QUIZ 6B

Answer the following questions based on the given loaded loop-gain of an amplifier in feedback. Assume that a positive, purely real feedback factor F is used. Always answer with at least 4 significant digits.

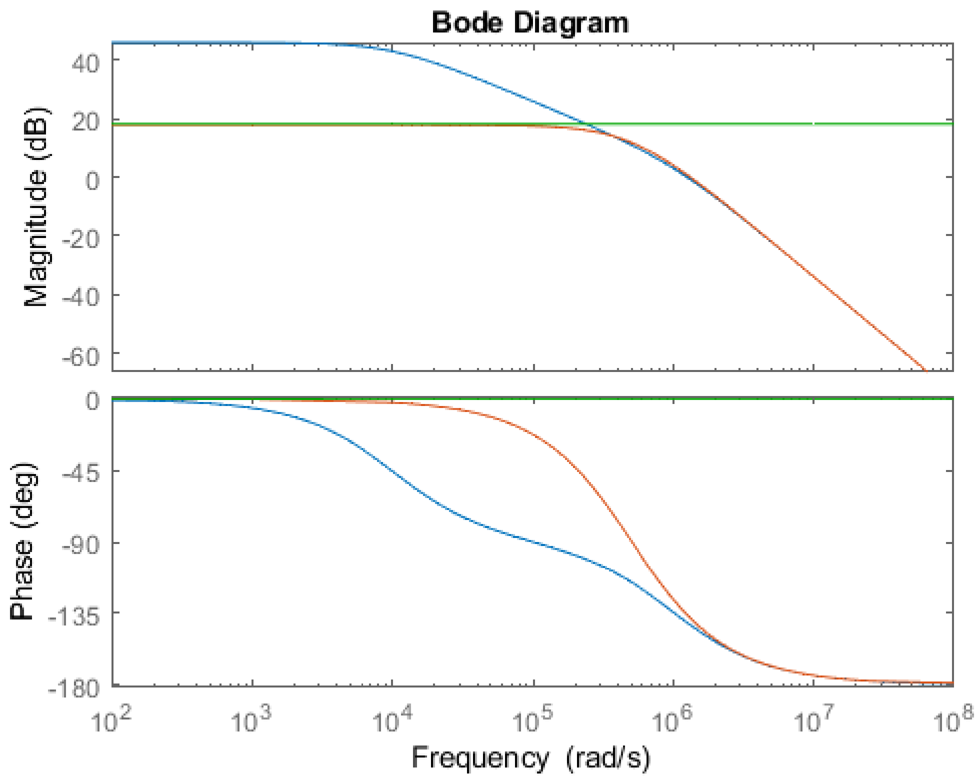
Contents

- Given 1
- Given 2

Given 1

$$A(s) = \frac{200}{(1+\frac{s}{10000})(1+\frac{s}{1000000})}$$

```
figure(1);
hold on;
s = tf('s');

% Parameters
poles = [10^4 10^6];
openLoopGain = 200;


% Feedback Factor
F = (( (poles(1)+poles(2))^2 / (4*poles(1)*poles(2)) )-1) / openLoopGain;
% Loop Gain
T = openLoopGain * F;

% Closed Loop Gain
closedLoopGain = openLoopGain / (1+T);
% Absolute frequency where coincident poles occur
pole_ClosedLoop_Critical = (poles(1)+poles(2)) / 2;

% Bode Plot (Open-Loop)
H_open = openLoopGain / ( (1+s/poles(1)) * (1+s/poles(2)) );
bode(H_open);

% Bode Plot (Closed-Loop)
H_closed = closedLoopGain / ( (1+s/(pole_ClosedLoop_Critical) )^2 );
bode(H_closed);

% Bode Plot (Feedback Factor)
bode(1/F, 1, 'g');


hold off;
```



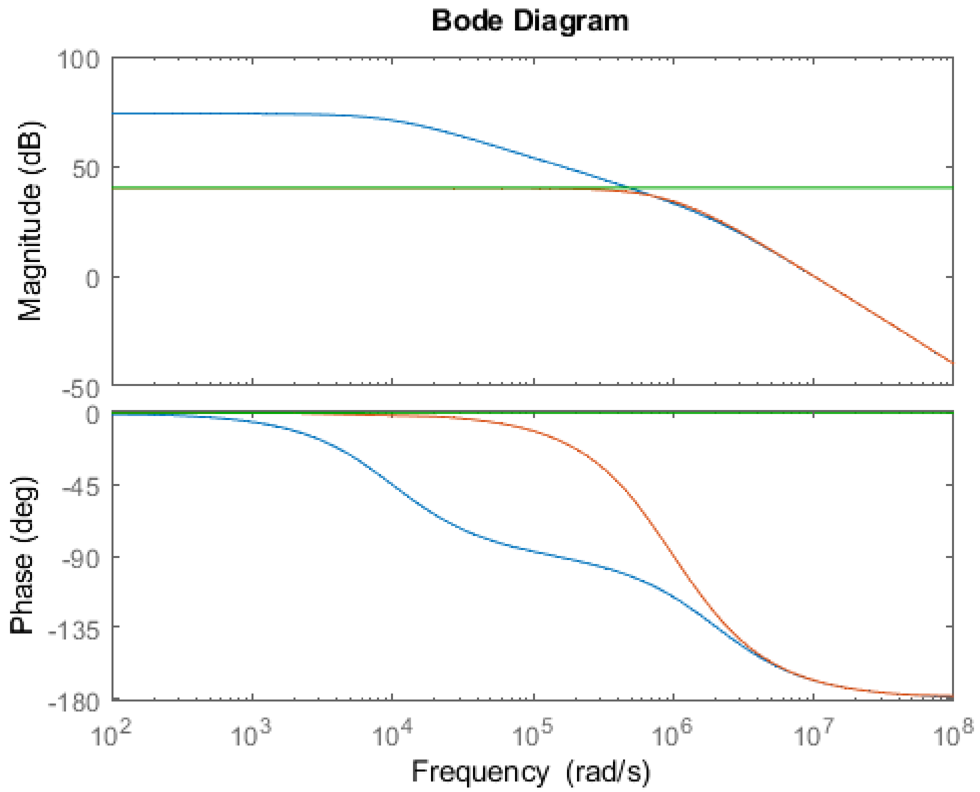
1. What is the open-loop DC gain? $A_0 = 46.0205dB$
2. What is the open-loop bandwidth? $BW_{open-loop} = 10000\frac{rad}{s}$
3. What is T_0 (in linear value) such that the closed-loop poles are coincident? $T_{0,crit} = 24.5025$
4. What is the DC closed-loop gain in dB with $T_0 = T_{0,crit}$? $A_{CL,0} = 17.8889dB$
5. At what absolute frequency will the coincident poles occur? $\omega_{CL,crit} = 50500\frac{rad}{s}$
6. What is the closed-loop bandwidth with the poles being coincident? $BW_{closed-loop,crit} = 324359.2056\frac{rad}{s}$

Given 2

$$A(s) = \frac{5000}{(1+\frac{s}{10000})(1+\frac{s}{2000000})}$$

```
figure(2);
hold on;
s = tf('s');

% Parameters
poles2 = [10^4 2*10^6];
openLoopGain2 = 5000;

% Feedback Factor
F2 = (( (poles2(1)+poles2(2))^2 / (4*poles2(1)*poles2(2)) )-1) / openLoopGain2;
% Loop Gain
T2 = openLoopGain2 * F2;

% Closed Loop Gain
closedLoopGain2 = openLoopGain2 / (1+T2);
% Absolute frequency where coincident poles occur
pole_ClosedLoop_Critical2 = (poles2(1)+poles2(2)) / 2;
```

```
% Bode Plot (Open-Loop)
H_open2 = openLoopGain2 / ( (1+s/poles2(1)) * (1+s/poles2(2)) );
bode(H_open2);

% Bode Plot(Closed-Loop)
H_closed2 = closedLoopGain2 / ( (1+s/(pole_ClosedLoop_Critical2) )^2 );
bode(H_closed2);

% Bode Plot (Feedback Factor)
bode(1/F2, 1, 'g');


hold off;
```



1. What is the open-loop DC gain? $A_0 = 73.9794dB$

2. What is the open-loop bandwidth? $BW_{open-loop} = 10000\frac{rad}{s}$

3. What is T_0 (in linear value) such that the closed-loop poles are coincident? $T_{0,crit} = 49.5012$

4. What is the DC closed-loop gain in dB with $T_0 = T_{0,crit}$? $A_{CL,0} = 39.9133dB$

5. At what absolute frequency will the coincident poles occur? $\omega_{CL,crit} = 1005000\frac{rad}{s}$

6. What is the closed-loop bandwidth with the poles being coincident? $BW_{closed-loop,crit} = 645502.9771\frac{rad}{s}$

Published with MATLAB® R2021a