program_control_lib

March 25, 2023

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import scipy
from scipy import signal
from control import tf
import control
```

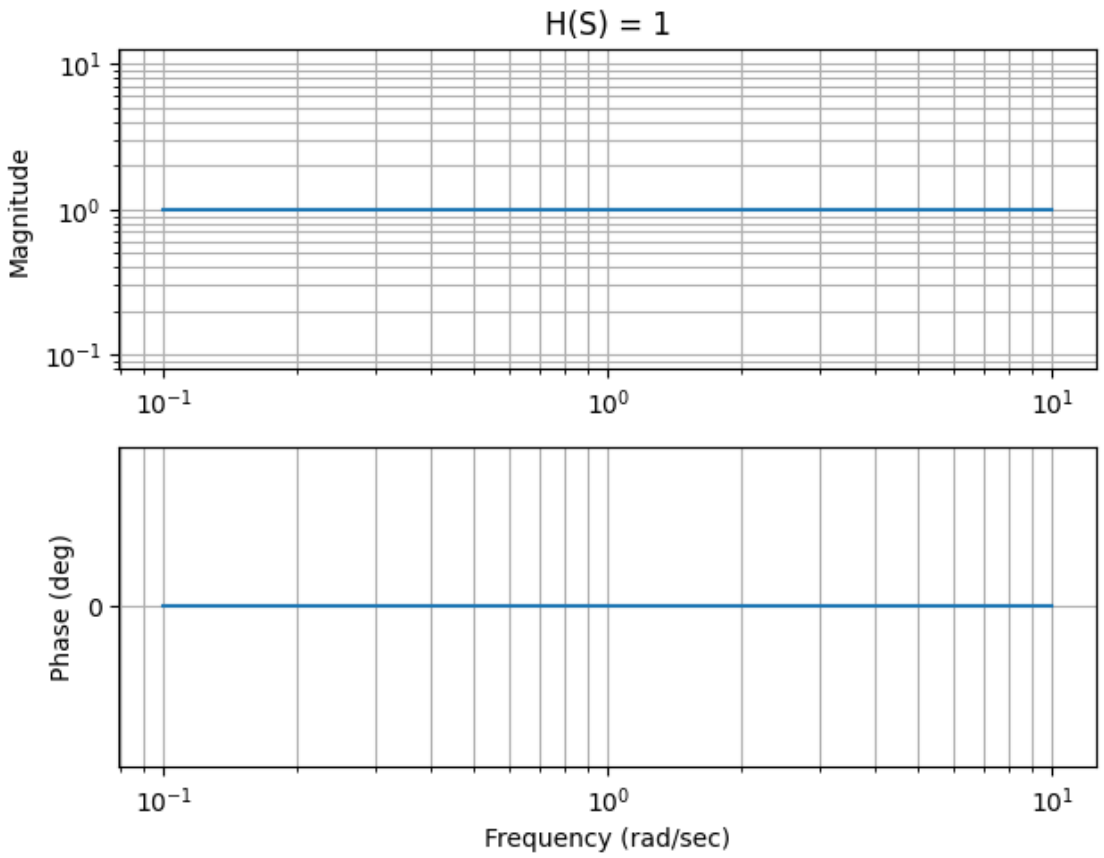
Question 2:A

[ ]:
```
# H(S) = 1
G = tf([1],[1])
print(G)
mag,phase,omega = control.bode(G)

plt.tight_layout()
ax1,ax2 = plt.gcf().axes     # get subplot axes
plt.sca(ax1)                 # magnitude plot
plt.title("H(S) = 1")
```

```
1
-
1
```

[ ]:
```
Text(0.5, 1.0, 'H(S) = 1')
```



Question 2:B

H(S) = S/(S + 1000 + S^2 * 10^-6), R out = 1000 Ohm, C1 = 10^-6 F, L1 = 1 mH,

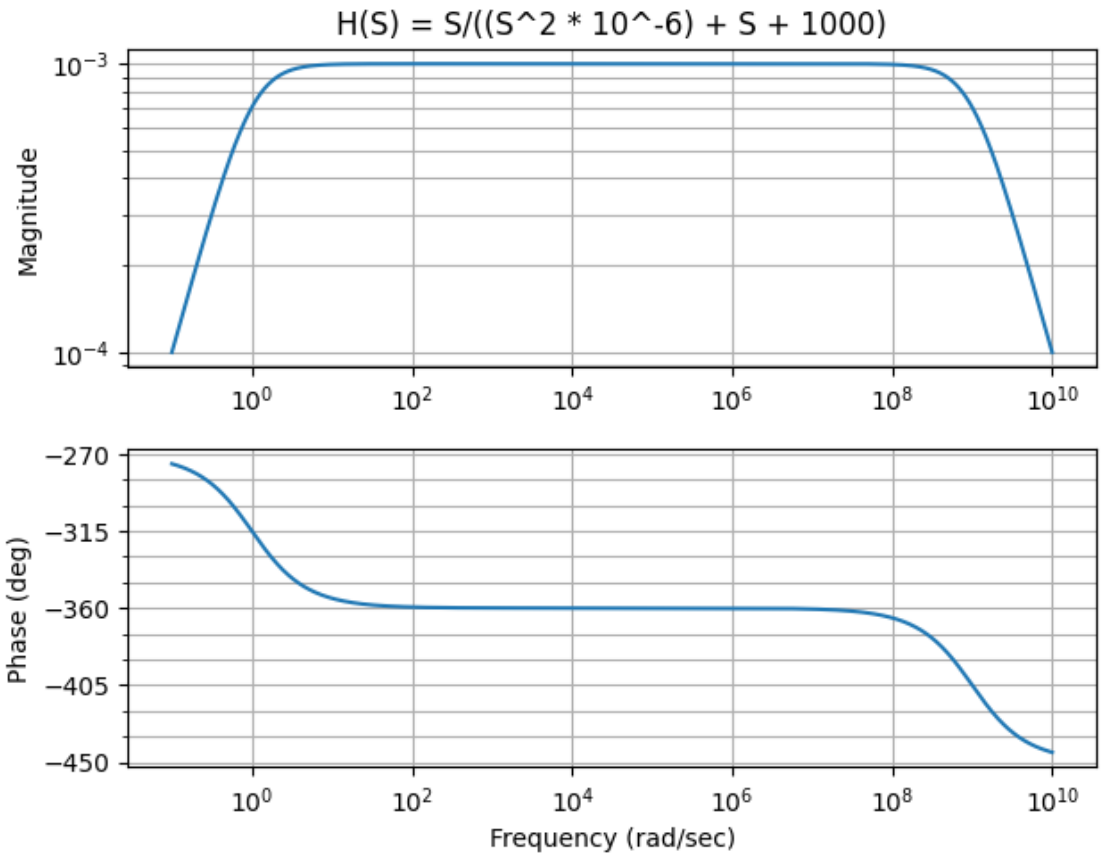
[ ]:
```
# num = [1, 0]
# den = [1*10**-9 ,1*10**-3 ,1]

G1 = tf([1, 0],[1*10**-9 ,1*10**-3 ,1])
print(G1)
mag,phase,omega = control.bode(G1)

plt.tight_layout()
ax1,ax2 = plt.gcf().axes     # get subplot axes
plt.sca(ax1)                 # magnitude plot
plt.title("H(S) = S/(S + 1000 + S^2 * 10^-6)")
```

```
            s
-------------------------
1e-06 s^2 + 1000 s + 1000
```

[ ]: Text(0.5, 1.0, 'H(S) = S/((S^2 * 10^-6) + S + 1000)')



Question 2:C; Lout = 2k, H(S) = S*Rout

[ ]:
```
# num = [2*10**-3 ,0]
# den = [1]

G2 = tf([2*10**-3 ,0],[1])
print(G2)
mag,phase,omega = control.bode(G2)

plt.tight_layout()
ax1,ax2 = plt.gcf().axes      # get subplot axes
plt.sca(ax1)                  # magnitude plot
plt.title("H(S) = 0.002 S")
```

```
0.002 s
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   1
```
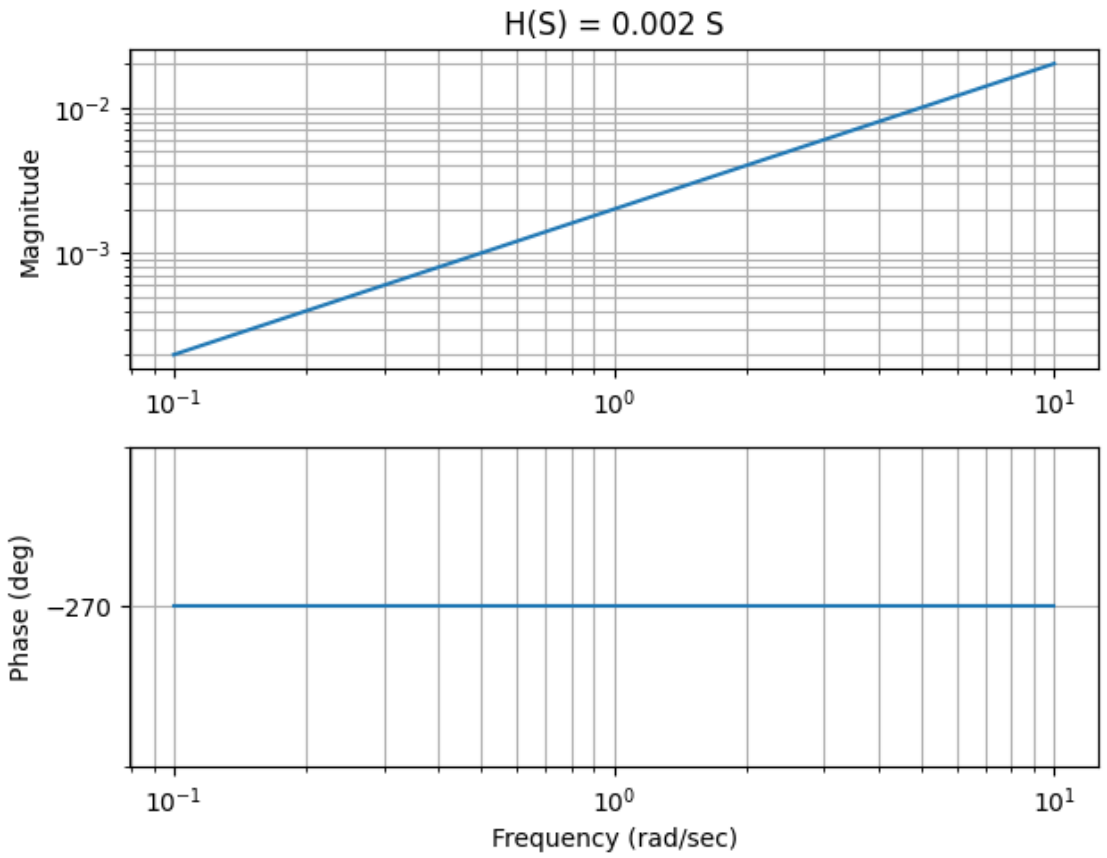

[ ]: Text(0.5, 1.0, 'H(S) = 0.002 S')



Question 2:D, L2 = 2mH, Rout = 1k, C1 = 1 micro F, H(S) = S/ [S^2 * (L2/Rout) + S + 1/(C1*Rout)]

[ ]:
```
# num = [1, 0]
# den = [(2*10**-3)/10**3, 1, 1/(10**-6*10**3)]

G4 = tf([1, 0],[(2*10**-3)/10**3, 1, 1/(10**-6*10**3)])
print(G4)
mag,phase,omega = control.bode(G4)

plt.tight_layout()
ax1,ax2 = plt.gcf().axes     # get subplot axes
plt.sca(ax1)                 # magnitude plot
plt.title("H(S) = S/(S + 1000 + 2*S^2 * 10^-6)")
```

```
          s
--------------------
2e-06 s^2 + s + 1000
```

[ ]: Text(0.5, 1.0, 'H(S) = S/(S + 1000 + 2*S^2 * 10^-6)')