

Exercise-1

The task is to setup a laptop with microphone input and loud-speaker output for further audio experiments (see Figure 1 and 2). This requires calibrating the A/D/A of the laptop and the external devices of mic and loud-speaker (LS). It is important to have the external analog devices to work simultaneously.

Calibration parameters:

a) SBNR: signal to background noise ratio

Since the devices A/D/A, mic and LS are not perfect we need to know the errors and non-linearities that they introduce. Human hearing is acute with about 100 dB (10^{10}) dynamic range and about 9 octaves (2^9) of hearing bandwidth.

(i) Using Matlab/Octave generate a file of a single sinusoid of known frequency, amplitude and phase.

You can use the following function for simultaneous record/playback of the sinusoid file:

<https://www.mathworks.com/help/audio/ref/audioplayerrecorder-system-object.html>

If you don't have a Full-Duplex sound card, consider installing ASIO4ALL
<http://www.asio4all.org/>

(ii) Compare the recorded sinusoid file and the original sinusoid file and determine the playback/record delay.

(iii) After compensating for the delay compute the RMS distortion between the two files. This is the THD for the chosen frequency.

b) It may be noted that we can measure the A/D/A only distortion using an electrical loop back of the speaker output to the mic input, after checking the required signal levels and impedance matching. We can then check that the distortion should increase as we connect both the mic and LS and how far separated the two devices are placed.

Determine all the above parameters and submit a short report of the findings.

PSI5720 - SPATIAL AUDIO SIGNAL PROCESSING

We advise use setup #1 (Figure 1). Using a notebook, it is necessary to buy a low-cost audio interface.

Examples: Placa de Som USB 7.1 Dupla Ideal para Virtual DJ para 2 fones, Adaptador Placa De Som USB 7.1 Entrada P2 Fone E Microfone, Empire Adaptador de Placa de Som USB.

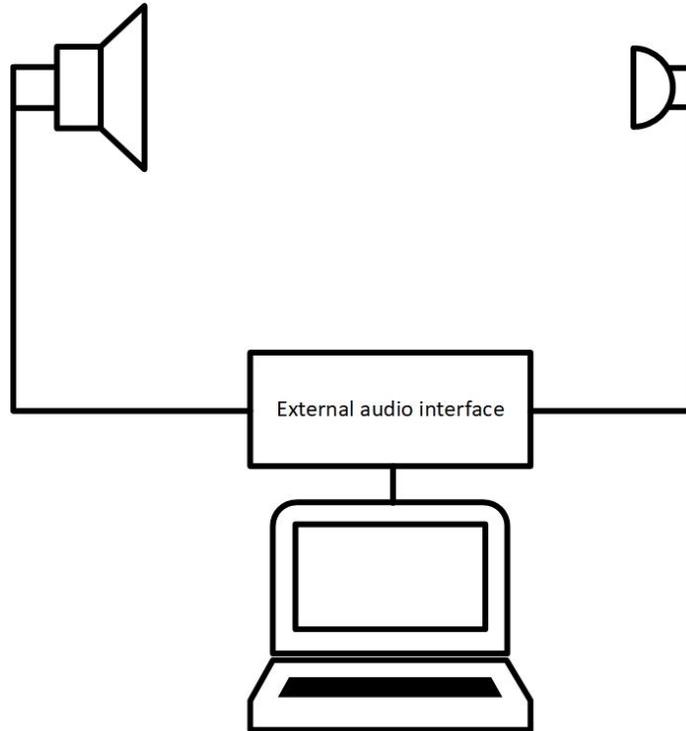


Figure 1 – Setup with an external audio interface.

Figure 2 shows the setup using the internal notebook MIC and an external loudspeaker. This setup has a lot of problems. It is good to have separate devices and keep them away from a surface (table surface will cause absorption of sound energy and its directivity).

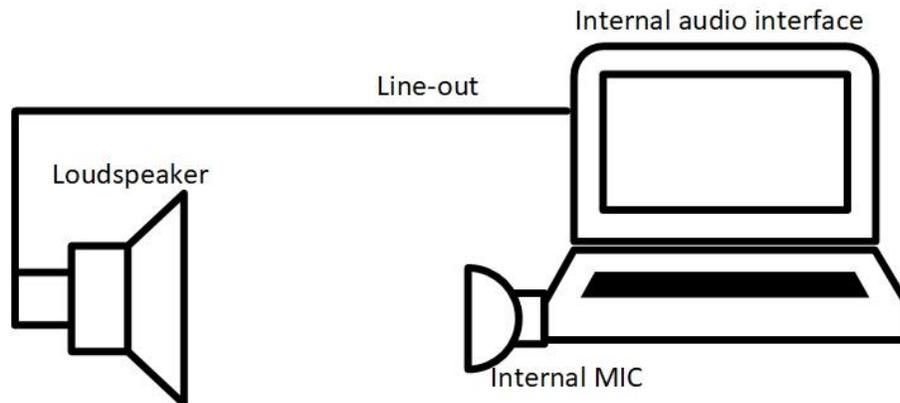


Figure 2 - Setup with an internal audio interface.