→ SPNS - 31/6/2015 —— ELEC 3004 - LECTURE 3

INTERPRETATIONS of LINEAR SYSTEMS (LTI)

$$\vec{y} = A\vec{x}$$

$\vec{x}$: input : $\mathbb{R}^n$

$\vec{y}$: output : $\mathbb{R}^m$

$[A]$: A : $m \times n$

A: x (inputs) $\longrightarrow$ outputs

$$\vec{y} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} \qquad \vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$$

$$A = \begin{bmatrix} a_{11} & \text{—} & a_{1n} \\ a_{21} & \ddots & | \\ a_{m1} & & a_{mn} \end{bmatrix}$$

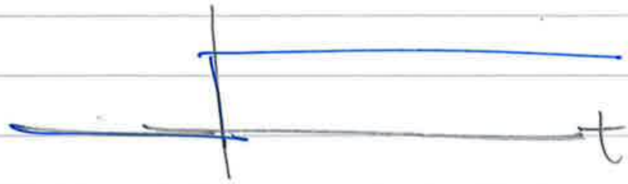
→ SPAN - 3/16/2019

Sampling Notes

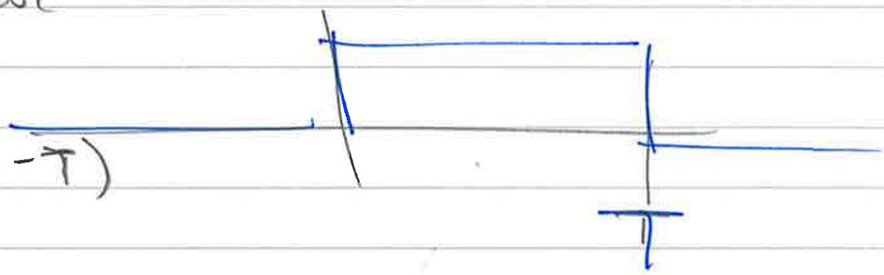
Unit-step function

$$u(t) = \begin{cases} 0, & t < 0 \\ 1, & t > 0 \end{cases}$$

→ rectangular step



— rectangular pulse



$p(t) = u(t) - u(t-T)$

→ $u(t-T)$: delayed step

↳ zero for $(t-T)<0 \Rightarrow \boxed{t<T}$

unity for $\boxed{t>T}$

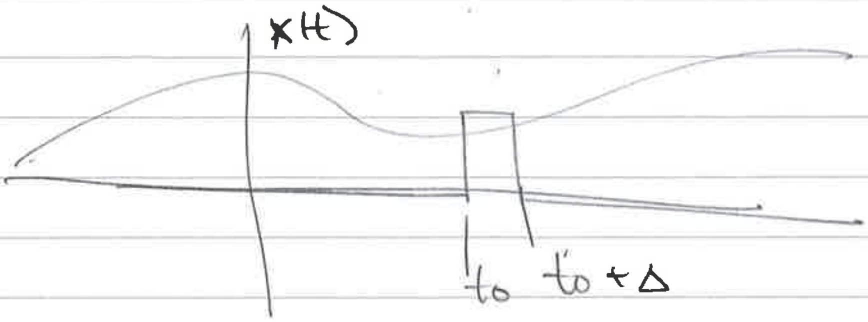
unit impulse function (Dirac Delta) δ

1. $\delta(t) = 0$ for $t \neq 0$
2. $\delta(t) =$ UNDEF for $t = 0$
3. $\int_{t_1}^{t_2} \delta(t)\,dt = \begin{cases} 1 & \text{if } t_1 < 0 < t_2 \\ 0 & \text{otherwise} \end{cases}$

Derivative of unit-step.

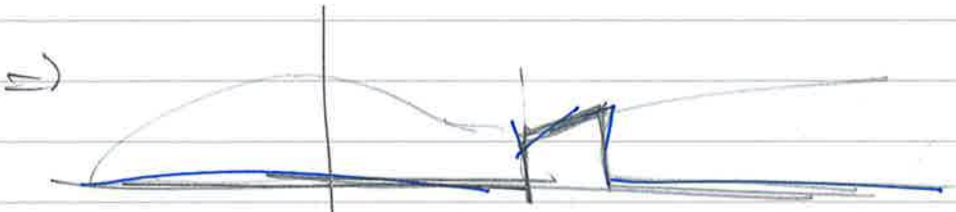
Unit impulse properties

$$y(t) = x(t) \cdot \delta(t-t_0)$$



$$\tilde{\delta}(t-t_0)$$

$\Rightarrow$



$$y(t) = x(t)\,\delta(t-t_0) = x(t_0)\,\delta(t-t_0)$$

$\Rightarrow$ Shifting property

$$\int_{-\infty}^{\infty} x(t)\,\delta(t-t_0)\,dt = \underline{x(t_0)}$$

$\longrightarrow$ IN FREQUENCY DOMAIN

$$X(j\omega) = \int_{-\infty}^{\infty} \delta(t-t_0)\,e^{-j\omega t}\,dt$$