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Improvement of acoustic transmission loss by active modal mass control

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This paper deals with an alternative modal control approach to reduce the sound transmission through a structure excited by an acoustic wave. Active control enables to conserve the characteristics of lightness while improving acoustic performances. For light and small structures having small modal overlap, the "modal mass damping control" is proposed. The aim of this control is to modify the modal distribution of high radiation efficiency modes with modal virtual mass and modal virtual damping. The interest of this approach is that at low frequencies, the active virtual mass effects shift down eigen frequencies to less audible frequency range while reducing vibration amplitudes in a broad frequency range. The modal virtual mass control appears to be a good complement to a standard damping control which is exclusively efficient at resonances. In order to detail the concept of the proposed method, an application is presented on a double panel equipped with piezoelectric patches. The structure is excited by a distributive acoustic plane wave. Acoustic transmission loss factors of the simulated controlled and the non-controlled smart structure are shown and optimization is discussed.