ECE 310 Online
Summer 2019

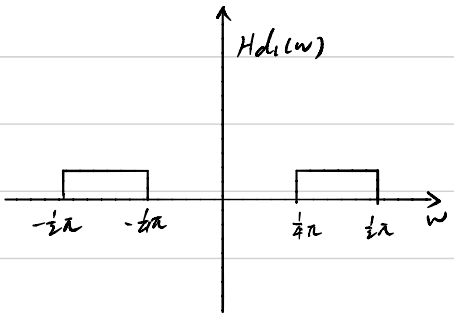
HW8

Zhicong Fan
zhicongz

(1) (a) $f_s = 12 \times 2 = 24\text{kHz}$

(b) 300 Hz $\Rightarrow$ 600π rad/s $\Rightarrow \frac{600\pi}{24000} = \frac{1}{40}\pi$

6000 Hz $\Rightarrow$ 12000π rad/s $\Rightarrow \frac{12000\pi}{24000} = \frac{1}{2}\pi$

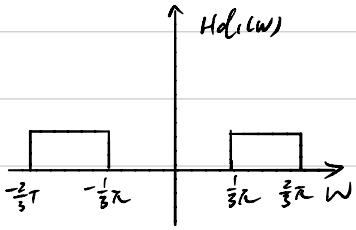


(c) $2\pi - 24000\pi T = 12000\pi T$

so $T = \frac{1}{18000}\text{s}$

(d) $w_1 = \frac{6000\pi}{18000} = \frac{1}{3}\pi$

$w_2 = \frac{12000\pi}{18000} = \frac{2}{3}\pi$



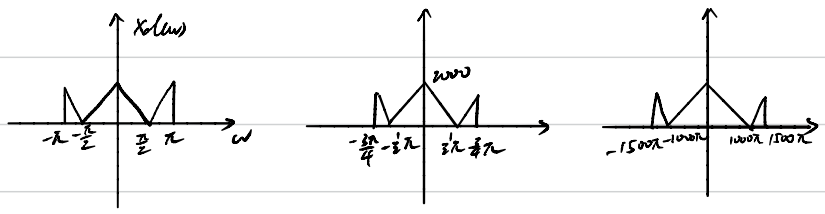
(2) (a) $f_s = 2 \times 5 = 10\text{kHz} = \frac{1}{10000}\text{s}$

(b) $w_c = \frac{\pi}{8} \times 10000 = 1250\pi$ $f = \frac{1250\pi}{2\pi} = 625$ rad/s

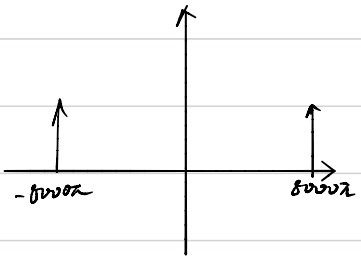
(c) $w_c = \frac{\pi}{8} \times 20000 = 2500\pi$ $f = \frac{2500\pi}{2\pi} = 1250$ rad/s

(3)

(a)



(b)



4. (a) $\frac{z^2+3z+2}{2z^2+3z-1}$ rational function $\Rightarrow$ IIR

(b) $\frac{z+1}{z^2-\frac{z}{6}-\frac{1}{6}}$ rational function $\Rightarrow$ IIR

(c) $2+z^{-1}-\frac{1}{3}z^{-2}$ polynomial $\Rightarrow$ FIR

5. (a) $\{h_n\}_{n=0}^{2} = \{2,1,2\}$ even symmetry. Type I GLP & FIR, $\alpha=0$, $M=1$, $R(\omega)=4\cos(\omega)$

(b) $\{h_n\}_{n=0}^{2} = \{1,2,3\}$ not symmetry $\Rightarrow$ not GLP

(c) $\{h_n\}_{n=0}^{2} = \{-1,3,1\}$ not symmetry $\Rightarrow$ not GLP

(d) $\{h_n\}_{n=0}^{4} = \{1,1,1,-1,-1\}$ odd symmetry. Type II GLP, Type III FIR $\alpha=\frac{\pi}{2}$, $M=2$, $R(\omega)=2(\sin(2\omega)+\sin\omega)$

(e) $\{h_n\}_{n=0}^{2} = \{1,0,-1\}$ odd symmetry. $\alpha=\frac{\pi}{2}$, $M=1$, $R(\omega)=2\sin(\omega)$

(f) $\{h_n\}_{n=0}^{3} = \{2,1,1,2\}$ even symmetry $\begin{cases}\text{Type I GLP} & \alpha=0,\ M=\frac{3}{2},\ R(\omega)=4\cos(\frac{1}{2}\omega)+2\cos(\frac{3}{2}\omega)\\ \text{Type II FIR}\end{cases}$