Numerical computation of the diffuse field absorption coefficient of porous materials by using alpha cabins

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The Alpha Cabin (or small reverberation room) is widely used in the automotive industry [1,2,3] inasmuch as the frequency range and sample size is adapted to the requirements of automotive acoustics. The main goal of this work consists of a detailed description of the numerical procedures to determine the diffuse field absorption coefficient associated with a porous material by using the reverberation time technique [4,5].

Firstly, a numerical methodology based on the computation of the decay modes of the cabin is described. Following [4,5], to quantify the absorption of a sample firstly is necessary to compute the reverberation time associated with the empty room and the reverberation time in the cabin with an absorbing sample. In order to compute the Sound Pressure Level at several points inside the cabin, it is necessary to solve an eigenvalue problem inside the alpha cabin. Thus, reverberation times are measured without and with the tested sample and the absorption coefficient is computed by using the Sabine expression. Since this numerical approach does not allow us to obtain accurate results, a new numerical methodology is used. The modal expansion is replaced by a full time-dependent discretization [6] and the American standard ASTM C423-09 [7] is used to compute the decay rates. Then, the reverberation times are based on the local average of the pressure values in different time windows.

Finally, some numerical results of the reverberation times and the absorption values associated with different samples of porous materials are compared with measured data showing a significant agreement.

Keywords: Diffuse field, reverberation time, numerical simulation

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