

Fourier Series Approximation of a Square Wave

Prelab 8

Spring 2024

1 Purpose

Find a general expression for the coefficients of a Fourier series.

2 Deliverables

Typed and properly formatted derivation of the k -th Fourier series coefficients a_k and b_k .

3 Tasks

Consider the square wave in figure 1. Assume this is a real-valued function and can be explained by the Fourier series:

$$x(t) = \frac{1}{2}a_0 + \sum_{k=1}^{\infty} a_k \cos(k\omega_0 t) + b_k \sin(k\omega_0 t) \quad (1)$$

Where,

$$a_k = \frac{2}{T} \int_0^T x(t) \cos(k\omega_0 t) dt \quad (2)$$

$$b_k = \frac{2}{T} \int_0^T x(t) \sin(k\omega_0 t) dt \quad (3)$$

$$\omega_0 = \frac{2\pi}{T} \quad (4)$$

1. Find the expressions for a_k , b_k , and $x(t)$.

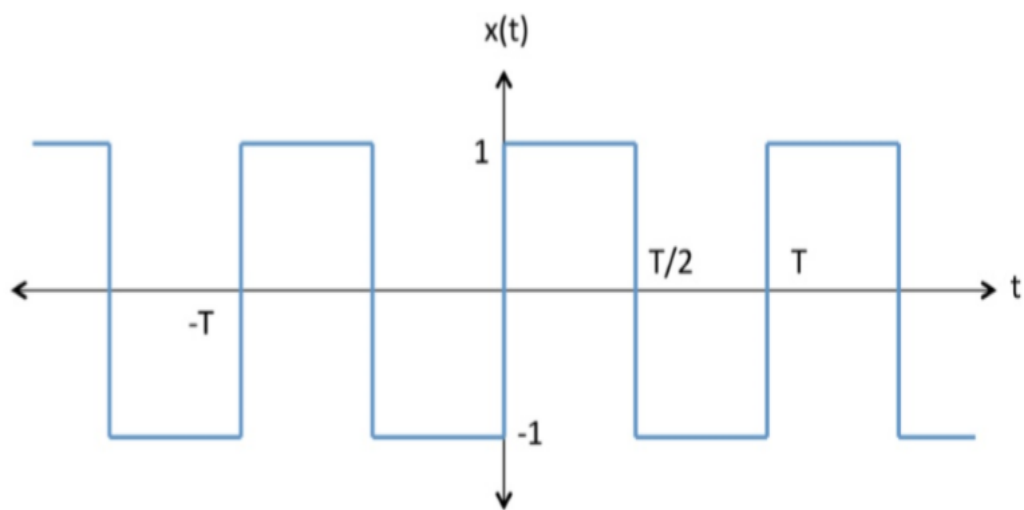


Figure 1: Square Wave for ECE 351 Prelab 8