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Active-passive multilayered panels for reduction of both acoustic reflection and transmission

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The design of panels reducing both acoustic reflection and transmission for a wide frequency range is a problem of considerable practical interest for building or transport industries. Classically, these panels are made up of elastic plates bonded to poroelastic layers. Such structures are efficient in the middle and high frequency range but exhibit a lack of performance at low frequency. Hybrid passive/active cells previously developed at the LMFA have proved their efficiency for global noise reduction. They combine passive means (elastic plates, poroelastic material) and active control through a piezoelectric actuator to ensure high panel performance throughout the whole frequency range. In this paper, two systems are described. The first one is a multilayered panel combining two cells: the first cell on the emission side ensures high absorption, the second cell located at the rear face aims at reducing transmission. The second structure consists of a double-plate system using a micro-perforated plate on the emission side and an active plate on the transmission side. The performance of the two systems are examined through analytical or numerical simulations developed for plane waves and diffuse field conditions, and through experiments carried out for plane waves under normal incidence.