1. Stair –ease function

This function is series of step as show in the figure and can be express as

$$f(t) = \begin{bmatrix} 0 & t < 0 \\ A & 0 \le t < b \\ 2A & b \le t < 2b \\ 3A & 2b \le t < 3b \\ 4A & 3b \le t < 4b \end{bmatrix}$$

2. Ramp function

The ramp function represents an uniform change with time.

f(t)=at

f(s)=$\frac{a}{s^2}$

f(t)=-at

f(s)=$\frac{-a}{s^2}$

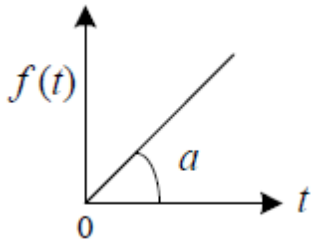

Fig.5 Ramp function

3. Rectangular pulse

The function is defined as the positive step change at period of the time and then negative step change mathematically, the pulse function of magnitude k is defined as:

$$f(t) = \begin{bmatrix} o & t < 0 \\ k & 0 \le t < a \\ 0 & t \ge a \end{bmatrix}$$

$$f(s) = \frac{k}{s} - \frac{k}{s}e^{-as}$$

$$f(s) = \frac{k}{s}(1 - e^{-as})$$

$$f(t) = \begin{bmatrix} o & t < 0 \\ -k & 0 \le t < a \\ 0 & t \ge a \end{bmatrix}$$

$$f(s) = \frac{-k}{s} + \frac{k}{s}e^{-as}$$

$$f(s) = \frac{k}{s}(e^{-as} - 1)$$

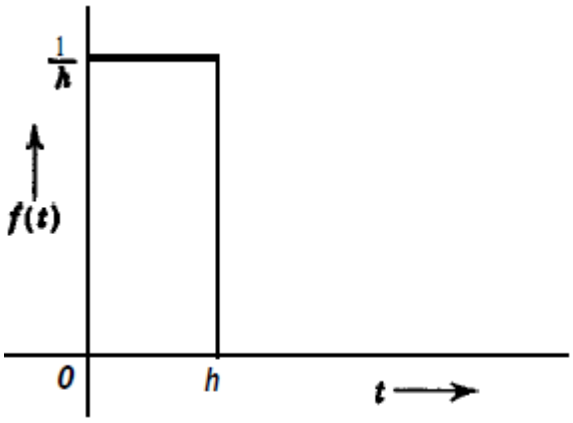

Fig.6 Rectangular pulse

4. Impulse

$$f(t) = \frac{k}{a}U(t) - \frac{k}{a}u(t - a)$$

$$f(s) = \frac{k}{as}(1 - e^{-as}) = \frac{k}{as} - \frac{k}{as}e^{-as}$$

$$\mathcal{L}[\delta(t)] = \lim_{a \to 0} \frac{k}{as}(1 - e^{-as})$$

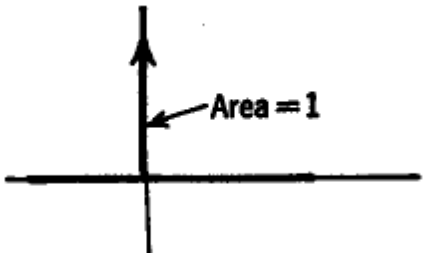

Fig.7 Ideal unit impulse

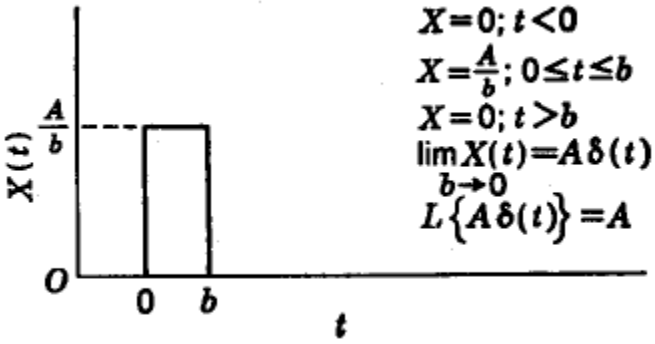

Fig.8 Impulse function