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Anomalous acoustic dispersion in architected microlattice metamaterials SEBASTIAN KRDEL, ETH - Zurich, ANTONIO PALERMO, University of Bologna, CHIARA DARAIO, Caltech — The ability to control dispersion in acoustic metamaterials is crucial to realize acoustic filtering and rectification devices as well as perfect imaging using negative refractive index materials. Architected microlattice metamaterials immersed in fluid constitute a versatile platform for achieving such control. We investigate architected microlattice materials able to exploit locally resonant modes of their fundamental building blocks that couple with propagating acoustic waves. Using analytical, numerical and experimental methods we find that such lattice materials show a hybrid dispersion behavior governed by Biot's theory for long wavelengths and multiple scattering theory when wave frequency is close to the resonances of the building block. We identify the relevant geometric parameters to alter and control the group and phase velocities in this class of acoustic metamaterials. Furthermore, we fabricate small-scale acoustic metamaterial samples using high precision SLA additive manufacturing and test the resulting materials experimentally using a customized ultrasonic setup. This work paves the way for new acoustic devices based on microlattice metamaterials.

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