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Peridynamic Analysis on Failure of Cantilever Beam Subjected to a Concentrated Force and Uniform Distributed Traction

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ABSTRACT

Peridynamics (PD) is a reformulation of the classical continuum mechanics. Its core consists in that a weighted integral of relative displacement over a spatial domain is used instead of the spatial derivative of displacement in governing equations of deformation. Based on an improved technique of exerting traction on boundary surface, an improved peridynamic motion equation has been proposed within the framework of the peridynamic(PD) theory. It is more natural and easier to deal with boundary conditions for the elastic deformation and fracture analysis. Under the enhancement effect in the constructed transfer functions of boundary traction, there is not needed the surface correction technique due to the material points closed to the boundary surface is the incompleteness horizon in the numerical algorithm. Following the new peridynamic motion equation, we calculate the deflection and fracture of a cantilever beam subject to a concentrated force at the free end and uniform distributed traction on the upper side. The acquired numerical solutions are close to the analytical solutions of elasticity and numerical solutions given by the finite element method. The results show that the improved technique of exerting traction on boundary surface is valid for calculating the deformation and failure of solid. It provides a new method and path for the analysis of traction boundary value problems in peridynamics.

KEYWORDS

Peridynamics; peridynamic motion equation; elastic deformation; fracture; cantilever beam

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