

Exame Normal 2020 (em matéria 2ª frequência) - 6, 7 e 8

período

$$⑥ \quad X_{\text{DFT}}(\omega) = \sum_{q=-\infty}^{\infty} \begin{cases} 0, & \omega < (20\pi q - 6\pi) \text{ rad/s} \vee \omega > (20\pi q + 6\pi) \\ \frac{(\omega - 20\pi q - 10\pi)(\omega - 20\pi q + 10\pi)}{2\pi^2}, & (20\pi q - 6\pi) \leq \omega \leq (20\pi q + 6\pi) \end{cases}$$

a) $\omega = 2\pi f_a \Leftrightarrow 20\pi = 2\pi f_a \Leftrightarrow f_a = 10 \text{ Hz}$

b) $\omega_0 = \frac{\pi}{5} \text{ rad}$

c) filtro que passe entre $20\pi q \pm 6\pi$, tem que ser um filtro passa-banda.

⑦ $f_a = 2000 \text{ Hz}$ $f_i = 330 \text{ Hz}$ $f_a = 440 \text{ Hz}$

a) $\text{erro} = |\text{valor} - (k \Delta f)|$ $\Delta f = \frac{1}{\Delta t}$ $\Delta f = 152$

$0 = |\text{valor} - (\frac{k}{\Delta t})| \Leftrightarrow$ $k = \frac{x}{\Delta f}$ $k = \frac{x}{\frac{1}{\Delta t}} \Leftrightarrow \Delta t \cdot k = k$
 $\Leftrightarrow 0 = |\text{valor} - (\frac{152}{\Delta t})|$

Resposta: $\frac{1}{22} \text{ s}$

b) $\Delta t = 0,25 \text{ s}$ $\Delta f = \frac{1}{0,25} = 4 \text{ Hz}$ $\omega_0 = \frac{2\pi}{N} = \frac{2\pi}{500} = \frac{\pi}{250}$

$N = f_a \Delta t = 2000 \times 0,25 = 500$

c) 6ª janela

$C_3 = 2 \left| \frac{x_{\text{DFT}}[3]}{N} \right| = 2 \left| \frac{-500}{500} \right| = 2, \theta_3 = \pi$

tamanho janela

$x_{\text{DFT}}[-3] = -250j$

$x_{\text{DFT}}[-3] = -500$

$x_{\text{DFT}}[3] = -500$

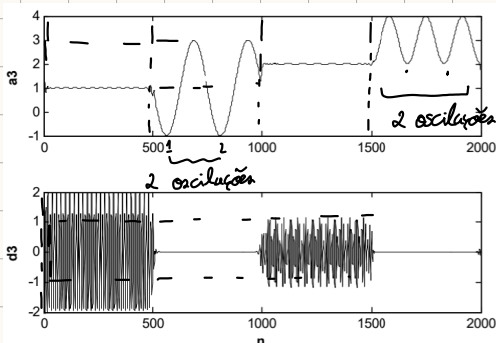
$x_{\text{DFT}}[5] = 250j$

$C_5 = 2 \left| \frac{250j}{500} \right| = 2 \times \frac{1}{2} = 1, \theta_5 = \frac{\pi}{2}$

$SN \leq n < 6N$
 $2500 \leq n < 3000$

$$x_6[n] = \left(2 \cos\left(2\pi \frac{n}{250} + \pi\right) + \cos\left(\frac{\pi}{250}n - \frac{\pi}{2}\right) \right) (u[n-2500] - u[n-3000])$$

8) a)



$$f_2 = 2000 \text{ Hz} \rightarrow \frac{1}{4}$$

decomposição nível 3 - 62,5 - 125 d3

n	0 - 499	500 - 999	1000 - 1499	1500 - 1999
A partir de d3:	$f \in [62,5, 125] \text{ Hz},$ $C = 2$		$f \in [62,5, 125] \text{ Hz},$ $C = 1$	
A partir de a3:	$f = 4 \text{ Hz}, C = 1$ \downarrow 1×4	$f = 0 \text{ Hz}, C = 1$ \downarrow $f = 8 \text{ Hz}, C = 2$ \downarrow 2×4	$f = 4 \text{ Hz}, C = 2$ \downarrow 2×4	$f = 0 \text{ Hz}, C = 3$ \downarrow $f = 8 \text{ Hz}, C = 1$ \downarrow 2×4

$$\frac{2000}{2500} = 1 \quad 1 \times \frac{1}{4} = \frac{1}{4}$$

b) 2 menores não nulas $\rightarrow d_6$, seria o menor nível de detalhe.