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Supplemental Material: Microlattice metamaterials for tailoring ultrasonic transmission with elasto-acoustic hybridization

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Static lattice design maps

To investigate the effective static properties of the microlattices, we analyzed lattices using finite element simulations and quasi-static experimental measurements, considering 16 different combinations of R_0 and R_1 (Fig. S1(a)). The experimental value of the samples' stiffness agrees well with the numerical predictions. The effective density of the lattice structures was calculated dividing their mass by the volume of a unit cell integrated numerically. Density variation as a function of the two radius parameters is shown in Fig. S1(b).

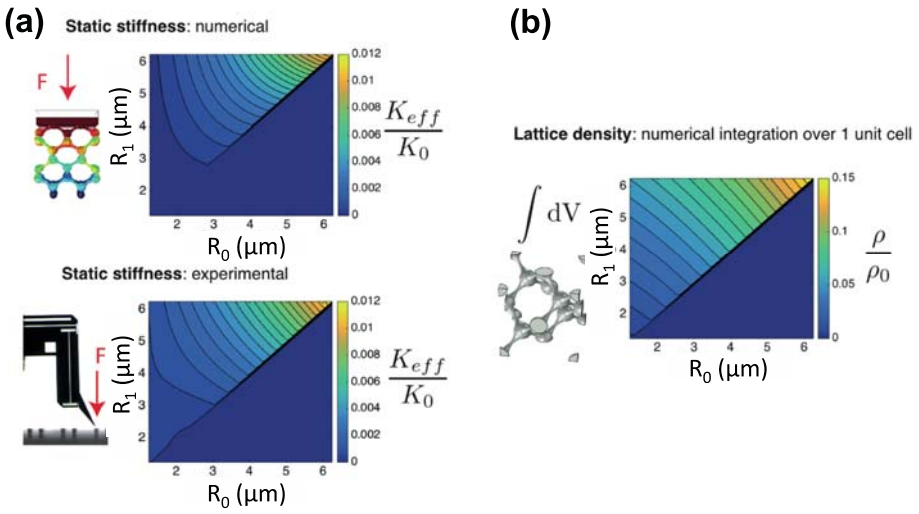

FIG. S1. (a), Static numerical and experimental measurements for different lattice geometries with design maps. (b), Relative density of the lattice as a function of the radii R_0 and R_1.

Pure Elastic Dispersion

We show the band structure of a dry lattice A (Fig. S2), to compare the response of the lattice in the presence and absence of fluid as a surrounding medium. The dispersion relation shows 3 modes propagating from the zero point (1 longitudinal and 2 degenerate shear modes). There exist also a large band gap between 12-27 MHz, which is not visible in the response of the structures immersed in fluid, as described in the main paper. We also highlight the eigenmodes of the truss elements in the dry lattice (see Fig. S2(b)), at a frequency of 35 MHz.

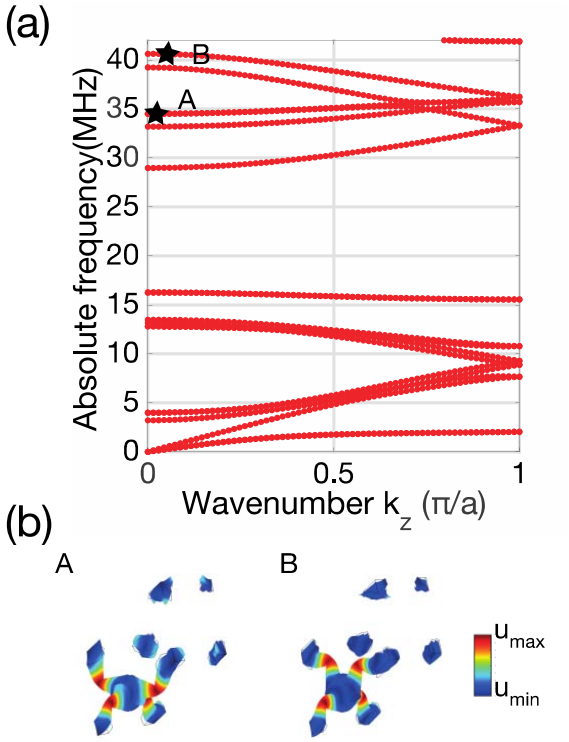

FIG S2. (a), Band structure of the dry lattice A and (b), mode shapes of first bending modes at positions A and B in the dispersion diagram.

Propagation along *x*-direction

In addition to the wave propagation along the z-direction, we study the propagation along the x-direction (Fig. S3). We show the occurence of a second band gap, induced by the perpendicular (in the *x*-*y* plan) movement of the truss elements (see Fig. S3(b)).

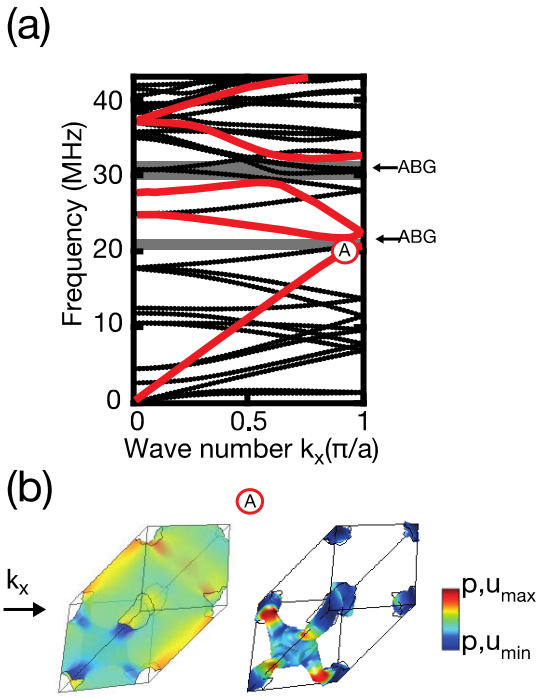

FIG S3. (a), Band structure of the elastic lattice A in the x-direction. (b), Presseure field and displacement mode shapes of first bending mode at position A in the dispersion diagram.