Wave control of scattering in a locally resonant 3-port acoustic system

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We study the scattering properties of a 3-port systems composed by 3 connected waveguides. Each waveguide is loaded by an Helmholtz resonator operating in the low frequency regime.
We find the conditions and the corresponding configuration in order to achieve Coherent Perfect Absorption (CPA) either by considering the same input for all ports (symmetric CPA) or for different inputs (asymmentric CPA). For particular configurations and due to the properties of the scattering matrix, we show that asymmetric CPA is achieved for an infinite choice of input waves. We also identify specific conditions for which tuning the phase of the input waves leads to perfect transmission from CPA. In addition, we find the conditions and the corresponding configuration to obtain channeling, directing the energy inputed from two ports to escape out of the system from the third one.
An experimental demonstration of the above phenomena is proposed by using 3 cylindrical waveguides and resonators with tunable cavities.