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MULTISCALE SIMULATION OF FRACTURE USING PERIDYNAMIC ENRICHMENTS WITHIN THE PARTITION OF UNITY METHOD

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ABSTRACT

Partition of unity methods are of domain decomposition type and provide the opportunity for multiscale and multiphysics numerical modeling and simulation. Different physical models can exist within a partition of unity method scheme for handling problems with zones of linear elasticity and zones where fractures occur. Here, the peridynamic model is used in regions of fracture only whereas a partition of unity method is used on the whole daomain especially in the surrounding linear elastic media.

Our method is novel in that we evolve the crack path using peridynamics locally and transfer the geometry of the crack path in the damaged media to the global partition of unity method. Here, Heaviside and Westergaard functions are used to model the crack based on the crack path obtained from peridynamics. We do not transfer information of the peridynamic fields to the partition of unity method directly, solely the crack geometry. The first steps for a combined peridynamic and partition of unity method simulator are presented. We show that the local peridynamic approximation can be utilized to enrich the global partition of unity method approximation to capture the true material response with high accuracy efficiently. Test problems are provided demonstrating the validity and potential of this numerical approach.

REFERENCES

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