

## Noise removal (Lab. 05)

A file, (lyd\_05.wav) contains music with a disturbing two-tone noise. In this lab you shall identify the noise and reduce it as much as you can. At the same time, music quality should be kept as much as possible.

1) Identify the noise frequencies. (Use FFT).

2) Try to reduce the noise with a FIR filter.

Tip: The attenuation at the cut-off frequency is only 6 dB, so you have to specify a wider stop band.

3) Try to reduce the noise with an IIR filter<sup>1</sup>. (This can be a lot more efficient than using a FIR filter as long as linear phase response is not required).

Tip: Use two band stop filters, one for each frequency that is to be removed. Use the method of manually placing poles and zeros.

4) How many multiplications and additions per second must be performed when a FIR and when an IIR filter is used?

### Functional description of pre-programmed part

The main vi has 3 states: “read and load a wav-file”, “play wav-file” and “stop soundcard and wait”. When the program starts or the button “New File” is clicked, the state machine enters state “read and load a wav-file”. A pop up window allows you to select a wav-file and the selected file is loaded into the program. The state machine will now go to state “play wav-file”. In this state the file’s samples are divided into segments of length 4096 samples. The samples can be passed to the sound card output one segment at a time, eventually via a filter you design.

When all samples of the file are played, the state machine goes to state “stop soundcard and wait” and will stay there until “new file” is clicked or the program is stopped. If “new file” is clicked while the file is playing, it will stop the sound card and go to state “read and load a wav-file” ready for a new file selection.

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<sup>1</sup>Again, please read the description of any filter function and double check how coefficients are defined in the function before we use it. One should never assume the filters coefficients are configured according to our imagination. In this particular case, please note that a0 in the transfer function is 1 by default and shall not be typed into the coefficient arrays.