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Effects of thermal relaxation on nonlinear mesoscopic elastic materials

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LISA simulations of the ultrasonic wave propagation in multigrained materials have succeeded in reproducing most of the recently observed nonclassical nonlinear effects, such as stress-strain hysteresis and discrete memory in quasi-static experiments and a downwards shift of the resonance frequency and the generation of odd harmonics at specific amplitude rates in dynamics experiments. By including a simple mechanism of thermally activated random transitions, we can reproduce well other experimental results, such as the conditioning and relaxation of the specimen. In addition the new model allows us to make several predictions, which can be easily verified experimentally. The model is also applied to resonant dynamic experiments in order to study slow dynamics effects.

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