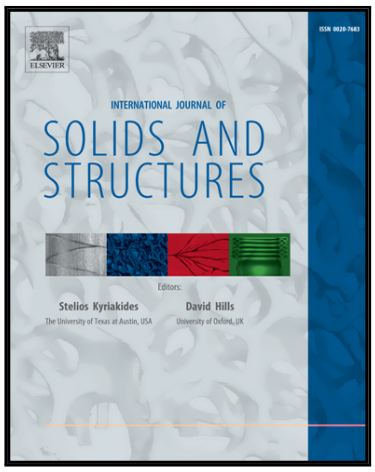

Interaction of Highly Nonlinear Solitary Waves with Elastic Solids Containing a Spherical Void

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Interaction of Highly Nonlinear Solitary Waves with Elastic Solids Containing a Spherical Void

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Abstract

Numerical calculations are performed to examine the interaction of highly nonlinear solitary waves in one-dimensional granular crystals with elastic solids containing a defect in the form of an embedded spherical void. The calculations are based on a coupled numerical model, combining concepts of discrete and finite elements. It is found that the delay and force amplitude of the reflected solitary waves are controlled by the local contact stiffness of the inspected sample, and are strongly affected by the size and depth of the embedded void. Moreover, the predictions show a steady increase of delay of the reflected solitary waves with increasing void radius for a fixed void depth, approaching the pristine case (no void) at sufficiently small void sizes. It is also found that the detectability of voids near the surface generally increases with decreasing sample's elastic modulus, and can be further increased by adjusting the striker velocity. The findings from this study can be used for developing a solitary wave-based diagnostic scheme to inspect elastic solids with void-like defects.

Keywords: wave propagation, finite elements, discrete elements, non-destructive testing

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