Intermediate Dynamics: Homework 19

Due: day month year

1 Fourier Analysis

Consider a string of length L which is fixed at both ends ($x = 0$ and $x = L$). Suppose that at $t = 0$ the string is at rest but has been distorted so that

$$y(x) = Ax(L - x).$$

The relevant Fourier series expansion is

$$y(x) = \sum_{n=1}^{\infty} a_n \sin(n\pi x/L).$$

a) Determine the Fourier series coefficients, A_n.

b) For which n is $A_n = 0$?

c) Consider the terms in the Fourier series expansion for which $A_n = 0$. Are the corresponding functions $\sin(n\pi x/L)$ symmetric or antisymmetric about the point $x = L/2$?

d) Is $y(x)$ symmetric or antisymmetric about the point $x = L/2$? How do you think that this may be related to the fact that $a_n = 0$ for certain values of n?

2 King, *Vibrations and Waves*, 6.12, page 159.

3 King, *Vibrations and Waves*, 6.13, page 159.