**Course**: MSc in Environmental and Architectural Acoustics
**Unit:** Noise Control
**Subject:** Measurement of effectiveness of Absorbent material.

## Aim

- To measure the absorption coefficient in the reverberation chamber.
- To obtain experience of reverberation time measurements
- To investigate the relative important of absorbent to source and receiver position
- To use a simple computer prediction model

## Instrumentation

1. Loudspeaker with a power amplifier
2. Noronic 823 analyser. Incorporates a random noise generator, a microphone amplifier and a post processing module for RT calculations.
3. Microphone
4. Tripod
5. Calibrator
6. $9m^2$ of moveable absorbent (3 sections)
7. SLM

## Introduction and Theory

The relative position of absorbent in a room can make a significant difference to the sound field in the room. In noise control the order of importance is:

i) the source that is treated
ii) the path that is treated
iii) the receiver that is treated

## Procedure

1. Connect the output of Norsonics to the power amplifier and from there to the loudspeaker.
2. Place the loudspeaker facing the corner. Select a number of microphone positions which are 1m from the room surface. 2m from the loudspeaker and all at different heights. Ideally, there should be more than one loudspeaker position, but you will probably only have a limited number of positions. The standard requires the use of the following number of positions:

| | | |
|---|---|---|
| 100 to 250 Hz | 12 positions | 6microphones by 2 loudspeakers |
| *315 to 900 Hz* | *9 positions* | *3 microphones by 3 loudspeakers* |
| *1000 to 5000 Hz* | *6 positions* | *2 microphones by 3 loudspeakers* |

*Our suggestion is 2 microphone positions by 2 loudspeaker positions.*

3. Uise of Norsonic analyser
   i) Set Norsonic to REV time and 1/3 octave.
   ii) The Norsonic analyser has the ability to automatically scan a set of frequencies, store and average the stored values. Measure the reverberation time in the frequency range 100 Hz to 3150 Hz in 1.3 octave bands.

   *Scanning*

   *a) To complete a frequency scan from 100 Hz to 3150 Hz, press "100 Hz" button and then press "scan". The instrument will continue to scan provided it accepts the result but will stop if the background noise is too high, or if there is an overload*

   *b) To view the current values press "last". For our purposes you will have to write down (or print out) reverberation times for each microphone / loudspeaker position.*

   *c) To store the current set of results press "store" and then "avrg T".*

   *iii) Repeat ii) for another microphone position, then the same for the second loudspeaker position.*

   *iv) Print out the average reverberation time for all four measurements. Alternatively use your individual results to obtain the average for each frequency. You will need this data to substitute in Eq 3.*

   *v) Print out one sample decay curve for a low frequency and one for high frequency. Comment on the difference.*

   *vi) Clear the memory of the Normonic after you have obtained the results for the empty room. TO do that press "clear" and then "Avrg T".*

   *vii) Repeat ii) to vi) with the absorbent in the room by opening the doors*

   .
4. Now determine the absorption coefficient of the porous material as a function of frequency
5. Move the absorption from the centre of the room to the corner of the room and repeat the measurement, then split the 3 absorbent sections into individual pieces and repeat the measurement
6. Plot a graph of absorption coefficient against frequency.
7. If time allows, using the SLM take SPL measurements at the same positions for all source-receiver combinations.

**Predicton Model**

Using the computer prediction model

http://www.lsbu.ac.uk/enveng/acogrp/cism.htm

Predict the sound level and reverberation times of the receiver positions in the reverberation chamber with the various source-receiver-absorbent combinations.

**Report**

Write up your lab notes and include in your formal report the measurements and predictions for the reverberation chamber.

1. In what position did the absorbent material reduce the RT and SPL the most compared to the standard configuration? Why? Did the effectiveness vary with frequency?
2. How accurate was the simple computer prediction model?
3. What other noise control method would you recommend for the room?