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Additive Manufacturing of Porous Noise Absorbers

Absorbing unwanted sound waves without excessively constraining the air flow path is a recurring challenge across various engineering fields. Cellular porous materials are the most commonly employed solution to this ubiquitous problem. The properties of traditional porous materials result from the stochastic architecture of their cellular solid phase—a product of conventional foaming techniques. While these materials provide reliable acoustical performance, a lack of control over their cellular structure limits their structural applications. The recent emergence of additive manufacturing has opened up the possibility of fabricating porous materials with cellular microstructural topologies that were previously infeasible. In this talk, I will showcase a few examples of additively manufactured, porous noise absorbers being investigated in our Mechanics and Dynamics Lab at Wichita State University including: polymeric and metallic foams with triply periodic minimal surfaces with unit cell dimensions ranging from 50 μm to 2 mm; 3D printed fibers to help improve acoustical performance of load-bearing lattices; and aerogel-based absorbers with controlled microstructures printed using a novel freeze-casting approach. These ‘designer foams’ present a pathway towards realizing application-tailored microstructures that can help improve sound absorption behavior while enabling a new paradigm of multifunctional engineering design.