Assignment 3

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Q1. (a)

Initialize transfer function

```
warning('off','all')
s = tf('s');
G = exp(-0.005*s)*(-s+3)/((s+2)*(s+1000));
```

Set random intial values for wc, Gm, and Pm. Set 'a' and 'b' a bit wide apart from the wc

```
wc = 10;
a = 0.0003;
b = 3000;
Gm = 1;
Pm = 20;
```

Create a loop to update the value of wc so that we get the maximum value of wc where the required system parameters are satisfied. The value of K has been calculated by hand to eliminate the time delay error in MATLAB.

```
while(Pm<40 || Gm < 10^(6/20))
    L = ((-s+3)/(s+3))*exp(-0.005*s)*(s+a*wc)/((s^2)*(s+b*wc));
    K = (s+a*wc)*(s+2)*(s+1000)/((s+b*wc)*(s+3)*s^2);
    [mag2,phase] = bode(G*K,wc);
    K = K/mag2;
    [Gm,Pm,Wcg,Wcp] = margin(G*K);
    if (Pm > 40 && Gm > 10^(6/20))
        [Gm,Pm,Wcg,Wcp] = margin(G*K)
        margin(G*K)
        wc
        break
    end
    wc = wc - 0.05;
end
```

```
Gm = 2.1877
Pm = 41.1215
Wcg = 2.9535
Wcp = 1.3500
```

Bode Diagram
Gm = 6.8 dB (at 2.95 rad/s) , Pm = 41.1 deg (at 1.35 rad/s)
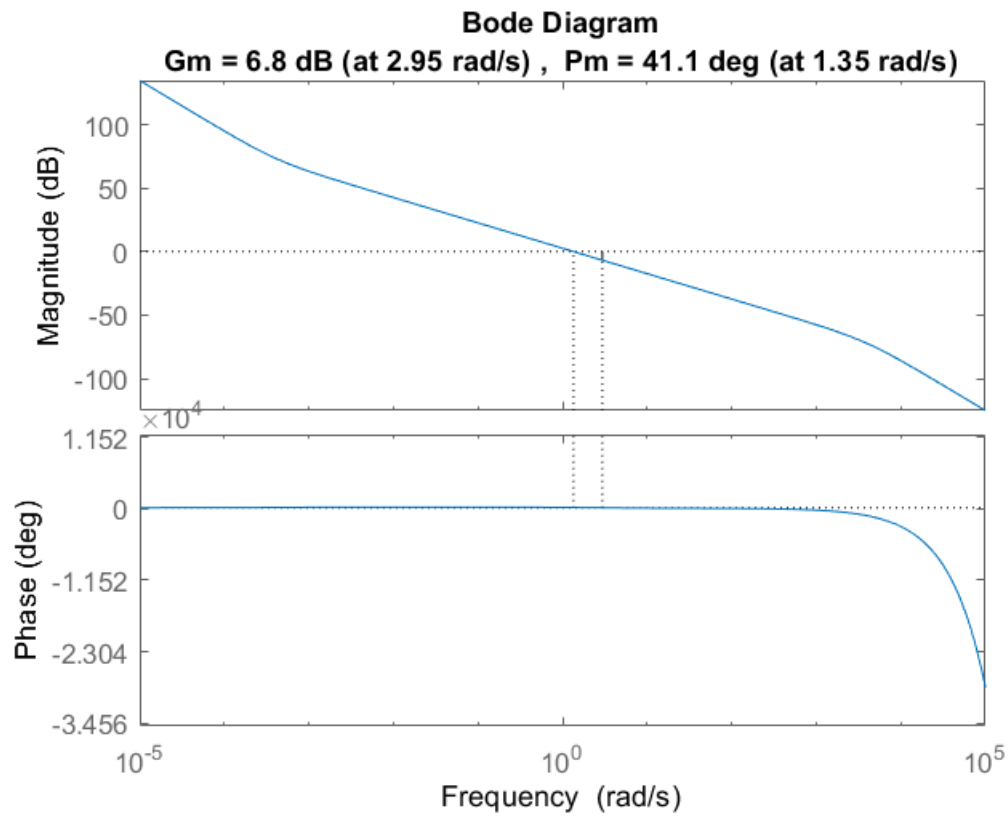

```
wc = 1.3500
```

magnitude bode plot of the sensitivity function.

```
bodemag(1/(1+G*K))
```

Bode Diagram