Week 3: Problem 3

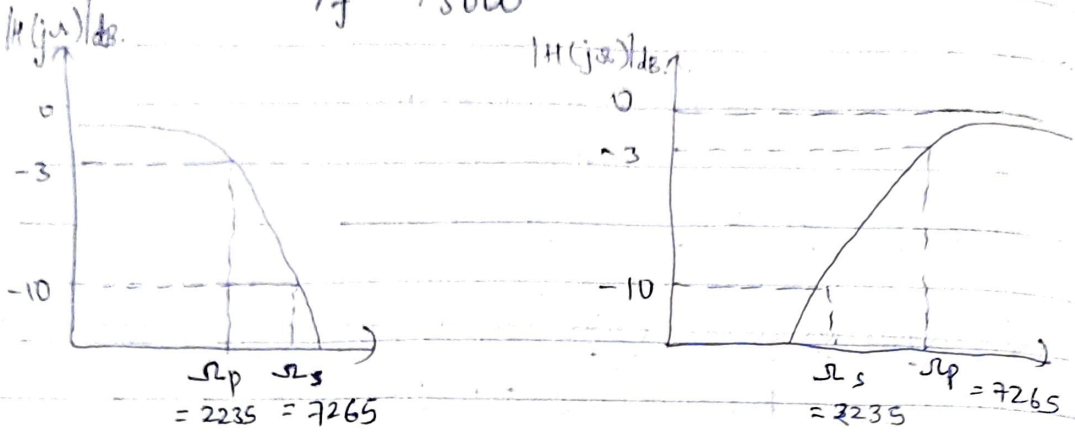
Name: Mikias. T.
Unique ID: 2005713

$\alpha_p = 3dB.$

$w_c = w_p = 2 \times \pi \times 1000 = 2000\pi$ rad/sec

$\alpha_p = 10dB$; $w_b = 2\pi \times 350 = 700\pi$ rad/se

$T = 1/f = 1/5000 = 2 \times 10^{-4}$ sec.



$$\Omega_p = \frac{2}{T} \tan \frac{w_p T}{2} = \frac{2}{2 \times 10^{-4}} \tan \frac{(2000\pi \times 2 \times 10^{-4})}{2}$$

$$= 10^4 \tan(0.2\pi) = 7265 \text{ rad/sec}$$

$$\Omega_s = \frac{2}{T} \tan \frac{w_s T}{2} = \frac{2}{2 \times 10^{-4}} \tan \frac{(700\pi \times 2 \times 10^{-4})}{2}$$

$$10^4 \tan(0.07\pi) = 2235 \text{ rad/sec}$$

Transfer function of highpass filter.

$$H(s) = \frac{1}{s+1}\Big|_{s = 7265/s}$$

$$= \frac{s}{s+7265}$$

bilinear transformation

$$H(z) = H(s)\Big|_{s = 2/T\left(\frac{1-z^{-1}}{1+z^{-1}}\right)}$$

Name: Nikita M.
Unique ID: 2005119

$$= \frac{S}{S+7265} \Big|_{S=\frac{2}{2\times10^{-4}}\left(\frac{1-z^{-1}}{1+z^{-1}}\right)}$$

$$= \frac{1000\left(\frac{1-z^{-1}}{1+z^{-1}}\right)}{1000\left(\frac{1-z^{-1}}{1+z^{-1}}\right)+7265}$$

$$H(z) = \frac{0.5792(1-z^{-1})}{1-0.1584z^{-1}}.$$

$$H(z) = y(z)/x(z).$$

$$\frac{y(z)}{x(z)} = \frac{0.5792(1-z^{-1})}{1-0.1584z^{-1}}$$

$$y(z) - 0.1584z^{-1} = 0.5792x(z) - 0.5792x(z)z^{-1}$$
$$y(z).$$

$$y(z) = 0.5792x(z) - 0.5792x(z)z^{-1} + 0.1584z^{-1}y(z)$$