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Soft 3-D Phononic Crystals: Design and engineering of the band-gap and propagation directionality PAI WANG, SAHAB BABAEE, JONGMIN SHIM, KATIA BERTOLDI, Harvard University, BERTOLDI'S GROUP TEAM — We present a new class of 3-D bi-continuous soft phononic crystals. Different solid-fluid inter-penetrating periodic micro-structures are proposed for the geometric configurations. Buckling and large deformation of the meta-material is intentionally exploited as a novel and very simple approach to tune and transform the phononic band gaps as well as the preferential propagation directions of acoustic and elastic waves. The nonlinear effects of both geometry and material behavior during the deformation are investigated. The dispersion relations of deformed phononic crystals are calculated by using frequency domain numerical simulations on the unit cell of spatial periodicity. The characteristics of soft phononic crystals are demonstrated with tunable band-gaps, adjustable directionality and adaptive refractive index. This study provides us with a deeper understanding of the design parameters and engineering guidelines for various potential applications, including sound filters in noise-cancelling devices, wave guides, acoustic imaging equipment and vibration isolators.

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