

MODELLING AIRBORNE SOUND TRANSMISSION BETWEEN COUPLED ROOMS

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1. INTRODUCTION

The room acoustic modeling software Odeon is based on ray tracing in combination with a secondary source radiation method for reflections after a certain transition order, typically 0 – 3 order of reflection. In version 9.0 of this software the option of sound transmission modeling has been introduced. This feature is thought to be useful in projects like schools, offices and industrial halls, where the interesting sound propagation is not limited to a single room. The method may be particularly useful for the prediction of sound insulation between spaces with non-diffuse sound fields like rooms with very uneven distribution of sound absorption and/or special room shape.

2. METHOD

The principle is illustrated in Fig. 1. In a two-dimensional section is shown a large number of sound particles (representing the ray tracing of a large number of rays), starting from a point in the source room. When hitting a normal surface the particles are reflected back into the room in accordance with a reflection and scattering model. However, when the particles hit a surface, which has been marked as a transmission surface, a certain fraction of the particles are transmitted, i.e. they jump through the surface into the adjacent room where they continue the propagation. In this way the transmitting surface becomes a sound source that radiates into the receiver room. In Odeon version 9.2 the fraction of transmitted particles has been set to 10%, which is found to be a good compromise. The transmitting surface may be either a single surface or two parallel surfaces, as the case shown in Fig. 1. This allows the absorption material to be different at the two sides of the surface.

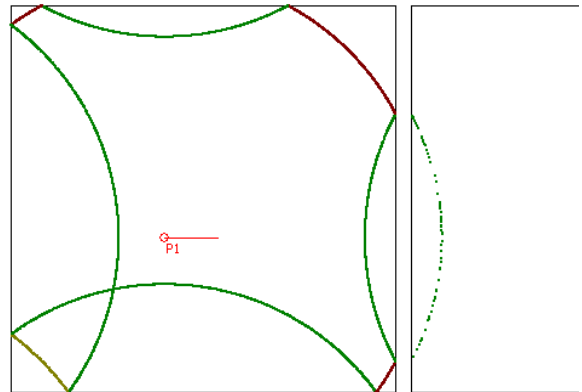


Figure 1. *Illustration of a sound wave being reflected from the boundaries in the source room (left) and partly transmitted into the adjacent room. P1 is the source.*

3. CONCLUSIONS

The transmission model in the Odeon version 9.2 has been presented and evaluated in a number of tests. The results from the tests show that the model takes into account the absorption in the source room and the adjacent room. The method also yields accurate results in the tested cases of non-diffuse sound in very long rooms. The results from a special test case have demonstrated that the method can handle correctly combinations of several transmitting surfaces with different areas and reduction indexes.