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Propagation of rarefaction pulses in particulate materials with strain-softening behavior ERIC HERBOLD, School of Materials Science and Engineering, Georgia Institute of Technology, VITALI NESTERENKO, University of California, San Diego — We investigate rarefaction waves in nonlinear periodic systems with a 'softening' power-law relationship between force and displacement to understand the dynamic behavior of this class of materials. A closed form expression describing the shape of the strongly nonlinear rarefaction wave is exact for exponent in force interaction law equal to 0.5 and agrees well with the shape and width of the pulses resulting from discrete simulations. A chain of particles under impact was shown to propagate a rarefaction pulse as the leading pulse in initially compressive impulsive loading in the absence of dissipation. Compression pulses generated by impact quickly disintegrated into a leading rarefaction solitary wave followed by an oscillatory train. Such behavior is favorable for metamaterials design of shock absorption layers as well as tunable information transmission lines for scrambling of acoustic information.

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