MATLAB Tutorial 7. Bode Plot

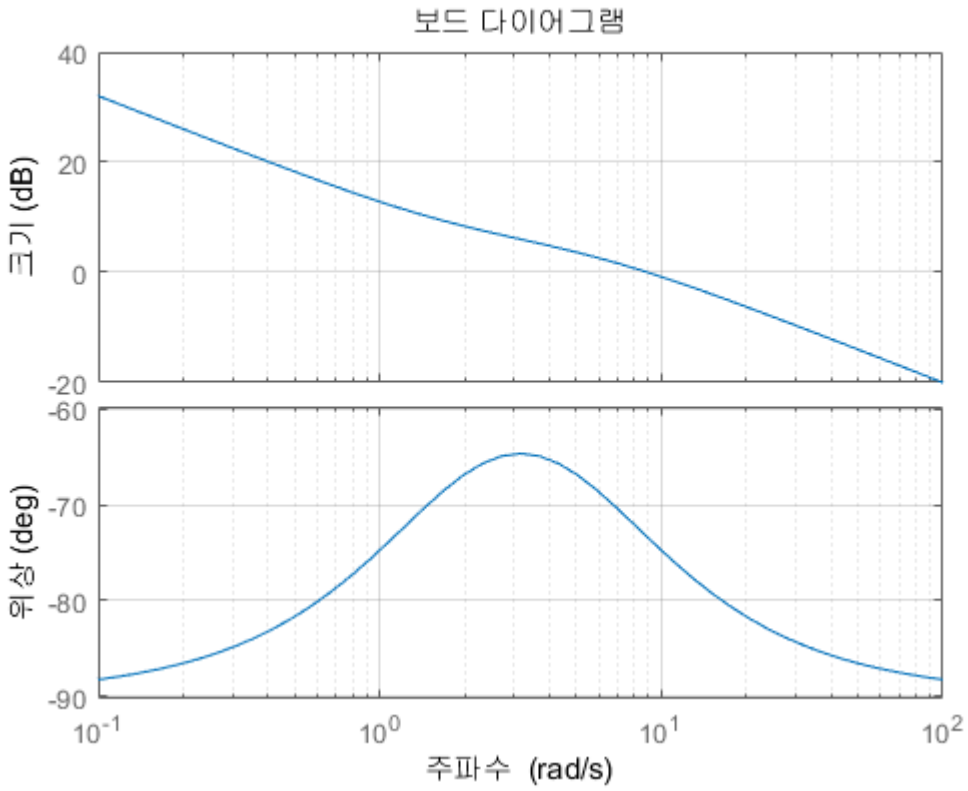
1. Bode Plot 그리기

```
clc; clear; close all
% 전달함수 만들기
s = tf('s');
G1 = tf(10);
G2 = s+2;
G3 = 1/s;
G4 = 1/(s+5);
G = G1*G2*G3*G4
```

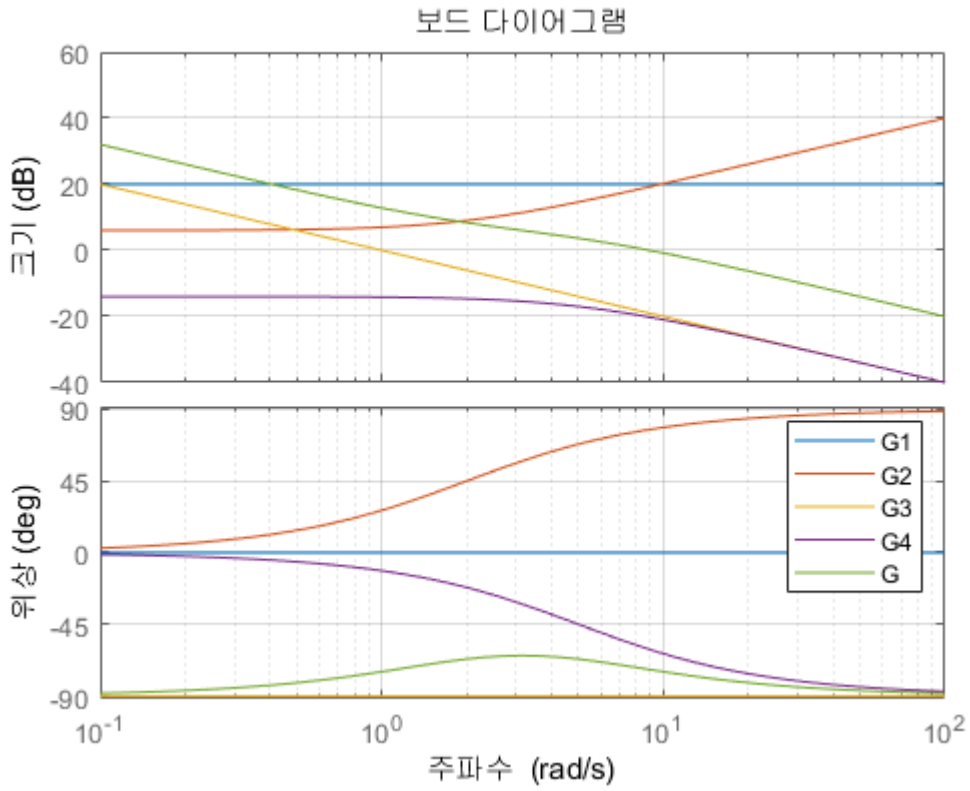
```
G =

  10 s + 20
  ---------
  s^2 + 5 s
```

연속시간 전달 함수입니다.

```
% bode plot 그리기
bode(G)
grid on
```



```
% bode plot 여러개 동시에 그리기
bode(G1, G2, G3, G4, G)
legend('G1', 'G2', 'G3', 'G4', 'G')
grid on
```




```
% bode plot 합산 관계 숫자로 확인하기
% 주파수 만들기
w = [(1:9)*0.1, (1:9)*1, (1:9)*10];

G_list = [G1, G2, G3, G4];
wlen = length(w);
gain_list = zeros(4, wlen);
phase_list = zeros(4, wlen);
for i=1:4
    % 각 기본요소의 bode plot 값 계산
    [mag, phase, wout] = bode(G_list(i), w);
    gain_list(i, :) = 20*log10(mag);
    phase_list(i, :) = phase;
end

gain_list
```

```
gain_list = 4×27
   20.0000   20.0000   20.0000   20.0000   20.0000   20.0000   20.0000   20.0000 ···
    6.0314    6.0638    6.1172    6.1909    6.2839    6.3949    6.5225    6.6652
   20.0000   13.9794   10.4576    7.9588    6.0206    4.4370    3.0980    1.9382
  -13.9811  -13.9863  -13.9950  -14.0071  -14.0226  -14.0415  -14.0637  -14.0892
```

```
phase_list
```

```
phase_list = 4×27
         0         0         0         0         0         0         0         0 ···
    2.8624    5.7106    8.5308   11.3099   14.0362   16.6992   19.2900   21.8014
  -90.0000  -90.0000  -90.0000  -90.0000  -90.0000  -90.0000  -90.0000  -90.0000
   -1.1458   -2.2906   -3.4336   -4.5739   -5.7106   -6.8428   -7.9696   -9.0903
```

```
% G의 bode plot 값과 기본요소들의 결과를 합산한 값과 비교
[mag_G, phase_G, wout] = bode(G, w);
mag_G = reshape(mag_G, [1, length(w)]);
gain_G = 20*log10(mag_G)
```

```
gain_G = 1×27
   32.0503   26.0569   22.5798   20.1426   18.2819   16.7903   15.5568   14.5142 ···
```

```
gain_sum = sum(gain_list, 1)
```

```
gain_sum = 1×27
   32.0503   26.0569   22.5798   20.1426   18.2819   16.7903   15.5568   14.5142 ···
```

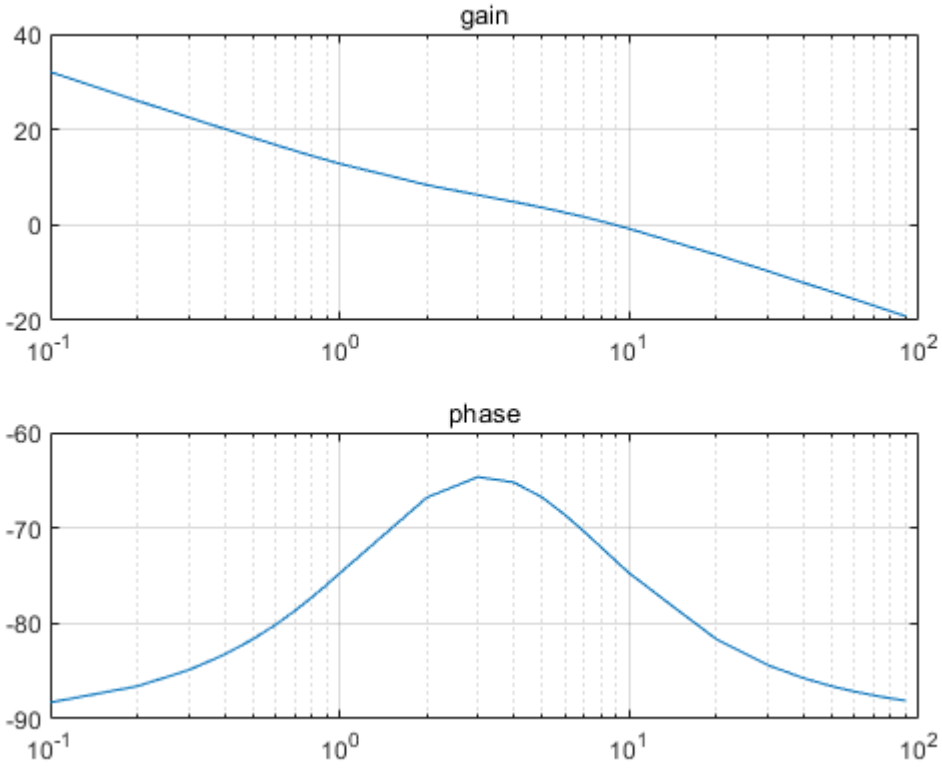
```
phase_G = reshape(phase_G, [1, length(w)])
```

```
phase_G = 1×27
  -88.2834  -86.5800  -84.9029  -83.2640  -81.6743  -80.1435  -78.6796  -77.2889 ···
```

```
phase_sum = sum(phase_list, 1)
```

```
phase_sum = 1×27
  -88.2834  -86.5800  -84.9029  -83.2640  -81.6743  -80.1435  -78.6796  -77.2889 ···
```

```
% 합산 결과를 그래프로 다시 그리기
subplot(2,1,1)
semilogx(w, gain_sum)
title('gain')
grid on
subplot(2,1,2)
semilogx(w, phase_sum)
title('phase')
grid on
```


gain
40
20
0
-20
10^{-1}
10^{0}
10^{1}
10^{2}
phase
-60
-70
-80
-90
10^{-1}
10^{0}
10^{1}
10^{2}