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Guiding of High Amplitude Stress Waves Through Stress-Induced Domain Switching in Multiphase Materials JULIAN RIMOLI, LUCA GUIDONI, BRETT REICHARD, MASSIMO RUZZENE, Georgia Institute of Technology — Periodic and graded Multiphase Materials (MMs) are of great interest to scientists and engineers because of their unique static and dynamic mechanical properties, and the design flexibility they provide. In the linear range operation, MMs can be designed to attenuate vibrations over wide frequency bands and in specified directions, as defined by topology, geometry and material of the unit cell. Similarly, unit cell design and topology can be selected to obtain a desired anisotropy in the material, which can be exploited to alter the path of propagation of elastic and high amplitude stress waves. Specifically, steering of waves in preferential directions can be achieved through the proper arrangement of periodic hard inclusions within a matrix. Such a capability is extremely important for the design of materials capable of guiding stress waves to propagate along specified paths. In the present work, we explore the use of periodic metamaterials for wave management in force protection applications. We define topologies which adapt to high amplitude mechanical inputs, and study through numerical simulations and experiments local and global instabilities which lead to adaptive mechanical behavior through topological and structural modifications.

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