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Fluid-structure Interactions for the Design of Adaptive Acoustic Metamaterials FILIPPO CASADEI, KATIA BERTOLDI, Harvard University, .
TEAM — The present research focuses on the analysis of fluid-structure interactions as a new paradigm for the design of adaptive phononic crystals and acoustic metamaterials. Whereas in conventional design procedures couplings between structures and fluids represent a source of concern due to the possible onset of catastrophic instabilities, in this research such interactions are exploited as the enabling mechanism for mechanical adaptation. Analytical and numerical models illustrate how such interactions can be exploited for the design of periodic structures with wave propagation properties that can be controlled by the surrounding fluid environment. Analysis of the dispersion relations computed for one-dimensional phononic crystals and acoustic metamaterials show that the location of frequency bandgaps is directly correlated to the conditions of the external fluid flow. Direct simulations of assemblies of finite size and preliminary experimental results are presented to further illustrate the concept.

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