EE-384 **Classwork-2**

Problem 1: Using filter and difference equation

Matlab provides the filter function which is a Direct Form-II transposed implementation of the standard difference equation. Such functions save coding time and help us to focus more on the system behavior.

a) Re-do problem-3 of Classwork-2 and implement $y(n) = \frac{x(n)+x(n-1)+x(n-2)}{3}$ using the **'filter'** command to filter out the high frequency components of the ECG signal.

b) Instead of using 'filter' command, convolute the ECG signal with h = [1/3, 1/3, 1/3] using **'conv'** function. Compare the result with that of (a).

c) Write your own convolution function and re-do (b) using your convolution function.

Problem 2: Basics about sinusoids and sampling rate

Let the sampling rate *fs* be 50 Hz, and the time array *t* varies from 0 to 1 second.

a) Create and plot a sine signal $\boldsymbol{y_1(t) = \sin(2\pi f_1 t)}$, where $\boldsymbol{f_1 = 10\ Hz}$

b) Create and plot a sine signal $\boldsymbol{y_2(t) = \sin(2\pi f_2 t)}$, where $\boldsymbol{f_2 = 60\ Hz}$

c) Can you differentiate between $\boldsymbol{y_1(t)}$ and $\boldsymbol{y_2(t)}$ plot? Why?

Problem 3: Signal data to sound

Let the sampling rate *fs* be 50 kHz, and the time *t* varies from 0 to 1 second.

a) Create and plot a 2 kHz signal $\boldsymbol{y_1(t) = \sin(2\pi f_1 t)}$ using Matlab. Let the horizontal axis vary from 0 to 0.01 second. Use the command '*sound(signal, sampling rate)*' to listen the tone.

b) Create, plot and listen to the sine signal $\boldsymbol{y_2(t) = \sin(2\pi f_2 t)}$**,** where $\boldsymbol{f_2 = 6\ kHz}$**.** How different is the sound of y_2 in comparison to the sound of y_1?

c) Create, plot and listen to the sine signal $\boldsymbol{y_3(t) = \sin(2\pi f_3 t)}$**,** where $\boldsymbol{f_3 = 25\ kHz}$**.** Can you still hear the sound?