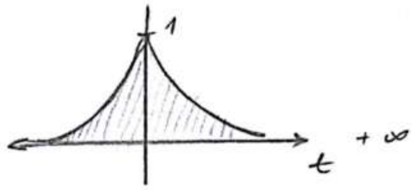
2) a) $x_1(t) = e^{-|t|}$

ENERGÍA $= \int_{-\infty}^{\infty} |x_1(t)|^2 \, dt$



$E = \int_{-\infty}^{\infty} |e^{-|t|}|^2 \, dt = 2 \cdot \int_{0}^{\infty \; -\infty} e^{-2t} \, dt$

$u = -2x$

$du = -2 \cdot dx \rightarrow dx = -\frac{1}{2} du$

$= 2 \cdot \int_{0}^{\infty} e^{u} \cdot \left(-\frac{1}{2}\right) du$

$= 2 \cdot \left(-\frac{1}{2}\right) \cdot \int_{0}^{\infty} e^{u} \cdot du$

$= \cancel{2} \cdot \left(-\frac{1}{\cancel{2}}\right) \cdot \left(-\frac{e^{u}}{2}\right)\Big|_{0}^{\infty}$

$= -1 \cdot \frac{e^{u}}{2} = -\frac{e^{-2x}}{2}\Big|_{0}^{\infty} = 1/2$

b) $x_2(t) = \text{SEN}(2\pi \cdot 5t) + \cos(2\pi \cdot 10t)$

$T_n = \frac{1}{f_n}$ → ACA USARIA EL M.C.M

SENALES PERIODICAS (f_1 → FRECUENCIA, f_2)

(NO TIENEN ENERGIA)

PERIODO $T_1 = \frac{1}{5}$ $T_2 = \frac{1}{10}$

HALLO EL MCD

$MCD(f_1, f_2) = 5 \longrightarrow f_0 = 5$ → SON PERIODICAS

MCD → gcd

POR SER SEÑALES REALES PUEDO REEMPLAZAR POR =

$$P_{TOT}\Big|_{x_1+x_2} = \frac{1}{T_0}\int_{<T_0>} |x_1(t) + x_2(t)|^2 dt = \frac{1}{T_0}\int_{<T_0>} (x_1(t) + x_2(t))^2 dt$$

ABRIMOS EL BINOMIO

$$= \underbrace{\frac{1}{T_0}\int_{<T_0>} x_1^2(t)dt}_{P_1} + \underbrace{\frac{1}{T_0}\int_{<T_0>} x_2^2(t)dt}_{P_2} + \underbrace{\frac{2}{T_0}\int_{<T_0>} x_1(t)\, x_2(t)\, dt}_{C}$$

C → NULA

$$P_{TOTAL}\Big|_{x_1+x_2} = P_1 + P_2 + \frac{2}{T_0}\int_{<T_0>} x_1(t)\, x_2(t) =$$

$$= P_1 + P_2 + \underbrace{\frac{2}{T}\int_0^T \text{SEN}(2\pi 5t) \cdot \cos(2\pi 10t)\, dt}$$

POR TABLA (IDENTIDAD)

$$\int \text{SEN}(p.x) . \cos(q.x)\, dx =$$

$$= -\frac{\cos[(p-q)x]}{2(p-q)} - \frac{\cos[(p+q)x]}{2(p+q)}$$

$$= 2 \cdot \int_0^T \text{SEN}(2\pi.5.t) . \cos(2\pi.10t)\, dt = \left[-\frac{\cos(-5.\pi.t)}{2.(-4\pi)} - \frac{\cos(15\pi t)}{2.(16\pi)}\right]_0^T$$

$$= -1 - 1 + 1 + 1 = 0$$

$$P_{TOT} = P_1 + P_2 + 0$$

$$P = \frac{A^2}{2}$$

$$P_{TOT} = \frac{1^2}{2} + \frac{1^2}{2} = 1$$

c) $f[n] = \left(\frac{1}{2}\right)^n \cdot u[n]$

TIENE ENERGÍA

EXPONENCIAL DECRECIENTE (FUNCION APERIODICA)

EL MODULO DESAPARECE PQ SIEMPRE ES POSITIVO

$$E = \sum_{n=-\infty}^{\infty} |f[n]|^2 = \sum_{n=-\infty}^{\infty} \left|\left(\frac{1}{2}\right)^n \cdot \underbrace{u[n]}_{=1}\right|^2 = \sum_{n=0}^{\infty} \left|\left(\frac{1}{2}\right)^n\right|^2 = \sum_{n=0}^{\infty} \left(\frac{1}{4}\right)^n$$

ANULA TODOS LOS VALORES CON $n<0$

SERIE GEOMETRICA

$$\sum_{n=0}^{\infty} q^n = \frac{1}{1-q} \; ; \text{ si } |q|<1$$

$$= \sum_{n=0}^{\infty} \left(\frac{1}{4}\right)^n = \frac{1}{1-(1/4)} = \frac{4}{3} \simeq \boxed{1{,}33}$$

a) $f[n] = \cos\left(\overset{\nearrow f}{\frac{\pi}{2}} \cdot n\right)$

FUNCION COSENO
PERIODICA, TIENE POTENCIA

$N_0 = \frac{2\pi}{\pi/2} \cdot k = 4$

$\frac{2\pi}{f}$

$n = 0, 1, 2, 3 \longrightarrow E = \frac{1}{N_0} \cdot \sum_{N_0} |f[n]|^2 = \frac{1}{4} \cdot \sum_{4} |\cos(\frac{\pi}{2} \cdot n)|^2$

$= \frac{1}{4} \cdot \left(\cos\left(\frac{\pi}{2} \cdot 0\right)^2 + \cos\left(\frac{\pi}{2} \cdot 1\right)^2 + \cos\left(\frac{\pi}{2} \cdot 2\right)^2 + \cos\left(\frac{\pi}{2} \cdot 3\right)^2 + \ldots \cancel{\cos\left(\frac{\pi}{2} \cdot 4\right)}\right) = \boxed{\frac{1}{2}}$

$n = 0, 1, 2, 3$ A PARTIR DEL 4 SE REPITE

SE REPITE