EE3900 - Assignment 1

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1 Problem

3.31 (b) Let

$$x[n] = \begin{cases} 1, & 0 \le n \le 7 \\ 0, & 8 \le n \le 9 \end{cases} \tag{1.1}$$

be a periodic signal with fundamental period $N = 10$ and Fourier series coefficients a_k. Also let

$$g[n] = x[n] - x[n-1] \tag{1.2}$$

(b) Determine the Fourier series coefficients of g[n]

2 Solution

From part (a) we have that period of $g[n] = 10$. Let b_k be the Fourier series coefficients of $g[n]$

$$g[n] = \begin{cases} 1, & n = 0 \\ 0, & 1 \le n \le 7 \\ -1, & n = 8 \\ 0, & n = 9 \end{cases} \tag{2.1}$$

$$b_k = \frac{1}{10} \sum_{n=\langle 10 \rangle} g[n] e^{-\mathrm{j}k(2\pi/10)n} \tag{2.2}$$

$$= \frac{1}{10} \left(e^{-\mathrm{j}k(2\pi/10)\times 0} - e^{-\mathrm{j}k(2\pi/10)\times 8} \right) \tag{2.3}$$

$$b_k = \frac{1}{10} \left(1 - e^{-\mathrm{j}8k(2\pi/10)} \right) \tag{2.4}$$