Problems for Signals and Systems

Chapter 4-1. Fourier Series Representation of Periodic Signal

- **The definition of Fourier series**,

1. Determine the Fourier series (trigonometric and exponential) of the symmetric periodic square wave shown in Figure 4.1

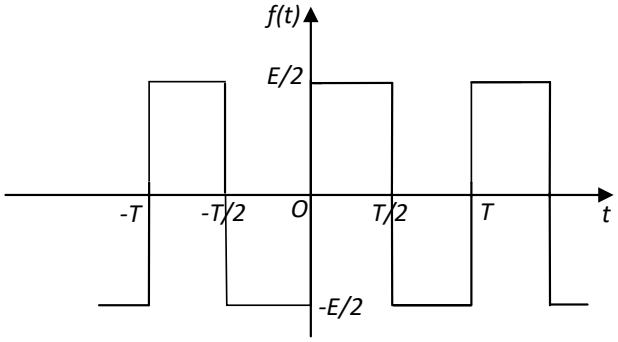

Figure 4.1

2. Determine the trigonometric and exponential Fourier series of the periodic signal shown in Figure 4.2. Plot its amplitude spectrum and phase spectrum.

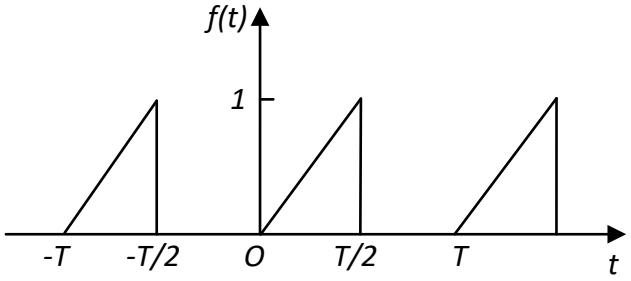

Figure 4.2

- **The properties of Fourier series**

3. Use the properties of Fourier series to resolve 1 and 2 again.

4. Determine if it is possible to use frequency-selective filters with variable center frequency to sort out frequency component of 5, 12, 20, 50, 80 and 100 kHz

from the periodic rectangular pulse defined in Figure 4.3 (given the pulse width $\tau = 20\mu s$, amplitude $E = 10V$, frequency $f = 5kHz$).

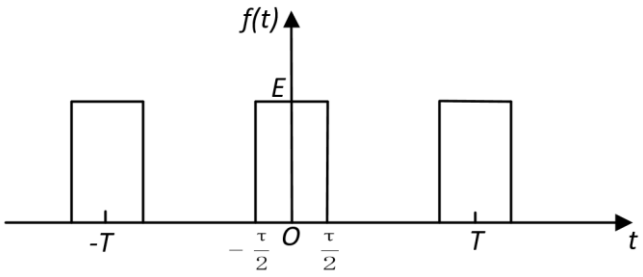

Figure 4.3

5. For each of the following Fourier series coefficients of a continuous-time signal that is periodic with period 4, determine the signal x(t) in each case

(a) $a_k = \begin{cases} 0, & k = 0 \\ (j)^k \frac{sink\pi/8}{2k\pi}, & otherwise \end{cases}$

(b) $a_k = \begin{cases} jk, & |k| < 3 \\ 0, & otherwise \end{cases}$