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### Strongly nonlinear behavior of granular chains and granular composites

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Strongly nonlinear behavior of granular phononic crystals composed of stainless steel cylinders and PTFE spheres is considered experimentally and numerically. The tenability of phononic band gap in this two-mass prestressed chain was investigated. The results show that the phononic band gap exists within audible frequency regime (20~20,000 Hz) and can be tuned by changing the value of prestress. Influence of the weak and strong nonlinearity on the propagation of signals with frequencies inside band gap was investigated.

The mechanical properties of reactive materials (e.g., high density mixtures of polytetrafluoroethylene (PTFE), aluminum (Al) and tungsten (W) powders) where unconsolidated granular packing of metal particles plays significant role in the dynamic behavior was investigated. It was found that dynamic strength can be tailored by changing the morphology of the particles and porosity. Cold isostatically pressed PTFE-Al-W powder composites with fine metallic particles and a higher porosity exhibited higher ultimate compressive strength than less porous composites having equivalent mass ratios with coarse W particles. Based on the numerical analysis it was concluded that a mesoscale force chains between the fine metallic particles are responsible for this unusual phenomenon.

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