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Nonlinear modal enrichment in phononic crystals[1] STEFANO GONELLA, R. GANESH, University of Minnesota — Recent years have seen the advent of strategies to design metamaterials and phononic crystals with adaptive characteristics. Adaptivity is the ability of a system to autonomously modify its behavior in response to detected changes in the operating conditions. In this work we discuss the opportunities for the design of adaptive phononic crystals enabled by the exploitation of the nonlinearity embedded in the system. A well-known manifestation of nonlinearity is the generation of higher harmonics which, in complex dispersive systems, enables a rearrangement of the spectral response whereby part of the energy of an excited wave is deployed to a higher-frequency region of the band diagram, with the possibility to hop onto a different branch. The result is a mixture of modes with different (and possibly complementary) characteristics and an augmentation of the dynamic functionalities of the medium. In this work, we illustrate the versatility of this paradigm through a portfolio of lattice configurations. In these examples, mode hopping manifests either through the activation of new directional patterns in the wavefield, or through an enrichment of the wave modal content, for example by activating longitudinal components in wavefields originally dominated by shear mechanisms.

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Stefano Gonella
University of Minnesota

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