

Worksheet 10

Fri, Apr 12

Spring 2019

Roll# Student 1:

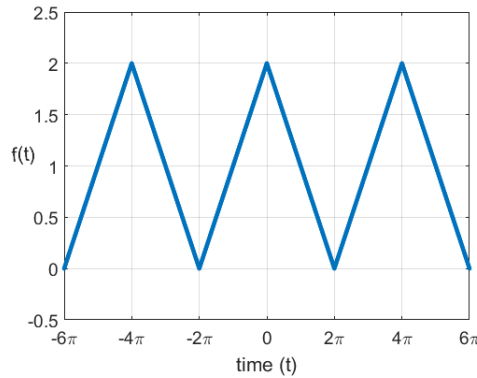
Roll# Evaluator 1:

Roll# Student 2:

Roll# Evaluator 2:

Problem 1 [20 minutes]

Consider the following periodic function $f(t)$ with complex Fourier series coefficients c_n .

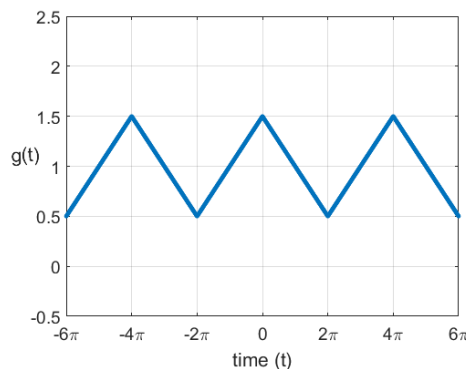


- (a) What are time period T and fundamental frequency ω_0 of $f(t)$?
- (b) Write down the frequencies of component sinusoidal waves that will form the Fourier series of $f(t)$.
- (c) Find the value of c_0 .
- (d) Given that $c_n = \frac{2}{\pi^2 n^2} (1 - (-1)^n)$ for $n \neq 0$. Based on whether $f(t)$ is even or odd, predict if its amplitude and phase spectra are even or odd.
- (e) Now plot its amplitude and phase spectra for $-5 \leq n \leq 5$.

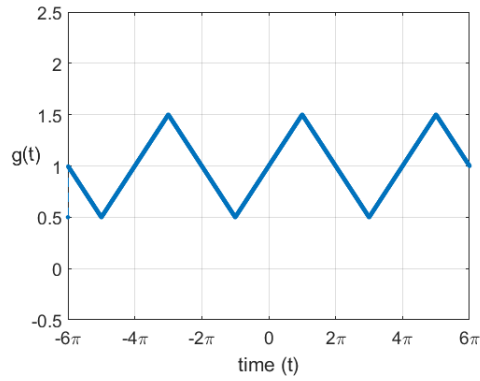
Problem 2 [50 minutes]

For each of the following periodic functions $g(t)$ with complex Fourier series coefficients d_n , answer the following using your answers to Problem 1 and without evaluating any coefficients through integration.

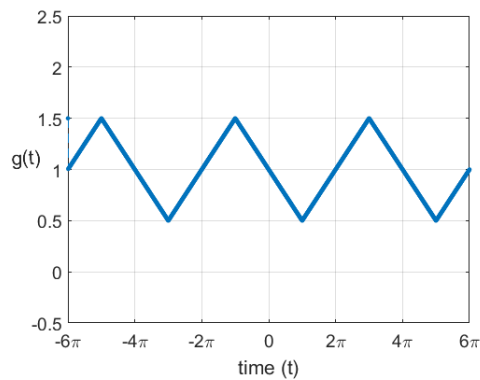
- (a) .



(b) .



(c) .



- (i) What are time period T and fundamental frequency ω_0 of $f(t)$?
- (ii) Specify whether the function is even, odd or neither?
- (iii) Based on (ii) predict the form of d_n (real, pure imaginary or complex).
- (iv) Based on (ii) predict the relationship between d_n and d_{-n} .
- (v) Based on (iv), predict if amplitude and phase spectra are even, odd or neither.
- (vi) Express $g(t)$ in terms of $f(t)$, where $f(t)$ is the function the Problem 1.
- (vii) Using (vi) and suitable properties of Fourier series, evaluate the complex Fourier series coefficients of $g(t)$.
- (viii) Plot its amplitude and phase spectra for $-5 \leq n \leq 5$, and verify your answer to (v).