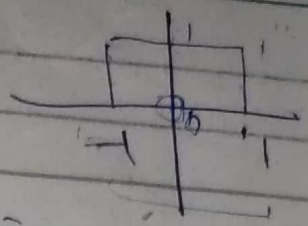
$s+1=0$

$s=-1$

26 Sept, 2023

DSP

→ Why signal processing.



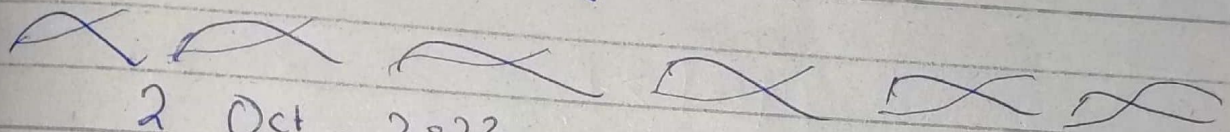
1- Signals are everywhere ...

A = 2 - 1

2 - 1+1

Human to Human
Human to Machine
Machine to Machine

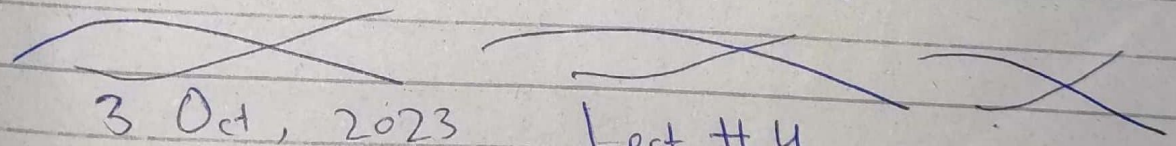
Discrete-Time Signal



2 Oct, 2023

2.4 GHz Wi-fi Signal

Bandwidth ≈ like gold mine.



3 Oct, 2023 Lect #4

Cont. Signal

1 def
2. Math
3. Software
4. Users

---

t = -5, -4.9, -4.8, ---- 5

Size(t) 1 x 101

Length(t) = 101

9th Oct, 2023

$$\int_{-\infty}^{\infty} \delta(t) = u(t)$$

$$\int_{-\infty}^{\infty}$$

★ Parabolic Signal

$$A\alpha^n \qquad b.e^{j\varphi}$$

$$-1 < \alpha < 0$$
$$0.1 < \alpha < 1$$

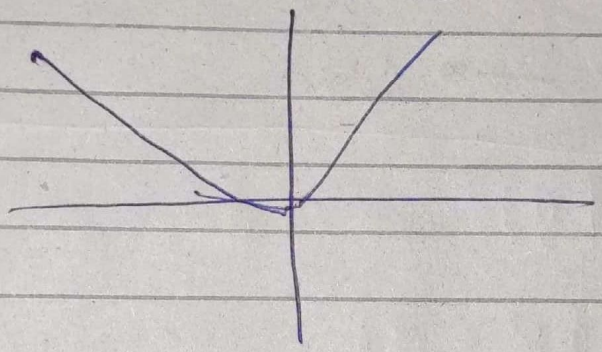
$$|\alpha| > 1$$

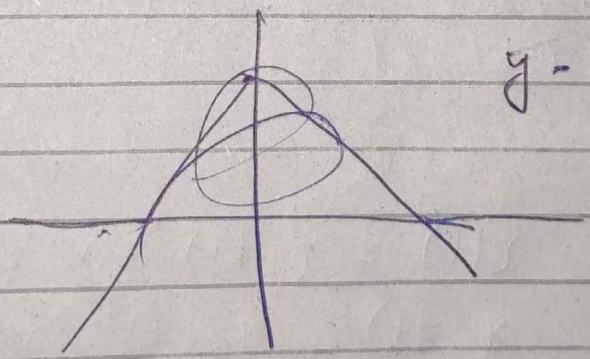
Assignment (1)

$$f = \frac{3}{1 \times 10^{-3}} S =$$

$$y = 1 - \frac{|x|}{2}$$

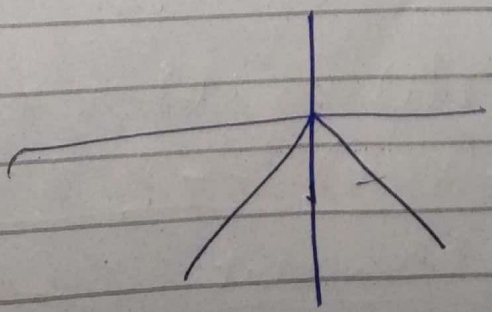
$y = |x|$



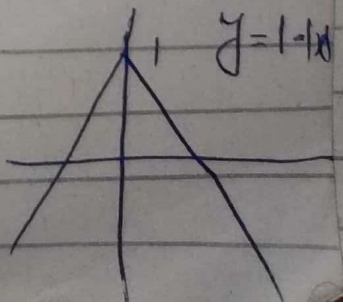


$y =$

$y = -|x|$

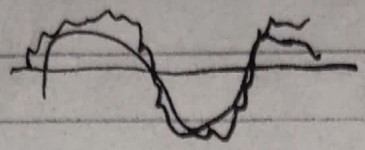


$y = 1 - |x|$



13 Oct 2023

Average ⟶ Smoothen



Memory / Memoryless
Linear / Non-linear
Causal / Non-Causal
Time Variant / ~~Non-t~~ Time Invariant

Accumulator ⟶ Adder

6th / Nov / 2023

Odd sig are also called anti symmetric (x with -ve)

$$x(t) = x_e(t) + x_o(t) \quad \text{— (i)}$$

$$x(-t) = x_e(t) - x_o(t) \quad \text{— (ii)}$$

$$x(t) = x_e(t) + x_o(t)$$

$$-x(-t) = -x_e(t) + x_o(t)$$

$$\frac{x(t) - x(-t)}{2} = \frac{2x_o(t)}{2}$$

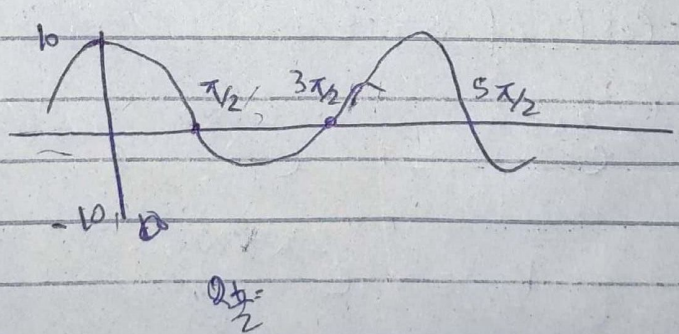
$= a +/- \text{rand}();$

$$x_o(t) = \frac{x(t) - x(-t)}{2}$$

$x(t) = 10\cos t$

$x(-t) = 10.\cos t$

Even	Odd
$x_e(t) = \frac{10\cos 2t + 10\cos 2t}{2}$	$x_o = \frac{10\cos 2t - 10\cos 2t}{2}$
$\boxed{x_e(t) = 10\cos 2t}$	$\boxed{x_o = 0}$



$x(t) = 10 + 10\cos(2t)$

$x(-t) = 10 + 10.\cos(2t)$

$$x_e(t) = \frac{(10 + 10\cos(2t)) + (10 + 10\cos(2t))}{2}$$

$$x_e(t) = 10 + 10\cos(2t)$$

$$x_o(t) = \frac{(10 + 10\cos(2t)) - (10 + 10\cos(2t))}{2}$$

N → no. of samples / second

$$x(n) = \cos(2\pi f_o n)$$

$$x[n+N] = \cos(2\pi f_o n + 2\pi f_o N)$$

$$\cos(2\pi f_o n) = \cos(2\pi f_o n + 2\pi f_o N)$$

$$e^{2\pi f_o n} = e^{2\pi f_o n} \cdot e^{2\pi f_o N}$$

$$1 = e^{2\pi f_o N}$$

Classification of signal

★ Even & Odd Signal

$x(t)$ ⟶ standard even

if odd Comp = 0

Composite Signal,

$$x(t) = x_1(t) + x_2(t) + x_3(t)$$

10, 20, 30, 40, 50, 60

$$T = LCM(T_1, T_2, \dots T_6)$$

③ Deterministic Signal V.S Random Signal / Stochastic Signal / probabilistic Signal.

④ Energy & Power Signals.

Normalized

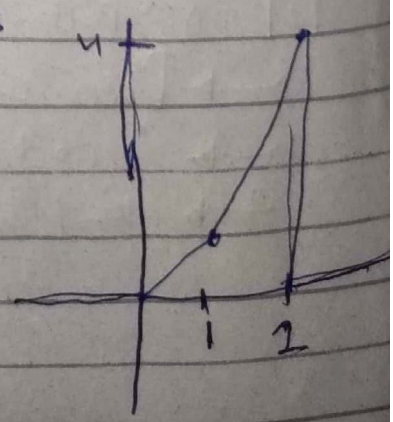
$$\int_{-\infty}^{\infty} |x(t)|^2$$

Time Limited but not always

$x(t) = t \quad t = [0, 1]$

$2t \quad t = [1, 2]$

$0 \quad$ otherwise



$$E_g = \int_{-\infty}^{\infty} |x(t)|^2 \, dt$$

$$= \int_0^1 |x(t)|^2 + \int_1^2 |x(t)|^2$$

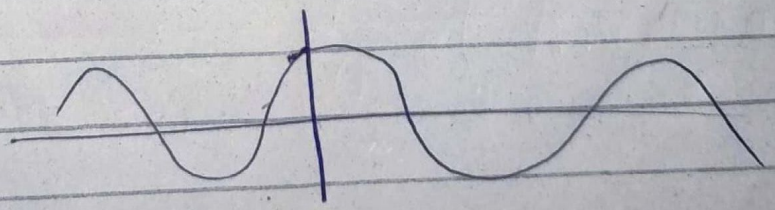
$$= \int_0^1 t^2 \, dt + \int_1^2 4t^2$$

$$= \frac{t^3}{3}\Big|_0^1 + \frac{4t^3}{3}\Big|_1^2$$

$$= \left[\left(\frac{1}{3}\right) - (0)\right] + \left[\frac{32}{3} - \frac{4}{3}\right]$$

$$= 1/3 + \frac{28}{3} = \frac{29}{3}$$

$$x(t) = A \cdot \cos(\omega_0 t + \theta)$$



$$P = \frac{1}{T} \int_{-T/2}^{T/2} A^2 \cdot \cos^2(\omega_0 t + \theta) \, dt$$

$$= \frac{A^2}{T} \int_{-T/2}^{T/2} \left(\frac{1 + \cos(2\omega_0 t + 2\theta)}{2} \right)$$

$$P = \frac{A^2}{2T}\left[\int_{-T/2}^{T/2}(1) + \int_{-T/2}^{T/2}\cos(2\omega_0 t + 2\theta)\right] \quad \text{(the cos integral} \to 0\text{)}$$

$$P = \frac{A^2}{2T}\left[T/2 + T/2\right]$$

$$P = \frac{A^2}{2T}\left[T\right]$$

$$\boxed{P = A^2/2}$$