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Solitary and shock waves in discrete double power law materials[1]
ERIC HERBOLD, VITALI NESTERENKO, Department of Mechanical and Aerospace Engineering, University of California at San Diego, La Jolla, California 92093-0418 — A novel strongly nonlinear metamaterial is composed using a periodic arrangement of toroidal rings between plates. The toroids are considered massless strongly nonlinear springs where the force versus displacement relationship is described by two additive power-law relationships. In these systems the nonlinearity is due to the dramatic change of the contact plane, which starts as an arbitrarily thin circle then increases in thickness with increasing compression. Solitary and shock waves are examined numerically and experimentally using three different types of polymer or rubber o-rings allowing mitigation of higher amplitude shock impulses in comparison with granular systems. In these systems a train of pulses can consist of two separate groups related to two strongly nonlinear regimes with different values of exponents, depending on the amplitude. In experiments two types of shock waves (monotonic or oscillatory) were observed depending on the type of o-rings.

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Vitali Nesterenko
Department of Mechanical and Aerospace Engineering,
University of California at San Diego, La Jolla, California 92093-0418

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