest is the kinetic relation for the crack tip velocity in the peridynamics and how it relates to the local kinetic relation (LEFM theory). We will show that in the limit of vanishing nonlocality, we recover the classical kinetic relation from the peridynamics formulation. We will present numerical results that support the theory. Another application of peridynamics recently gaining much attention is in the granular media. DEM based methods can describe the interaction in particulate media very well but lack the capacity to model the intra-particle fracture. Towards this, we have developed and implemented a model referred to as PeriDEM that combines the advantages of nonlocal fracture theory and DEM. The parameters in the model can be tuned to achieve desired damping effects and desired inter-particle contact strengths. We will show preliminary results for simple settings. For the two-particle test, we will perform some mesh convergence studies. The work on peridynamics is joint work with Dr. R. Lipton (Louisiana State University). The work on PeriDEM is joint work with Dr. R. Lipton and Dr. P. Desai (Rice University).

BIO SKETCH

Prashant K. Jha is the Peter O'Donnell Postdoctoral Fellow at The University of Texas at Austin. He worked at the Department of Mathematics, Louisiana State University, as a postdoctoral scholar before joining UT Austin. In August 2016, Prashant received PhD from Civil and Environmental Engineering, Carnegie Mellon University. He is broadly interested in the development and application of mathematical models and the use of high-performance computational resources to key and present-day relevant problems. The current focus includes the development and application of tumor growth models and mechanical deformation and fracture in solids and granular media.