醫療儀器之應用電路與電路原理(2/4)

Signals and Noise

Chapter 5

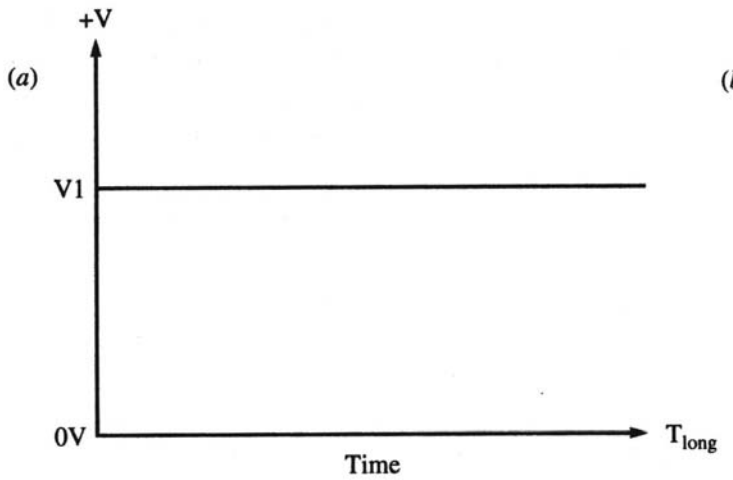
Signals and Noise

- Types of signals

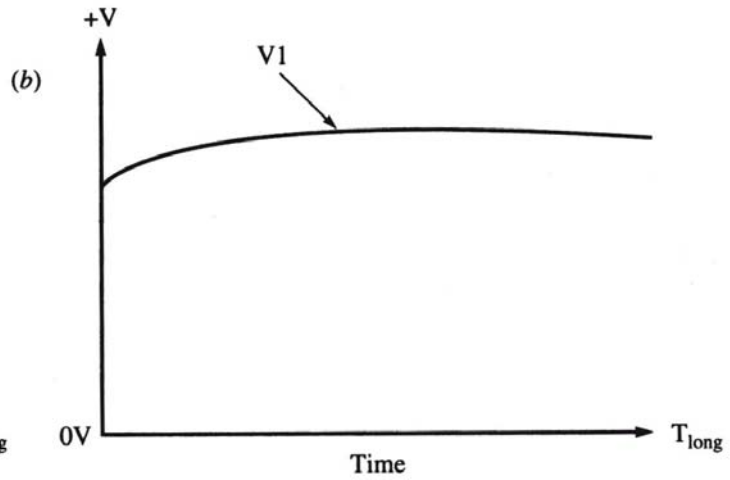
  -Signals can be categorized in several ways, according to time domain behavior

$$v = f(t),\ i = f(t)$$

  - Static and quasistatic signals



Static



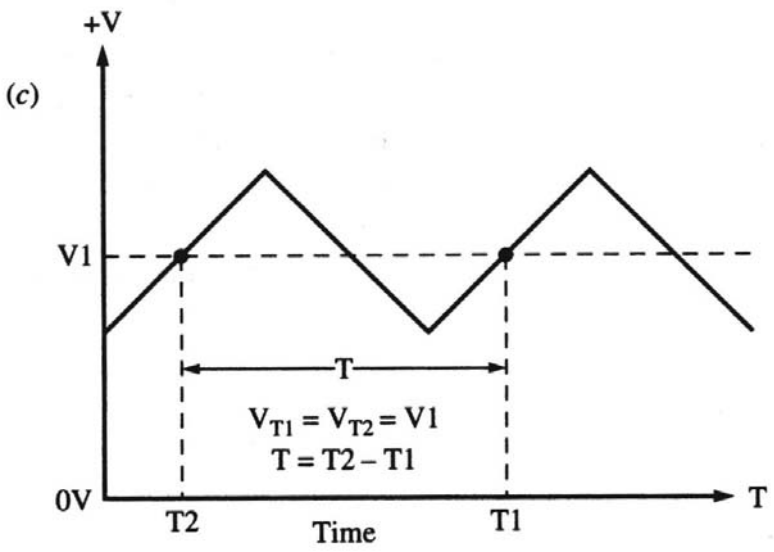
Quasistatic

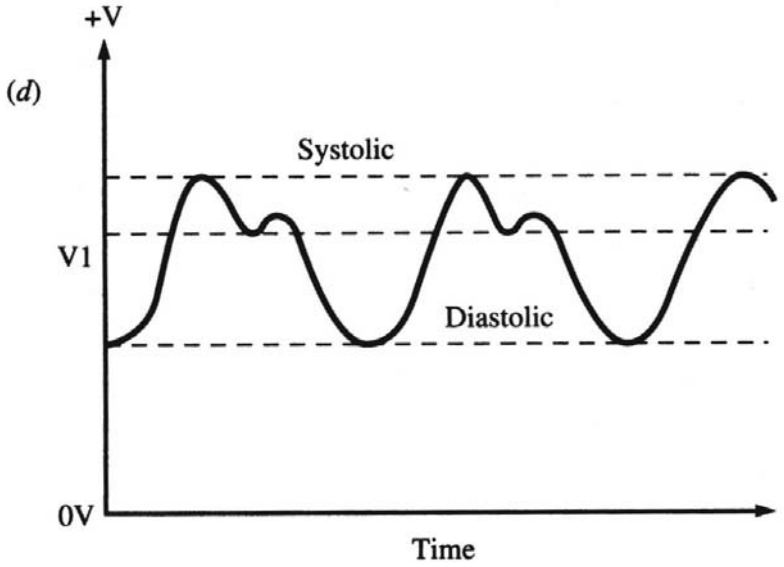
Signals and Noise

- Periodic signals
  - ✓ Repeats itself on a regular basis

$$V(t) = V(t+T)$$

- Repetitive signals
  - ✓ It is quasiperiodic signal $f(t) = f(t+T)$





Signals and Noise

- Transient signals
  - ✓ One time event or periodic event in which the event duration is very short compared with the periodic of the waveform

$$T_2 <<< T_1$$

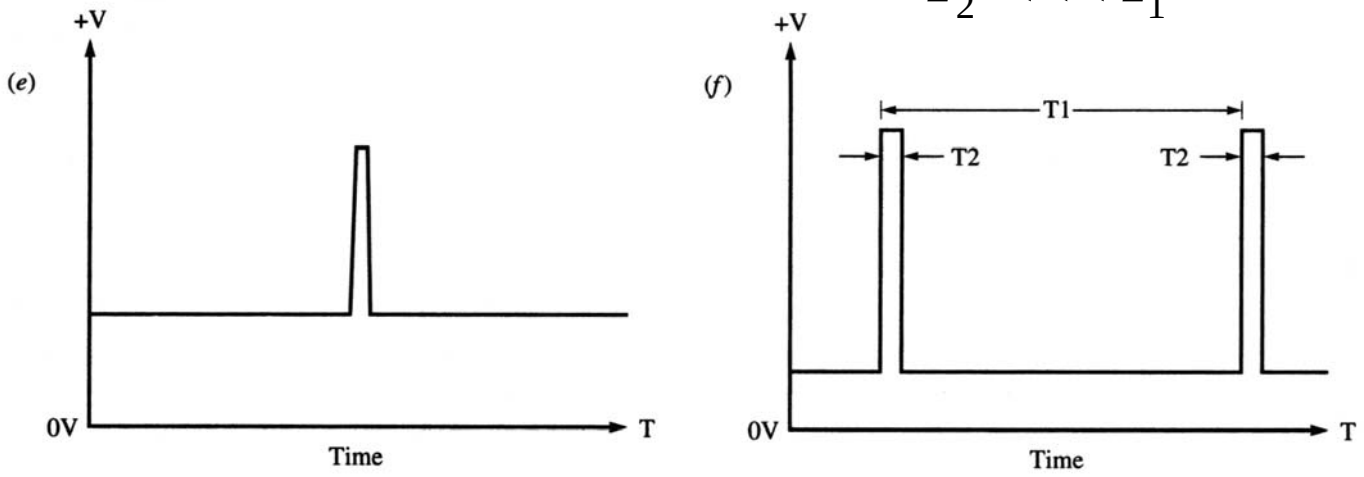


Figure 5-1
Signal types. (*a*) Static signal. (*b*) Quasistatic signal. (*c*) Periodic signal. (*d*) Repetitive signal. (*e*) Single-event transient signal. (*f*) Repetitive-transient or quasi-transient signal.

Signals and Noise

- Sine waveform

$$v = V_M \sin(2\omega t)$$

v : instantaneous amplitude of sine wave
V_M : peak amplitude
ω : angular frequency($2\pi f$)
t : time in seconds

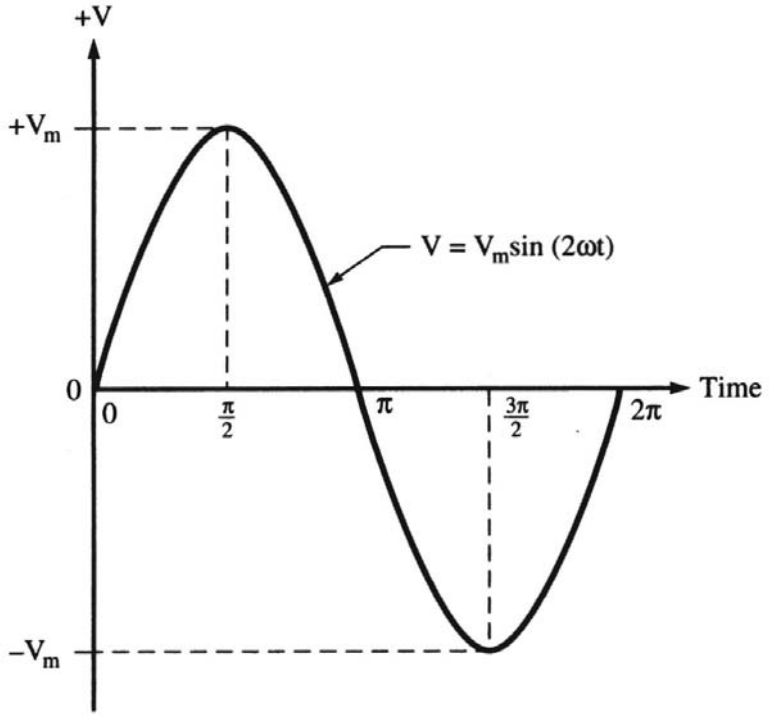


Figure 5-2
Sinusoidal waveform.

Signals and Noise

- Fourier series –use the fast Fourier transform(FFT)
  - Any waveform can be expressed

$$f(t) = \frac{a_0}{2} \int_{n=1}^{\infty} [a_n \cos(n\omega t) + b_n \sin(n\omega t)]$$

a_n , b_n: represent the amplitudes of harmonics

n : integer

- ✓ The term $\frac{a_o}{2}$ is the average value of $f(t)$ over one complete terms, dc component
- ✓ The amplitude coefficients are expressed

$$a_n = \frac{2}{T} \int_0^T f(t) \cos(n\omega t) dt$$

$$b_n = \frac{2}{T} \int_0^T f(t) \sin(n\omega t) dt$$