Subwavelength Total Acoustic Absorption with Degenerate Resonators

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We report the experimental realization of perfect sound absorption by sub-wavelength monopole and dipole resonators that exhibit degenerate resonant frequencies. This is achieved through the destructive interference of two resonators' transmission responses, while the matching of their averaged impedances to that of air implies no backscattering, thereby leading to total absorption. Two examples, both using decorated membrane resonators (DMRs) as the basic units, are presented. The first is a flat panel comprising a DMR and a pair of coupled DMRs, while the second one is a ventilated short tube containing a DMR in conjunction with a sidewall DMR backed by a cavity. In both examples, near perfect absorption, up to 99.7%, has been observed with the airborne wavelength up to 1.2 m, which is at least an order of magnitude larger than the composite absorber. Excellent agreement between theory and experiment is obtained.