! Answers: "Loudspeaker Signals and Ear Signals" - English

UdK Berlin
Sengpiel
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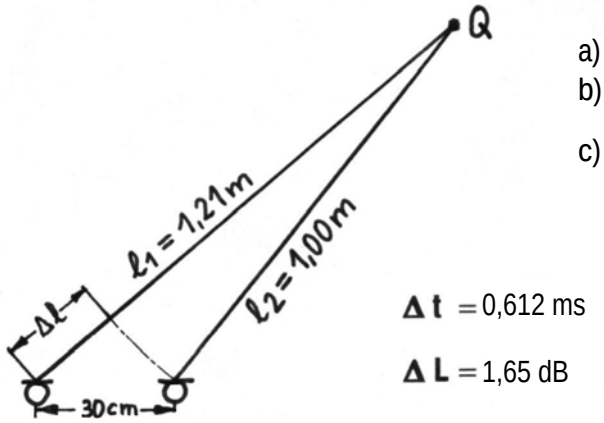
F + A

1. A sound source is to find at point Q which sends his sound to the microphone system as AB time-of-arrival stereophony.

a) Which time difference Δt do you find at the microphones? b) Which level difference ΔL do you find at the microphones? c) What is the percentage of the phantom source shift on the loudspeaker basis from the center to a side?



a) $\Delta t = (l_1 - l_2) / c$ = 0,21 / 343 = 0,000612 s = 0,612 ms
b) $\Delta L = 20 \times \log (l_1 / l_2) = 20 \times \log (1{,}21 / 1)$ = 1,65 dB

c) The phantom source shift for Δt = 0,612 ms is about 62 % and for ΔL = 1,65 dB this is about 13 %.
So the total phantom source shift is 62 + 13 = 75 % to the right, that is 3/4 R.

2. What is the difference between a) an AB main microphone, b) an AB adding microphone and c) an AB room microphone for a large orchestra recording? Tell the particular microphone spacing a.

a) An AB main microphone system stands relativly close to the orchestra and has to distribute the phantom source shifts at the loudspeaker basis evenly. In front of an orchestra this microphone spacing should be around $\boldsymbol{a}$ = 70 cm.

b) An AB adding microphone system makes no equal distribution of the phantom sound sources. The sound pictures are moved in the direction of the loudspeakers. The sound picture is crowded in the speakers. This microphone spacing should be around $\boldsymbol{a}$ = 1,00 to 1,20 m.

c) An AB room microphone system should record also decorrelated low frequency room signals, which appear as room flanks. This microphone spacing should be around $\boldsymbol{a}$ = 2 to 3 m.

2. What was the name of the scientist, who showed with his "Duplex-Theory", that for directional hearing the two values of ITD (Interaural Time Differenz) and ILD (Interaural Level Difference) are necessary at the ear drums?

That was Lord Rayleigh, also called John William Strutt.

3. Which low frequencies do the human hearing predominatly need for the directional localization?

That are frequencies lower than 800 Hz?

4. Which high frequencies do the human hearing predominatly need for the directional localization?

That are frequencies higher than 1600 Hz.

5. The value for the maximum time difference of the ear signals (ITD) was found to be around 0.63 ms (630 µs). How much is the calculated effective ear spacing (ear distance) at 90° sound incidence? Tell the formula. (Speed of sound c = 343 m/s at 20°C.)

Time difference Δt = effective ear spacing a / speed of sound c.

$\Delta t = a / c$, that is $a = \Delta t \times c$ = 0.00063 × 343 = 0.216 m = 21.6 cm.

6. Do we have to use shielded speaker cables at the connection of a power amplifier and a loudspeaker? Please, tell the reason with the answer.

Because the amplifier has a very low output impedance of less than 0.1 ohm and the loudspeaker has a small input impedance of around 8 ohms, and needs high voltage to get im motion. There is no danger, that loud-speaker cables catch unwanted signals. Therefore we need no shielding of those cables.

Many users assume not correctly that we need here impedance matching Zin = Zout.