SIF3012 Computational Physics
2025-2026 Semester 1
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BLOCK 4

Exercise 1

Let's consider an example of the FFT to de-noise some signal. Consider the following equation:
$f(t) = \sin(2\pi f_1 t) + \sin(2\pi f_2 t)$
with frequencies $f_1 = 50$ and $f_2 = 120$. Compute this function from x=0 to x=0.25 in steps of 0.001 and add a certain amount of white gaussian noise, to obtain something similar as the signal shown in Fig. 1, top:

Exercise 2

Compute the Fourier Transform creating a code for the FFT method. Plot the power spectral distribution based on the FFT, as shown in Fig. 1, middle

Exercise 3

Remove (filter) the components in the frequency that arise due to the gaussian noise and leave only those from the initial signal. Perform the inverse FFT to recover the signal. Make a plot to compare the filtered and the clean signal, as shown in Fig.1, bottom.
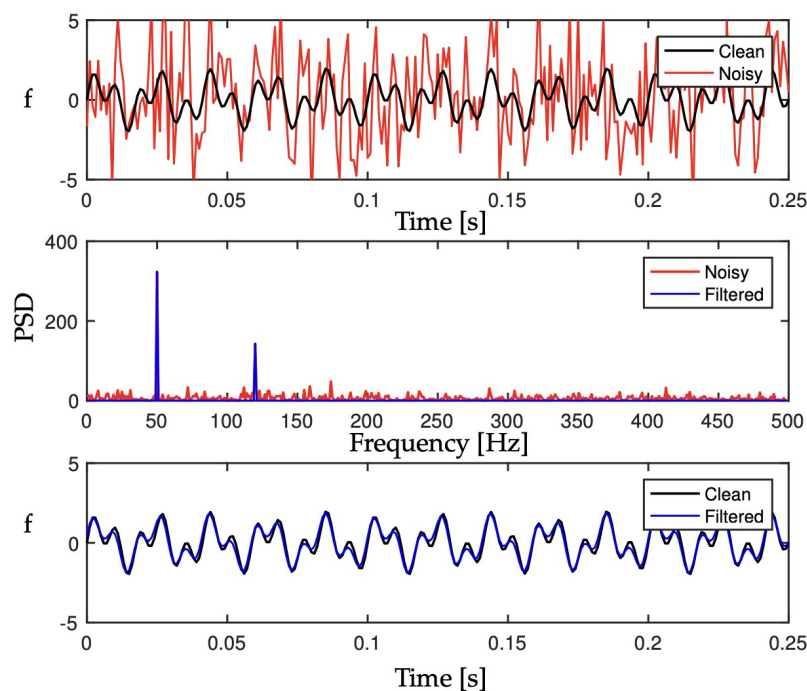
Figure 1: De-noising with FFT. (top) Noise is added to a simple signal given by a sum of two sine waves. (middle) In the Fourier domain, dominant peaks may be selected and the noise filtered. (bottom) The de-noised signal is obtained by inverse Fourier transforming the two dominant peaks.