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Development of a pressure based room acoustic model using impedance descriptions of surfaces

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ABSTRACT
If a simulation tool is to be used for the optimization of absorbent ceilings, it is important that the simulation tool includes a good description of the surface. This study therefore aims at developing a model which can describe surfaces by their impedance values and not just by their statistical absorption coefficient, thus retaining the phase and the angle dependence. The approach of the proposed model will be to calculate the pressure impulse response using a combination of the image source method and acoustic radiosity. The image source method will account for the specular reflections and acoustic radiosity will account for the diffuse reflections.
This paper presents the motivation for the new model in the form of results in literature, which show the importance of retaining the angle dependence and phase information in reflections along with simple examples of angle dependent reflection from a porous absorber.
Keywords: Room acoustics, computer modelling

1. INTRODUCTION

In many models used for room acoustic simulations very simple descriptions of the surface properties are used. For some room configurations these simplified descriptions are not suitable, and in some cases these simplifications cause great errors in the prediction of the sound field. A widely used description of surface properties is the statistical absorption coefficient combined with scattering coefficients. The statistical absorption coefficient only expresses how large a fraction of energy incident on a surface is reflected independently of the angle at which the sound hits the surface and thereby disregards any angle dependence of the absorption and phase shifts in the reflection. Especially if the purpose of the room simulations is to optimise the properties of the surfaces then the surface properties should be carefully controlled and thoroughly described. In the present model it is therefore proposed to use an impedance description of the surfaces, which can account for both the angle dependence and the phase shift upon reflection.

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