Architectural Acoustics

Excercises week 7

Room Acoustics

27-03-2020

Question 1

The dimensions of a small room are: L = 7 m, W = 6 m , H = 3 m

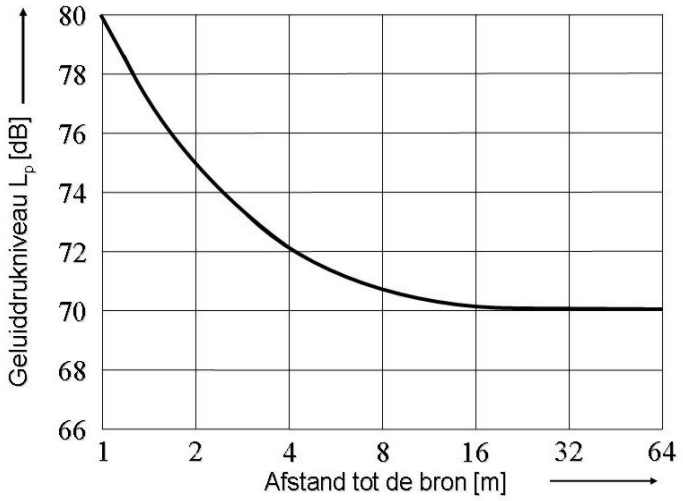
a) What is the Schroeder frequency?
b) What is the lowest axial eigenfrequency?
c) What is the lowest tangential eigenfrequency?
d) What is the lowest obligue eigenfrequency?

Question 2

a) Describe the difference between 'near field' and 'far field'.
b) Describe the difference between 'diffuse field' and 'direct field'.
c) What is the definition of reverberation time in terms of level [dB] and time [s]?
d) What is the difference between T_{20} and T_{30}?

Question 3

The graph below shows the result of a sound pressure level measurement in a hall using a small omnidirectional sound source (Q = 1).

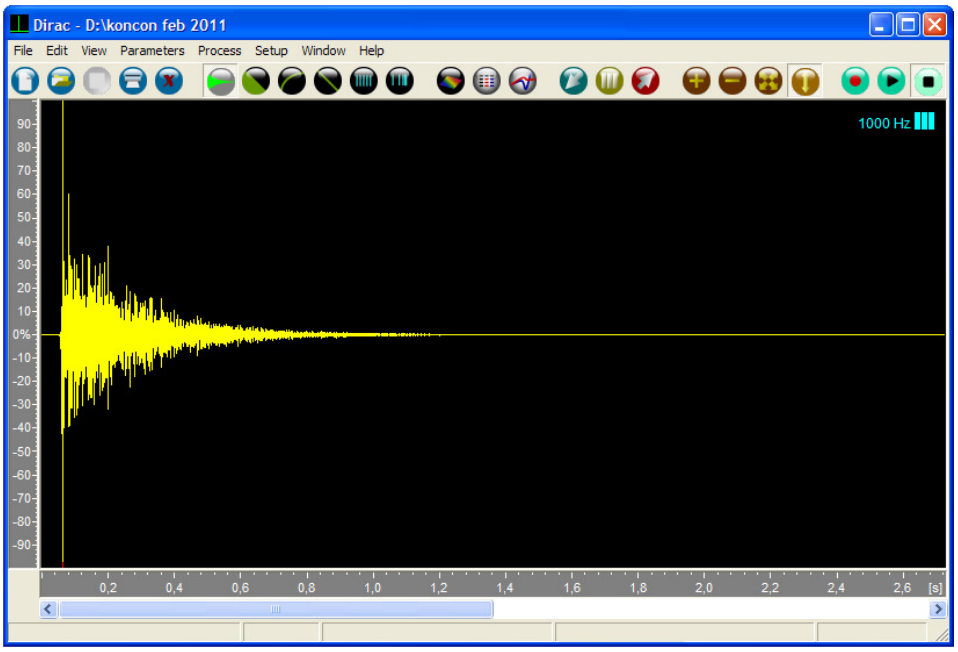


Translation: Geluiddrukniveau = Sound Pressure Level
Afstand tot de bron = Sound-Receiver-distance

a) What is the diffuse field sound pressure level (Lp_{diff})?
b) What is the sound power level of the sound source (L_W)?
c) What is the critical distance (galmstraal r_k)?
d) Draw (in the same graph) the sound pressure level line for the same sound source in a free field (for instance: anechoic room: room with 100% sound absorption)

Question 4

The picture below shows the result of one acoustical measurement. It is the 1kHz octave band sound pressure graph p(t).

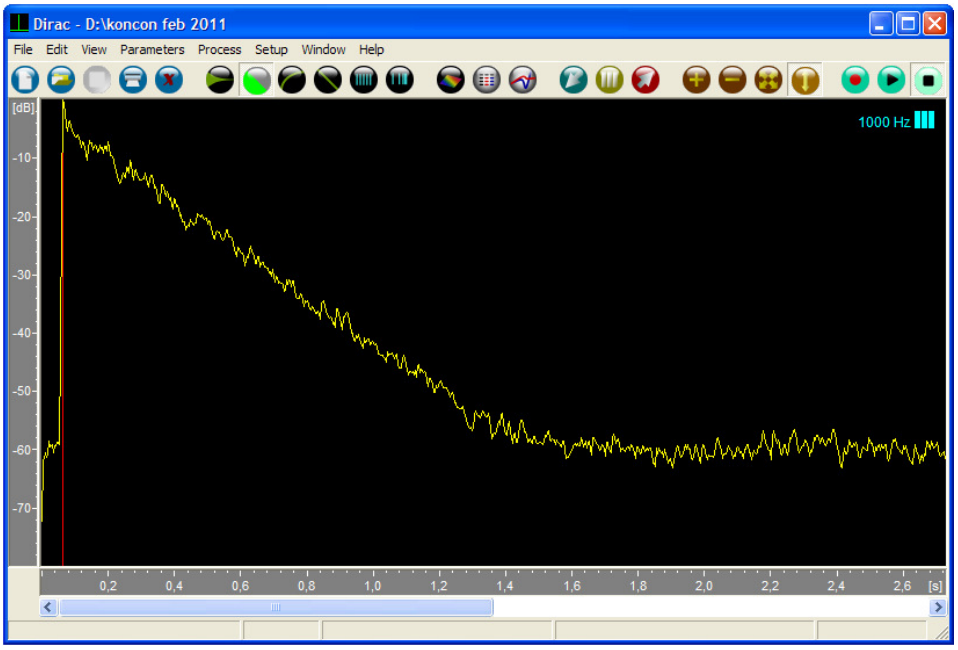


Screen dump: sound pressure graph.

a) How is this sound pressure graph called?
b) How can you obtain this graph?
c) Mention an example of a typical room acoustical parameter to assess music transfer and a typical parameter to assess speech transfer?

Question 5

The picture below is derived from the pressure graph (see Question 4). It is called the Energy-Time-Curve (ETC).



Screen dump: Energy-Time-Curve

a) How can you derive this graph from a pressure graph?
b) What is the first peak in the graph (at position of the red line)?
c) What is the decay range in dB of this measurement?
d) How can you increase the decay range of an ETC?
e) What is the reverberation time (no definition; a value please)? Explain/discuss!

Question 6

Which statement is <u>not</u> correct? The Q-factor of a (loud)speaker box

1 is equal to $10^{\frac{q}{10}}$ and can have a value less than 1
2 depends on the listening direction
3 can have a value less than 1 and depends on frequency
4 is expressed in dB