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Towards Phononic Topological Insulators PAI WANG, KATIA BERTOLDI, School of Engineering and Applied Sciences, Harvard University — Recent studies in optics have shown that the concept of topological insulators can be extended to band theories of classical waves and bosonic systems. Here, we present some design considerations in realization and observation of topological edge states for phonons. The goal is to achieve topologically protected one-way propagation of surface acoustic / elastic waves against back-scattering and localization due to defects and disorders by utilizing phononic crystals, which have micro-structures with periodicity comparable to the wavelength of the propagating elastic waves. Both theoretical and practical challenges in creating non-reciprocal elastic media will be discussed. Possible candidates include temporal modulation of phononic crystals, coupled wave guides, chiral local resonators, artificial magneto-acoustic effects and asymmetric body forces induced by external fields. These symmetry breaking mechanisms can potentially lead to the phononic analogue of electronic quantum hall effect. The robustness of reflection-immune unidirectional elastic wave has promising applications in surface acoustic wave (SAW) devices that are widely used in modern telecommunication, geophysics as well as micro-fluidics.

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