Effect of Particle Discretisation and Horizon Size on the Displacement and Damage Plot Using Bond-Based Peridynamics

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Abstract Peridynamics (PD) represents a new non-local theory of continuum mechanics which uses integro differential equations instead of the typical local partial differential equations in its formulation. Thus, it is suitable for modelling fracture mechanics, where a continuum domain is modelled through particles connected via physical interactions. The PD formulation allows us to model spontaneous crack initiation, and crack branching without the need for special mathematical treatment. The value of parameters such as particle discretisation and horizon size will be checked to make sure that it agreed to the result from Finite Element Method (FEM) in elastic deformation before proceed to the failure mode. In PD, failure criterion is established when its stretch value exceeds a prescribed critical stretch value. In the classical bond model or Prototype Microelastic Brittle (PMB), the bond force grows linearly with the bond stretch, and the value suddenly goes down to zero when the bond stretch exceeds its critical value. This study will focus on the effect of horizon size and particle discretisation on PD displacement of elastic analysis, and damage patterns with PMB damage model. The proposed study leads to a better understanding of how horizon size and particle disretisation affect the damage patterns in PD frameworks.

Keywords Peridynamics · Cracks · Prototype microelastic brittle

1 Introduction

Peridynamic or Peridynamics (PD) theory, is a non-local theory, that was introduced by Silling [1] and Silling et al. [2] at Sandia National Laboratories, USA in an attempt to deal with the discontinuities. It is related to the non-local theory studied by Eringen et al. [3–5], which only particles placed inside a certain radius from a

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