Sprawozdanie – WEAIIB, AiR	
Podstawy Automatyki 2	
Ćwiczenie 8: Zapasy stabilności	
Czwartek, 14:30	Data wykonania: 11.05.2023
Roman Nowak	Data zaliczenia:
	Ocena:

Ćwiczenie ma celu przeanalizowanie wpływu paremetrów regulatora PID na stabilność układu - wartości zapasów modułu i fazy

Analizę przeprowadzamy dla czterech obiektów o podanych niżej transmitancjach.

$$G(s) = \frac{1}{s^3 + 3s^2 + 3s + 1},$$

$$G(s) = \frac{1}{s^3 + 2s^2 + 2s + 1},$$

$$G(s) = \frac{2}{s^3 + 3s^2 + 2s + 1},$$

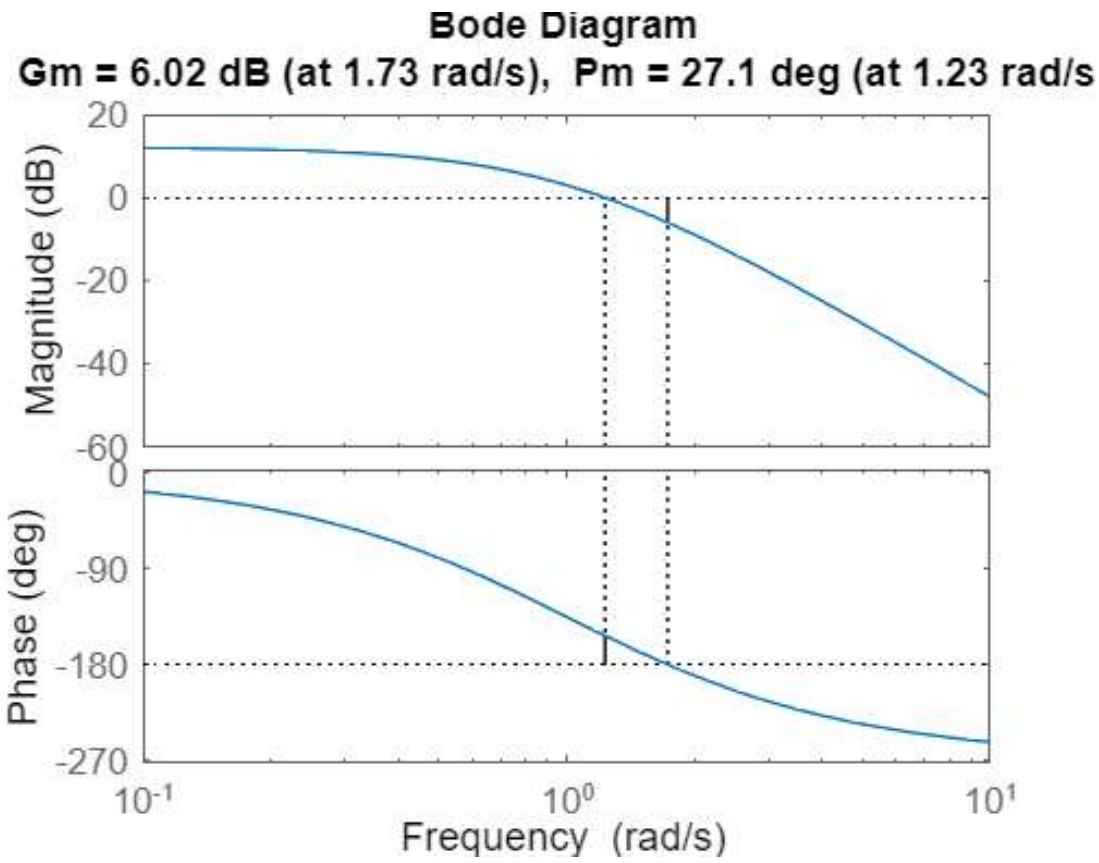
$$G(s) = \frac{1}{2s^3 + s^2 + s}.$$

```
G1 = tf([1], [1 3 3 1]);
G2 = tf([1], [1 2 2 1]);
G3 = tf([1], [1 3 2 1]);
G4 = tf([1], [2 1 1 0]);
```

```
k1 = 8.0011 / 2
```

```
k1 = 4.0006
```

```
zapasy(G1, k1, 0, 0);
```

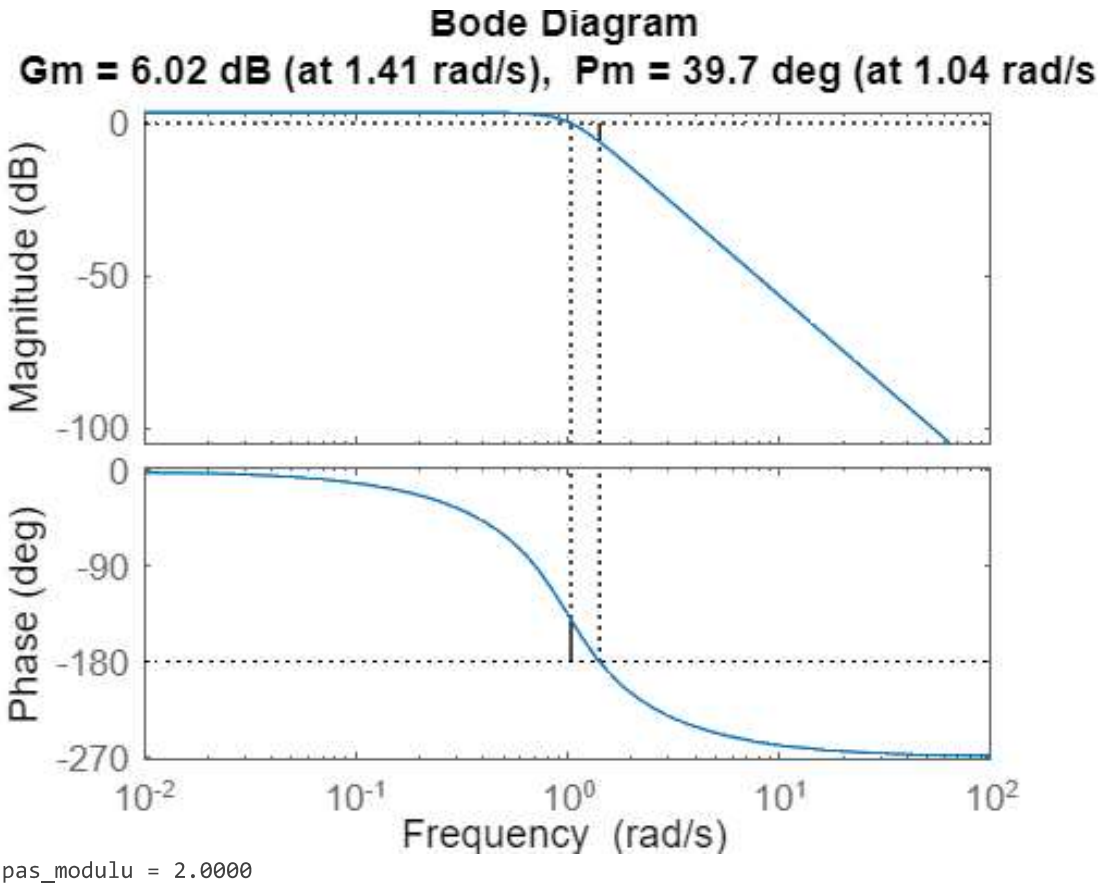



```
zapas_modulu = 2.0000
zapas_fazy = 27.1360
```

```
k2 = 3 / 2
```

```
k2 = 1.5000
```

```
zapasy(G2, k2, 0, 0);
```

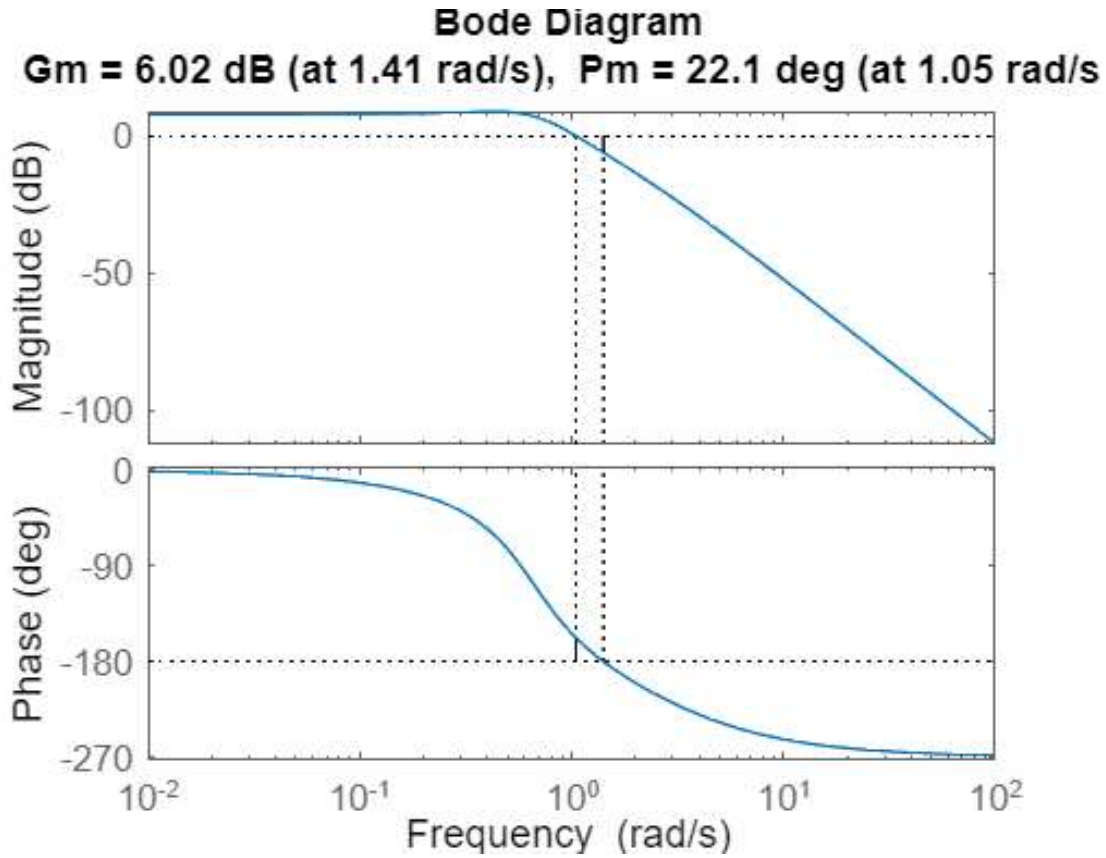



```
zapas_modulu = 2.0000
zapas_fazy = 39.6836
```

```
k3 = 5.0029 / 2
```

```
k3 = 2.5015
```

```
zapasy(G3, k3, 0, 0);
```

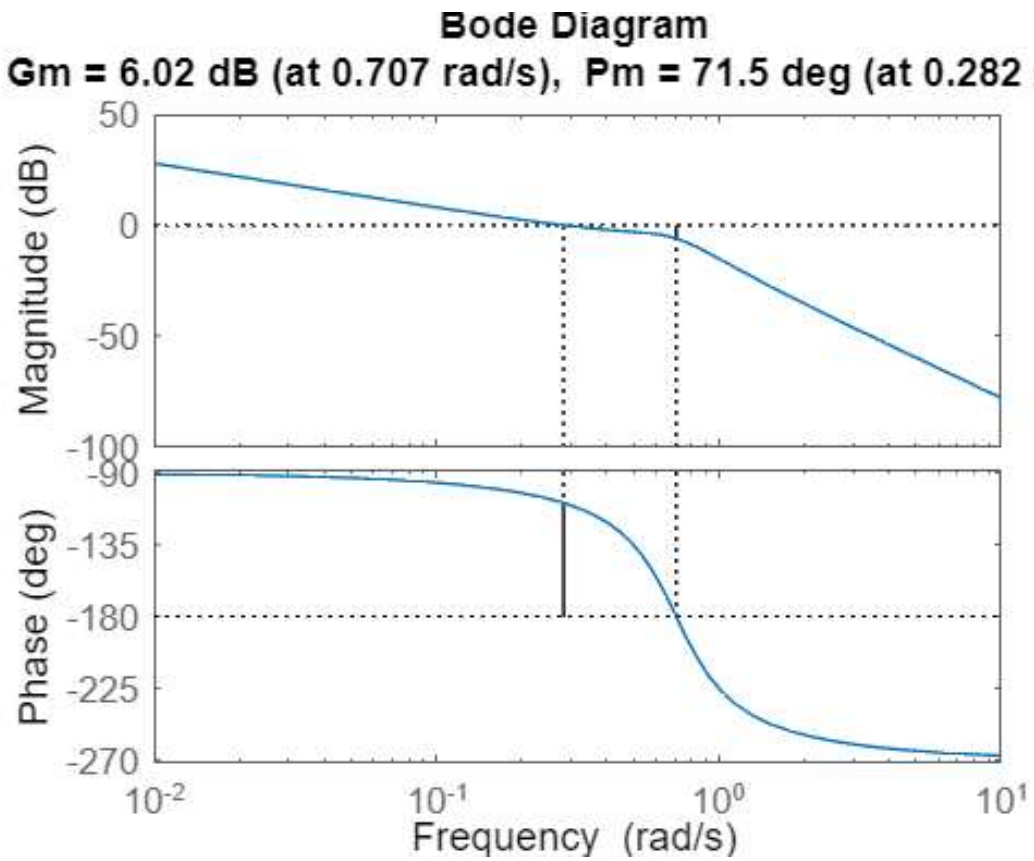



```
zapas_modulu = 2.0000
zapas_fazy = 22.0773
```

```
k4 = 0.5 / 2
```

```
k4 = 0.2500
```

```
zapasy(G4, k4, 0, 0);
```

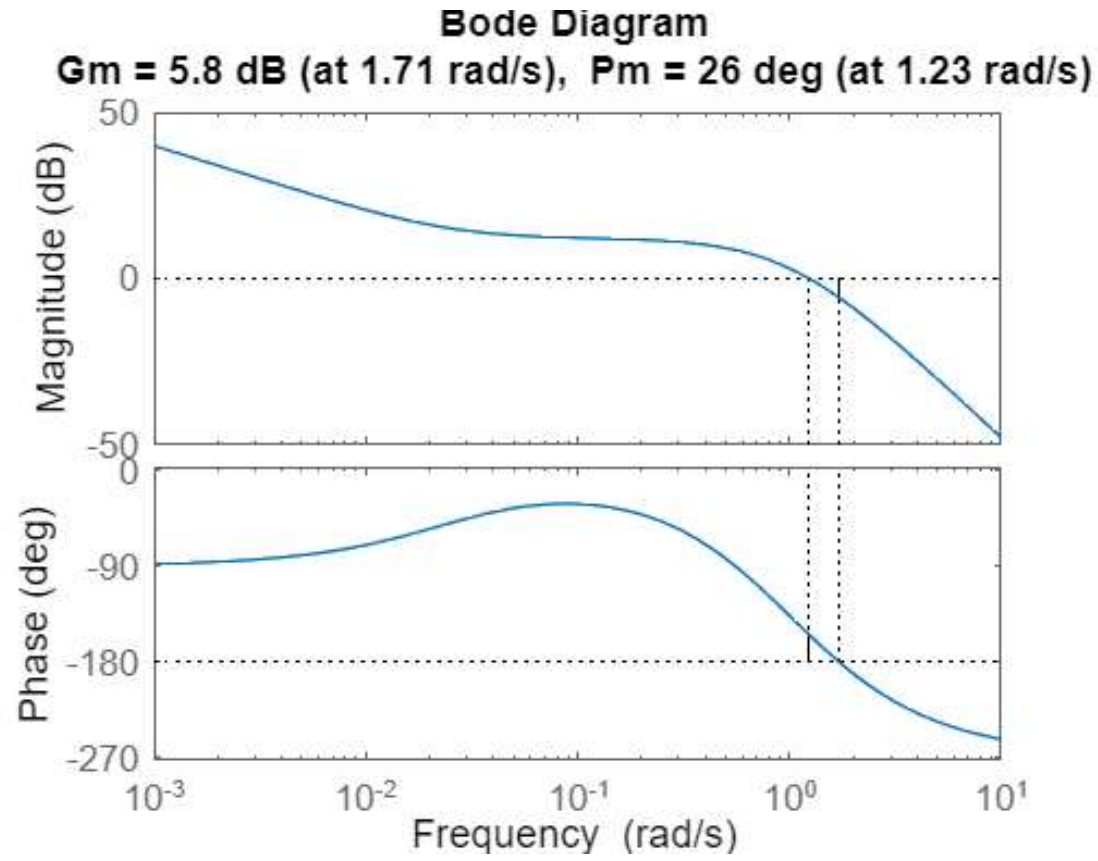



```
zapas_modulu = 2.0000
zapas_fazy = 71.4778
```

```
alfa = 0.1
```

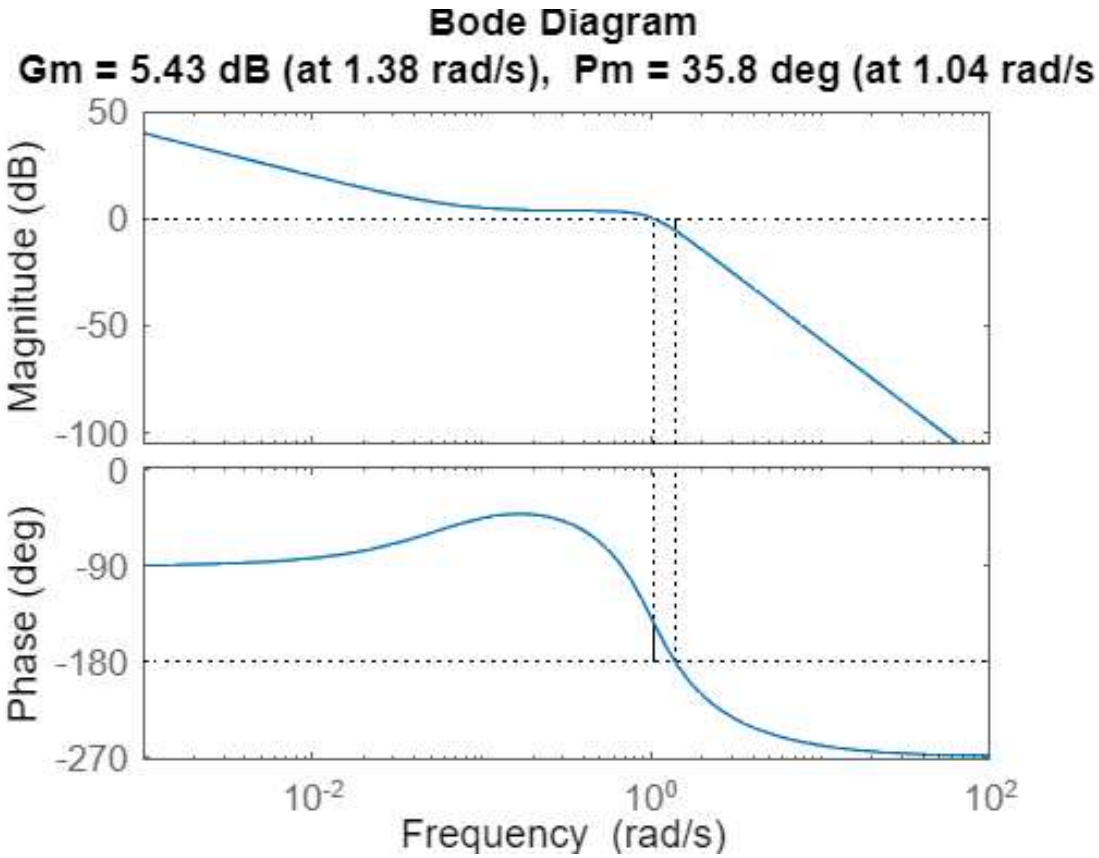
```
alfa = 0.1000
```

```
zapasy(G1, k1, alfa, 0);
```



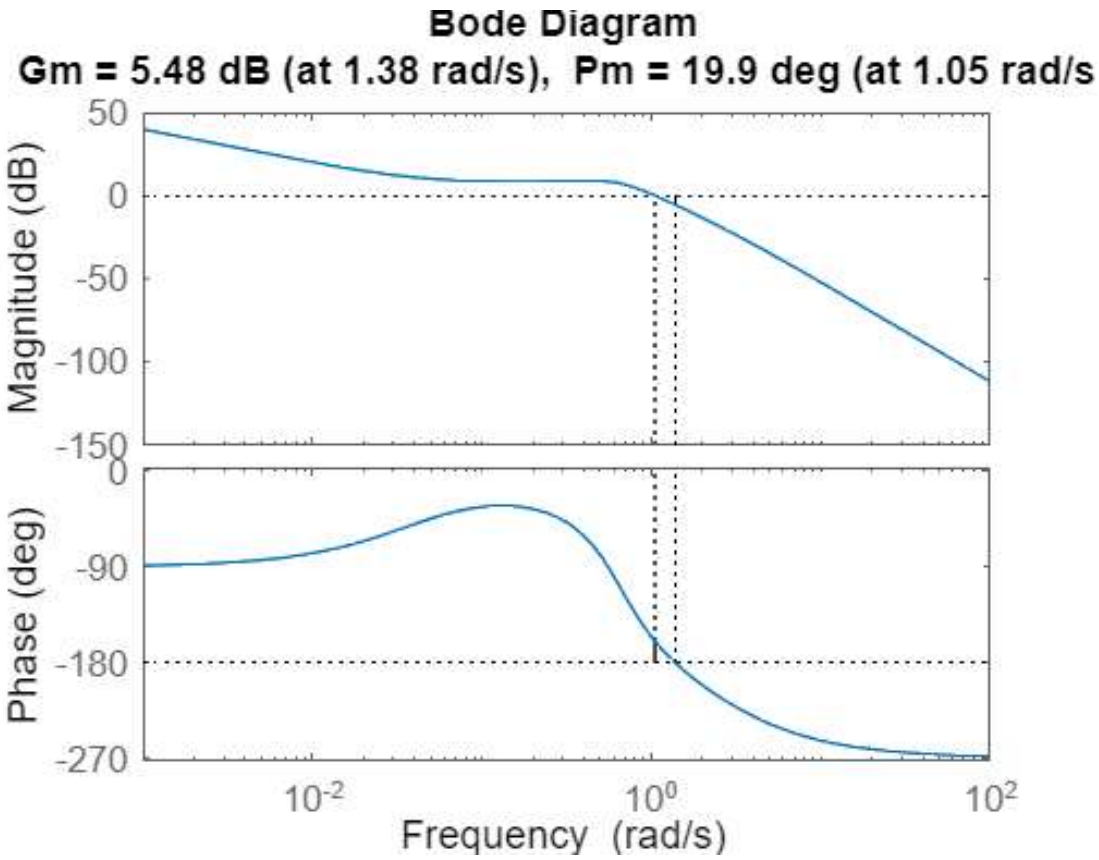

```
zapas_modulu = 1.9502
zapas_fazy = 25.9651
```

```
zapasy(G2, k2, alfa, 0);
```



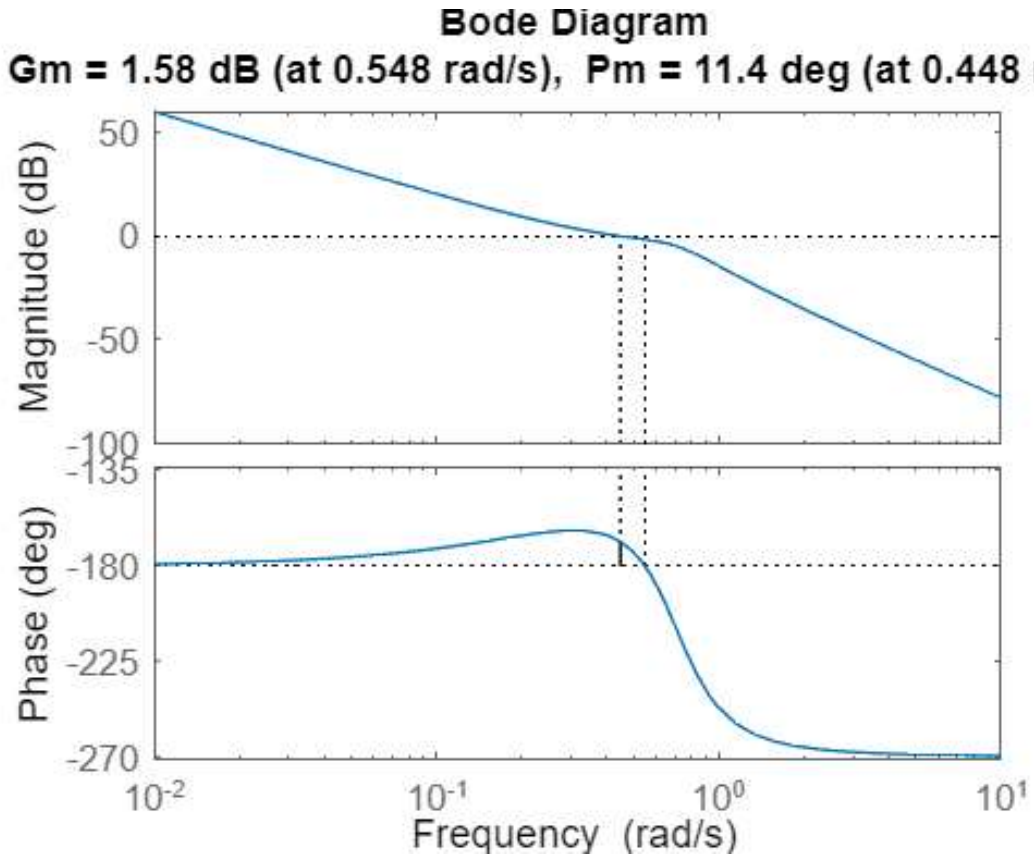

```
zapas_modulu = 1.8690
zapas_fazy = 35.8373
```

```
zapasy(G3, k3, alfa, 0);
```




```
zapas_modulu = 1.8802
zapas_fazy = 19.8733
```

```
zapasy(G4, k4, alfa, 0);
```

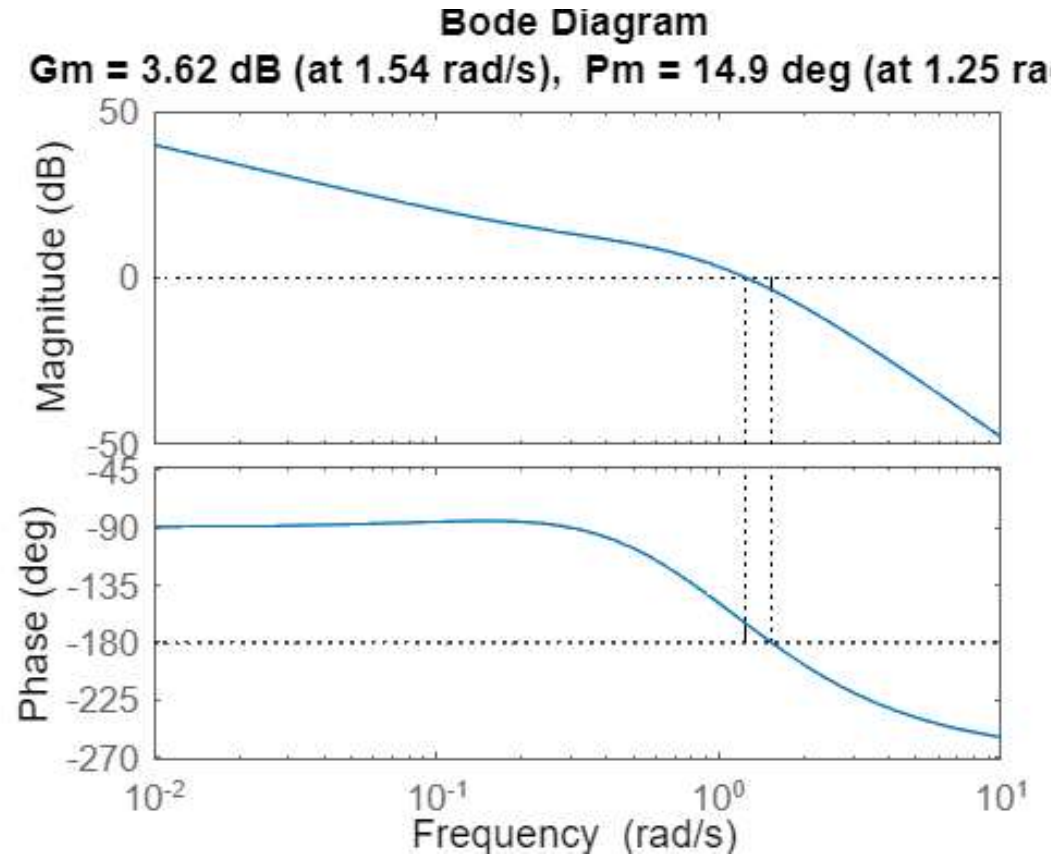



```
zapas_modulu = 1.2000
zapas_fazy = 11.4055
```

```
alfa = 1
```

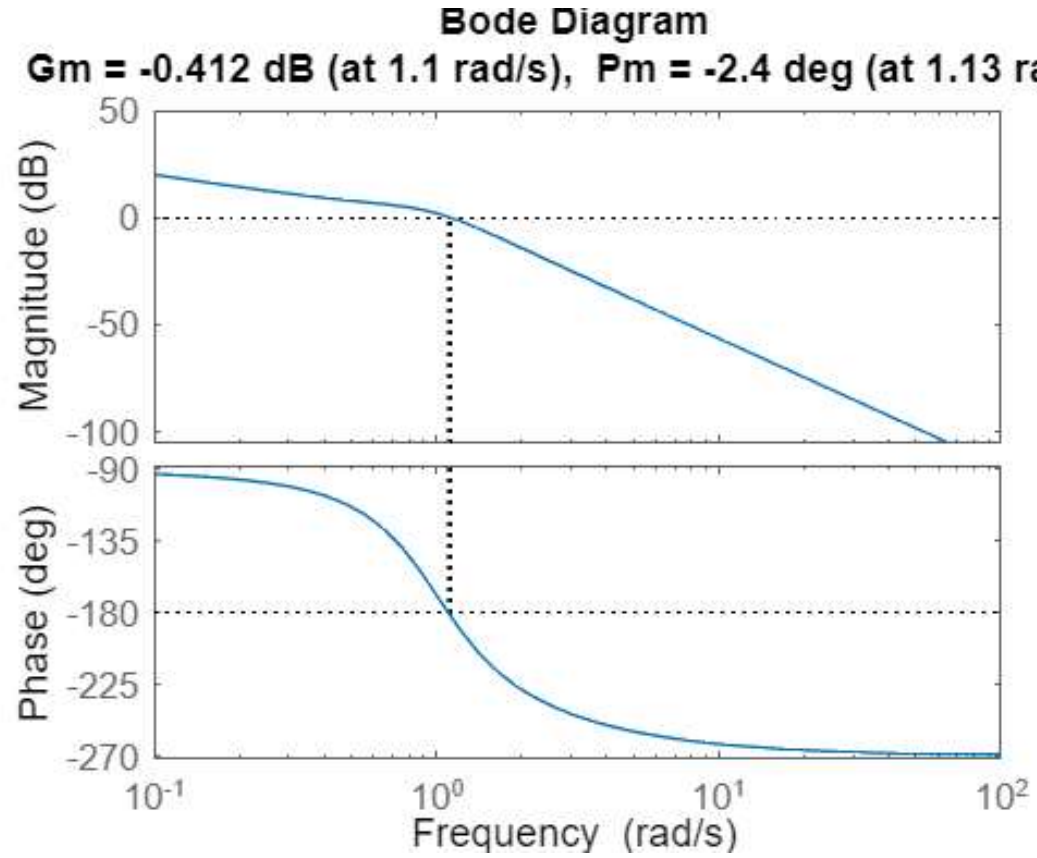
```
alfa = 1
```

```
zapasy(G1, k1, alfa, 0);
```



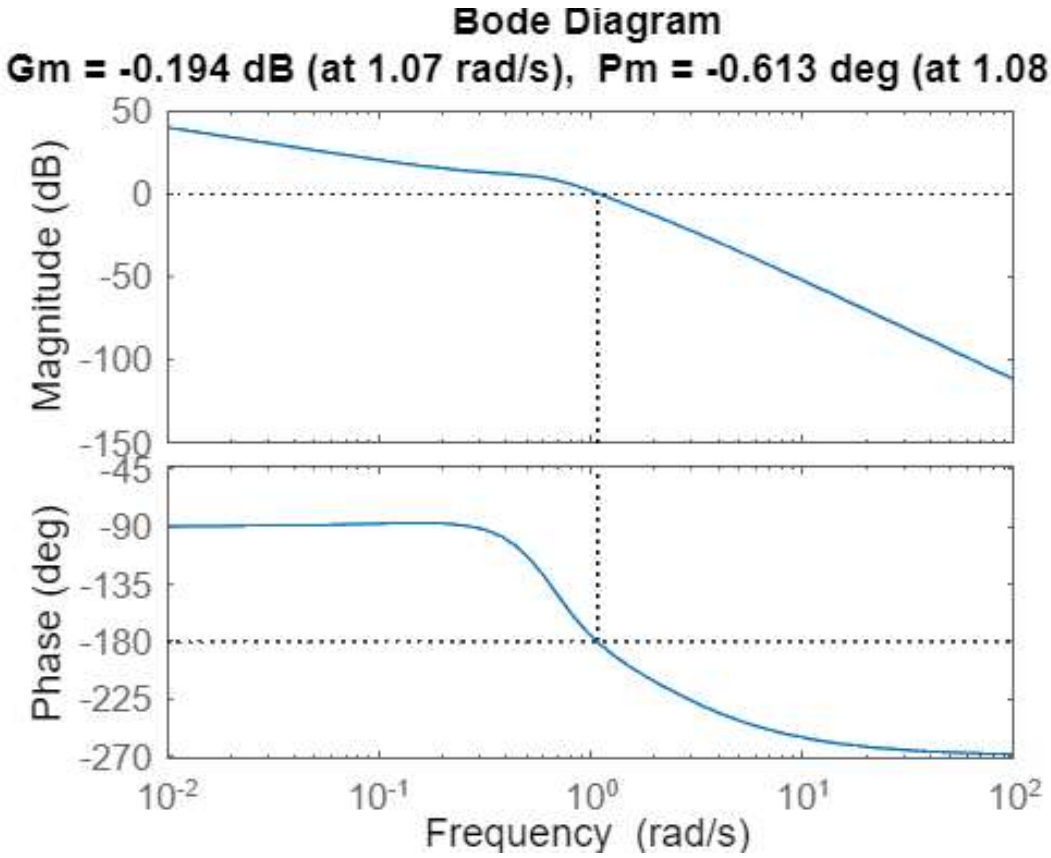
```
zapas_modulu = 1.5175
zapas_fazy = 14.8847
```

```
zapasy(G2, k2, alfa, 0);
```



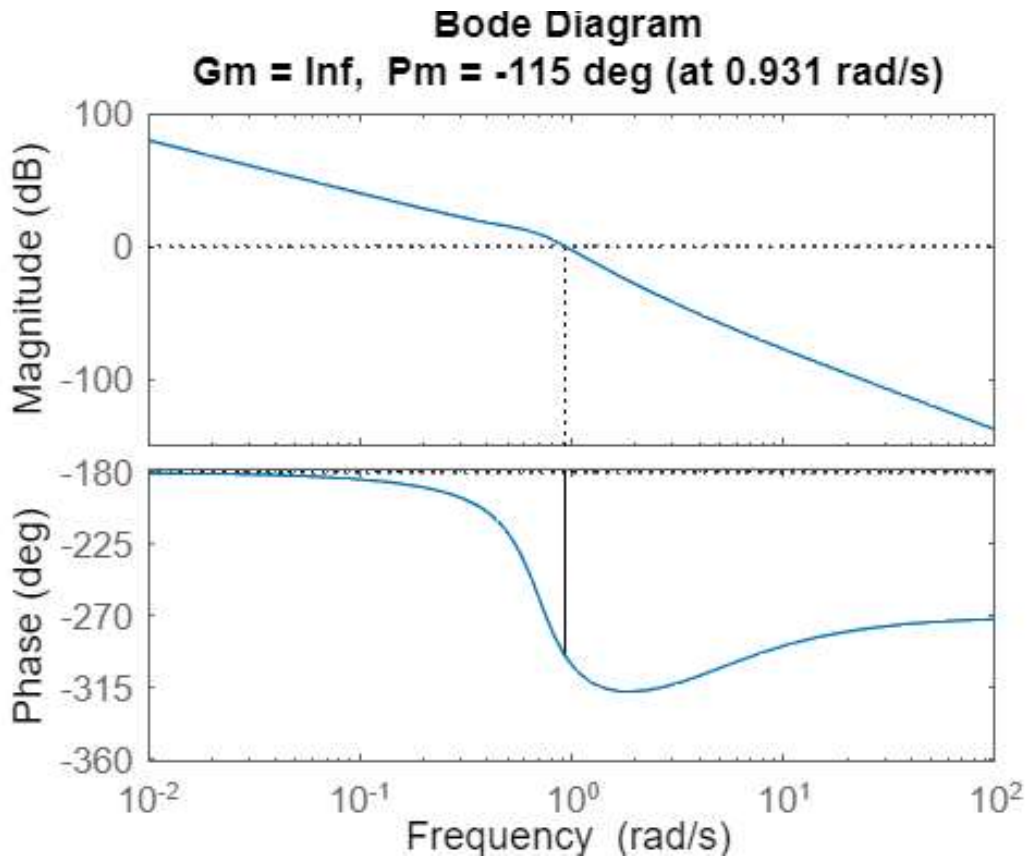

```
Warning: The closed-loop system is unstable.
zapas_modulu = 0.9537
zapas_fazy = -2.4014
```

```
zapasy(G3, k3, alfa, 0);
```



```
Warning: The closed-loop system is unstable.
zapas_modulu = 0.9779
zapas_fazy = -0.6135
```

```
zapasy(G4, k4, alfa, 0);
```

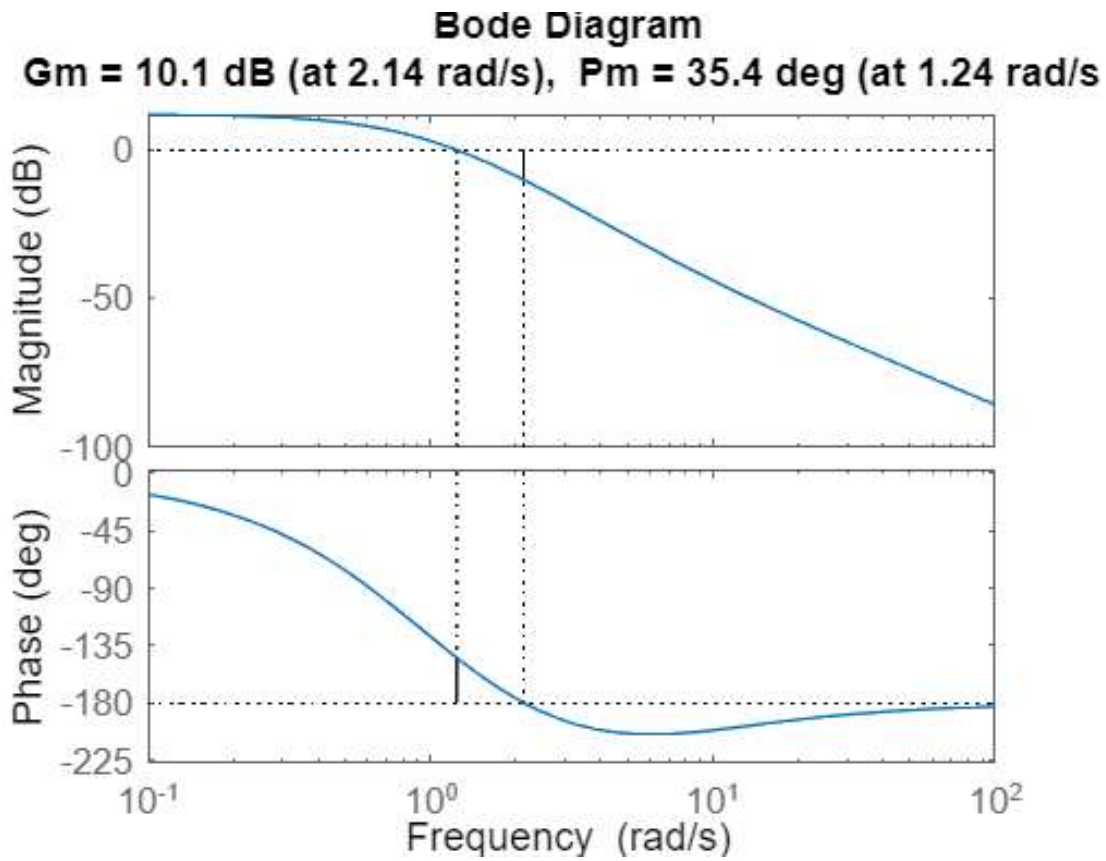



```
Warning: The closed-loop system is unstable.
zapas_modulu = 0
zapas_fazy = -115.1196
```

```
beta = 0.5
```

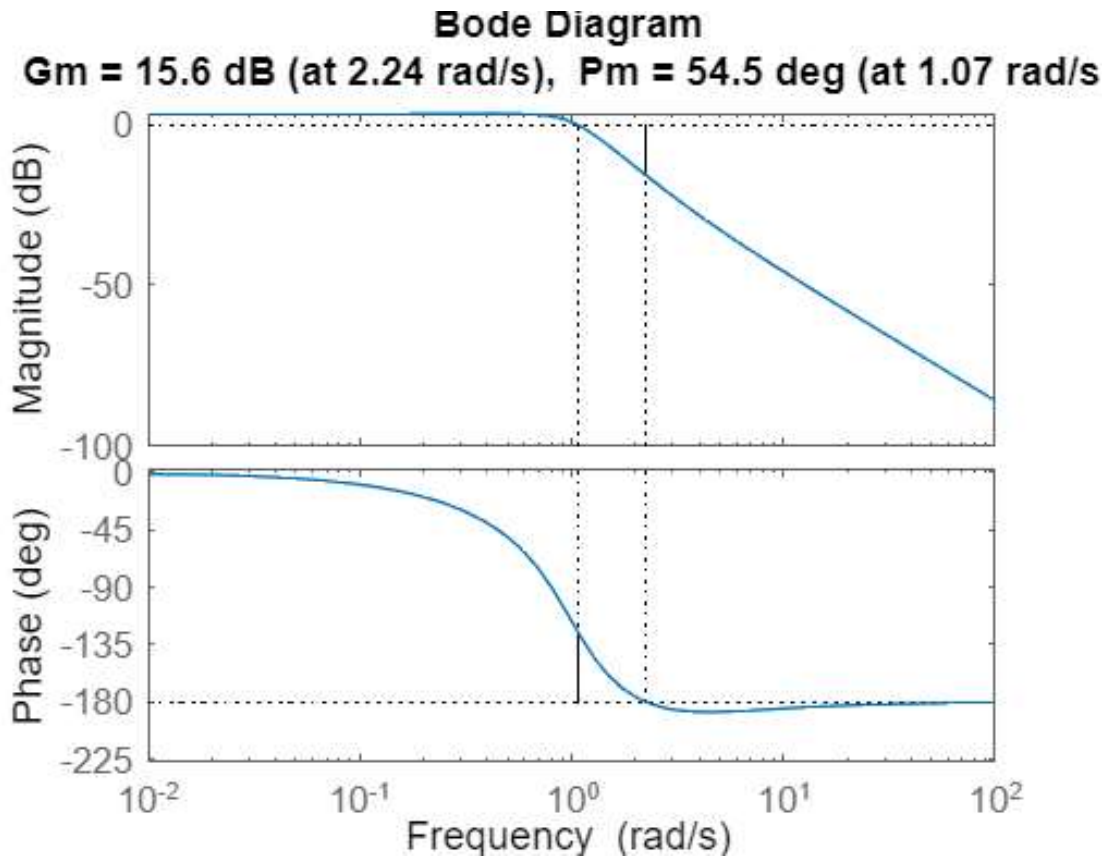
```
beta = 0.5000
```

```
zapasy(G1, k1, 0, beta);
```



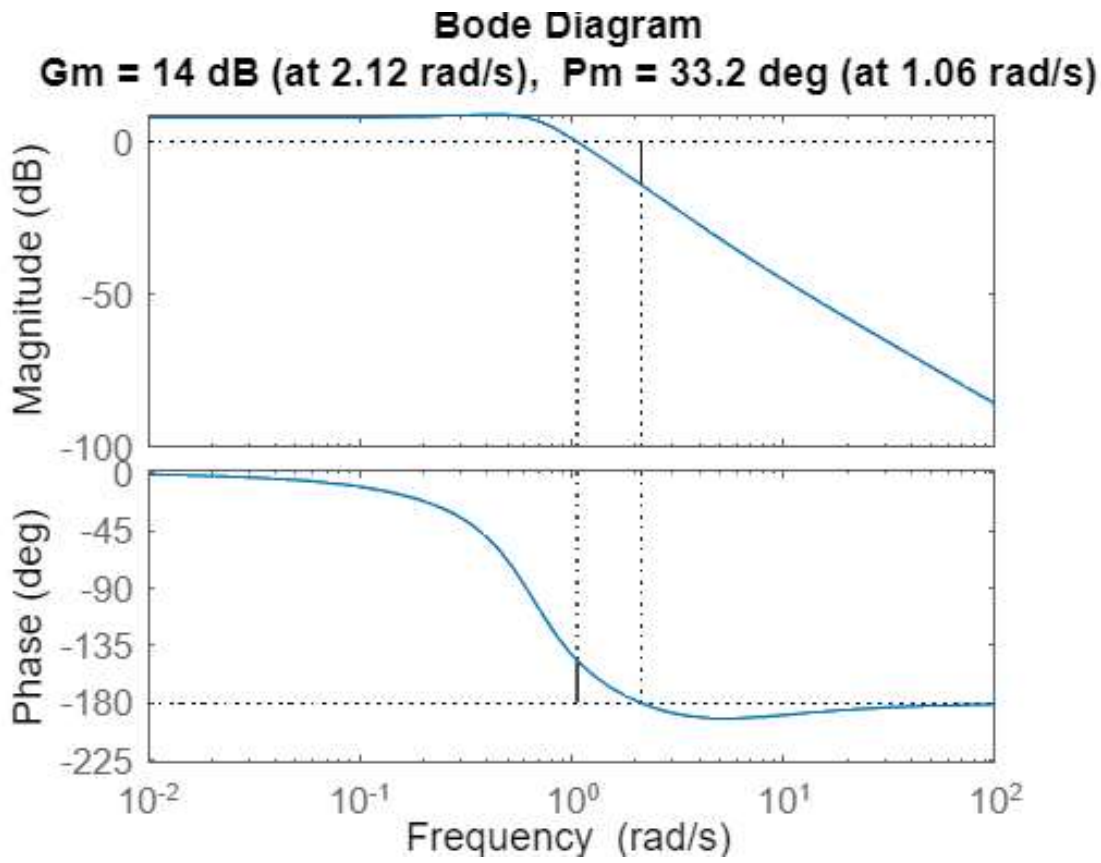

```
zapas_modulu = 3.1993
zapas_fazy = 35.4024
```

```
zapasy(G2, k2, 0, beta);
```



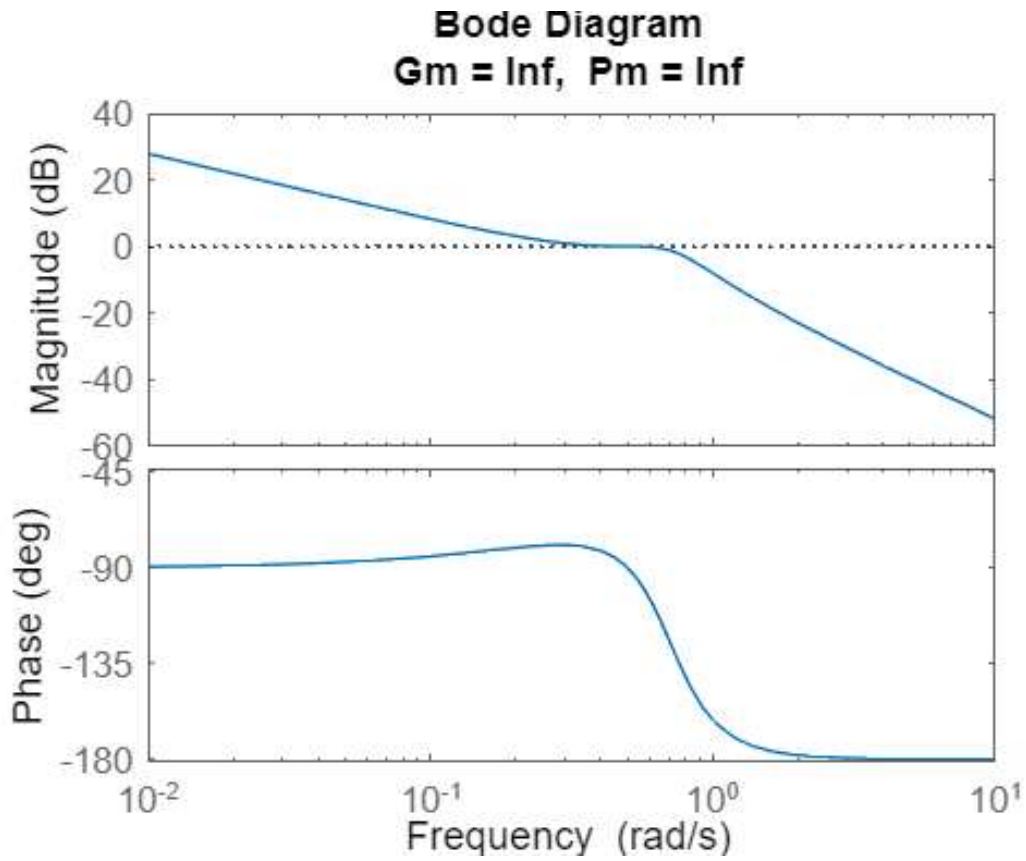

```
zapas_modulu = 6.0002
zapas_fazy = 54.4706
```

```
zapasy(G3, k3, 0, beta);
```




```
zapas_modulu = 4.9928
zapas_fazy = 33.2205
```

```
zapasy(G4, k4, 0, beta);
```

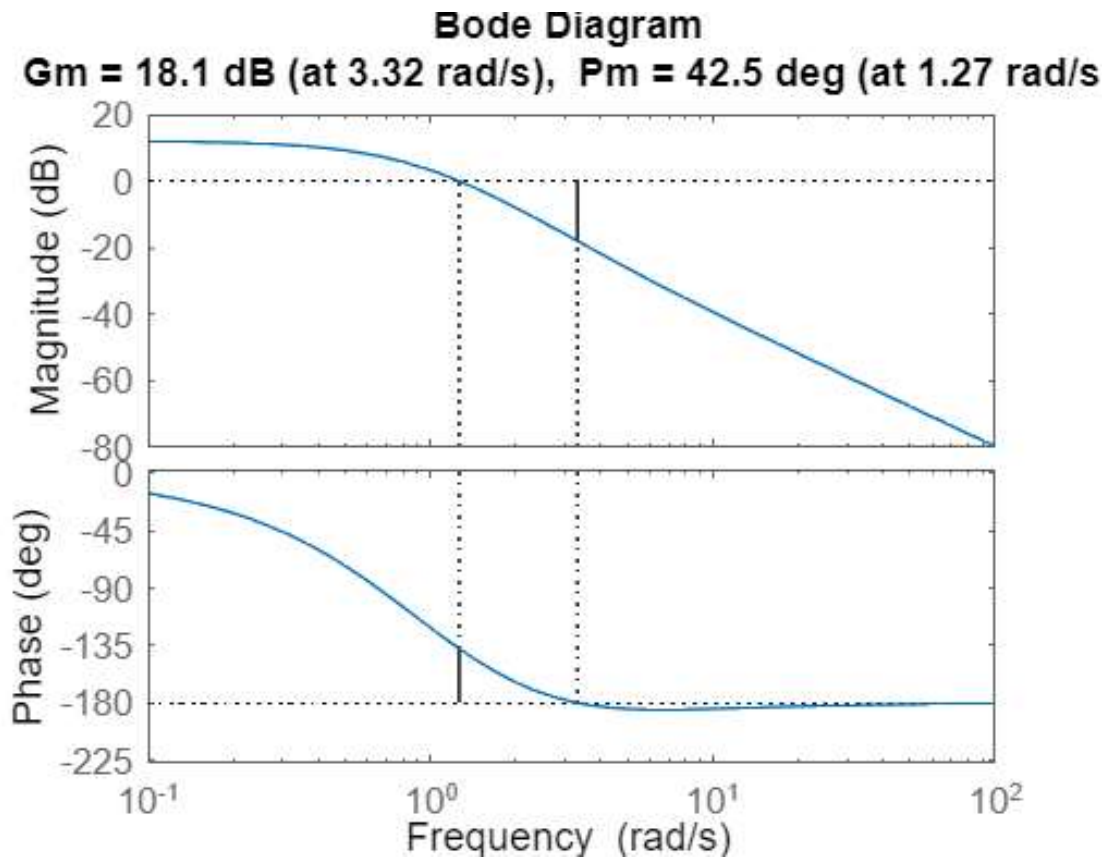



```
zapas_modulu = Inf
zapas_fazy = Inf
```

```
beta = 1
```

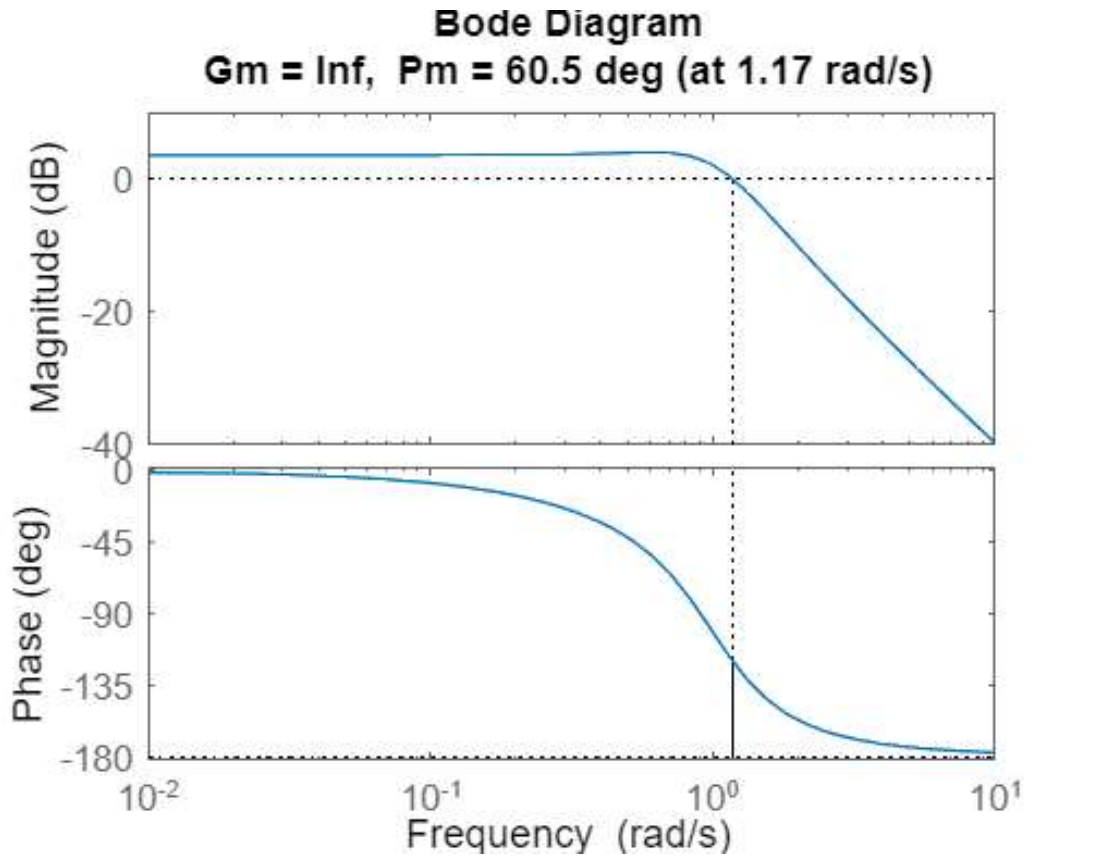
```
beta = 1
```

```
zapasy(G1, k1, 0, beta);
```



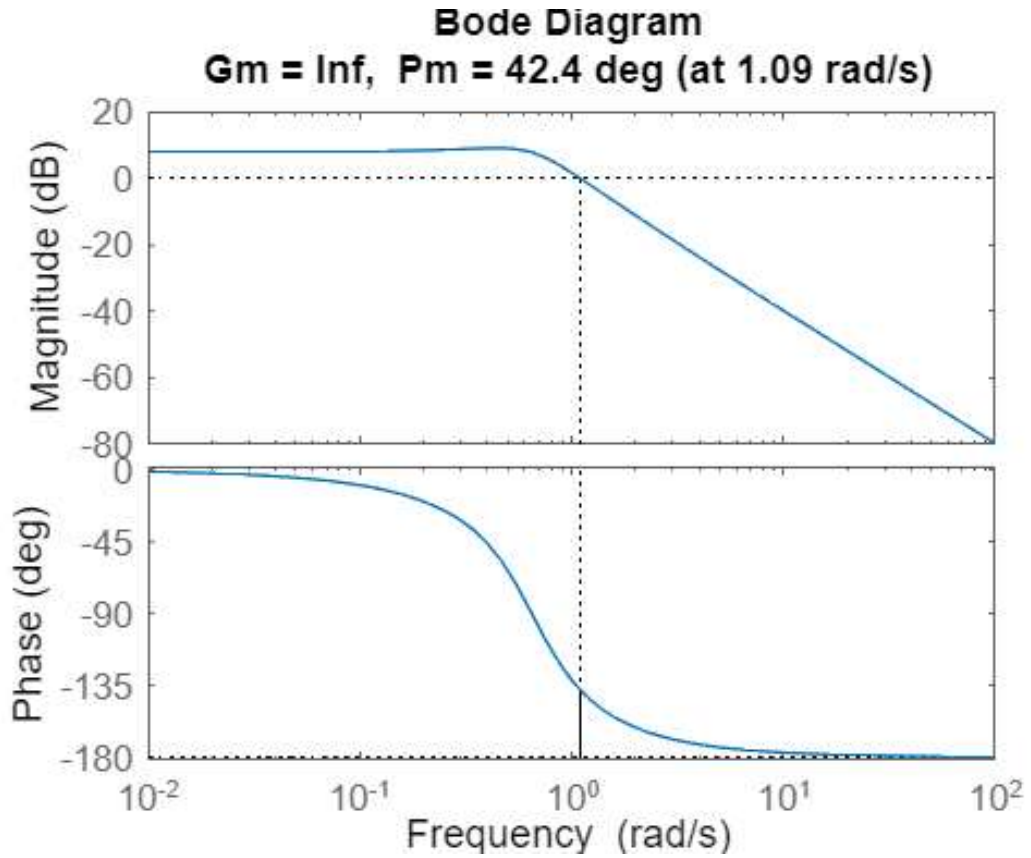

```
zapas_modulu = 7.9956
zapas_fazy = 42.5031
```

```
zapasy(G2, k2, 0, beta);
```



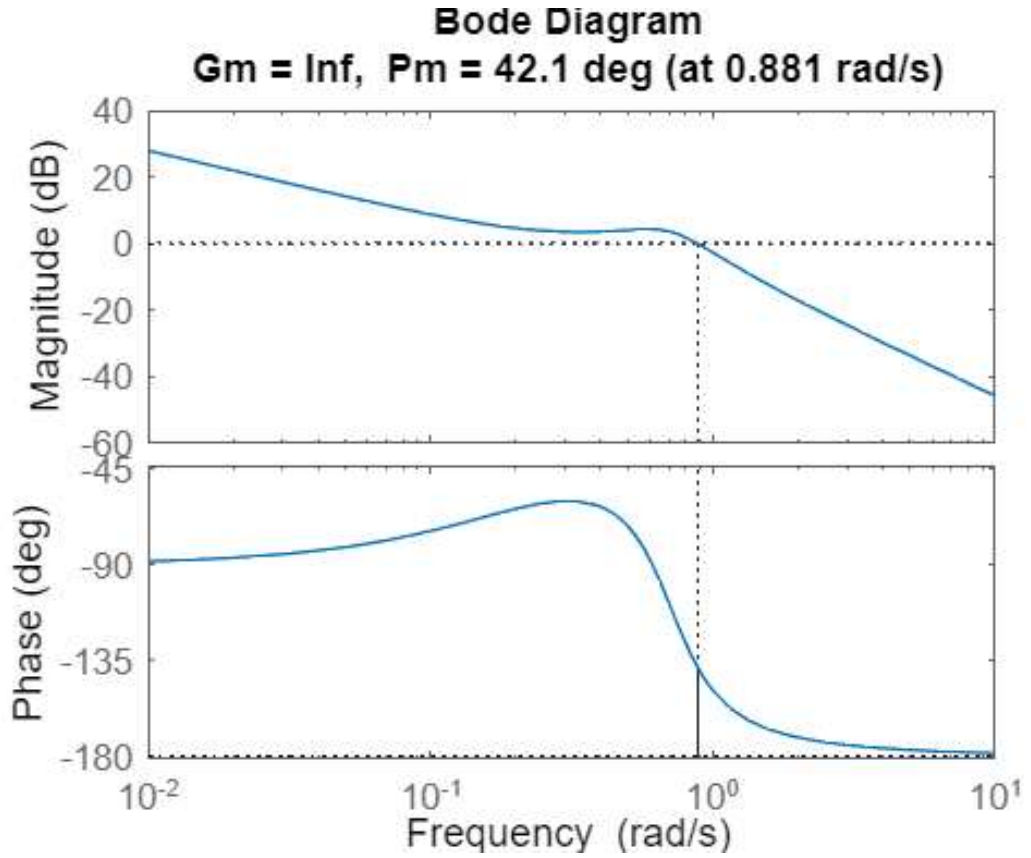

```
zapas_modulu = Inf
zapas_fazy = 60.5323
```

```
zapasy(G3, k3, 0, beta);
```




```
zapas_modulu = Inf
zapas_fazy = 42.4144
```

```
zapasy(G4, k4, 0, beta);
```




```
zapas_modulu = Inf
zapas_fazy = 42.0872
```

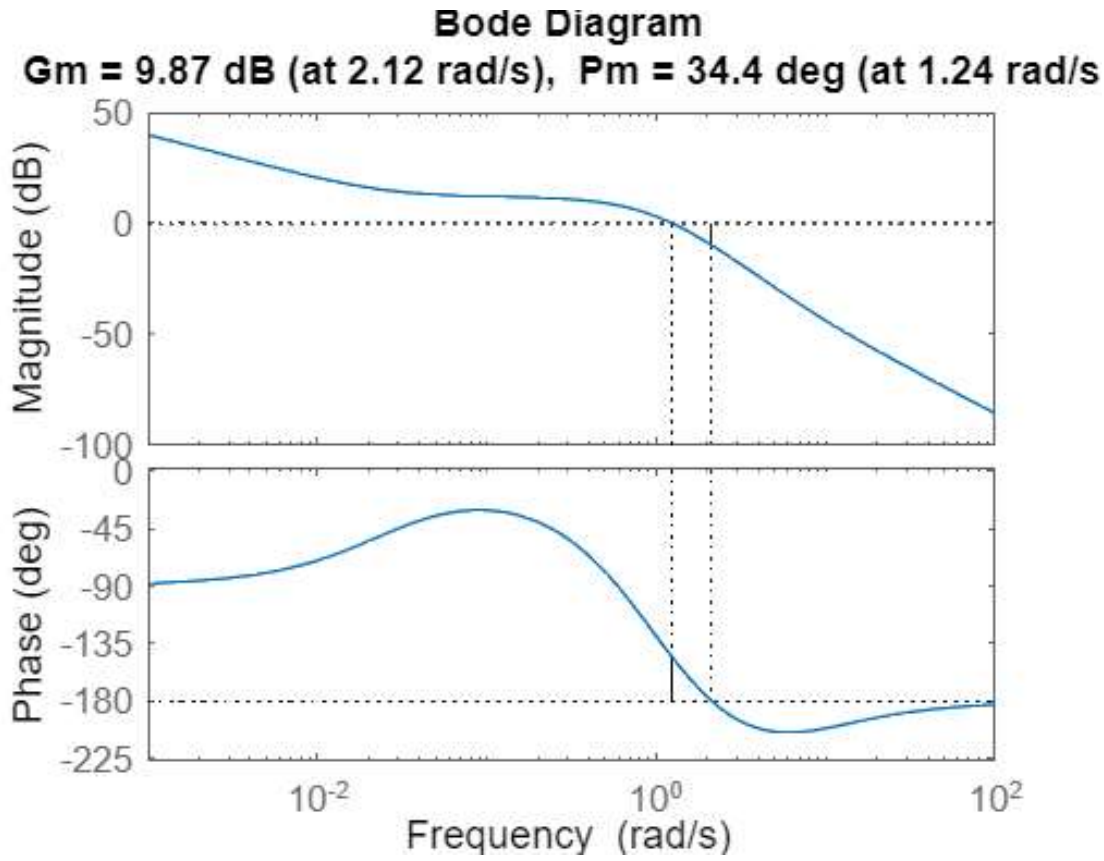
```
alfa = 0.1
```

```
alfa = 0.1000
```

```
beta = 0.5
```

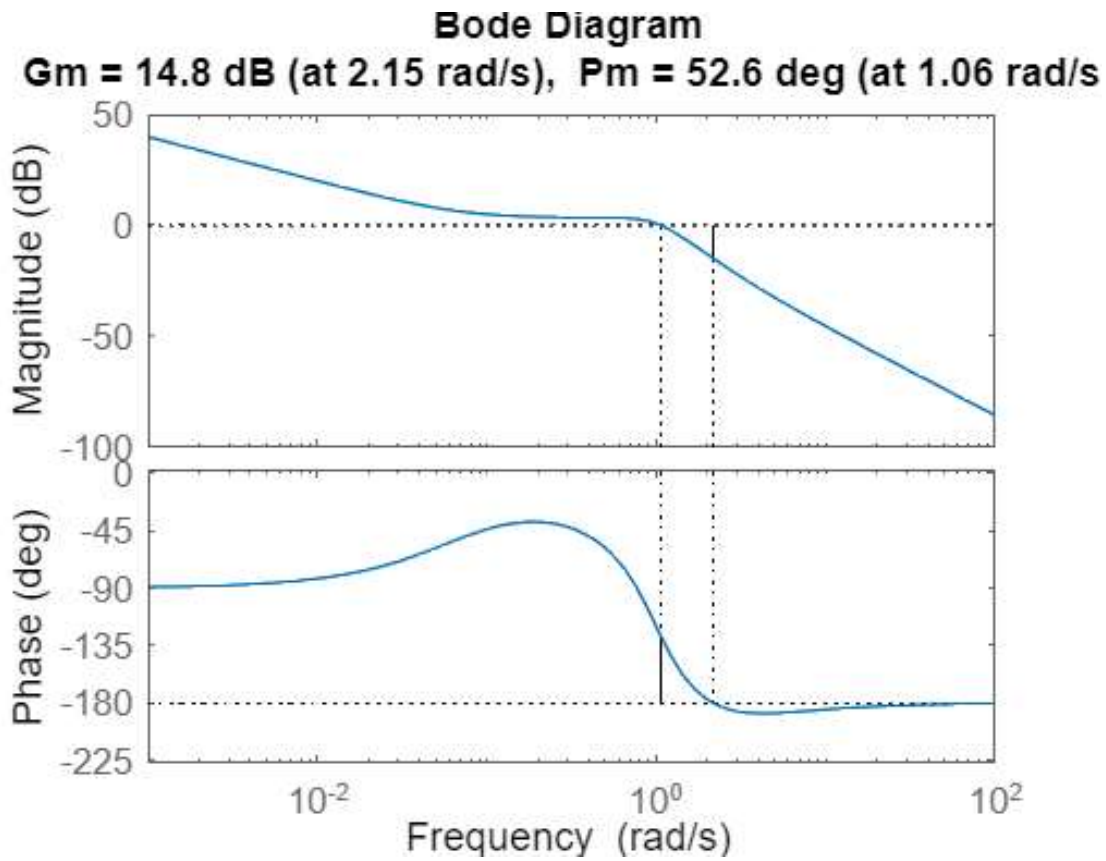
```
beta = 0.5000
```

```
zapasy(G1, k1, alfa, beta);
```



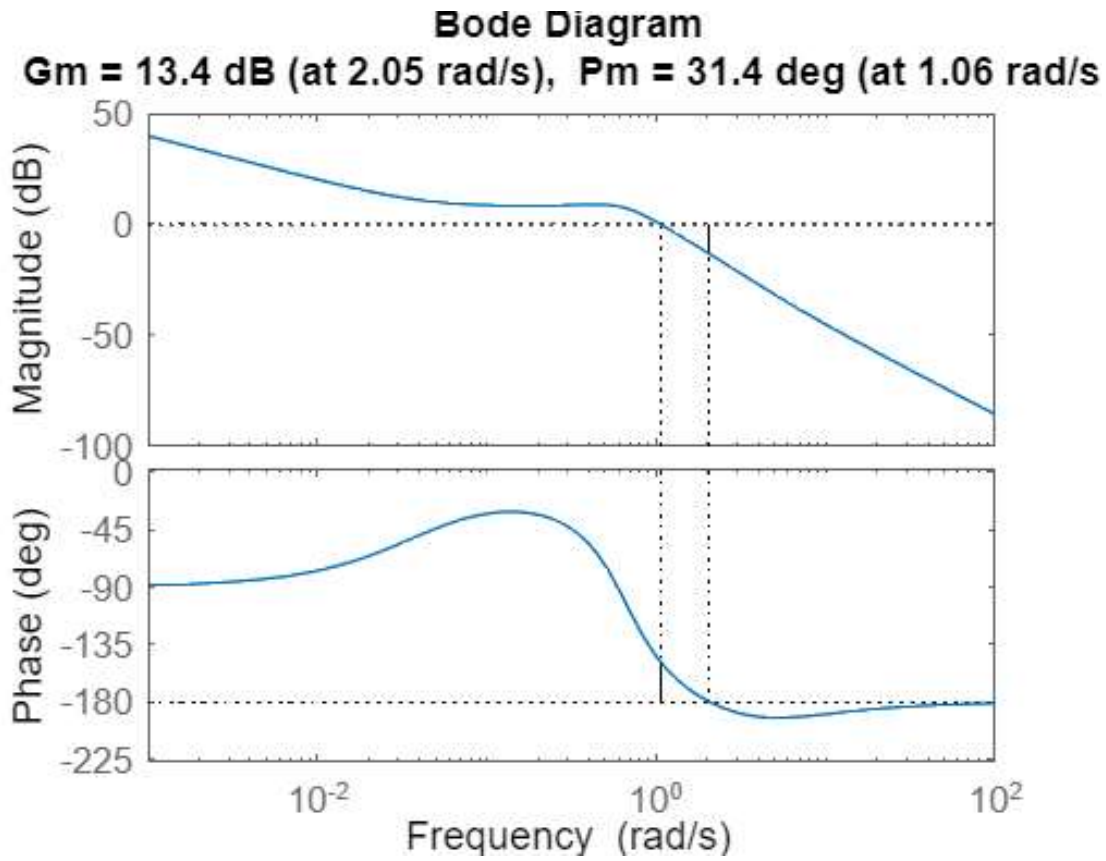

```
zapas_modulu = 3.1160
zapas_fazy = 34.3903
```

```
zapasy(G2, k2, alfa, beta);
```



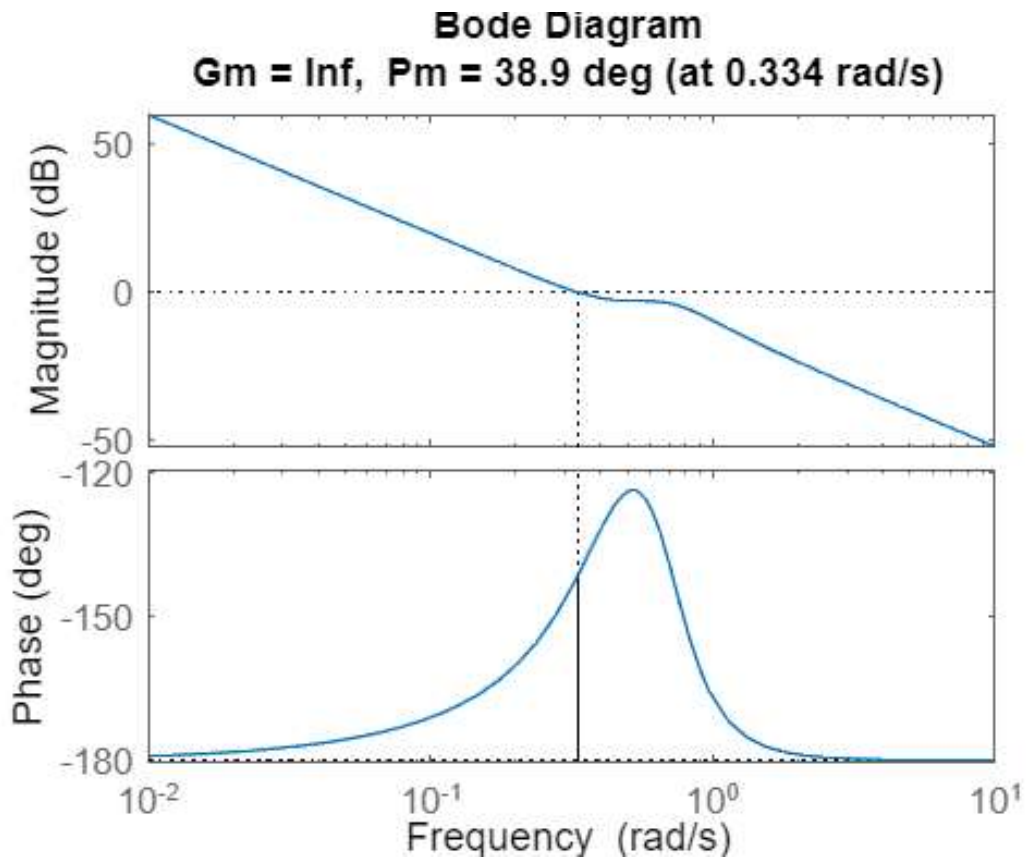

```
zapas_modulu = 5.5245
zapas_fazy = 52.5602
```

```
zapasy(G3, k3, alfa, beta);
```




```
zapas_modulu = 4.6619
zapas_fazy = 31.3695
```

```
zapasy(G4, k4, alfa, beta);
```




```
zapas_modulu = 0
zapas_fazy = 38.8882
```

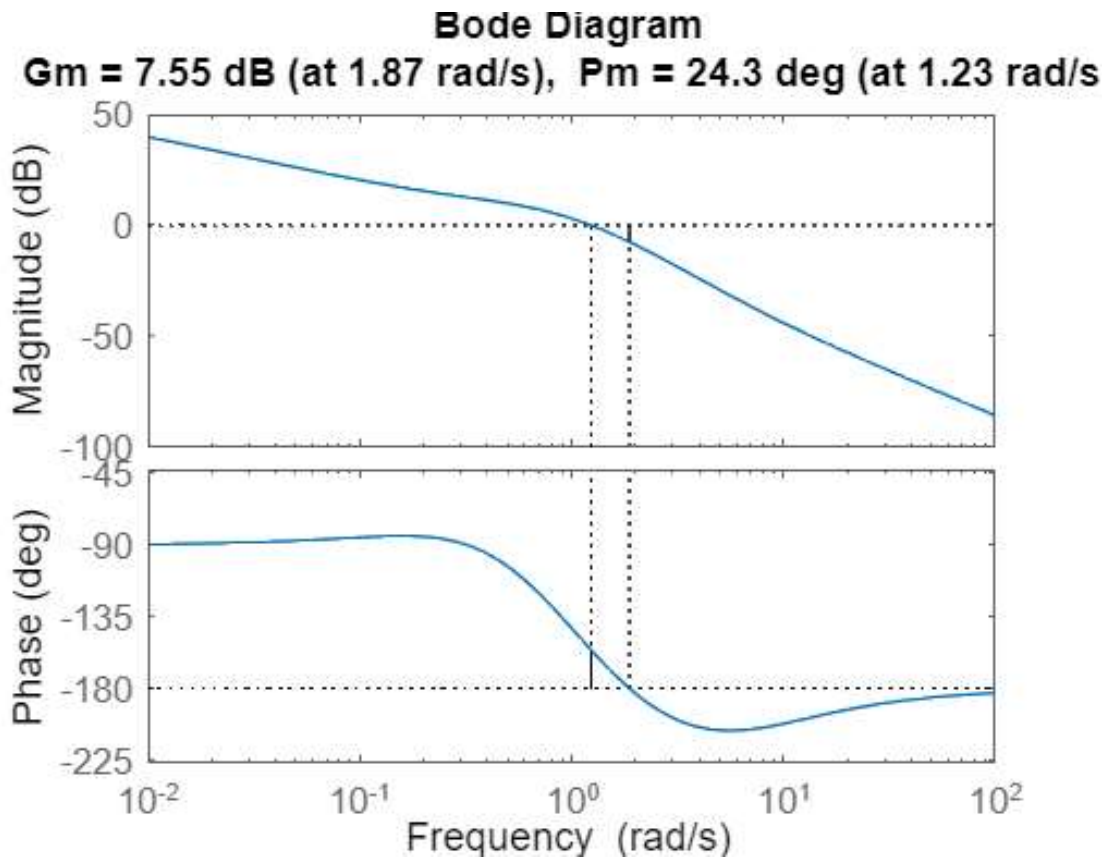
```
alfa = 1
```

```
alfa = 1
```

```
beta = 0.5
```

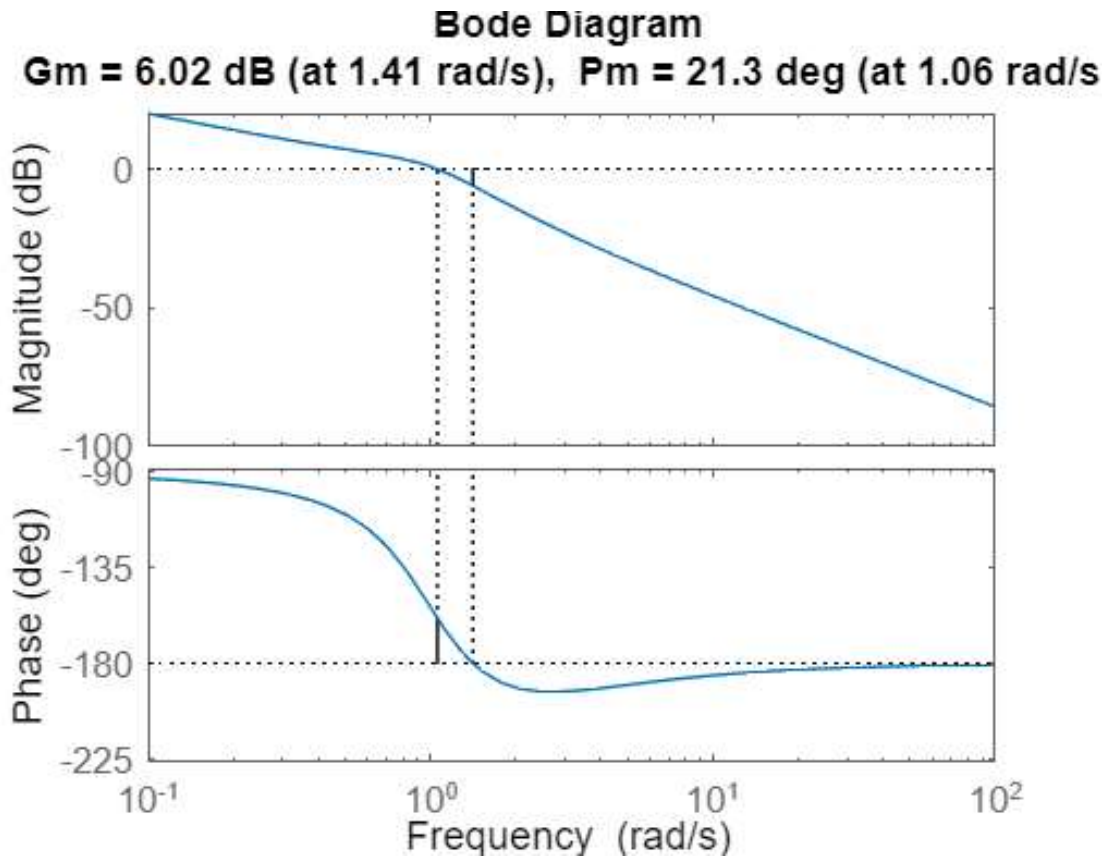
```
beta = 0.5000
```

```
zapasy(G1, k1, alfa, beta);
```



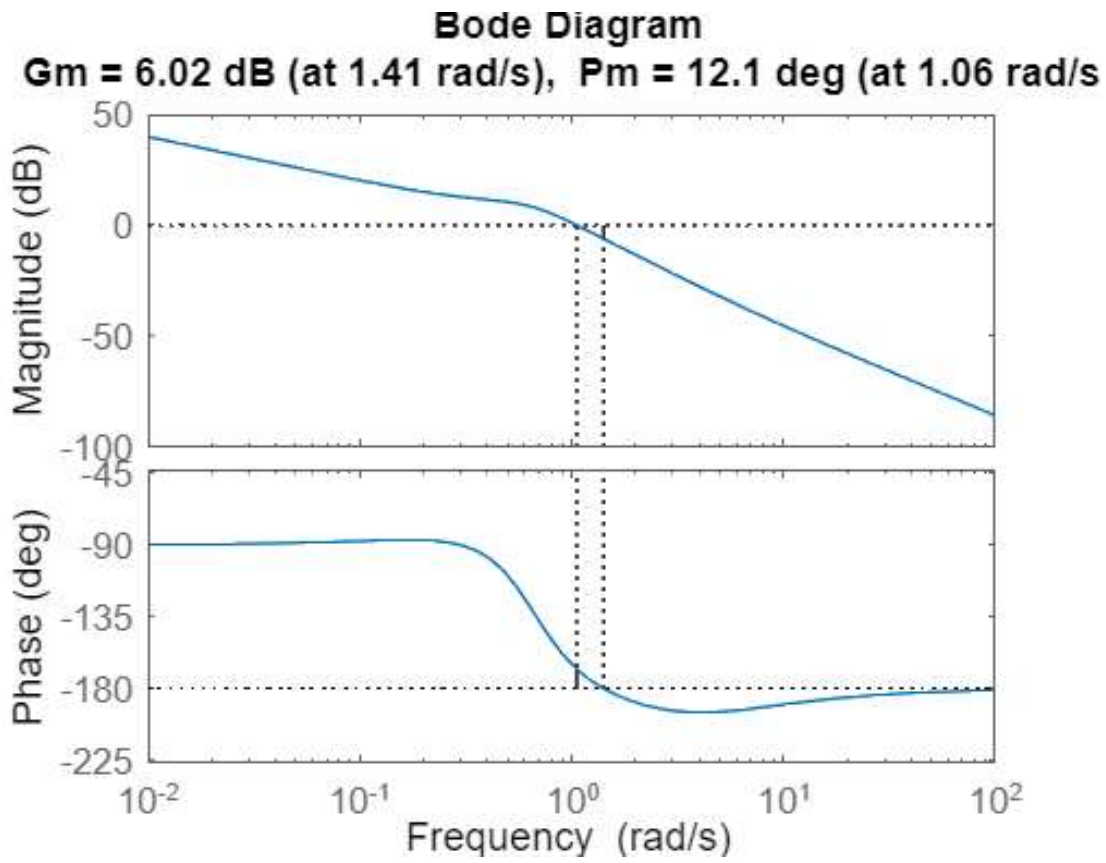

```
zapas_modulu = 2.3852
zapas_fazy = 24.3104
```

```
zapasy(G2, k2, alfa, beta);
```



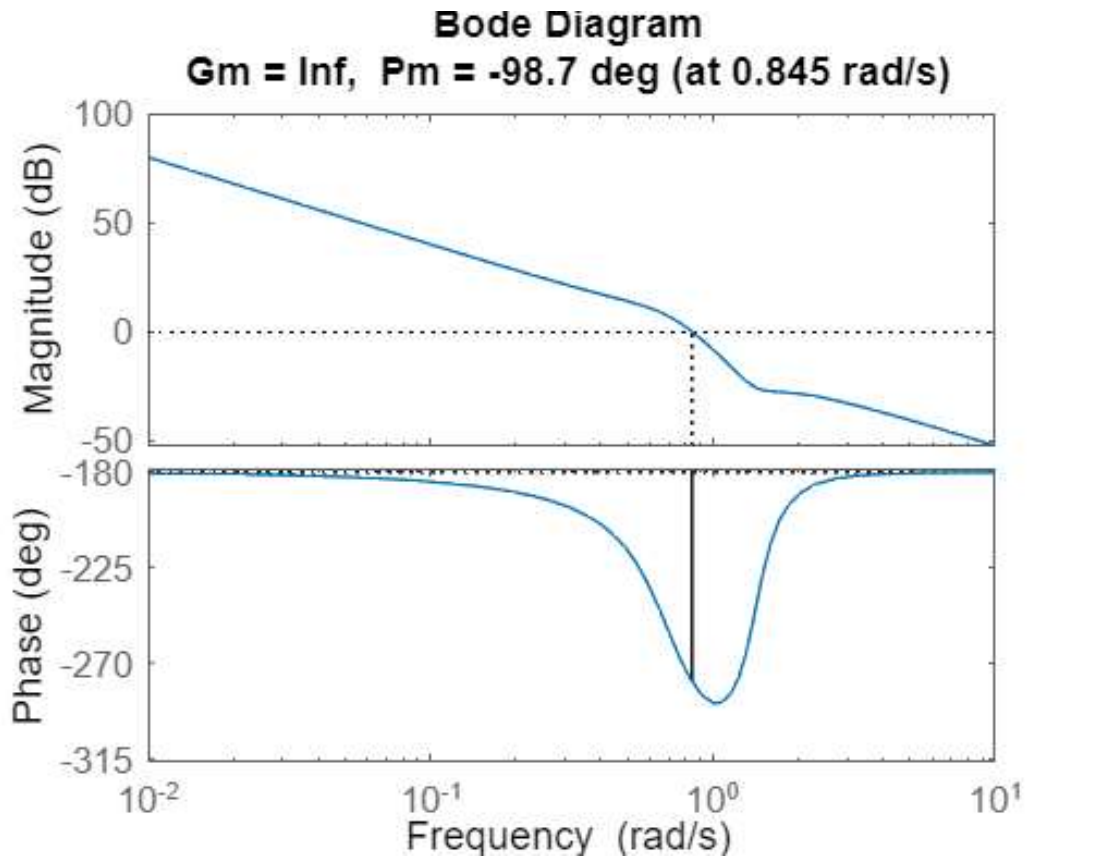

```
zapas_modulu = 2.0000
zapas_fazy = 21.2510
```

```
zapasy(G3, k3, alfa, beta);
```




```
zapas_modulu = 1.9989
zapas_fazy = 12.1106
```

```
zapasy(G4, k4, alfa, beta);
```




```
Warning: The closed-loop system is unstable.
zapas_modulu = 0
zapas_fazy = -98.6901
```

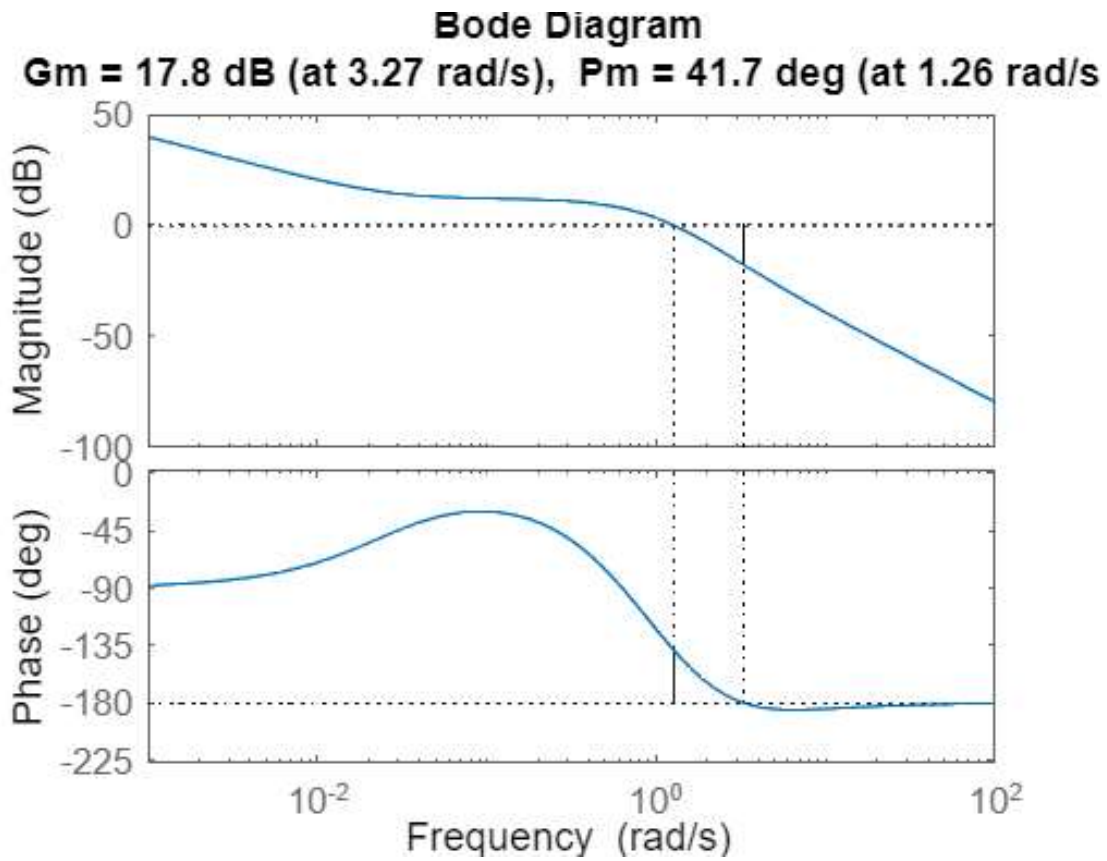
```
alfa = 0.1
```

```
alfa = 0.1000
```

```
beta = 1
```

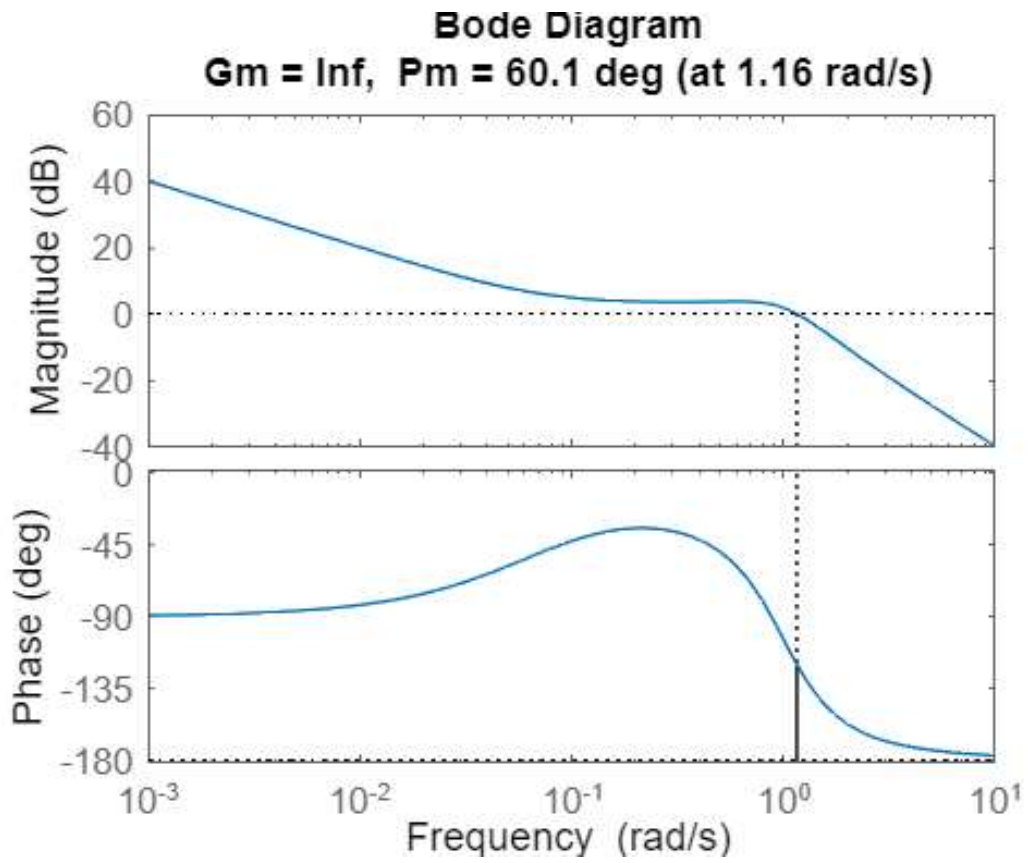
```
beta = 1
```

```
zapasy(G1, k1, alfa, beta);
```



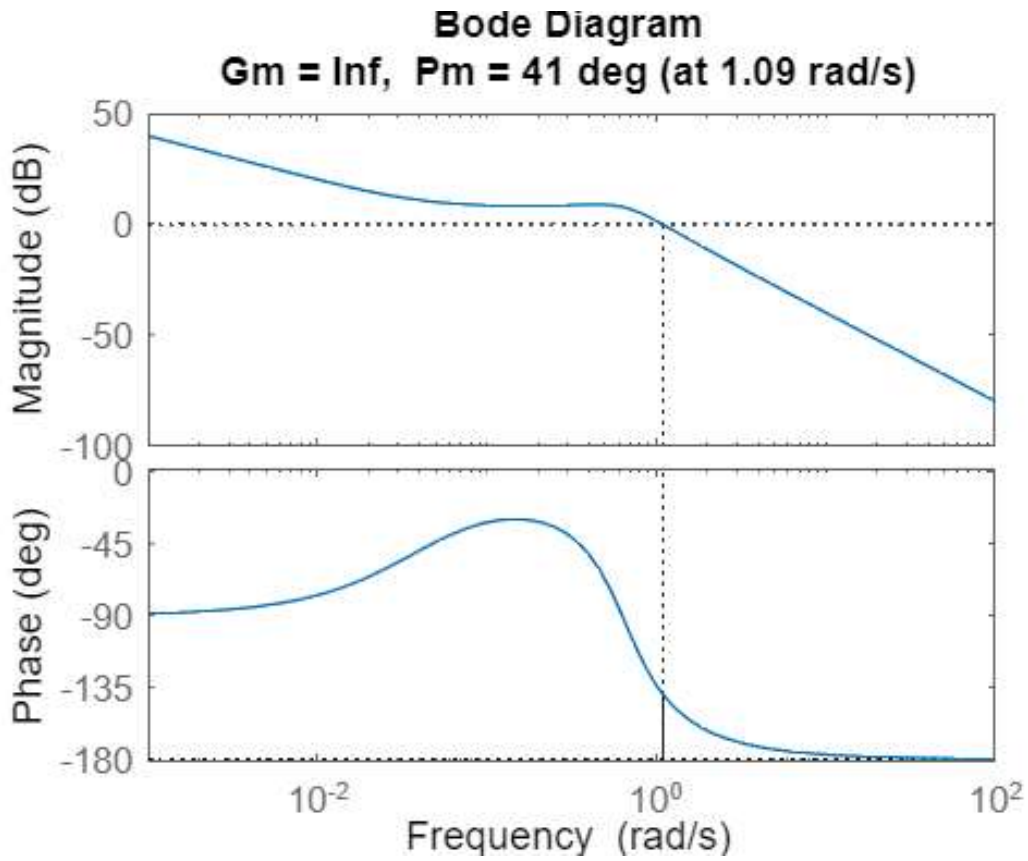

```
zapas_modulu = 7.7778
zapas_fazy = 41.6767
```

```
zapasy(G2, k2, alfa, beta);
```



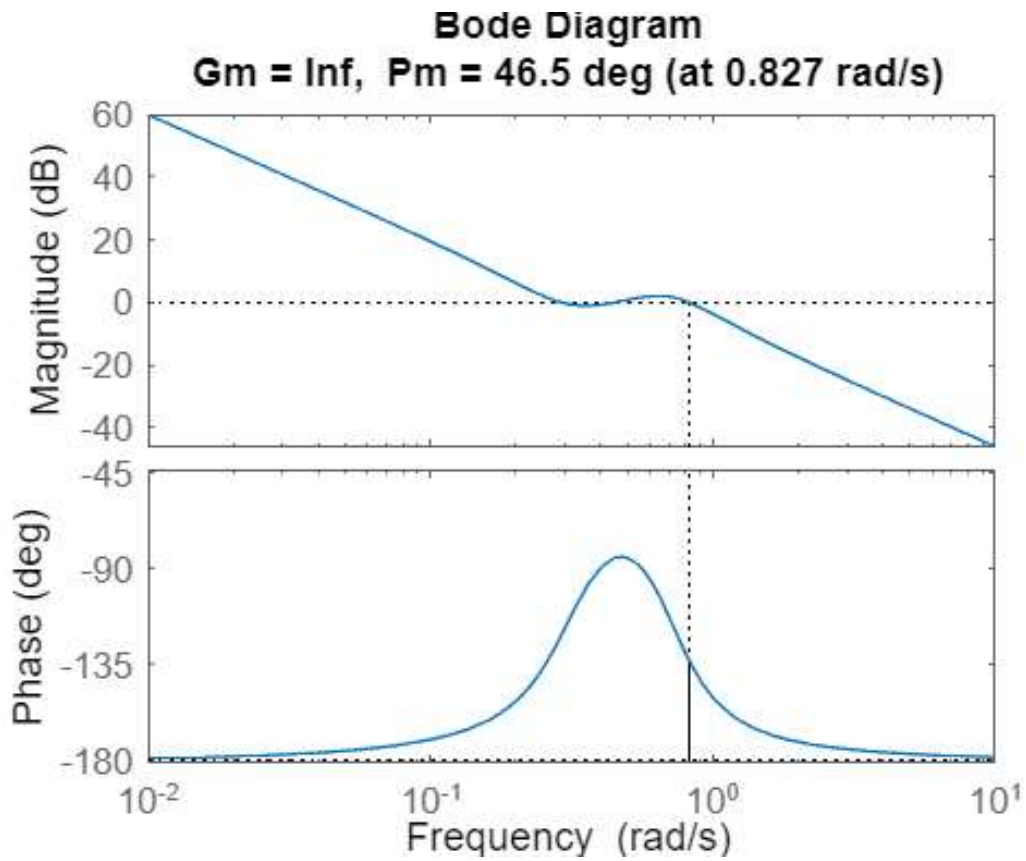

```
zapas_modulu = Inf
zapas_fazy = 60.0626
```

```
zapasy(G3, k3, alfa, beta);
```




```
zapas_modulu = Inf
zapas_fazy = 40.9998
```

```
zapasy(G4, k4, alfa, beta);
```




```
zapas_modulu = 0
zapas_fazy = 46.4855
```

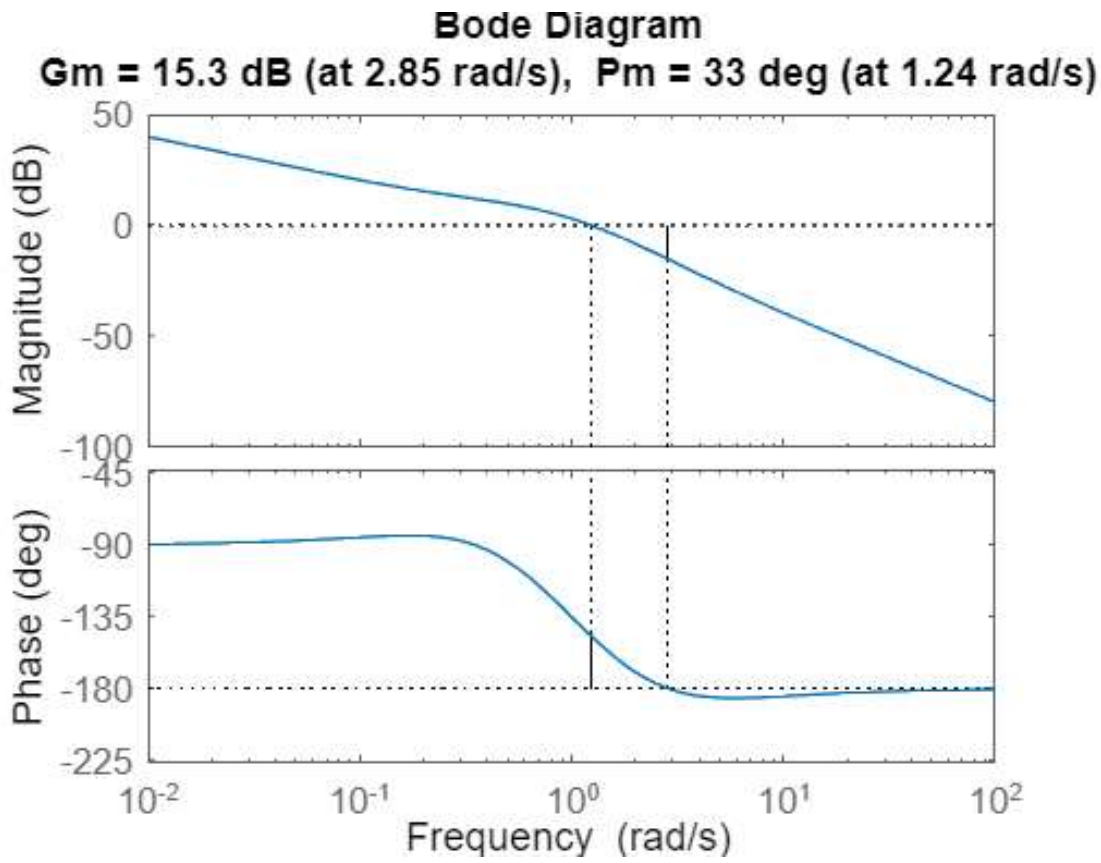
```
alfa = 1
```

```
alfa = 1
```

```
beta = 1
```

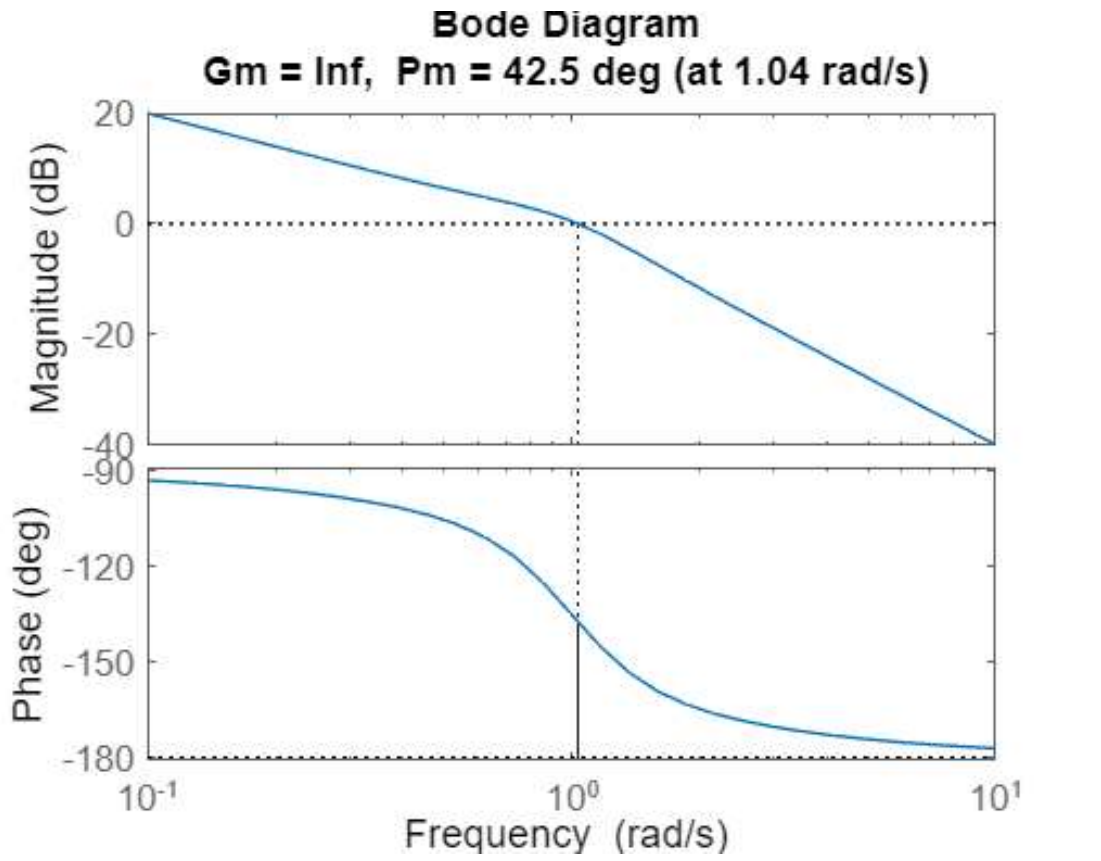
```
beta = 1
```

```
zapasy(G1, k1, alfa, beta);
```



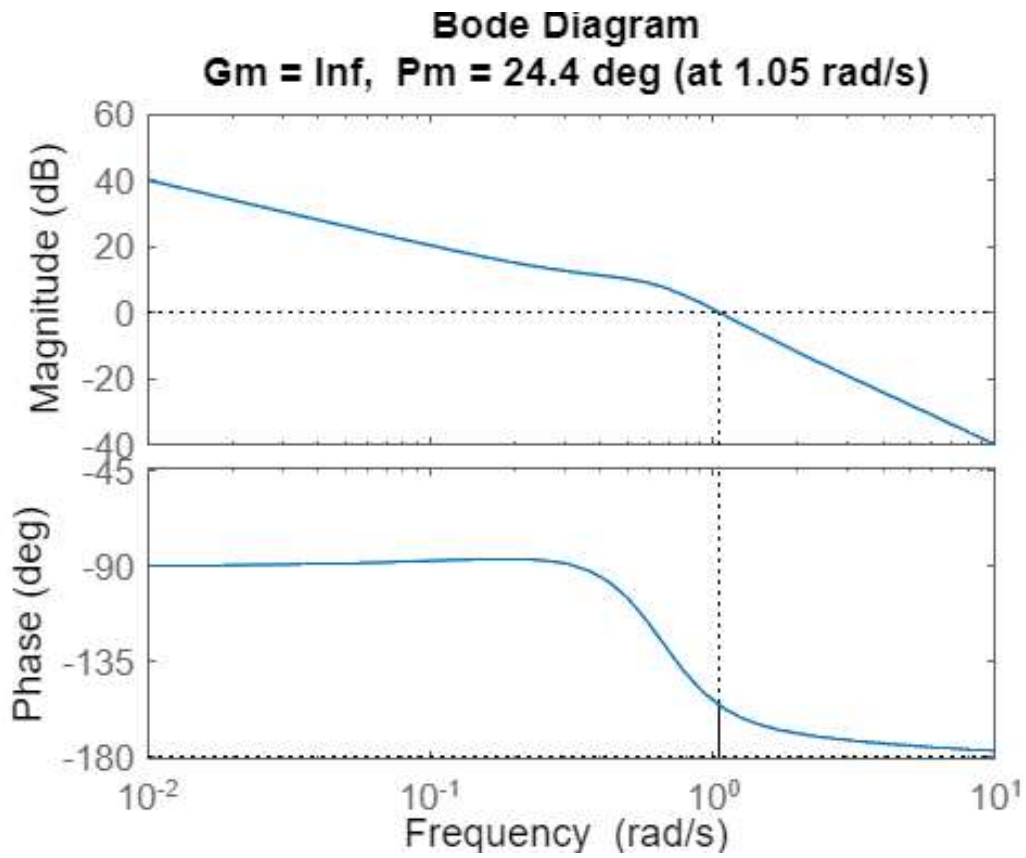

```
zapas_modulu = 5.8400
zapas_fazy = 32.9823
```

```
zapasy(G2, k2, alfa, beta);
```



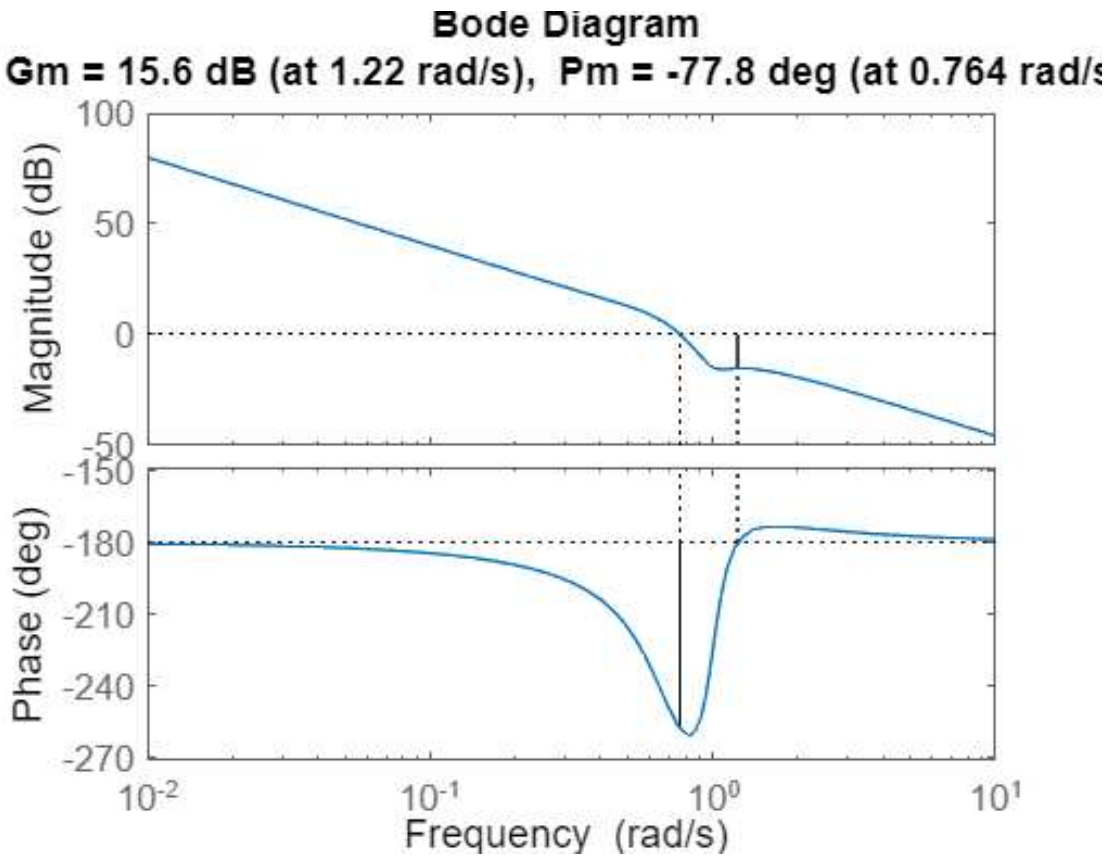

```
zapas_modulu = Inf
zapas_fazy = 42.4687
```

```
zapasy(G3, k3, alfa, beta);
```




```
zapas_modulu = Inf
zapas_fazy = 24.3700
```

```
zapasy(G4, k4, alfa, beta);
```




```
Warning: The closed-loop system is unstable.
zapas_modulu = 6.0000
zapas_fazy = -77.7540
```

```
function [] = zapasy(G, k, alfa, beta)
```

```
    Gr = tf([k], [1]) + tf([0 alfa], [1 0]) + tf([beta 0], [0 1]);
    margin(series(G, Gr))
    [Gm, Pm] = margin(series(G, Gr));
    zapas_modulu = Gm
    zapas_fazy = Pm
end
```

Wnioski

Udało się przeanalizować wpływ parametrów regulatora PID na wartości zapasów stabilności fazy. Wzrost wzmocnienia pogarsza stabilność, wzrost stałej całkowania zazwyczaj pogarsza stabilność, wzrost stałej różniczkowania poprawia stabilność jeśli jest niewielkie, jednak stała równa 1 była zbyt duża.