2005-04-21 JHR

ODEON Application note

Auralization of sound insulation between rooms

With ODEON it is possible to make a realistic auralization of the sound transmission from one room to the next, including the acoustical influence of the reverberation in the source room. The method is easy and straight forward, only necessary input data is the sound transmission loss in octave bands of the surface separating the two rooms.

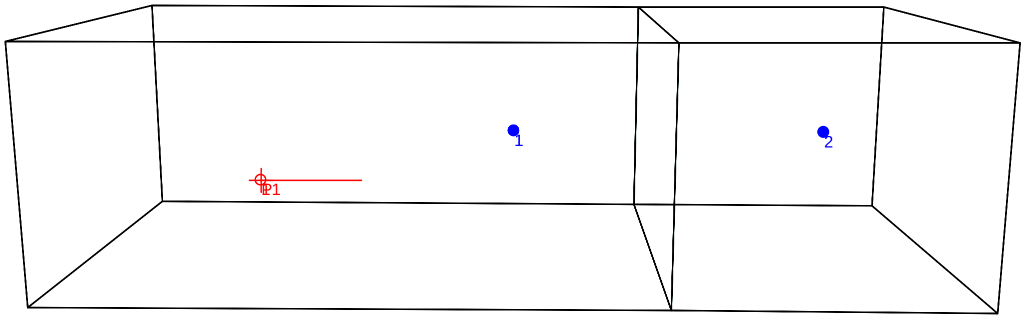

Fig.1. Two rooms separated by a wall. The location of the source and the two receivers is shown.

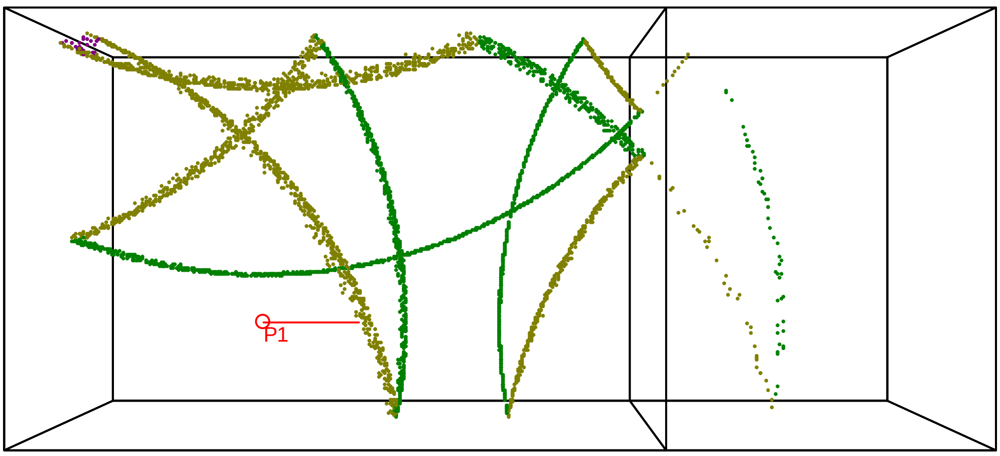

Fig. 2. Visualization of the sound reflections shortly after an impulse. Some of the particles have been transmitted into the receiving room.

1. Prepare the room model

- Define a source and a receiver in the source room and another receiver in the receiving room. Positions very close to the room boundaries should be avoided.
- The surface through which the sound transmission shall be simulated is given a transparency $\tau = 0.1$.

Note: During the ray tracing this will allow 10% of the rays that are incident on the surface to be transmitted into the receiving room, see Fig. 2. (This is equivalent to a transmission loss R = 10 dB at all frequencies, or a sound source with 10 dB less sound power level).
This will actually increase the apparent absorption coefficient of the surface with approximately 0,10. (To be accurate, $\alpha_{eff} = \alpha + \tau (1 - \alpha)$). This is true on both sides of the transmission surface.
If this increase in absorption is not acceptable, a smaller transparency can be used instead, e.g. $\tau = 0.01$. In this case the number of rays should be increased by a factor 100. (This is equivalent to a transmission loss R = 20 dB at all frequencies, or a sound source with 20 dB less sound power level).

- In the Room Setup set the calculation parameters as suggested for an engineering calculation, but increase the number of rays ten times (e.g. 10.000 rays in a simple box shapes room). This is in order to get a sufficient number of rays to be transmitted into the receiving room.

2. Calculate the sound in the source room

- Set the sound source as the default omni directional source and set the Overall Gain to a certain level, e.g. 90 dB is suggested.
- Define a job using this source and the receiver in the *source* room and make the point response calculation.
- Chose the sound to be used for the auralization, and set the recording level (Rec.lev.) as high as possible without overload.

3. Calculate the sound in the receiving room

- Define a new source by copying the first source and keep the same position in the source room, but set the Overall Gain 10 dB higher, i.e. 100 dB if it was set to 90 dB for the first calculation.
- In each octave band from 63 Hz to 8000 Hz insert the sound transmission loss as a *negative* value in the equalizer line (EQ) in the source definition.
- The description of the source may be used to identify the transmitting construction.

Note: If the transmission loss is not known at the extreme frequencies, it is necessary to extrapolate or guess a value. Typically, the 63 Hz transmission loss is equal to or less than the 125 Hz value, and the 8 kHz transmission loss is equal to or higher than the 4 kHz value. If a value of 0 dB is used it means total transmission as through an opening.

- Define a job using this source and the receiver in the *receiving* room and make the point response calculation.
- Then make the auralization using the same setting of the recording level (Rec.lev.) as above. Of course the level of the sound in the auralization may now be very low and difficult to hear, especially if a high sound insulation is simulated.

The sound insulation can be evaluated by comparing the auralization in the receiver room with the one in the source room, as made above.

If you want to listen to other sounds, the maximum recording level in the source room must be found for each sound that is used for the auralization, and the same recording level must be used in the receiving room auralization.

Remarks

The method described here requires that the absorption properties on both sides of the transmitting surface are identical.

The simulated transmission loss is limited to octave band frequency resolution.

The method automatically takes into account the area of the transmitting surface and the correct reverberation in both transmission rooms, allowing a realistic auralization.

When comparing auralizations in source room and receiving room, there is no need for any further calibration of the levels if the above description is followed