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Optimal Straw-like Metamaterial Design for Low Frequency Sound Absorption

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Straws or straw-like natural materials, such as wheat, reed or rattan, have been used as thermal insulation material for thousands of years throughout the world. But its functionality on sound absorption is only studied through rudimentary models and methods. Here, we propose an anisotropic acoustic metamaterial design, inspired by straw stack for perfect sound absorption. The physics of the porous media in idealized straw-stacks is enriched by tailoring inner resonances. The approach to this straw-inspired metamaterial relies on the homogenization of a periodic arrangement of straw-like quarter-wavelength resonators. Several optimal designs are found out by critical coupling technique And impedance tube measurements are performed on 3-D printed samples with controlled parameters to validate the theoretical results.