Project Report for ECE 351

PreLab 08 - Fourier Series Approximation of a Square Wave

Skyler Corrigan

October 12, 2022

ECE351 Code Repository:
$https://github.com/ElfinPeach/ECE351_Code.git$

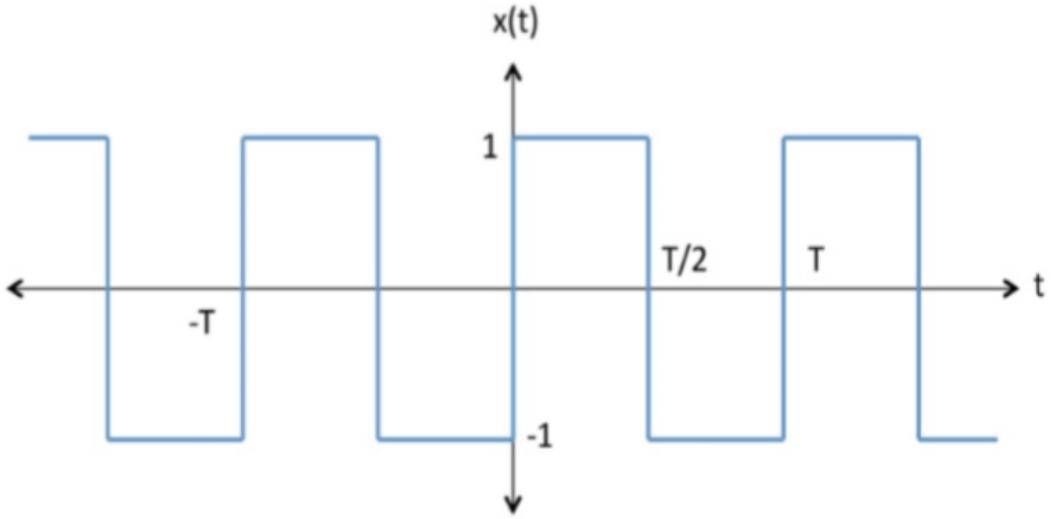
ECE351 Report Repository:
$https://github.com/ElfinPeach/ECE351_Report.git$

Contents

1 The Whole Dang Thang

For this prelab, the Fourier Series of the following image was found:

Figure 1



The following equations can be used to define the function:

$$x(t) = \frac{1}{2}a_0 + \sum_{n=1}^{\infty} a_k \cos(k\omega_0 t)$$
$$a_k = \frac{2}{T}\int_0^T x(t)\cos(k\omega_0 t)dt$$
$$b_k = \frac{2}{T}\int_0^T x(t)\sin(k\omega_0 t)dt$$
$$\omega_0 = \frac{2\pi}{T}$$

Since this is an odd function, $a_0 = a_k = 0$.
For b_k:

$$b_k = \frac{1}{k\pi}(-cos(k\pi) + 1 + cos(2k\pi) - cos(2k\pi)$$
$$\text{if k is even, } b_k = 0$$
$$\text{if k is odd, } b_k = \frac{4}{k\pi}$$
$$\text{Therefore: } x(t) = \sum_{k=1}^{\infty} \frac{4}{k\pi}\sin(k\omega_0 t)$$