# Homework 4: Oscillations and waves II

## PHY250 - Fall 2021

<span style="color:red">Deadline: 23/19/2021</span>

## Exercise 1

Consider a simple pendulum of length $\ell = 2$, simulate its motion considering that it is not dumped. Do not consider small oscillations.

Which numerical method is the best choice. What happens when you use the Euler Method?

## Exercise 2

Consider the motion of a mass attached to a spring ($m = 1, k = 1, x_0 = 1, v_0 = 0$), simulate the motion of the particle for the following cases:

1. SHO motion.

2. Damped motion with $b = 0.1, b = 1.1, b = b_{cri}$.

3. Compare the motion of both: plot the position, velocity and acceleration vs. time for all the cases.

4. Now consider that there is also an external force with angular frequency $\omega$ that is acting on the system. Plot the the position vs. time for different frequencies $\omega$, make an animation.

## Exercise 3

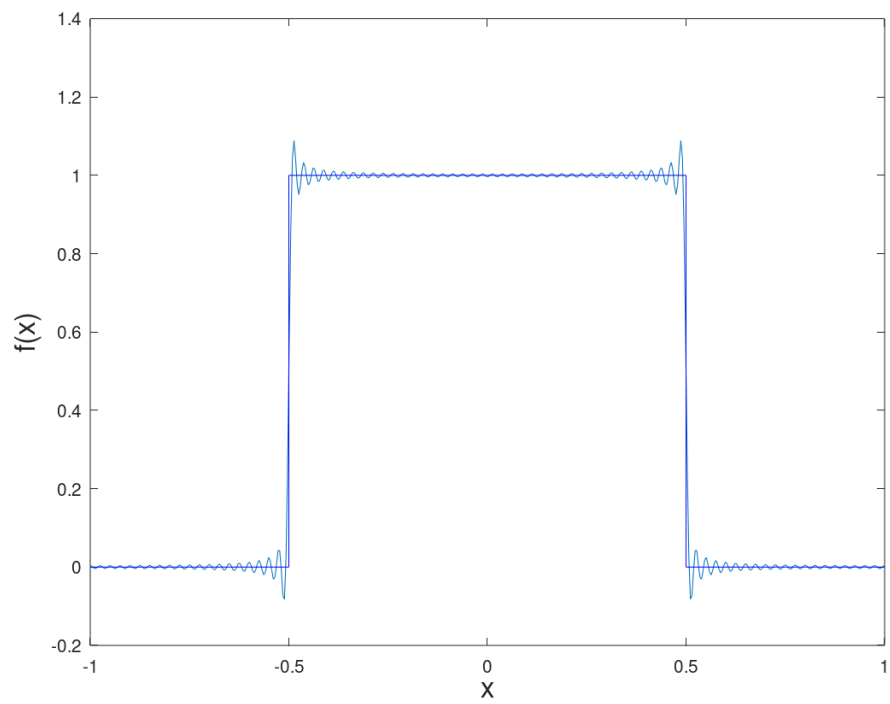Calculate the first 40 terms of the Fourier expansion for a square wave (Fig.1). Make an animation in which you plot both, the function and the Fourier expansion.

Figure 1: Square function + Fourier expansion.