First Pan American Congress on Computational Mechanics
PANACM 2015
April 27-29, 2015, Buenos Aires, Argentina

A Blending Approach to Concurrently Couple Peridynamics and Classical Continuum Mechanics

Pablo Seleson*, David Littlewood†, Stewart A. Silling§

* Oak Ridge National Laboratory
One Bethel Valley Road, P.O. Box 2008, MS 6164, Oak Ridge, TN 37831, USA
selesonpd@ornl.gov http://web.ornl.gov/~psc/

† Sandia National Laboratories
P.O. Box 5800, MS 1322 Albuquerque, NM 87185-1322, USA
djlittl@sandia.gov http://www.sandia.gov/~djlittl/

§ Sandia National Laboratories
P.O. Box 5800, MS 1322 Albuquerque, NM 87185-1322, USA
sasilli@sandia.gov http://www.sandia.gov/~sasilli/

ABSTRACT

Peridynamics is a nonlocal reformulation of classical continuum mechanics. In contrast to classical models, governing equations in peridynamics are based on spatial integration, rather than spatial differentiation, of displacement fields. Therefore, peridynamics has been applied to the description of material failure and damage. As a nonlocal model, peridynamics is computationally more expensive than classical models; this motivates the development of concurrent multiscale methods, for which peridynamics is applied in regions where discontinuities appear or may be generated, whereas classical models are used elsewhere. A main challenge in concurrent multiscale modeling is how to couple different models without introducing spurious effects. We derive blending schemes to concurrently couple peridynamics and classical continuum mechanics, avoiding common artifacts present in these types of methods. We demonstrate the performance of the coupling schemes analytically and numerically.