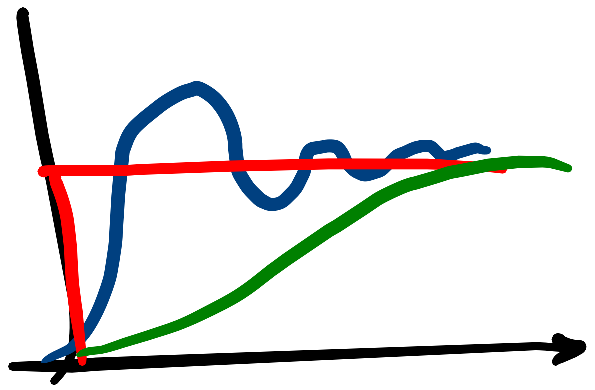
Minicurso Sistemas Lineares

Aula 5

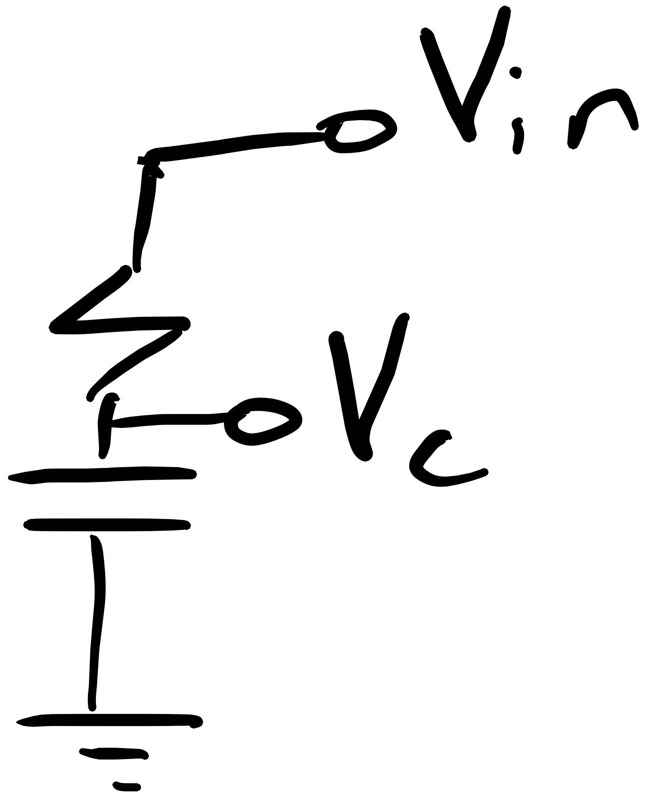


CAEEL

Lucas Zischler

Exercício

Ache $H(\omega)$ $\quad R = 1\,\Omega \quad C = 100\,\mu F$



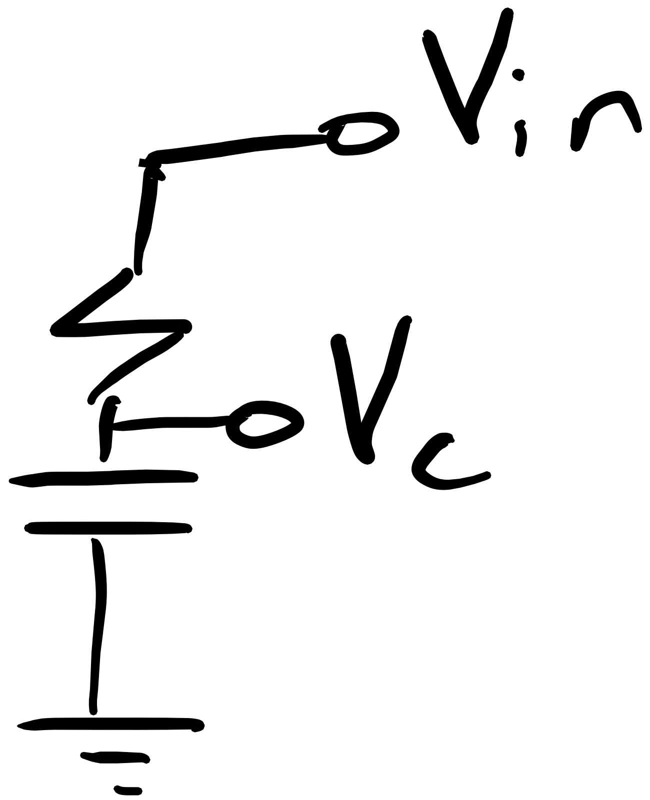
$$\frac{sC \cdot 1/sC}{sC\,(R + 1/sC)} = \frac{1}{RCs+1}$$

$$|Re + j\,Im| = \sqrt{Re^2 + Im^2}$$

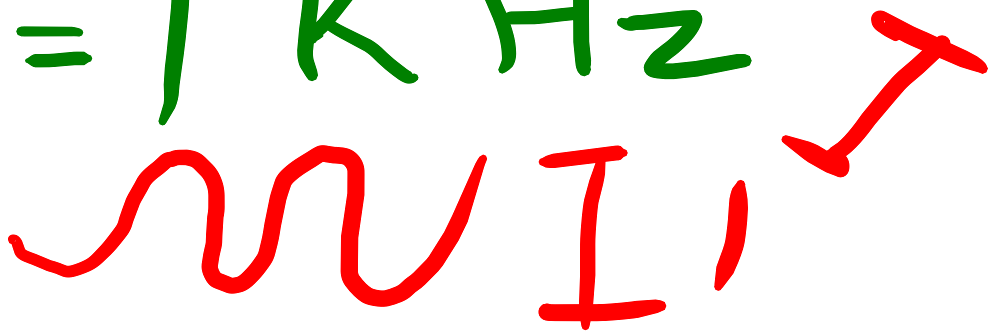
$$\frac{1}{j\omega RC+1} = \frac{1}{j\omega 100 \cdot 10^{-6} + 1} =$$

Exercício

Ache $H(\omega)$ $\quad R = 1\,\Omega \quad C = 100\,\mu F$



$\omega = 2000\pi \qquad f = 1\,KHz$



$V_c = V_{in} \cdot 0.8467$

$\omega = 20.000\pi \qquad f = 10\,KHz$

$V_c = V_{in} \cdot 0.1571$

Passa baixa

Transformada Inversa Fourier

$$F(\omega) = 1 \int_{-\infty}^{\infty} f(t)\, e^{-j\omega t}\, dt$$

$$f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega)\, e^{+j\omega t}\, dt$$

$$f(t) = \mathcal{F}^{-1}\{F(\omega)\}$$

Propriedades

~ As mesmas de Laplace ~
são válidas

Deslocamento

$$\mathcal{F}\{f(t-b)\} = e^{-bj\omega}F(\omega)$$

Derivada

$$\mathcal{F}\{t^m f(t)\} = j^m \frac{d}{d\omega} F(\omega)$$

Propriedade da Simetria

$$\mathcal{F}\{F(t)\} = 2\pi f(-\omega)$$

$$\mathcal{F}^{-1}\{f(\omega)\} = \frac{1}{2\pi} F(-t)$$

Exemplo

$$\mathcal{F}\{S_2(t)\} \qquad S_2(\omega) = F(\omega)$$

$$\mathcal{F}^{-1}\{S_2(\omega)\} = \frac{G_2(t)}{2}$$

$$\mathcal{F}\left\{\frac{1}{2} G_2(t)\right\} = 1\, S_2(\omega^2/2)$$

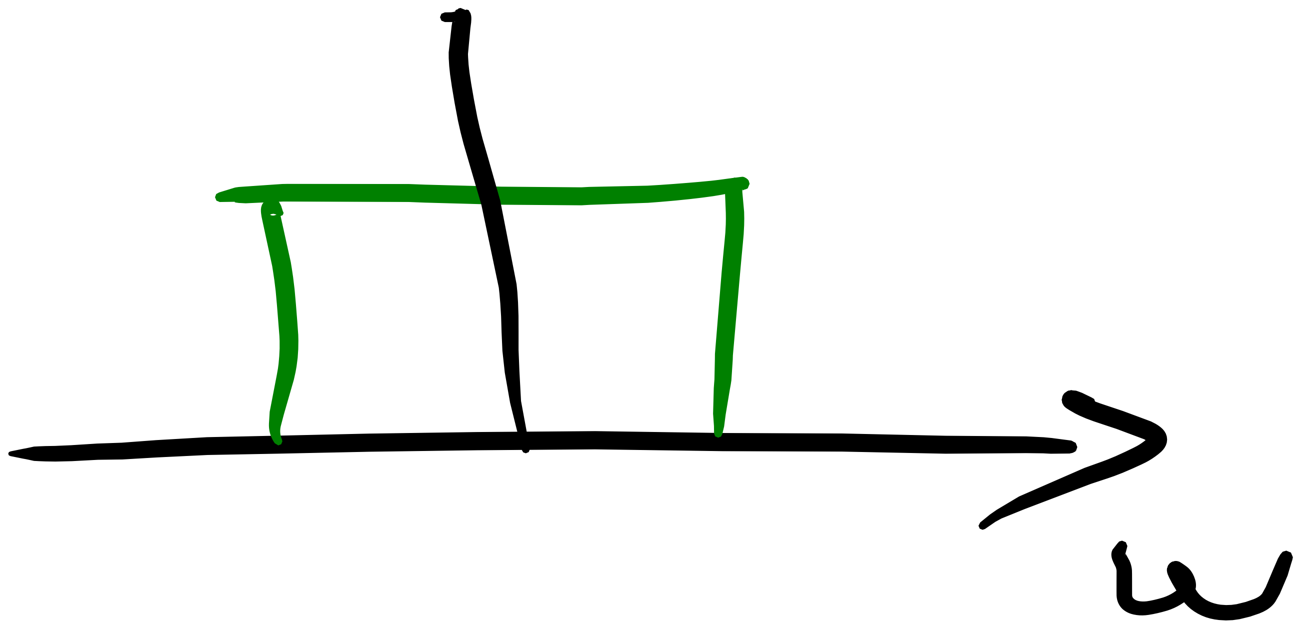
$$f(t) \qquad F(\omega)$$

$$2\pi f(-\omega) \quad = \mathcal{F}\{F(t)\}$$

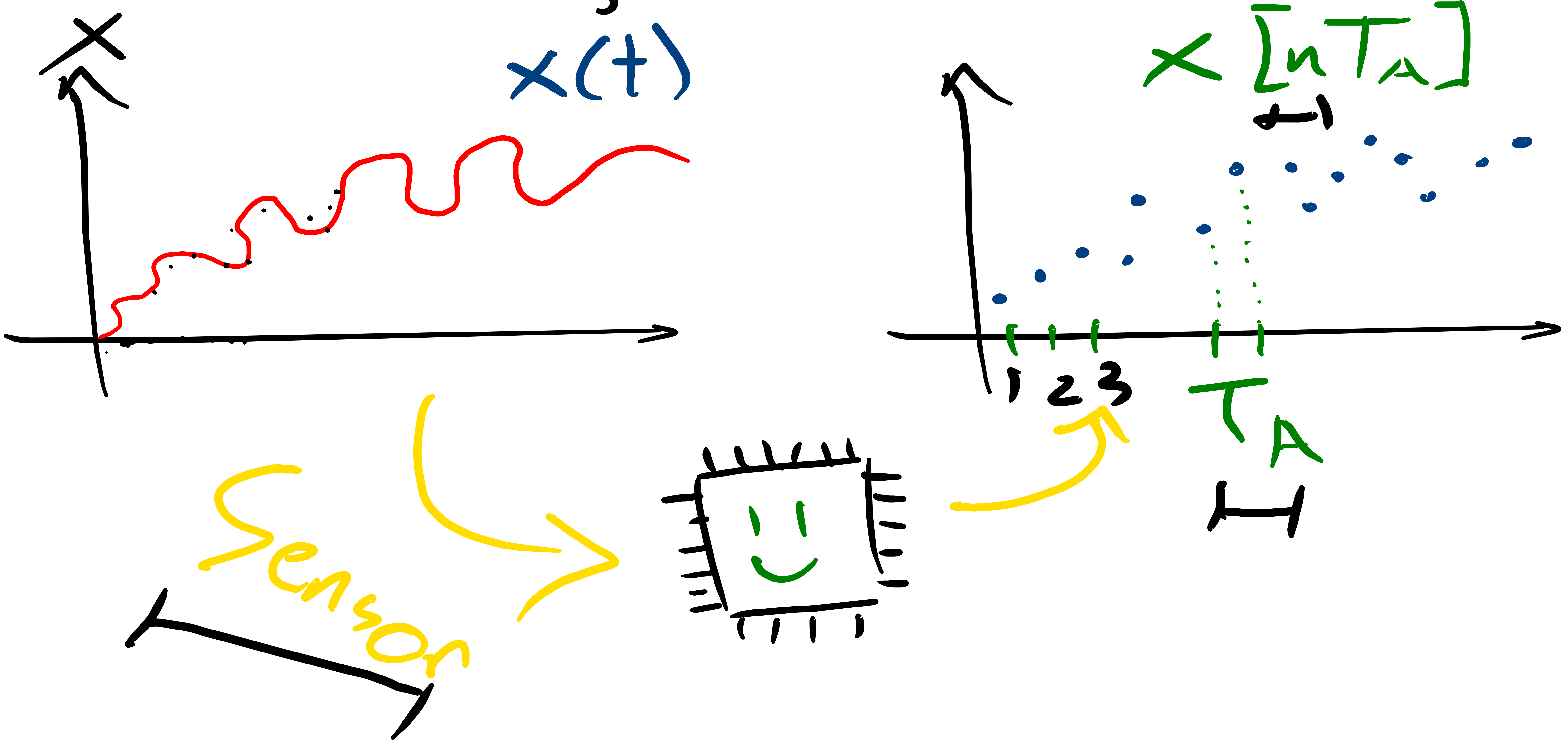
$$2\pi f(-\omega)$$

$$\cancel{2}\pi \frac{1}{\cancel{2}} G_2(-\omega) = \mathcal{F}\{F(t)\}$$

$$\mathcal{F}\{S_2(t)\} = \pi G_2(\omega)$$



Discretização de um Sinal



Convolução Discreta

$$f_1(t) * f_2(t) = \int_{-\infty}^{\infty} f_1(\beta) f_2(t-\beta)\, d\beta$$

$$f_1[nT_A] * f_2[nT_A] = \sum_{m=-\infty}^{\infty} f_1[mT_A] f_2[nT_A - mT_A]$$

Transformada Z

$$\mathcal{L}\{f[nT_A]\} = \int_{-\infty}^{\infty} f[nT_A]\, e^{-snT_A}\, dt$$

$$z = e^{+sT_A}$$

$$\mathcal{Z}\{f[n]\} = \sum_{n=-\infty}^{\infty} f[n]\, z^{-n}$$

Transformada do Expoente

$$\mathcal{Z}\left\{ a^{-(n-b)} u[n-b] \right\} = \frac{z^{-b}}{1-(az)^{-1}}$$

$$\sum_{b}^{\infty} a^{-n+b} z^{-n} = \sum_{b}^{\infty} a^{b} (az)^{-n}$$

$$\sum_{b}^{\infty} 2^{b} (2z)^{-n} \qquad r = (2z)^{-1}$$

$$\underbrace{\sum_{0}^{\infty} 2^{b} r^{-n}} - \sum_{0}^{b} 2^{b} r^{-n}$$

$$2^{b}\left[\frac{1 - r^{\infty}}{1 - r} - \frac{1 - r^{b}}{1 - r}\right]$$

$$2^5\left[\frac{1-r^{+\infty}}{1-r}-\frac{1-r^5}{1-r}\right]$$

$$=$$

$$2^5\left[\frac{(2z)^{-5}}{1-(2z)^{-1}}\right]=\frac{z^{-5}}{1-(2z)^{-1}}$$

$$\sum_{b}^{\infty} a^{b} (az)^{-n} \qquad r = (az)^{-1} = \frac{1}{az}$$

$$= a^{b} \left[\frac{1 - \overset{\to 0}{r^{\infty}}}{1 - r} - \frac{1 - r^{b}}{1 - r} \right]$$

$$\left| \frac{1}{az} \right| < 1 \qquad |az| > 1$$

$$a^{b} \left[\frac{(az)^{-b}}{1 - (az)^{-1}} \right]$$

Exercício

1. $\mathcal{F}^{-1}\left\{\omega\, u(\omega)\right\}$

2. $\mathcal{Z}\left\{G_2[n]\right\}$

Material e informações de contato:

www.lucas.zischler.nom.br

Obrigado pela atenção