

Echo Cancellation

Part 1:

Download to your working directory the original audio signal:

[Pa11.wav](#)

Connect your headphones to the sound card output of your PC and listen to this signal. You must correct the echo that is present on the signal. For this you will need to analyze the autocorrelation function of the signal. You can calculate it through

- the Inverse Fourier Transform of the PSD of the signal (PSD given by the square of the modulus of the signal FFT),
- the use the Matlab function xcorr.

Then you need to build a theoretical model for the signal (It's up to you to propose a model):

$$x(n) = \dots$$

You deduce what should be the theoretical autocorrelation function of the signal. By analyzing the measured autocorrelation function, you can identify the parameters of the echo signal and try to correct it.

Think to formalize your work.

Part 2:

The signal to download is the following: [canal.wav](#)

Correct the signal knowing that it was obtained by swapping the high and low frequencies (with the exception of the zero frequency and the frequency $F_s/2$). For example, with $N = 8$:

Frequencies	0	$F_s/8$	$2F_s/8$	$3F_s/8$	$F_s/2$	$5F_s/8$	$6F_s/8$	$7F_s/8$
Matlab indices	1	2	3	4	5	6	7	8
After Swapping	0	$3F_s/8$	$2F_s/8$	$F_s/8$	$F_s/2$	$7F_s/8$	$6F_s/8$	$5F_s/8$