

The background of the slide features a complex network diagram. It consists of numerous small, dark grey circular nodes connected by thin, light grey lines. These lines form a web-like structure that fills the entire frame. A large, solid dark teal rectangle is positioned on the right side of the image, partially overlapping the network diagram. The text is centered within this teal rectangle.

Condition Monitoring of Structures, Machines and Processes

Tutorial

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MATLAB: DATA PROCESSING

Exercise 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 $f_1 = 0.5 \text{ Hz}$ 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 $f_2 = 1 \text{ Hz}$ 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.

Exercise 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.

Exercise 13 (advanced)

FFT: Fourier Transform

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

Task:

- Plot the power spectrum of the noisy signal generated in exercise 12. *Hint: Proceed analog to the example of the `fft()` documentation on [mathworks.com](https://www.mathworks.com/help/matlab/fft.html)*