Assignment 2
Frequency Analysis in MATLAB

Purpose:	Introduction to frequency analysis in MATLAB.
Preparation:	Read the chapters in the text book concerning SDOF and frequency analysis (Chapters 5, 8, 9 and 10). Study the MATLAB function fft.
Equipment:	Computer with MATLAB software. Three signals are given: Ass2_signal1 transient hammer force Ass2_signal2 vibration signal from passenger car. Ass2_signal3 vibration signal from radio mast
Software:	Matlab
Latest Submission date:	**2016-04-26**

Problem Description

For the three signals the relevant frequency spectra shall be computed and plotted. To check that the "right" spectrum is produced, the analysis shall be performed with two different fft record lengths for each of the three signals. Values to characterize the signals are also computed in the time and frequency domain. The signals are found on the course home page (It's Learning).

For each case, the signal will be contained in a vector x, and the sampling frequency is given by a variable fs.

Matlab Work

Task 1. Transient hammer force, ass2_signal1

Signal 1 is a force signal from a hammer impact, unit is Newton. Produce two transient spectra using fft, units Ns, one with analysis of the whole signal and the other one using only the first 2048 samples of the signal. Plot the spectra in the same diagram with colours black and red respectively.

What would the maximum displacement response be if this force is applied to the mass of a SDOF system with
M = 10 kg, C = 20 Ns/m , K =160000 N/m
Use the result of the spectrum analysis to determine the answer.

Task 2. Vibration from rotating machinery, ass2_signal2

Signal 2 is a vibration recorded in a passenger car with the engine running at constant speed. Unit: m/s^2

Produce two rms spectra, and plot them versus frequency in linear format. Use the MATLAB function fft, the flattop window and 50% overlap. The frequency range in the plot shall be 0 – 150 Hz. One spectrum shall be calculated with fft block size 4096 and should be plotted in black, while the other spectrum shall be calculated with fft block size 8192 and be plotted in red in the same diagram as the black spectrum.

What is the rms value of the frequency component near 58 Hz? Give the values from the two spectra calculated above. Then filter the vibration signal in a band pass filter, 56-60 Hz, and determine the rms value from the filtered time signal.

Task 3. Vibration from a wind excited structure, ass2_signal3

Signal 3 is a vibration recorded inside a box containing electronics. The box was mounted at 50 m height in a telecommunication mast. Unit: m/s^2

Produce two power spectral densities, psd, and plot them versus frequency in semilogy format. Use the MATLAB function fft, the periodic hanning window and 50% overlap. The frequency range in the plot shall be 0 – 250 Hz. One psd shall be calculated with fft block size 4096 and should be plotted in black, while the other psd shall be calculated with fft block size 8192 and be plotted in red in the same diagram as the black psd.

Use the two spectra to calculate the rms value of the signal in the frequency range 100 – 250 Hz. Filter the vibration signal in a band pass filter, 100-250 Hz and calculate the rms value of the filter output in the time domain.

Report

A short and well written technical report shall be produced. **Use the Template on "itslearning"!**

Submission

Use "itslearning" to submit your report under the respective Lab and upload your report (before the deadline).

Good luck!