ICSV13 - Vienna
The Thirteenth International Congress on Sound and Vibration
Vienna, Austria, July 2-6, 2006

# CHARACTERIZATION OF LOW FREQUENCY SOUND FIELD IN THE SCALED CHAMBERS

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## Abstract

Numerical and experimental study is carried out to characterize sound fields of low frequency in a scaled reverberation chamber for measurement of sound insulation of panels. By using BEM, lower modes of the chamber are predicted and proved its validity from comparison with measurement. In order to destruct the identified lower modes, the effect of diffusers is numerically simulated. Based on numerical prediction, the diffuser as a kind of partial partitioning wall is installed on the nodal line. Experimental results evidently show that the first mode is disappeared but the other modes are not significantly changed.

## INTRODUCTION

The scaled reverberation chamber which is made for measurement of sound insulation performance should have a problem with diffuse sound field at the low frequency because its volume can not afford to have many modes enough for making diffuse or reverberant field, that is, one or two modes at the low frequency below 200 Hz dominate sound fields. Consequently, it makes a considerable error to measure space averaged sound pressure level. This study is to seek for smoothing the influence of such modes so as to reduce measuring error at the low frequency. BEM[1] is used for a tool of numerical simulation.

## NUMERICAL SIMULATION AND EXPERIMENTS FOR LOW FREQUENCY SOUND FIELDS

The scaled chamber is illustrated by Fig. 1. The specimen on test frame shown in Fig. 1

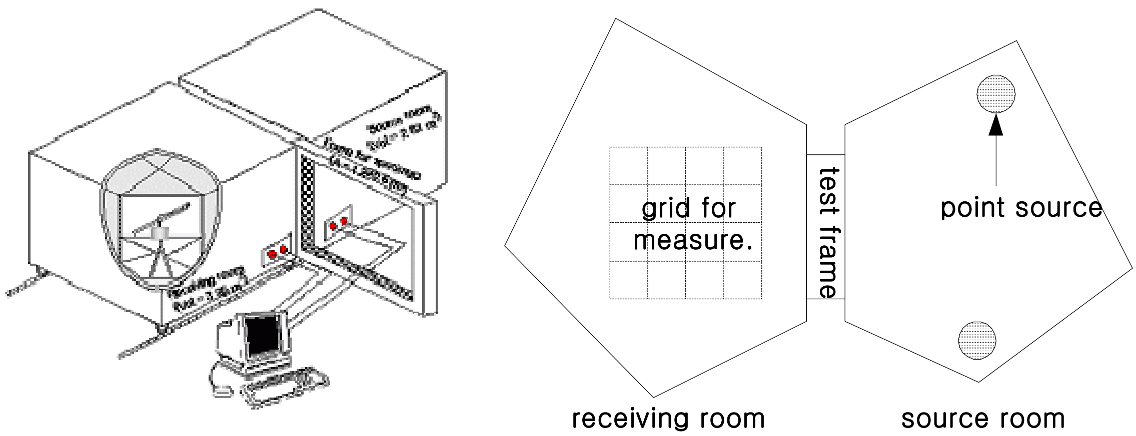
is a steel plate with thickness = 0.6 mm. A commercial program of SYSNOISE is used for a tool of numerical simulations. In analysis to identify lower modes in receiving room, the impedance of the specimen is assumed to be limp wall. Measurements of sound fields were made for the grid points as shown in Fig. 1. Fig. 2 compares prediction by BEM with measurements by 1/3 octave bands and shows good agreements. It is evident that the first mode occurs at 100 Hz band. In order to depress the first mode, the diffuser as a partial barrier was installed on the nodal line as shown in Fig. 3. The effect of diffuser is displayed in Fig. 3. It can be seen that owing to the diffuser, the first mode is disappeared but the other modes are not significantly changed. To see the effect of the diffuser in measuring sound insulation, Comparison are made for the specimen of glass 6mm as shown in Fig. 4. It can be seen that peaks and dips at the low frequency bands are considerably smoothed.

## SUMMARY (OR CONCLUSIONS)

In order to destruct the lower modes, the effect of diffusers is numerically simulated. Based on numerical prediction, the diffuser as a kind of partial partitioning wall is installed on the nodal line. Experimental results evidently show that the first mode is disappeared but the other modes are not significantly changed. Consequently, it is fine that peaks and dips at the low frequency bands are considerably smoothed.

## REFERENCES

[1] T.W. Wu, *Boundary Element Acoustics: Fundamentals and Computer Codes*. (WIT press, Boston, 2000).




(a) Schematic view of the chamber (b) Plane view of the chamber

Fig. 1. Scaled chamber for measuring sound insulation.

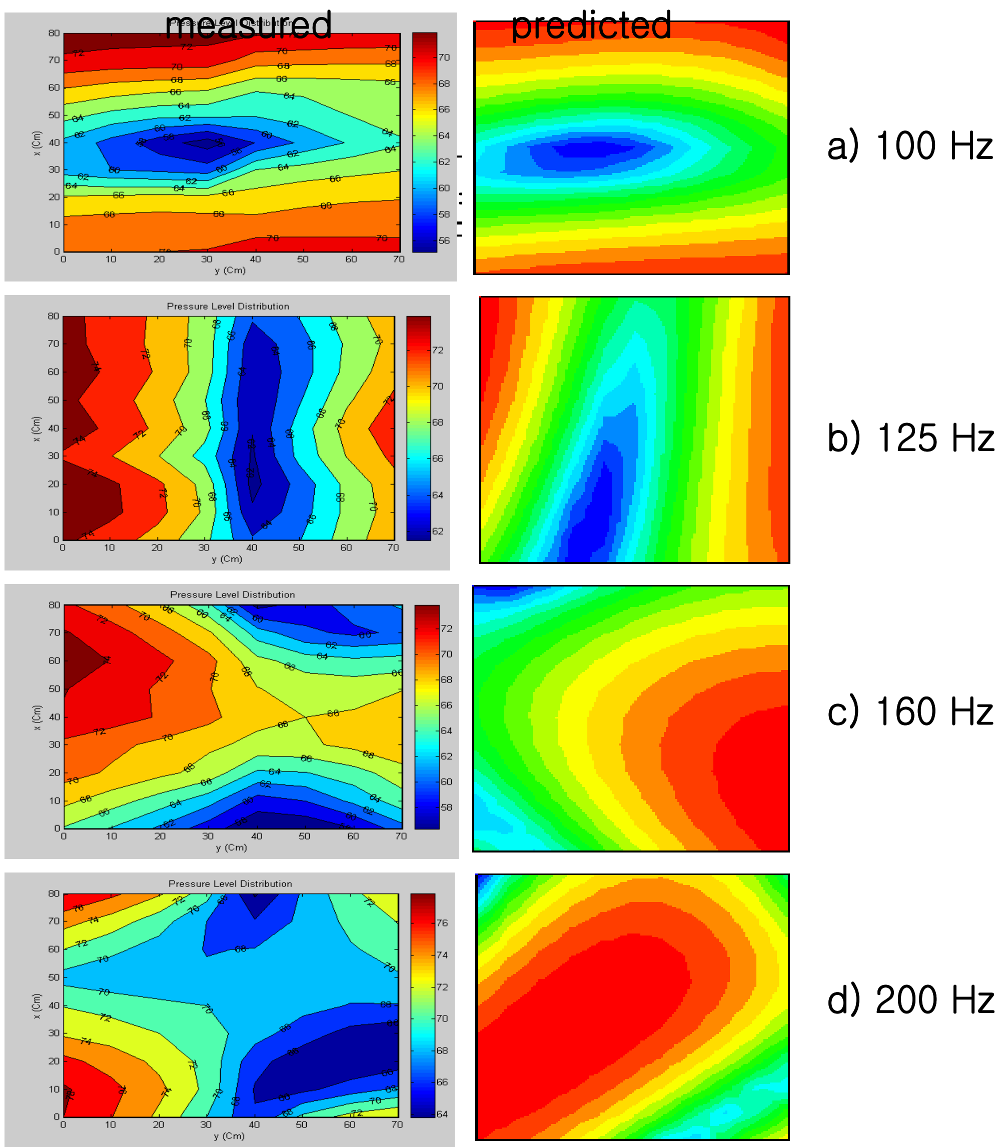



Fig. 2. Comparison between measured and predicted sound pressure level.

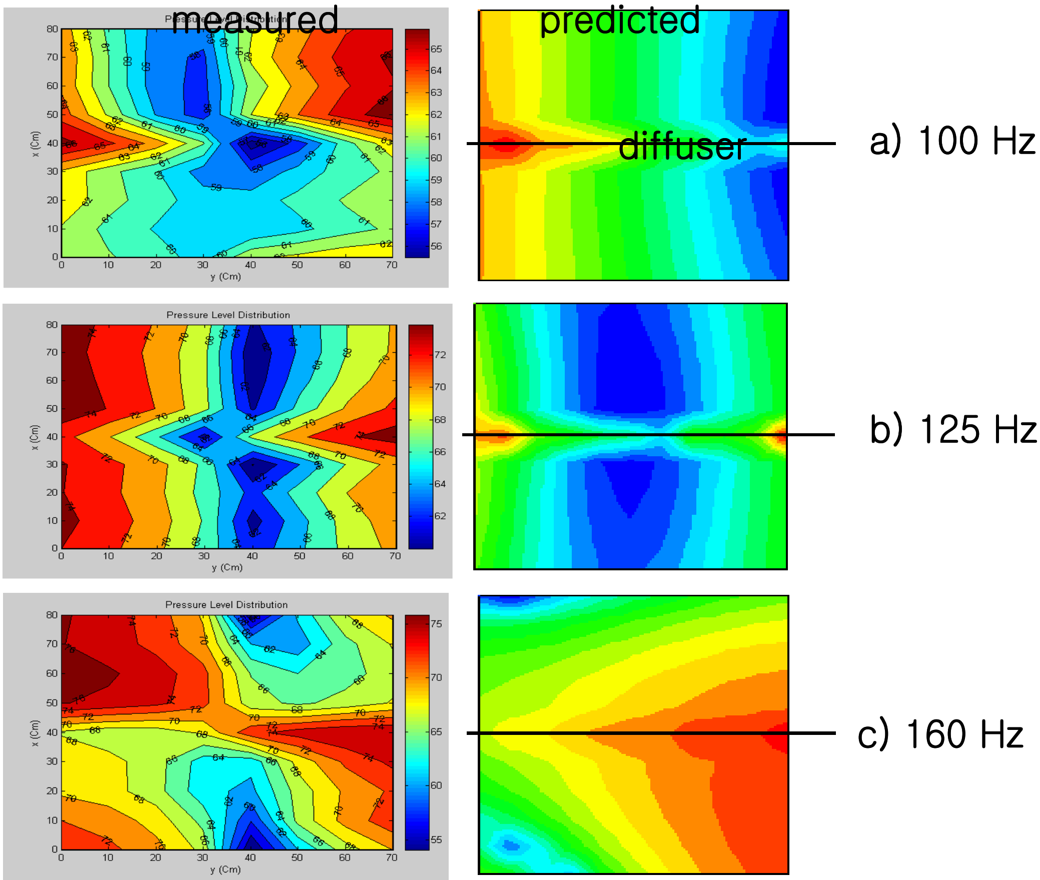



Fig. 3. Variation of sound pressure level with diffuser.

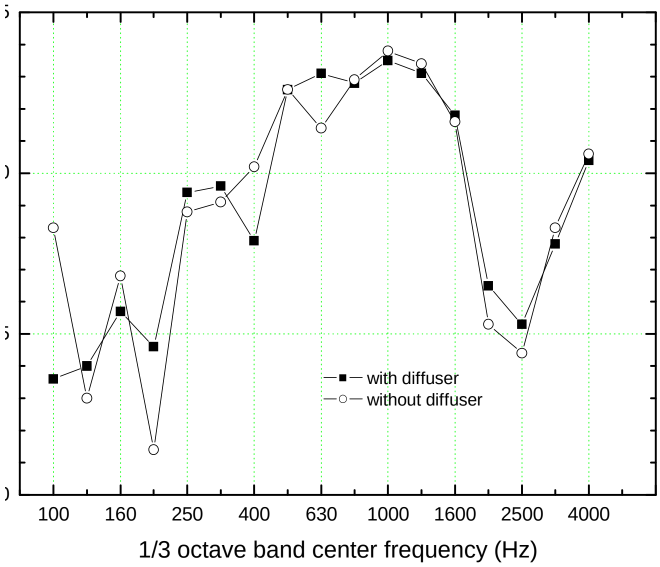



Fig. 4. Comparison between with and without diffuser in measuring sound insulation in the scaled chambers; specimen = glass 6 mm.