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Acoustic metafluid with anisotropic mass density and tunable sound speed: An approach based on suspensions of orientable anisotropic particles MARK SEITEL, STEPHEN TSE, JERRY SHAN, Rutgers University — We investigate liquid suspensions of micron-scale, anisotropic particles as potential acoustic metafluids having anisotropic and actively controllable acoustic properties. The effective mass density (and hence the sound propagation speed) of these metafluids can vary because the added mass of an anisotropic particle suspended in the fluid changes with the particle's orientation relative to the direction of the wave propagation. A suspension with disc-like particles oriented broadside to the direction of wave propagation is thus expected to have higher effective inertia and lower sound speed than a suspension with particles with end-on alignment. To test these predictions, sound speed is measured with a time-of-flight method in suspensions of micron-size nickel flakes suspended in oil, with and without magnetic-field-induced alignment of the particles. The sound speed, relative to the unaligned case, is found to decrease for particles oriented broadside to the sound wave, and increase for edgewise alignment. We also investigate the frequency dependence of the effective sound speed, since the added mass effect is expected to diminish as the flow becomes steady at low frequencies. The experimental results are compared to the predictions of a model proposed by Ahuja & Hardee (*J. Acoust. Soc. Am* 1978) for the acoustic properties of aligned oblate-spheroid suspensions.

Jerry Shan
Rutgers University

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