정보통신 수학 및 실습
Lab assignment

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Chapter 9 Lab Assignment

1. **Plot the absolute values of the transfer functions H(s) as the input frequency changes from 10 to 100000 and its interval of 50. Also indicate what kind of filters they are and their cutoff frequencies. Use log10 scale for angular frequency.**

a) $H(s) = \dfrac{1}{1 + \dfrac{s}{4000}}$

b) $H(s) = \dfrac{1}{1 + \dfrac{2000}{s}}$

c) $H(s) = \dfrac{1}{1 + \dfrac{s}{3000} + \dfrac{1000}{s}}$

```
f = [10:50:100000];
w = 2*pi*f;
h1 =abs(1 ./ (1+(j*w)/4000));
h2 = abs(1 ./ (1 + 2000./(j*w)));
h3 = abs(1 ./ ( j.*w./3000 + 1000./(j.*w) .+ 1));
semilogx(w, h1, w, h2, w, h3)
```
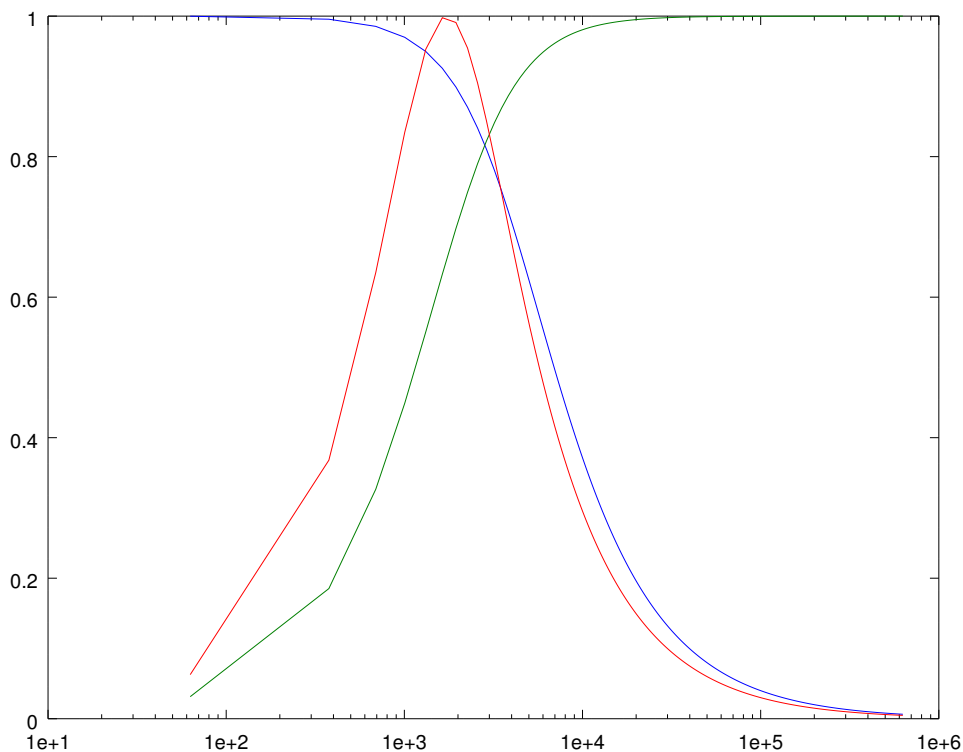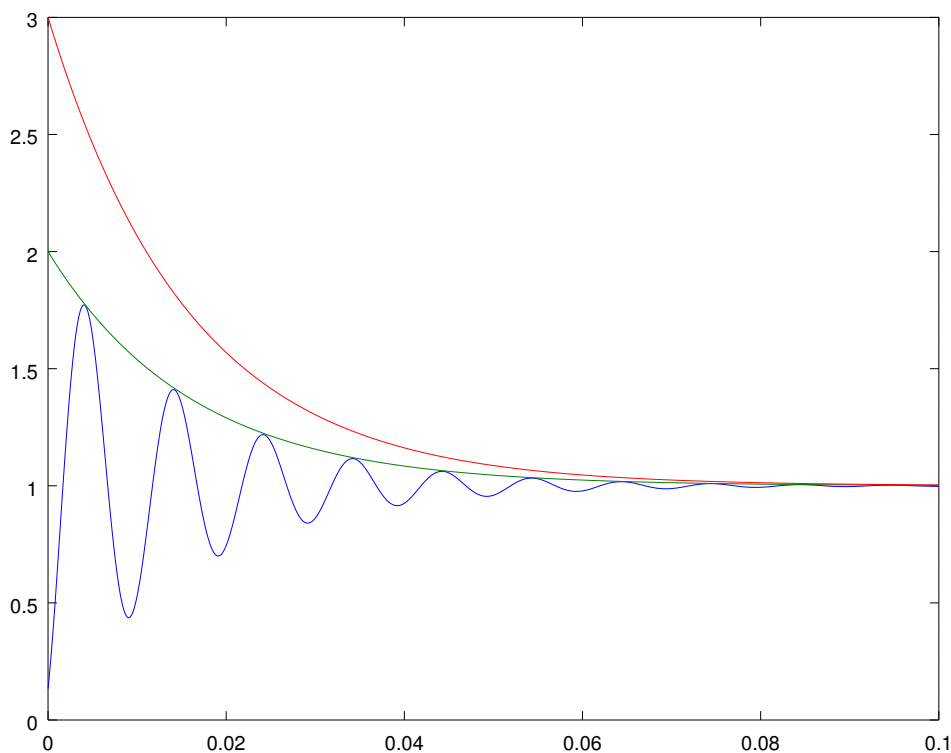
2. Plot x(t), t = [0:0.0001:0.1]

a) $x(t) = 1 + e^{-\xi\omega_0 t}\sin\left(\sqrt{1-\xi^2}\omega_0 t - \dfrac{\pi}{3}\right) \quad if \quad \xi = 0.1, \omega_0 = 2\pi 100$

b) $x(t) = 1 + e^{-\omega_0 t} + te^{-\omega_0 t} \quad when \quad \omega_0 = 2\pi 10$

c) $x(t) = 1 + 2e^{-\omega_0 t} \quad when \quad \omega_0 = 2\pi 10$

```
t  =  [0:0.0001:0.1];
xt = 1 + exp(−0.1 ∗ 2∗ pi ∗ 100 ∗ t) .∗ sin(sqrt(1−0.01) ∗ 2∗ pi ∗ 100 ∗ t − pi/3);
xt2 = 1 .+ (t +1 ) .∗ exp(t ∗ −2 ∗ pi ∗ 10);
xt3 = 1 .+ 2 .∗ exp(t ∗ −2 ∗ pi ∗ 10);
plot(t, xt, t, xt2, t, xt3)
```


3. The system has the following system differential equation:

$$y'' + 5y' + 4y = x, y(0) = 1, y'(0) = 0$$

Find H(s) and draw $\mid H(jw) \mid$ as a function of w

$s^2 Y(s) + 5sY(s) + 4Y(s) = X(s)$

$H(s) = \dfrac{1}{s^2 + 5s + 4}$

$H(jw) = \dfrac{1}{-w^2 + 5jw + 4}$

$|H(jw)| = \dfrac{1}{\sqrt{(4 - w^2)^2 - 25w^2}}$

```
f  =  [10:50:100000];
```

```
w = 2*pi*f;
h = abs(1 ./ sqrt((4 − w.^2).^2 .− (25 * w.^2)));
semilogx(w, h)
```