Practical work Signal Processing

Background

Sampling rate (SF): (also called sampling frequency) is a measure of how often an analog signal is converted to a digital signal. In other words, it is the number of times per second that an analog signal is measured and recorded in a digital form.

Sampling Period (SP): represents the time interval between two consecutive samples of a continuous signal. It is expressed in seconds and is given by the formula : SP = 1 / SF
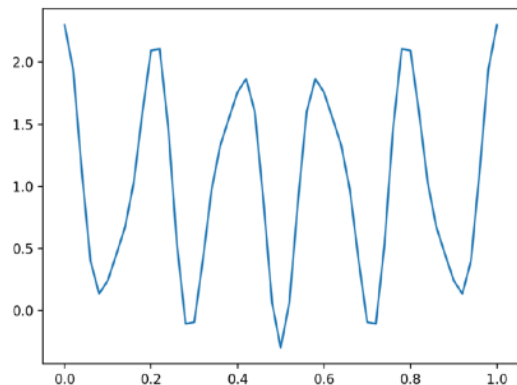
1. Fourier transform (1D)

1.1) Construct the following signal characterized by a sampling frequency equal to SR=50 and constituted by the sum of cosine functions with frequencies equal to 5 and 9 respectively:

s = 1+np.cos(2*np.pi*5*t) + 0.3*np.cos(2*np.pi*9*t)

The signal should look like this:

Tip: Deduce the time interval over which the signal is defined from the graph.

1.2) Compute the 1D Fourier transform using the function provided in the file ressources.py. Visualize the results and interpret them.

1.3) **Zero-padding**: Add zero-padding to the signal and compare the resolution of the Fourier Transform before and after padding. Does zero-padding introduce new frequency components or improve frequency resolution?

1.4) Apply a low-pass filter to the spectrum of the original signal (s) to remove the lower frequencies components. Reconstruct the signal from the resulting spectrum.

What do you remark ?