MULTISCALE COUPLING METHODS IN PERIDYNAMICS

PABLO SELESON

Abstract. Material failure and damage is a challenging problem in computational science and engineering. Peridynamics, a nonlocal reformulation of classical continuum mechanics, has been proposed as a suitable model for the simulation of cracks and their propagation in materials. As opposed to classical models based on partial differential equations, peridynamic equations do not assume spatial differentiability of displacement fields and can thus naturally represent material discontinuities. As a nonlocal model, based on spatial integration, peridynamics is computationally expensive compared to classical models. Consequently, multiscale methods to concurrently couple peridynamics and classical models are of interest toward efficient numerical simulations of peridynamic systems. The idea is to use peridynamic equations where cracks appear or may form, while using classical equations elsewhere. A main challenge is to design coupling schemes which avoid the introduction of spurious effects, such as ghost forces, wave reflections, and energy loss. In this talk, we will discuss coupling methods for peridynamics and classical continuum mechanics and demonstrate their performance through computational simulations.

Keywords: peridynamics, classical continuum mechanics, multiscale modeling, local-nonlocal coupling

Mathematics Subject Classifications (2010): 45K05, 74R99, 74S30, 70-08.

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Oak Ridge National Laboratory, One Bethel Valley Road, P.O. Box 2008, MS 6211, Oak Ridge, TN 37831-6211

E-mail address: selesonpd@ornl.gov