

PRESENTS

## Chapter 4 Sound propagation within a symphony orchestra

from the PhD thesis by Jens Jørgen Dammerud:

### **Stage Acoustics for Symphony Orchestras in Concert Halls**

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Introduction to Chapter 4:

The topic for this chapter is the basic objective situation on a stage with no enclosure around it. It is necessary to distinguish between the objective situation for small ensembles and large ensembles, such as symphony orchestras. For large ensembles, sound travelling between musicians more than a short distance apart is obscured by other musicians, their instruments and music stands. The primary aim here is to quantify this effect. Only limited studies of this situation are to be found in the literature. Krokstad et al. (1980) investigated sound levels for sound propagating through two rows of eight persons sitting on a flat floor. The results however only provide an indication of the attenuation to be expected within symphony orchestras. Ikeda et al. (2002) studied how to model sound behaviour within symphony orchestras by use of BEM (Boundary Element Method). Measurements of impulse responses across the stage with orchestra present were carried out to investigate the validity of the BEM modelling. [Skålevik \(2007\)](#) studied propagation of sound with orchestra present for one specific path within the orchestra using a directional loudspeaker as the sound source. The effect of source height and rotation were among the conditions investigated. No systematic study has been found which has investigated sound propagation within symphony orchestras along different paths and with or without risers on stage. However measurements by Krokstad and Ikeda were at full-scale and have proved very valuable to validate scale modelling techniques reported here.

The study reported here begins by looking at the empty stage for propagation between two points for the direct sound and floor reflection combined. To establish the influence of the orchestra, acoustic scale modelling was used to study the 'within-orchestra' sound (or more generally the 'within-ensemble' sound). [Go to thesis](#)

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