Época Normal 2020

⑥ $$X_{DTFT}(\omega) = \sum_{q=-\infty}^{+\infty} \begin{cases} 0, & \omega < (20\pi q - 6\pi) \vee \omega > (20\pi q + 6\pi) \\ \dfrac{(\omega - 20\pi q - 10\pi)(\omega - 20\pi q + 10\pi)}{2\pi^2}, & \text{otherwise} \end{cases}$$

a)
$$T_s\, X_{DTFT}(\omega) = \sum_{k=-\infty}^{+\infty} X_{FT}\left(\omega - k\frac{2\pi}{T_s}\right)$$

$$\Rightarrow -\frac{k\,2\pi}{T_s} = -20\pi k$$

$$\Rightarrow T_s = \frac{1}{10} \qquad f_s = 10\,Hz$$

b) $$C_0 = \frac{X_{FT}(0)}{T_0}$$

$$\Rightarrow C_0 = \frac{(-10\pi)(10\pi)}{2\pi^2}/T_0$$

$$= -50/T_0 =$$

$$\Omega_0 = \frac{2\pi}{N} \Leftrightarrow N = \frac{2\pi}{\frac{\pi}{5}} \Leftrightarrow N = 10$$

$$10 = \frac{T_0}{T_1} \Leftrightarrow \frac{10}{10} = T_0 \Rightarrow T_0 = 1\,s$$

c) Passa-Banda

⑦ $f_1 = 2000\ Hz$ Mi (330 Hz) Lá (440 Hz)

a) $f_k = k \cdot \Delta f$ $\quad \Delta f = \frac{f_1}{N}$

$\Rightarrow f_k = \frac{k}{t_{janela}}$ $\quad \Rightarrow \Delta f = \frac{2000}{2000 \cdot t_{janela}} = \frac{1}{t_{janela}}$

$330 = \frac{k}{t_{janela}} \Rightarrow$ $330 = 31k$ ✓ $\quad 440 = 31k$ ✗

$330 = 151k$ ✓ $\quad 440 = 151k$ ✗

$330 = 20k$ ✗ $\quad 440 = 20k$ ✓

$330 = 22{,}1k$ ✓ $\quad 440 = 22{,}1k$ ✓

R: $\frac{1}{22}$ s

b) $\Delta t = 0{,}25\ s$

$N = t_{janela} \times f_1 = 0{,}25 \times 2000 = 500$

$\Omega_0 = \frac{2\pi}{500} = \frac{\pi}{250}$ rad $\quad k = 3{,}5$

c) $X_{DFT}[k] = -250j\,\delta[k+5] - 500\,\delta[k+3] - 500\,\delta[k-3] + 250j\,\delta[k-5]$

$x[n] = \sum_{m=0}^{M} C_m \cos(m\Omega_0 n + \theta_m) = C_3 \cos(3\Omega_0 n + \theta_3) +$

$C_5 \cos(5\Omega_0 n + \theta_5)$

$c_3 = \frac{X[3]}{500} = -\frac{500}{500} \rightarrow C_3 = 2|c_3| = -2$, $\theta_3 = \pi$

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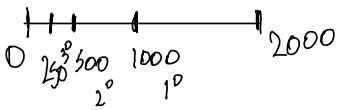
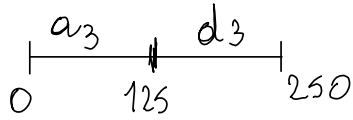
$c_5 = \frac{250j}{500} = \frac{j}{2} \rightarrow C_5 = 1$, $\theta_5 = \pi/2$

⑧- $f_1 = 2000\,Hz$





d_3	$f \in [125, 250]$ $C = 2$		$f \in [125, 250]$ $C = 1$	
a_3	$f = 0Hz, C = 1$	$f = 0Hz, C = 1$ $f = 8Hz, C = 2$	$f = 0\ C = 2$	$f = 0Hz, C = 3$ $f = 4Hz$ $C = 1$

b)

$a_4 \to [0; 62,5]$ $a_6 \to [0; 15,625]$ R: a_6

$a_5 \to [0; 31,25]$ $a_7 \to [0;$