Wave propagation in disordered and nonlinear phononic chains

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In this work we study discrete phononic lattices with either one or more degrees of freedom (d.o.f.) per cite by considering the longitudinal, transverse or rotational motion of macroscopically connected rigid particles. We focus our studies in the effects of disorder and nonlinearity. The main goal is to characterise and analyse the energy transport in the presence of disorder focusing on initial conditions in the form of localised wavepackets. We show how nonlinearity enhances the energy transport and more importantly how it pushes the system to energy equipartition. We establish a connection between chaos and the spreading of energy and show how localised chaos can emerge by particular choice of initial excitations. Finally, for the case of coupled degrees of freedom (transverse motion and rotational motion) we show how the polarisation of the lattice affects energy transport under strong disorder and we identify differences with the standard 1 d.o.f. case mostly due to the particular form of the dispersion relation at low frequencies.