Problem Set #5 Solutions

2.171

Problem 2

From the plot, we can see

There is a zero @ 10^{-3}

There is a pole @ 10^{-2}

There is a double pole @ 10^{-1}

zero:

$$\frac{z-\alpha}{1-\alpha} = \frac{z-.999}{1-.999} = 1000(z-.999)$$

pole(s):

$$\frac{1-\alpha}{z-\alpha} = \frac{1-.99}{z-.99} = \frac{1}{100}\ \frac{1}{z-.99}$$

$$\frac{1-2r\cos\Omega+r^2}{z^2-z(2r\cos\Omega)+r^2}$$

$\Omega = 10^{-1}$, $\frac{1}{2(1-r)} = \sqrt{10}$, $r = 0.9841$

$$\frac{1-2r\cos\Omega+r^2}{z^2-z(2r\cos\Omega)+r^2} = \frac{1}{100}\ \frac{1}{z^2-z(2r\cos\Omega)+r^2}$$

Gain of 10 at DC

$$G(z) = 1000(z-.999)\frac{1}{100}\left(\frac{1}{z-.99}\right)\frac{1}{100}\left(\frac{10}{z^2-z(2r\cos\Omega)+r^2}\right)$$

$$G(z) = \frac{z-.999}{z-.99}\ \frac{1}{z^2-z(2r\cos\Omega)+r^2}\Big), \quad \Omega = 10^{-1},\ r = .9841$$

Problem 3

1. VI C
2. III F
3. I A
4. V E
5. II B
6. IV D