EE411 MATLAB Exercise-I

The Fourier series of the rectangular wave shown in Fig.1 is given by

$$g(t) = \frac{4}{\pi} \sum_{n=1,3,5...}^{\infty} \frac{1}{n} \sin(n\pi t)$$

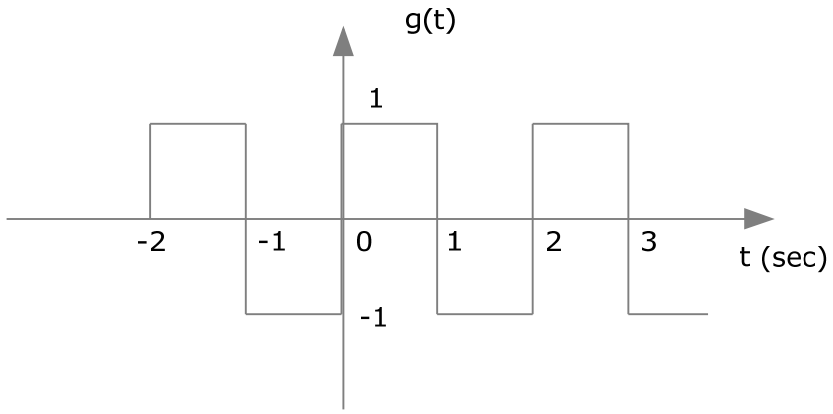

Fig. 1

(A) The signal g(t) can be approximated by truncation of the Fourier series. Let

$S_N(t) = \frac{4}{\pi} \sum_{n=1,3,5...}^{N} \frac{1}{n} \sin(n\pi t)$, (N is odd), use MATLAB to plot

(1) the rectangular wave in Fig.1 and $S_1(t)$ in the same frame for comparison.
(2) the rectangular wave in Fig.1 and $S_3(t)$ in the same frame for comparison.
(3) the rectangular wave in Fig.1 and $S_5(t)$ in the same frame for comparison.
(4) the rectangular wave in Fig.1 and $S_{11}(t)$ in the same frame for comparison.

Observe that $S_N(t)$ is approaching g(t) as N increases.

(B) Find the power of the signal g(t).

(C) If 90% power of the signal g(t) is to be included in $S_N(t)$, what is the minimum value of N?

(D) Plot $S_N(t)$, of which N is the minimum value required for $S_N(t)$ to include 90% of the total power of g(t).