

## Problem 1.15

Plot the frequency spectrum for the triangular wave of Prob. 1.11.

[TYPO: “frequency” should be “Fourier.”]

### Solution

The Fourier coefficients of the triangular wave in Prob. 1.11 were found to be

$$\begin{aligned} A_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} x(\theta) \cos n\theta \, d\theta \\ &= \frac{2}{\pi} \frac{1 - (-1)^n}{n^2\pi} \end{aligned}$$

and

$$\begin{aligned} B_n &= \frac{1}{\pi} \int_{-\pi}^{\pi} x(\theta) \sin n\theta \, d\theta \\ &= 0. \end{aligned}$$

Compute the quantities,  $|2c_n|$  and  $\phi$ .

$$\begin{aligned} |2c_n| &= \sqrt{A_n^2 + B_n^2} \\ &= \frac{2}{\pi} \frac{1 - (-1)^n}{n^2\pi} \\ \phi &= \tan^{-1} \frac{B_n}{A_n} \\ &= 0 \end{aligned}$$

The Fourier spectrum consists of two plots,  $\sqrt{A_n^2 + B_n^2}$  versus  $n$  and  $\phi$  versus  $n$ .



