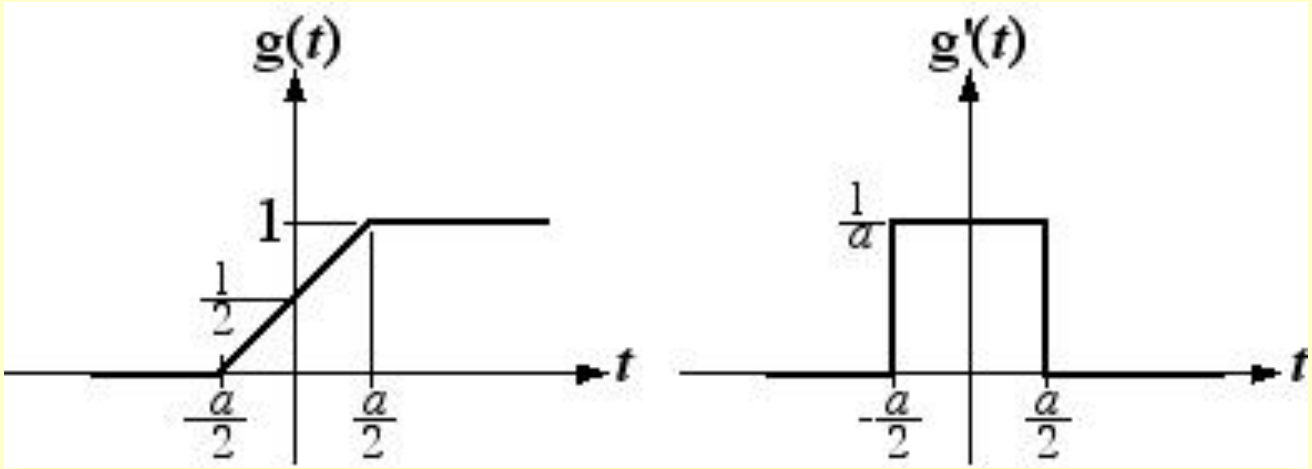
UNIT-1

(Lecture-7)

The Unit Impulse Signal

Unit Impulse Function

As a approaches zero, $g(t)$ approaches a unit step and $g'(t)$ approaches a unit impulse

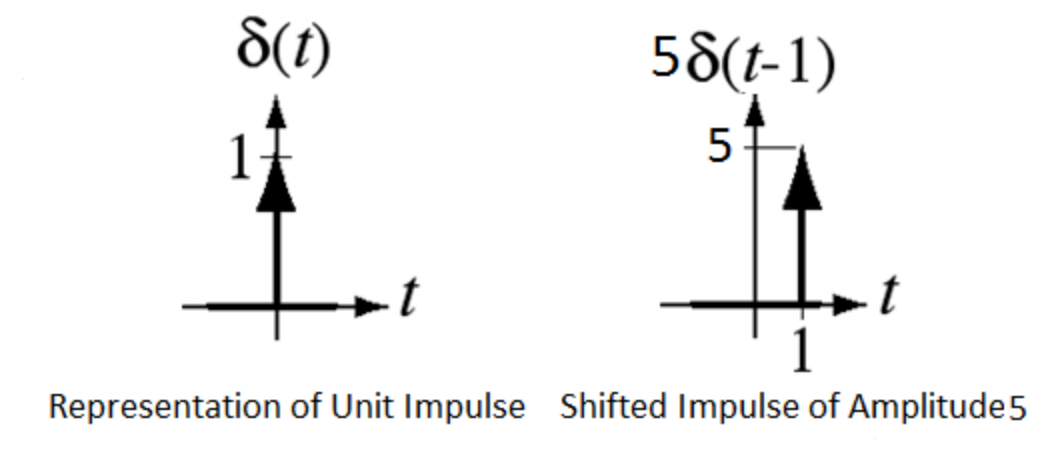


Functions that approach unit step and unit impulse

So unit impulse function is the derivative of the unit step function or unit step is the integral of the unit impulse function

Representation of Impulse Function

The area under an impulse is called its strength or weight. It is represented graphically by a vertical arrow. An impulse with a strength of one is called a unit impulse.



Representation of Unit Impulse Shifted Impulse of Amplitude 5

Properties of the Impulse Function

The Sampling Property

$$\int_{-\infty}^{\infty} g(t)\delta(t-t_0)dt = g(t_0)$$

The Scaling Property

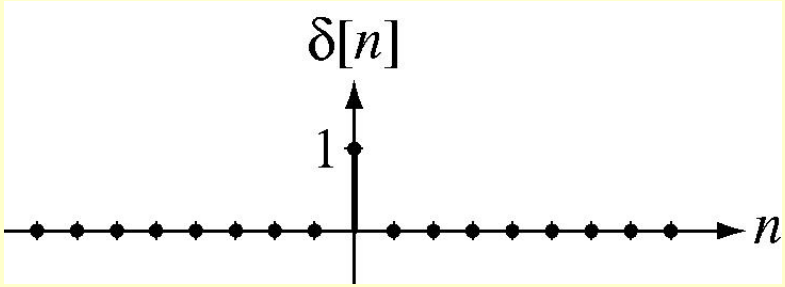
$$\delta\left(a(t-t_0)\right) = \frac{1}{|a|}\delta(t-t_0)$$

The Replication Property

$$g(t) \otimes \delta(t) = g(t)$$

Discrete Time Unit Impulse Function or Unit Pulse Sequence

$$\delta[n] = \begin{cases} 1 \ , & n = 0 \\ 0 \ , & n \neq 0 \end{cases}$$



$\delta[n] = \delta[an]$ for any non-zero, finite integer a.

Unit Impulse Train

The unit impulse train is a sum of infinitely uniformly-spaced impulses and is given by

$$\delta_T(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT) \quad , \quad n \text{ an integer}$$