Condition Monitoring of Structures, Machines and Processes

Tutorial

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MATLAB:
DATA PROCESSING

Exercice 12.1

Generating Test Signals

Task:

- Create a time series in an array with a given start time $t_S = 0$, end time $t_E = 10$ and sample frequency $\Delta t^{-1} = 10$.
  - Create a sinus – signal named sig with a frequency $f_1 = 0.5\ Hz$ and a amplitude of $A_1 = 1.3$ which is digitized corresponding to the given time series.
  - Add another sinus signal to sig with a frequency $f_2 = 1\ Hz$ and a amplitude of $A_2 = 3$ Recordings of real signals show noise content.
  - Add noise to sig by using random numbers. *Hint: A suitable function is randn() returning normally distributed random numbers, which can be multiplied by a scalar to adjust the noise magnitude. In this example use 0.8.*
  - Plot the signal and label the axes appropriately.

Exercice 12.2

Pre-processing Signals

Task:

- Extract the maximum and the mean of sig.
  - At which time does the maximum occur?
- Normalize the signal.
- Replot the normalized signal.

Exercice 13 (advanced)

FFT: Fourier Transform

- The Fourier Transform is a valuable method to analyse any kind of signals composed of oscillations.
  - MatLab offers a Y = fft(X) function computing the discrete Fourier transform Y of X.

Task:

- Plot the power spectrum of the noisy signal generated in excercise 12. *Hint: Proceed analog to the example of the fft() documentation on mathworks.com*