Classification of Signal

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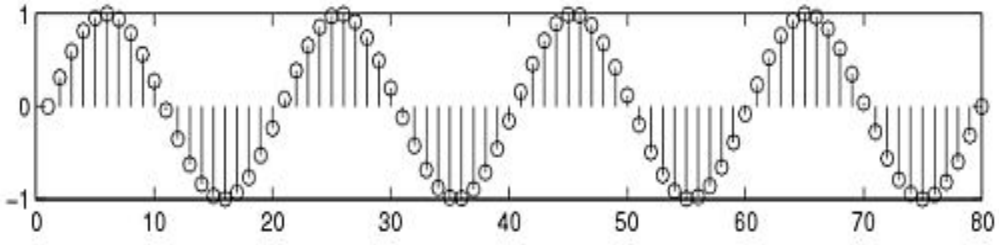
- Deterministic & Non Deterministic Signals
- Periodic & A periodic Signals
- Even & Odd Signals
- Energy & Power Signals

Deterministic & Non Deterministic Signals

Deterministic signals

- Behavior of these signals is predictable w.r.t time
- There is no uncertainty with respect to its value at any time.
- These signals can be expressed mathematically.

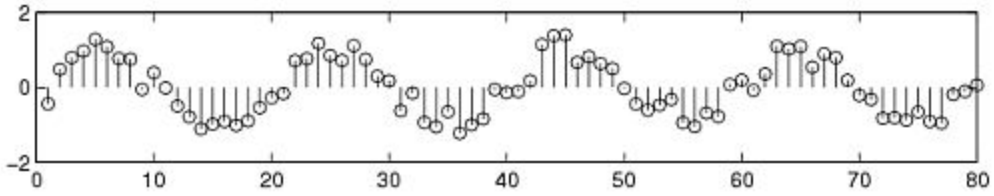
For example x(t) = sin(3t) is deterministic signal.



Deterministic & Non Deterministic Signals Contd.

Non Deterministic or Random signals

- Behavior of these signals is random i.e. not predictable w.r.t time.
- There is an uncertainty with respect to its value at any time.
- These signals can't be expressed mathematically.
- For example Thermal Noise generated is non deterministic signal.



Periodic and Non-periodic Signals

- Given x(t) is a continuous-time signal
- x (t) is periodic iff $x(t) = x(t+T_o)$ for any T and any integer n
- Example
  - $x(t) = A \cos(\omega t)$
  - $x(t+T_o) = A \cos[\omega(t+T_o)] = A \cos(\omega t+\omega T_o) = A \cos(\omega t+2\pi) = A \cos(\omega t)$
  - Note: $T_o = 1/f_o$; $\omega = 2\pi f_o$

Periodic and Non-periodic Signals Contd.

- For non-periodic signals

$$x(t) \neq x(t+T_o)$$

- A non-periodic signal is assumed to have a period $T = \infty$
- Example of non periodic signal is an exponential signal

Important Condition of Periodicity for Discrete Time Signals

- A discrete time signal is periodic if

$$x(n) = x(n+N)$$

- For satisfying the above condition the frequency of the discrete time signal should be ratio of two integers

$$\text{i.e. } f_o = k/N$$

Sum of periodic Signals

- $X(t) = x1(t) + X2(t)$
- $X(t+T) = x1(t+m_1T_1) + X2(t+m_2T_2)$
- $m_1T_1=m_2T_2 = T_o$ = Fundamental period
- Example: $\cos(t\pi/3)+\sin(t\pi/4)$
  - $T1=(2\pi)/(\pi/3)=6$; $T2 =(2\pi)/(\pi/4)=8$;
  - T1/T2=6/8 = ¾ = (rational number) = m2/m1
  - $m_1T_1=m_2T_2$ → Find m1 and m2→
  - 6.4 = 3.8 = 24 = T_o

Sum of periodic Signals – may not always be periodic!

$$x(t) = x_1(t) + x_2(t) = \cos t + \sin\sqrt{2t}$$

T1=(2π)/(1)= 2π; T2 =(2π)/(sqrt(2));

T1/T2= sqrt(2);

- Note: T1/T2 = sqrt(2) is an irrational number
- X(t) is aperiodic