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An Approach to Modeling Extreme Loading of Structures using Peridynamics[1] PAUL DEMMIE, Sandia National Laboratories — Peridynamics is a theory of continuum mechanics that is formulated in terms of integral equations rather than partial differential equations. It assumes that particles in a continuum interact across a finite distance as in molecular dynamics. The integral equations remain valid regardless of any fractures or other discontinuities that may emerge due to loading. In contrast, the differential equations of classical theory break down when a discontinuity appears. Peridynamics predicts the deformation and failure of structures under dynamic loading, especially failure due to fracture. Cracks emerge spontaneously as a result of the equations of motion and material model and grow in whatever direction is energetically favorable. The implementation does not require a separate law that tells cracks when and where to grow. We describe peridynamics theory and provide some examples of its application as implemented in the EMU computer code. EMU is mesh free. Therefore, it does not use elements, and there are no geometrical objects connecting the grid points. Hence, there is no need for a mesh generator when modeling complex structures. Only the generation of grid points is required.

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