

Observation of propagation of nonlinear localized oscillations in a mass-spring chain with excitation and attenuation ends

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Abstract: Mobile type of nonlinear localized oscillations have been excited by making mechanical experiments using a mass-spring chain which emulates the Fermi-Pasta-Ulam (FPU) one of β type [Phys. Lett. A 382 (2018) 1957-1961]. Letting the weight at one end of the chain driven sinusoidally with high frequency and large amplitude, localized oscillations have been excited intermittently near the end and propagated down the chain one after another at a constant speed. Because of the finite length of the chain, the localized oscillations traveling and reflected at the other end immediately interact and make the oscillation mode of the chain complicated. To pick up and observe one-direction propagation of the localized oscillations, we set an apparatus near the driving end to control the approach of excited oscillations into the chain and provide attenuation effects at the other end to suppress the reflection. In this paper we consider the relation of the speed of the propagation to the driving frequency and amplitude.

Keywords: Intrinsic localized mode (ILM), Discrete breather (DB), discrete nonlinear system, Fermi-Pasta-Ulam (FPU) chain, piecewise linear spring, mobile ILM