

## Programming Assignment 3

Out: 07/08/18 Due: 16/08/18

### Fourier series on a computer.

- a) Given a periodic signal  $x(t)$ ;  $x(t)$  can be represented by an appropriately sampled version  $x_n$  for just one period in Matlab.

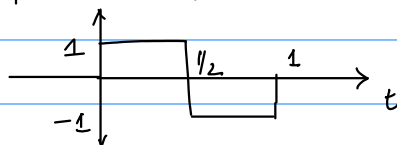
Your task is to write a function that takes in as input  $x_n$ , the period (say  $T_0$ ), and an integer  $k$  and compute  $c_k = 1/T_0 \int_{T_0} x(t) e^{-j2\pi kt/T_0} dt$ . Note that you cannot

really compute  $c_k$ , but rather you have to compute an approximation to  $c_k$  using  $x_n$ .

Check your answers with the  $c_k$  that you have got from solving problem ② of assignment 3.

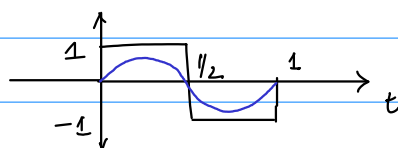
- b) Using the above function, write another in Matlab, that will take as input  $x_n$ , a lower limit and upper limit  $k_{min}$  and  $k_{max}$  for  $k$ , and  $T_0$ , and plot the magnitude and phase of the Fourier spectrum for the input  $x_n$  (which represents the actual c.T signal  $x(t)$ ).

- c) An alternate time domain view of Fourier series representation of a signal. Suppose  $x(t)$  is the periodic signal with one period given by-



Using the function that you written in b, find out  $c_k$ -s for  $k \in \{-10, -9, \dots, 9, 10\}$

- a) plot one period of  $x(t)$  and  $c_{-1} e^{-j2\pi f_0 t} + c_0 + c_1 e^{j2\pi k f_0 t}$  for the same period. Does your plot look similar to



- b) plot one period of  $x(t)$ ,  $\sum_{k=-5}^5 c_k e^{j2\pi k f_0 t}$  for the same period, and  $\sum_{k=-10}^{10} c_k e^{j2\pi k f_0 t}$  for the same period (use different colours for the 3 functions). What do you observe?