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Hybrid Foams for passive/active control of transmission loss of panels

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Absorbing materials are widely used in transport industry. Classical foams can efficiently improve transmission loss of panels, but only in the higher frequency range. For the lower part of the frequency range, structural active control can be a good strategy to reduce the vibratory level and induced noise. Trying to take advantage of those two points is the objective of the development of hybrid foams. Many practical and scientific aspects are related to their design: which passive material should be used? Which active material, and what shapes should be better? In order to understand the basics of the hybrid foams, some specific multiphysics models are developed, including vibro-acoustic modelling of foams, coupled with elasto-dynamics for structural parts and piezo-elastic models for active parts. The objective of the strategy is to try to take advantage of distributed actuators within the foam in order to modify the energy transmission path. The physical strategy is presented in the paper, together with the full description of the model, with numerical results. The main difficulty for the numerical part is the very high number of degrees of freedom which are required by the model. Some model reduction strategies are then investigated.