Computing the controller Hr(s) using the logarithmic diagrams

Compute and declare my transfer function

The transfer function has the following form:

$$H_f(s) = \frac{K_f}{s(T_f s + 1)}$$

Knowing that my values are Kf = 4 and Tf = 8, the function becomes:

$$H_f(s) = \frac{4}{s(8s + 1)}$$

I declare my transfer function in code:

```
Hf = tf(4,[8 1 0])
```

```
Hf =

        4
   ---------
   8 s^2 + s

Continuous-time transfer function.
```

The controllers that will be computed need to satisfy the following specifications:

$\varepsilon_{\text{stp}} = 0$

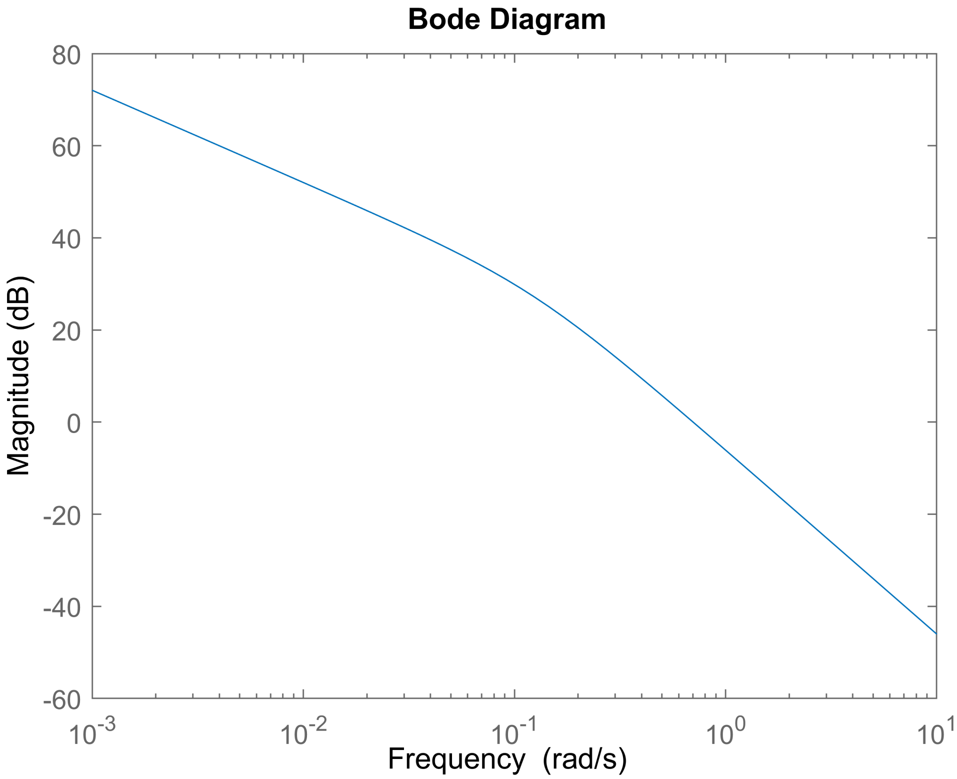
$t_r^* \leq 5 \text{ sec}$

$\sigma^* \leq 10\%$

$c_v \geq 3$

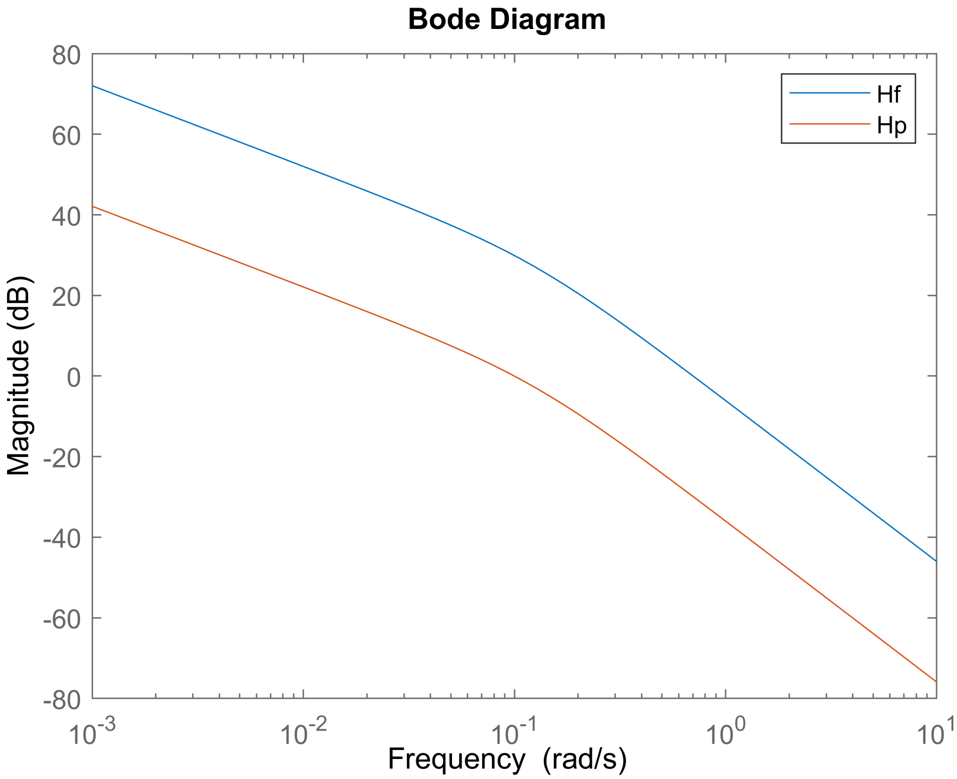
$\Delta w_b^* \leq 15 \frac{\text{rad}}{\text{sec}}$

```
bodemag(Hf)
```



Computing the P controller

```
Wco = 0.7; % cut-off frequency
Wc = 1/8; % corner frequency
o = 0.1; % overshoot
dr = abs(log(o))/sqrt(log(o)^2+pi^2); % damping ratio
A = 1/4/dr^2;
N = 20*log10(A);
F = 27;
Vr = 10^((N-F)/20);
figure;
hold on;
bodemag(Hf)
bodemag(Vr*Hf)
hold off;
legend("Hf","Hp");
```




```
Wco = 0.1;
Wn = 2*dr*Wco;
tr = 4/dr/Wn % settling time
```

```
tr = 57.2305
```

$t_r \leq 5$ "False"

```
Cv = -36 % the velocity coefficient read at w=1
```

```
Cv = -36
```

$c_v \geq 3$ "False"

```
deltaWb = Wco % the bandwidth
```

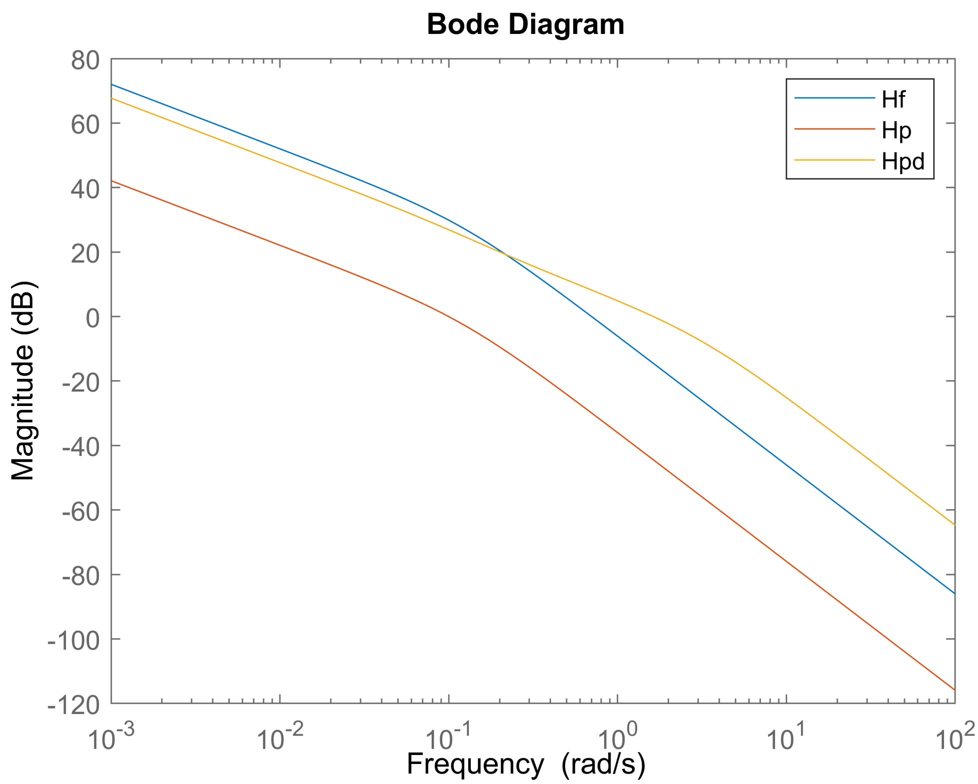
```
deltaWb = 0.1000
```

$\Delta w_b \leq 15$ "True"

Computing the PD controller

```
trstar = 3;
Wco2 = 2/dr^2/trstar;
Wco = 2/dr^2/tr;
Vr2 = Vr*Wco2/Wco;
td = 6;
```

```
Tn = td*trstar/tr;
figure;
hold on;
bodemag(Hf)
bodemag(Vr*Hf)
bodemag(Vr2*Hf*tf([td 1],[Tn 1]))
hold off;
legend("Hf","Hp","Hpd");
```

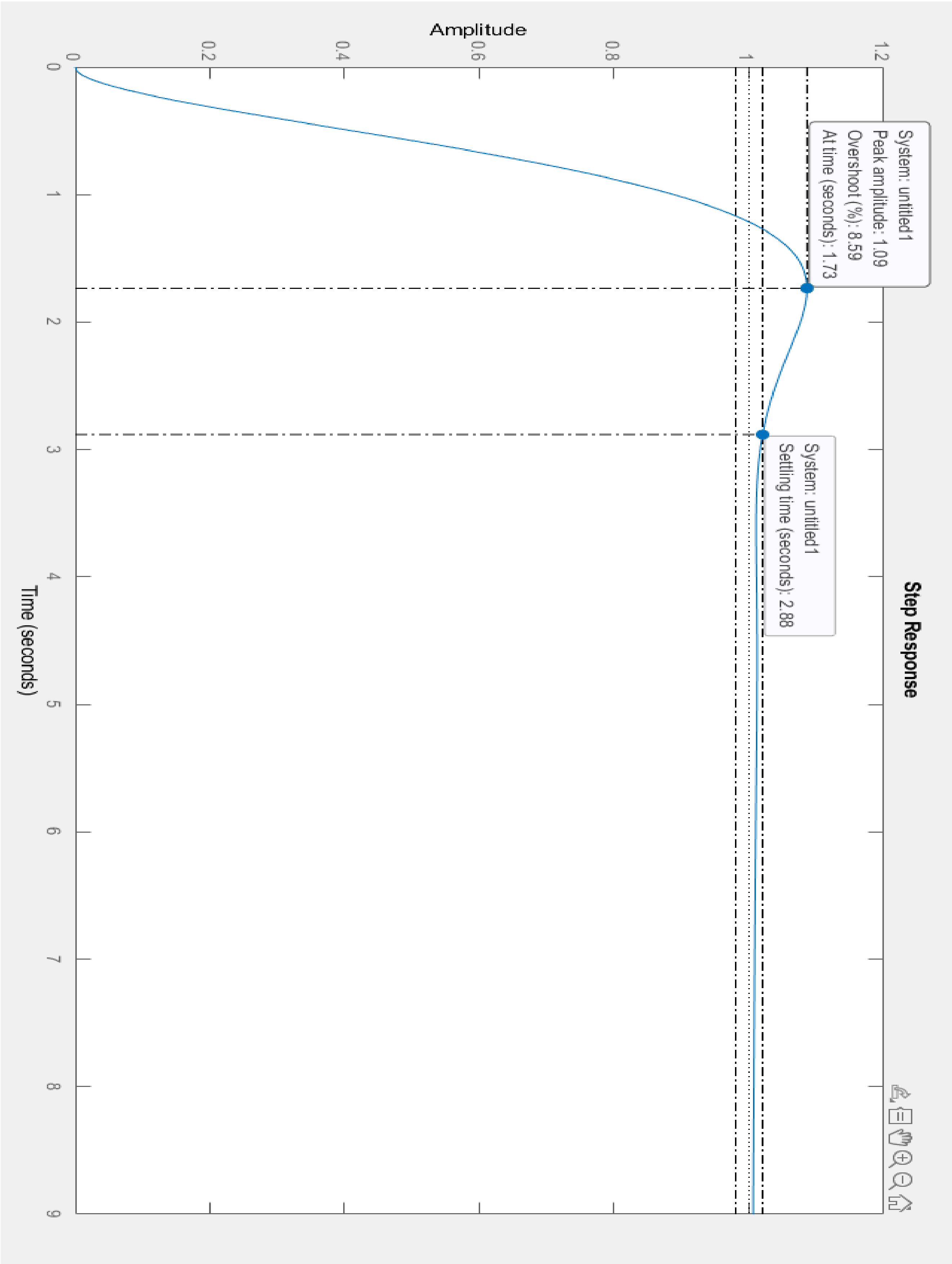



```
cv = 4.8 % the velocity coefficient read at w=1
```

```
cv = 4.8000
```

$c_v \geq 3$ "True"

```
figure;
% step(feedback(Vr2*Hf*tf([td 1],[Tn 1]),1))
```


Step Response
System: untitled1
Peak amplitude: 1.09
Overshoot (%): 8.59
At time (seconds): 1.73
System: untitled1
Settling time (seconds): 2.88
Amplitude
Time (seconds)
0
0.2
0.4
0.6
0.8
1
1.2
0
1
2
3
4
5
6
7
8
9