A sensitivity study for critical traction in quasi-static Peridynamics simulations

Patrick Diehl*, Marc Alexander Schweitzer†

* Institute for Numerical Simulation
Wegelerstr. 6, 53115 Bonn
diehl@ins.uni-bonn.de and http://schweitzer.ins.uni-bonn.de/people/diehl.html

† Institute for Numerical Simulation
Wegelerstr. 6, 53115 Bonn
schweitzer@ins.uni-bonn.de and http://schweitzer.ins.uni-bonn.de/people/schweitzer.html

ABSTRACT

We used the simple bond-based Peridynamics theory [1], an alternative non-local generalization of continuum mechanics, to obtain the critical traction before the propagation of the initial crack through the entire patch occurs. For this quasi-static problem a solution for the critical traction is predicted by the Linear Elastic Fracture Mechanics LEFM theory for prescribed values of the energy release rate and the Young's modulus. First studies for one material and middle particle density were made in [2].

We studied materials in the range from Polymethyl methacrylate (PMMA) up to Titan alloy and compared the obtained critical traction obtained in the simulation with the predicted value from LEFM theory. In this scenario we varied the particle density and the density of the material to study the sensitivity of these parameters to the simple bond-based Peridynamics. For a quasi-static problem the critical strain should be independent of the mass density.

To investigate the sensitivity of high particle densities in a wide range of materials we use sparse grids to reduce the number of simulations up to 50 percent.

We present the sensitivity of the critical traction depending on the Young's modulus , the energy release rate, the material density and the particle density. The results show that the critical traction before failure is independent of the density. The obtained value for the critical traction is limited by a model value, which differs up to 5 percent from the prescribed value of the LEFM theory.

REFERENCES

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