Coupling FEM and meshfree peridynamics for the simulation of hydraulic fracturing

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Over the last several years we have developed a nonlocal multiphysics model based on peridynamic theory for the simulation of hydraulic fracture processes. As weâĂŹve added complexity including fully implicit poromechanics and plasticity to the model, we have struggled with expensive computational runtimes even while utilizing a massively parallel implementation of the full peridynamics model. In this talk, we present a coupling method for simulating hydraulic fracture growth with peridynamics in regions near the fractures and using a standard Galerkin finite element formulation with adaptive mesh refinement in regions far from the growing fractures. This includes a method of converting the finite element nodes to meshfree peridynamics nodes "on the fly". The model, implementation, and efficacy of the technique are discussed.