

AN OBJECTIVE INVESTIGATION OF THE ACOUSTICS IN THREE NEWLY BUILT CONCERT HALLS

Rikard Ökvist

PhD Student
Division of Sound & vibration
Luleå University of technology
Luleå, Sweden
Tel. +46-70-3773400
rikard.okvist@ltu.se

Björn Tunemalm

Acoustical consultant,
MD
Tunemalm Akustik AB
Umeå, Sweden
Tel. +46-70-6890494
bjorn@tunemalm.se

Anders Ågren

Professor in Engineering Acoustics
Division of Sound & vibration
Luleå University of technology
Luleå, Sweden
Tel. +46-70-5757092
Anders.agren@ltu.se

ABSTRACT

In the north of Sweden, three new concert halls have been built in the last few years. The three halls are; Studio Acusticum in Piteå (2007), Kulturens hus in Luleå (2007) and Norrlandsoperan in Umeå (2002). The Acoustics of the halls have been designed by Tunemalm Akustik. There are noticeable differences between the halls. Studio Acusticum is a multipurpose concert hall where the variable acoustics is realized by a height adjustable ceiling and absorbing curtains. Variable volume is an unusual solution, which permits good acoustics without many of the drawbacks normally associated with multipurpose halls. Kulturens hus is also a multipurpose hall, but here the variable acoustics is realized by variable absorption. The walls can be changed from reflective to absorptive by a system of motor driven panels. The acoustic properties of the ceiling can also be changed. To attain very short reverberation times, absorptive curtains can be lowered on the stage and side walls. Norrlandsoperan does not have any means of varying the acoustics during concerts. It is thus a “true” concert hall, built to fulfill the requirements of symphonic music. Good acoustics is thus achieved on the cost of versatility.

During the winter of 07/08, a thorough investigation of the acoustics in these halls has been made. The investigation showed that each hall has its own distinct character, making them more or less suitable for different music. The measurements were made in accordance with ISO3382:1997, which describes the acoustic parameters used for objective concert hall evaluation. One of these parameters, Lateral Fraction (LF), was found to have reproducibility issues.