Silling, S. A.; **Zimmermann, M.**; **Abeyaratne, R.**
Deformation of a peridynamic bar. (English) Zbl 1061.74031
J. Elasticity 73, No. 1-3, 173-190 (2003).

Summary: The deformation of an infinite bar subjected to a self-equilibrated load distribution is investigated using the peridynamic formulation of elasticity theory. The peridynamic theory differs from the classical theory and other nonlocal theories in that it does not involve spatial derivatives of the displacement field. The bar problem is formulated as a linear Fredholm integral equation and solved using Fourier transform methods. The solution is shown to exhibit, in general, features that are not found in the classical result. Among these are decaying oscillations in the displacement field and progressively weakening discontinuities that propagate outside of the loading region. These features, when present, are guaranteed to decay provided that the wave speeds are real. This leads to a one-dimensional version of St.-Venant's principle for peridynamic materials that ensures the increasing smoothness of the displacement field remotely from the loading region. The peridynamic result converges to the classical result in the limit of short-range forces. An example gives the solution to the concentrated load problem, and hence provides the Green's function for general loading problems.

MSC:

74K10 Rods (beams, columns, shafts, arches, rings, etc.)
74A25 Molecular, statistical, and kinetic theories in solid mechanics

Keywords:

Fredholm integral equation; Fourier transform; Green's function; St.-Venant's principle

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