Exercise 1

B.5. Use Table B.3 to determine the Fourier transform of the pulse in Fig. B.17.

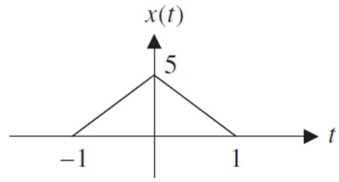

FIG. B.17

Triangular pulse in problem B.5.

B.6. Use Table B.3 to determine the Fourier transform for the pulse in Fig. B.18.

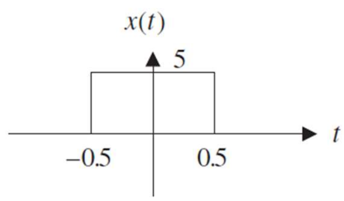

FIG. B.18

Rectangular pulse in problem B.6.

B.9. Solve the following differential equation using the Laplace transform method:

$$2\frac{dx(t)}{dt}+3x(t)=15u(t) \text{ with } x(0)=0.$$

(a) Determine$X(s)$.

(b) Determine the continuous signal $x(t)$ by taking the inverse Laplace transform of $X(s)$.

B.10. Solve the following differential equation using the Laplace transform method.

$$\frac{d^2x(t)}{dt^2}+3\frac{dx(t)}{dt}+2x(t)=10u(t) \text{ with } x'(0)=0 \text{ and } x(0)=0.$$

(a) Determine$X(s)$.

(b) Determine $x(t)$ by taking the inverse Laplace transform of $X(s)$.

B.11. Determine the locations of all finite zeros and poles in the following functions. In each case, make an s-plane plot of the poles and zeros, and determine whether the given transfer function is stable, unstable, or marginally stable.

(a) $H(s)=\frac{(s-3)}{(s^2+4s+4)}$

(b) $H(s)=\frac{s(s^2+5)}{(s^2+9)(s^2+2s+4)}$

(c) $H(s)=\frac{(s^2+1)(s+1)}{s(s^2+7s-8)(s+3)(s+4)}$

B.12. Given the transfer function of a system

$$H(s) = \frac{5}{s+5},$$

and the input $x(t) = u(t)$,

(a) determine the system impulse response $h(t)$;

(b) determine the system Laplace output based on $Y(s) = H(s)X(s)$;

(c) determine the system response $y(t)$ in the time domain by taking the inverse Laplace transform of $Y(s)$.

B.13. Given the transfer function of a system

$$H(s) = \frac{5}{s+5}$$

(a) determine the steady-state transfer function;

(b) determine the amplitude response and phase response in terms of the frequency ω;

(c) determine the steady-state response of the system output $y_{ss}(t)$ in time domain using the results from (b), given an input to the system as $x(t) = 5\sin(2t)u(t)$.

M.1: Make a Matlab routine for the calculation and summation of the N first harmonics of the Fourier series of a positive square wave function (Table B1). Use A=1 and T_0=1. Plot the results over two periods for N=1,3,7, and 30 in the same graph.