Accepted Manuscript

A reproducing kernel enhanced approach for peridynamic solutions

Marco Pasetto, Yu Leng, J.S. Chen, John T. Foster, Pablo Seleson

PII: S0045-7825(18)30253-6
DOI: https://doi.org/10.1016/j.cma.2018.05.010
Reference: CMA 11911

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date : 5 February 2018
Revised date : 30 April 2018
Accepted date : 11 May 2018

Please cite this article as: M. Pasetto, Y. Leng, J.S. Chen, J.T. Foster, P. Seleson, A reproducing kernel enhanced approach for peridynamic solutions, *Comput. Methods Appl. Mech. Engrg.* (2018), https://doi.org/10.1016/j.cma.2018.05.010

A Reproducing Kernel Enhanced Approach for Peridynamic Solutions

Marco Pasetto[a,*], Yu Leng[b,*], J. S. Chen[a], John T. Foster[b], Pablo Seleson[c]

[a] *Department of Structural Engineering, University of California San Diego, La Jolla, CA 92093*

[b] *Department of Petroleum and Geosystems Engineering, The University of Texas at Austin, Austin, TX 78712*

[c] *Computer Science and Mathematics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831*

Abstract

The most common discretization method for peridynamic models used in engineering problems is the node-based meshfree approach. This method discretizes peridynamic domains by a set of nodes, each associated with a nodal cell with a characteristic volume, leading to a particle-based description of continuum systems. The behavior of each particle is then considered representative of its cell. This limits the convergence rate to the first order. In this paper, we introduce a Reproducing Kernel (RK) approximation to the field variables in the peridynamic equations to increase the order of convergence of peridynamic numerical solutions. The numerical results demonstrate improved convergence rates in static peridynamic problems using the proposed method.

1. Introduction

Peridynamics is an integro-differential nonlocal reformulation of the classical theory of continuum mechanics. It was introduced in [45][49] to model spontaneous formation of cracks. Since balance laws are computed through integration rather than differentiation, assumptions on the spatial differentiability of displacement fields are not required. For this reason, the peridynamic formulation remains valid in the presence of displacement discon-

*Contributed equally