

Versuch 3

```

%diary('Versuch3_diary');
%%           Aufgabe 4.1.1           %%
%%           Gm und Gy              %%

%% Motorüfkt Gmot
Km=10, Tm1=0.02, Tm2=2;

Km =

    10

Tm1 =

    0.0200

Zm=[Km];
N1m=[Tm1 1];
N2m=[Tm2 1];
Nm=conv([N1m], [N2m]);
Gmot=tf(Zm,Nm);
%Gm=zpk(Gm);
%% Stellglied y
Ky=4, Ty=0.08;

Ky =

     4

Gy=tf(Ky,[Ty 1]);

%%           Aufgabe 4.1.2           %%
%%           Gs, Step von Gs        %%

Gs=Gy*Gmot;
%Gs=zpk(Gs);
figure('name','Step Gs');
step(Gs);
legend('Gs');
grid on;

%%           Aufgabe 4.1.3           %%
%%           Bode von Gmot,Gy,Gs    %%

figure('name','Bode Gmot, Gy, Gs');
bode(Gmot,Gy,Gs);
legend('Gmot','Gy','Gs');

%%           Aufgabe 4.1.3           %%
%%           Pole und Nullst. von Gs %%

%Gspolnul=zpk(Gs)
PGs=pole(Gs)

PGs =

   -50.0000

```

-12.5000
-0.5000

NGs=tzero(Gs)

NGs =

Empty matrix: 0-by-1

```
%%           Aufgabe 4.2.1           %%
%%           P,PI,PID-Regler         %%

%%           P-Regler
```

```
Kr_P=1;
Gr_P=Kr_P;
Go_P=Gr_P*Gs
```

Transfer function:
40

0.0032 s^3 + 0.2016 s^2 + 2.1 s + 1

```
%%           PI-Regler
```

```
Kr_PI=1;
Tn=2;
Gr_PI=Kr_PI*tf([Tn 1],[Tn 0]);
Go_PI=Gr_PI*Gs
```

Transfer function:
80 s + 40

0.0064 s^4 + 0.4032 s^3 + 4.2 s^2 + 2 s

```
%%           PID-Regler
```

```
Kr_PID=1;
Tr1=0.08, Tr2=2;
```

Tr1 =

0.0800

```
T=0.004;
num=conv([Tr1 1],[Tr2 1]);
den=conv([1 0],[T 1]);
Gr_PID=Kr_PID*tf(num,den);
Go_PID=Gr_PID*Gs
```

Transfer function:
6.4 s^2 + 83.2 s + 40

1.28e-005 s^5 + 0.004006 s^4 + 0.21 s^3 + 2.104 s^2 + s

```
%%           Aufgabe 4.3.1           %%
%% Bode von Grp*Gs, Grpi*Gs, Grpid*Gs  %%
```

```
figure('name','Bode von Go_P, Go_PI, Go_PID');
```

```
bode(Go_P, Go_PI, Go_PID);
legend('Go_P      mit Kr_P=1', 'Go_P_I      mit Kr_P_I=1', 'Go_P_I_D      mit
Kr_P_I_D=1');
```

```
%%          Aufgabe 4.3.2          %%
```

```
%%  Nyquist von Grp*Gs, Grpi*Gs, Grpid*Gs  %%
```

```
figure('name','Nyquist von Go_P, Go_PI, Go_PID');
nyquist(Go_P, Go_PI, Go_PID, {1 50});
legend('Go_P      mit Kr_P=1', 'Go_P_I      mit Kr_P_I=1', 'Go_P_I_D      mit
Kr_P_I_D=1');
axis([-2.5 0.5 -8 8]);
```

```
%%          Aufgabe 4.4          %%
```

```
%%          Wurzelortskurven          %%
```

```
figure('name','Wurzelortskurve von Go_P, Go_PI, Go_PID');
Subplot(2,2,1), rlocus(Go_P,'b'), legend('Go_P      mit Kr_P=1',2), axis([-
60 10 -50 50]);
Subplot(2,2,2), rlocus(Go_PI,'g'), legend('Go_P_I      mit Kr_P_I=1',2),
axis([-60 10 -50 50]);
Subplot(2,2,3), rlocus(Go_PID,'r'), legend('Go_P_I_D      mit Kr_P_I_D=1',2),
axis([-60 10 -50 50]);
```

```
%%          Aufgabe 4.5          %%
```

```
%%          Reglerentwürfe          %%
```

```
%%          P-Regler          %%
```

```
[a,p,w]=bode(Go_P);
[Gm_P,Pm_P,wa_P,wp_P]=margin(a,p-60,w)
```

```
Gm_P =
0.3637
```

```
Pm_P =
-29.3290
```

```
wa_P =
6.3831
```

```
wp_P =
13.2299
```

```
%%          PI-Regler          %%
```

```
[a,p,w]=bode(Go_PI);
[Gm_PI,Pm_PI,wa_PI,wp_PI]=margin(a,p-60,w)
```

```
Gm_PI =
```

0.3008

Pm_PI =

-31.5243

wa_PI =

5.4688

wp_PI =

13.2362

%% PID-Regler %%

```
[a,p,w]=bode(Go_PID);
[Gm_PID,Pm_PID,wa_PID,wp_PID]=margin(a,p-60,w)
```

Gm_PID =

0.6331

Pm_PID =

-11.0795

wa_PID =

22.8618

wp_PID =

32.9744

%% Regelstrecken mit neuem Kr %%

```
Go_P=Gm_P*Go_P;
Go_PI=Gm_PI*Go_PI;
Go_PID=Gm_PID*Go_PID;
```

%% Aufgabe 4.6.1 %%

%% Führungs-Übertragungsfunktion %%

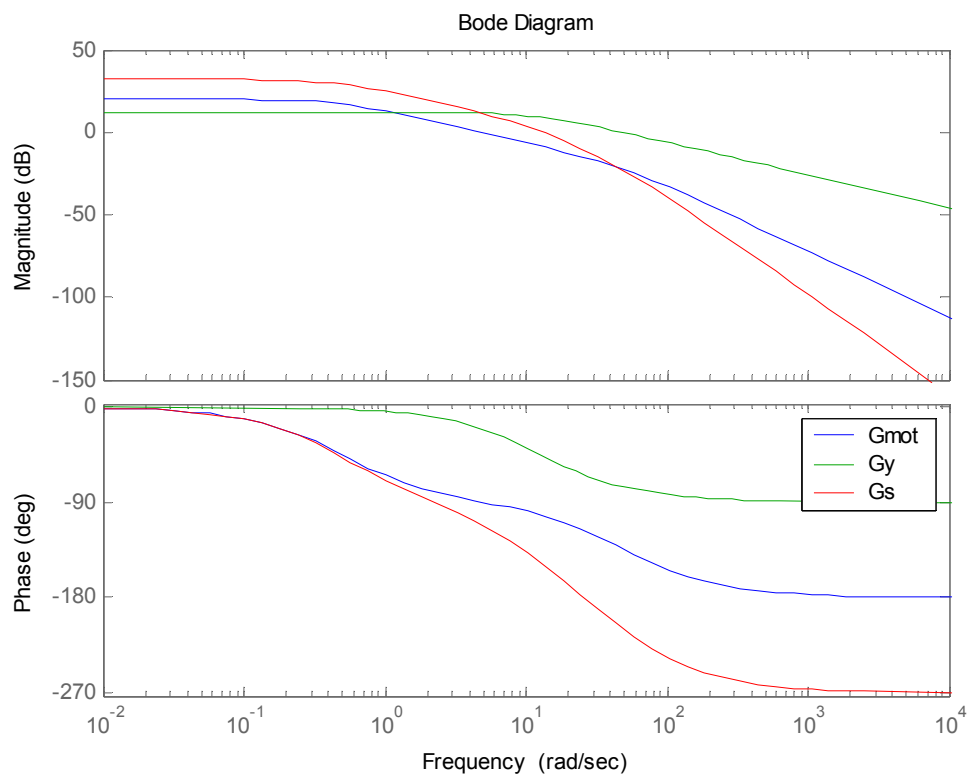
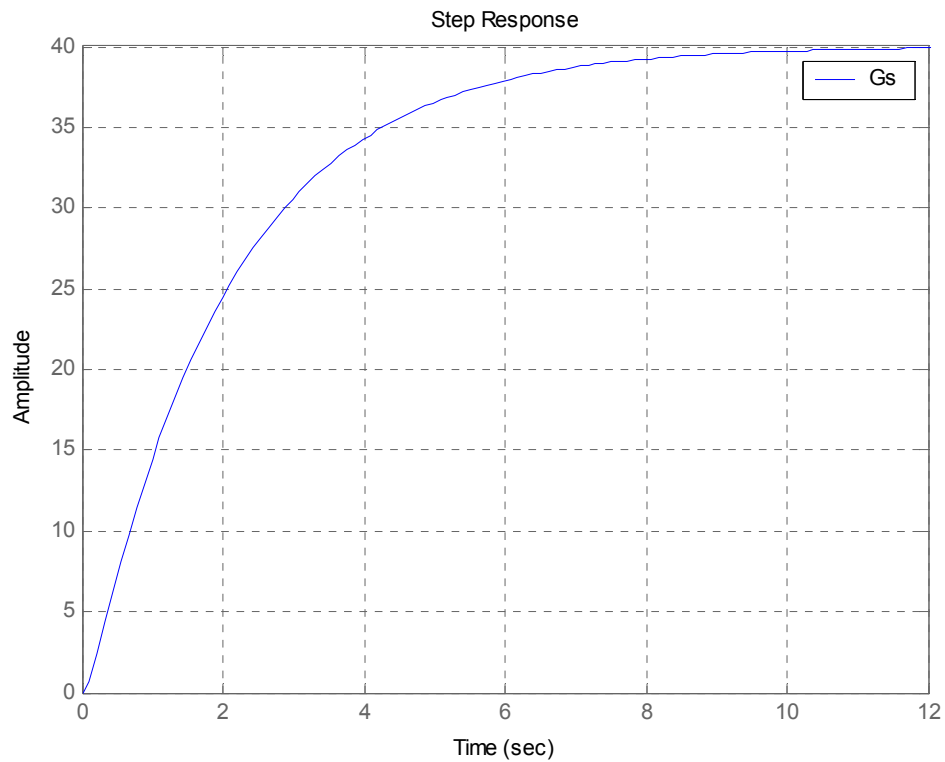
```
Gw_P=feedback(Go_P,1);
Gw_PI=feedback(Go_PI,1);
Gw_PID=feedback(Go_PID,1);
```

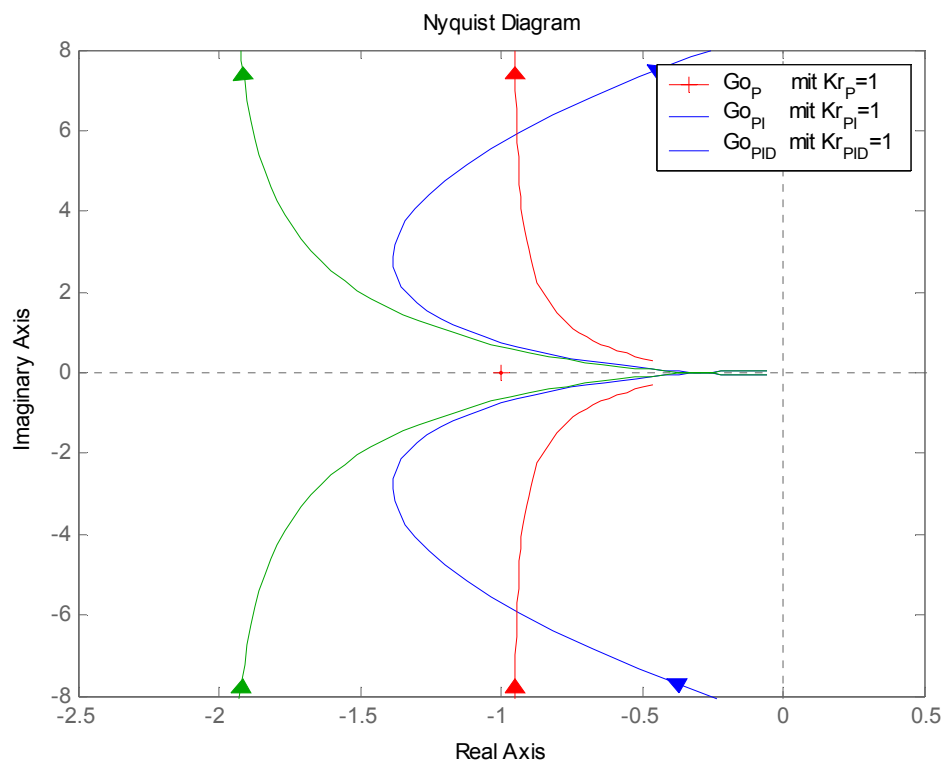
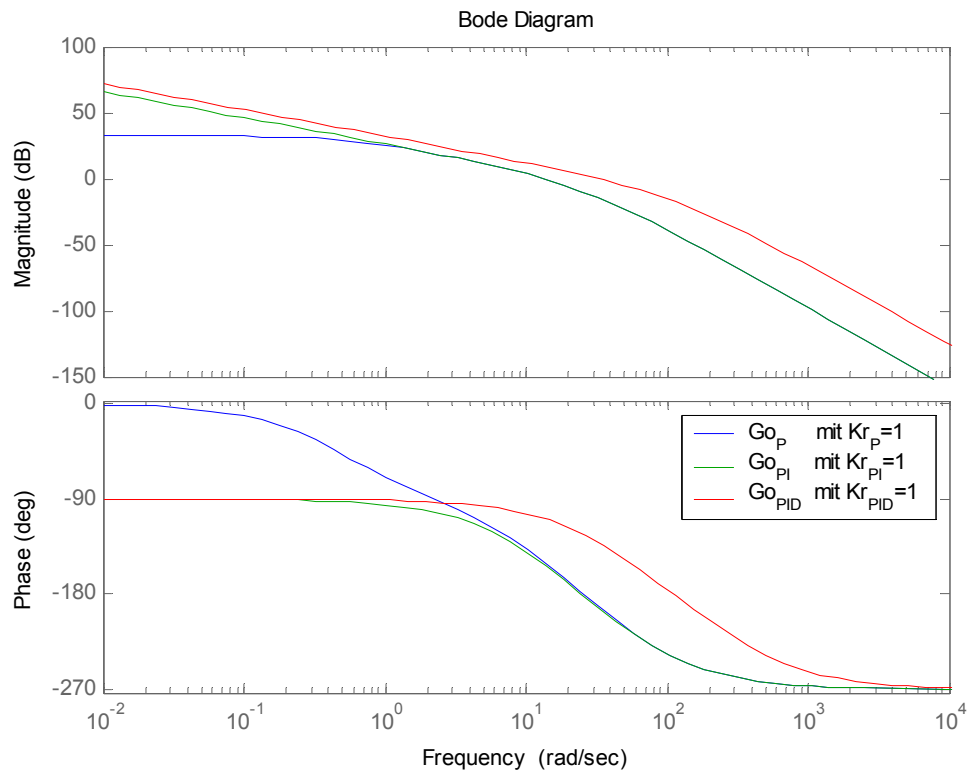
%% Aufgabe 4.6.2 %%

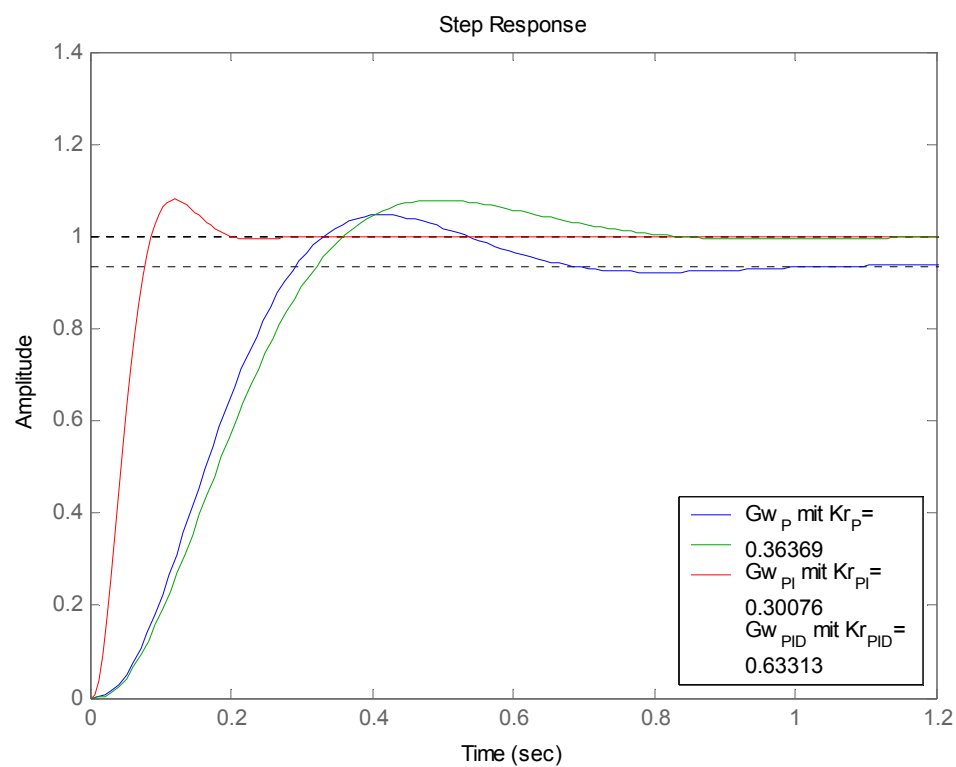
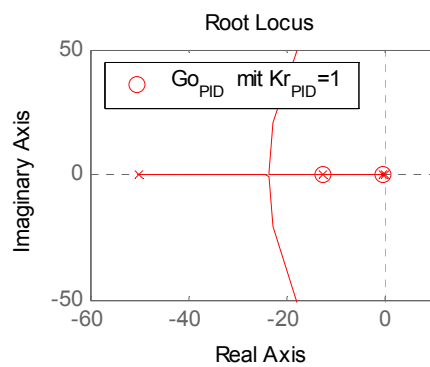
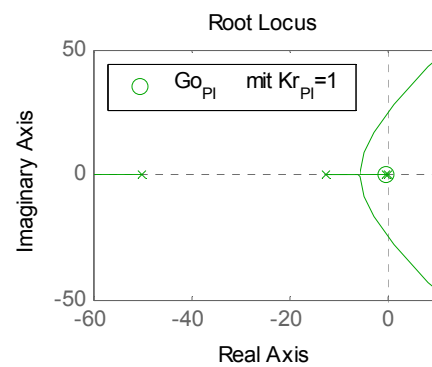
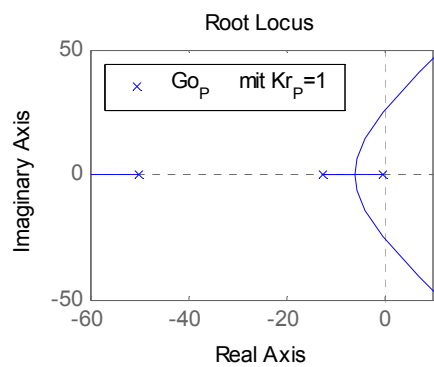
%% Sprungantwort %%

```
figure('name','Step von Gw_P, Gw_PI, Gw_PID');
step(Gw_P, Gw_PI, Gw_PID);
```

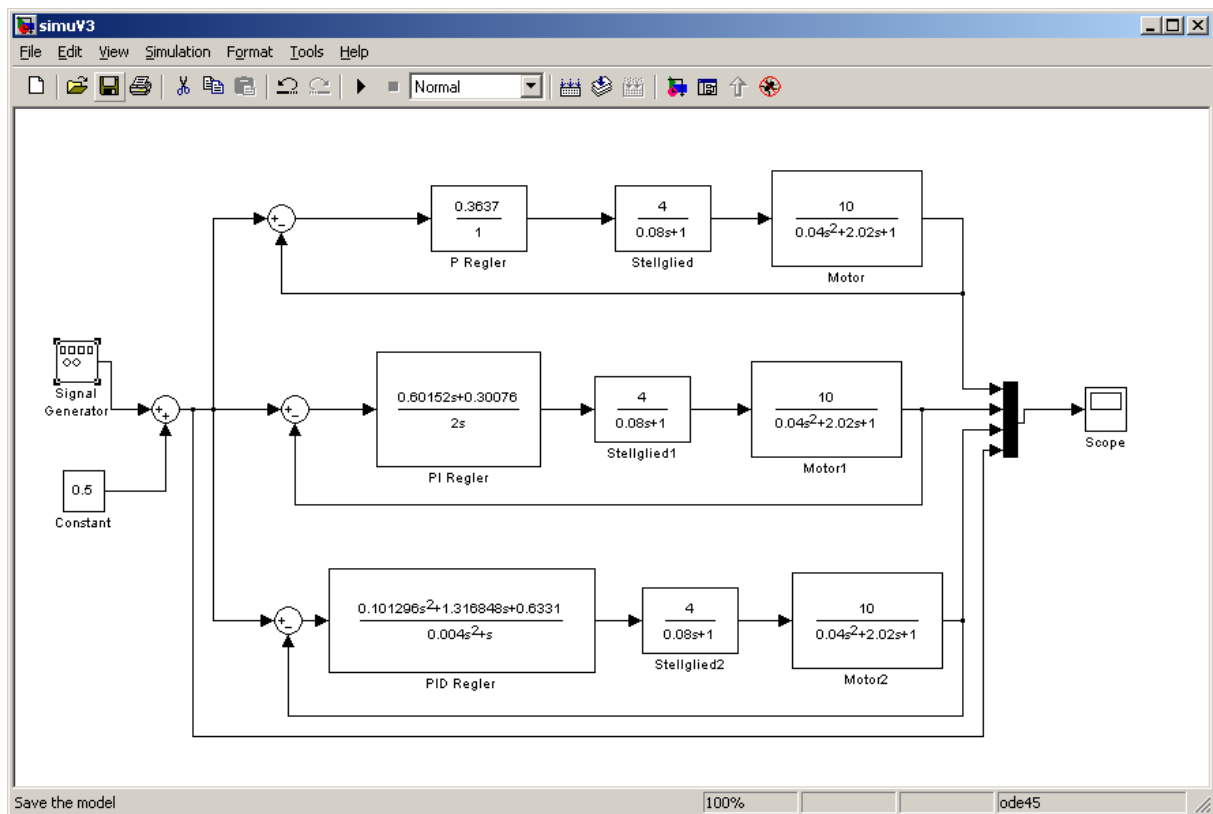
```
legend('Gw_P mit Kr_P=',num2str(Gm_P),'Gw_P_I mit  
Kr_P_I=',num2str(Gm_PI),'Gw_P_I_D mit Kr_P_I_D=',num2str(Gm_PID),4);  
>>
```





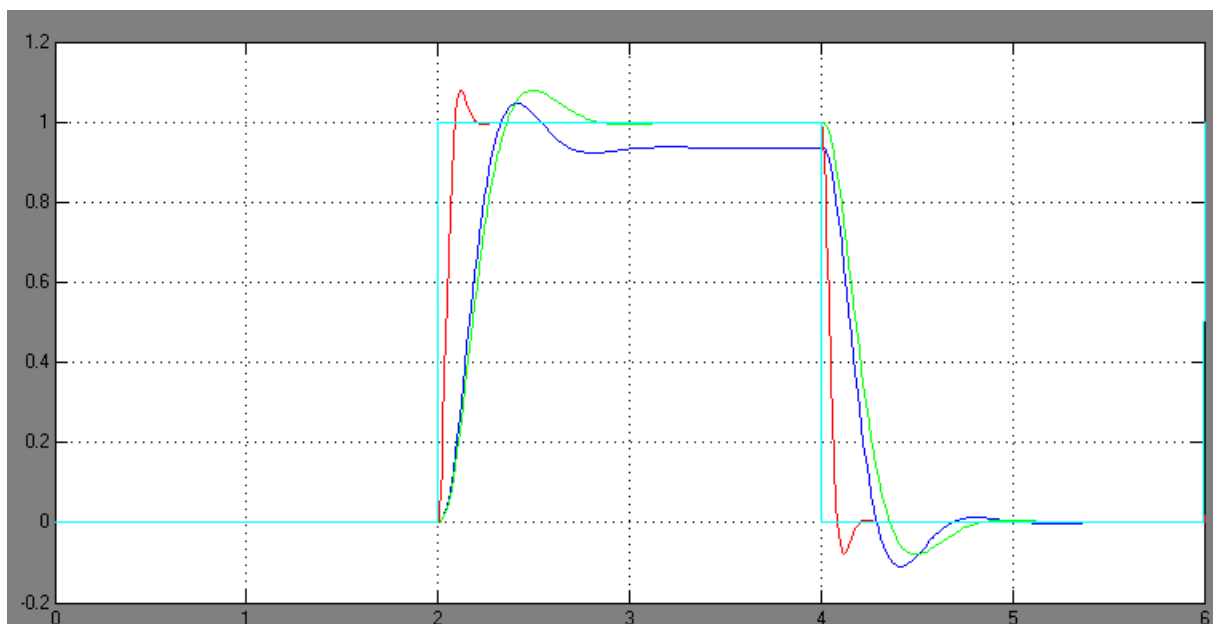


Aufgabe 4.7.1

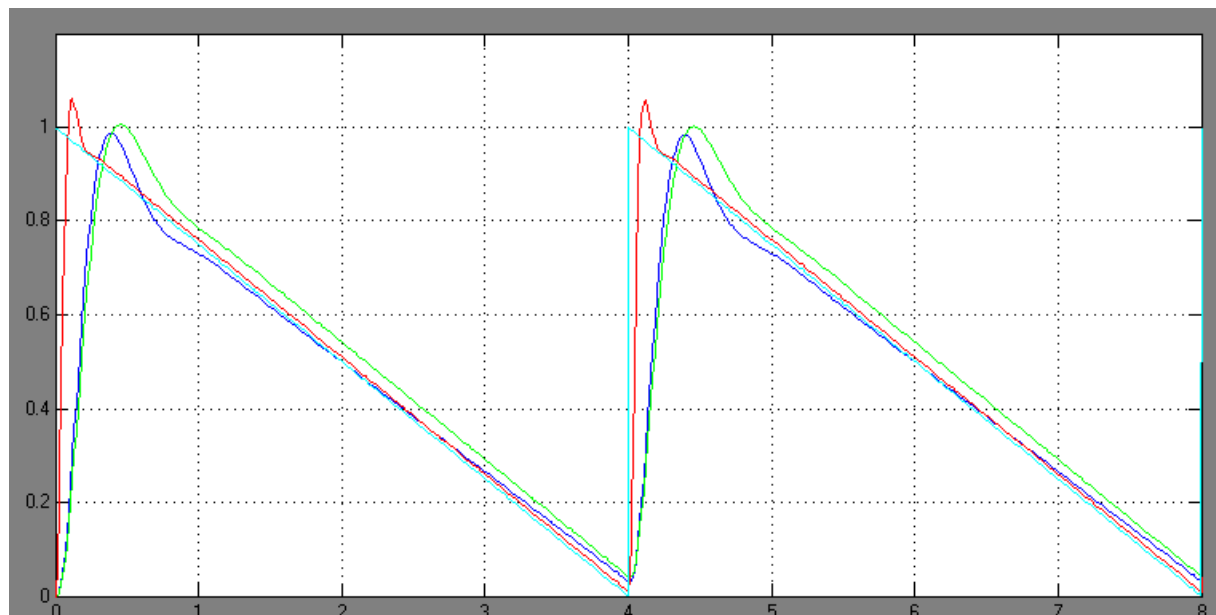


Aufgabe 4.7.2

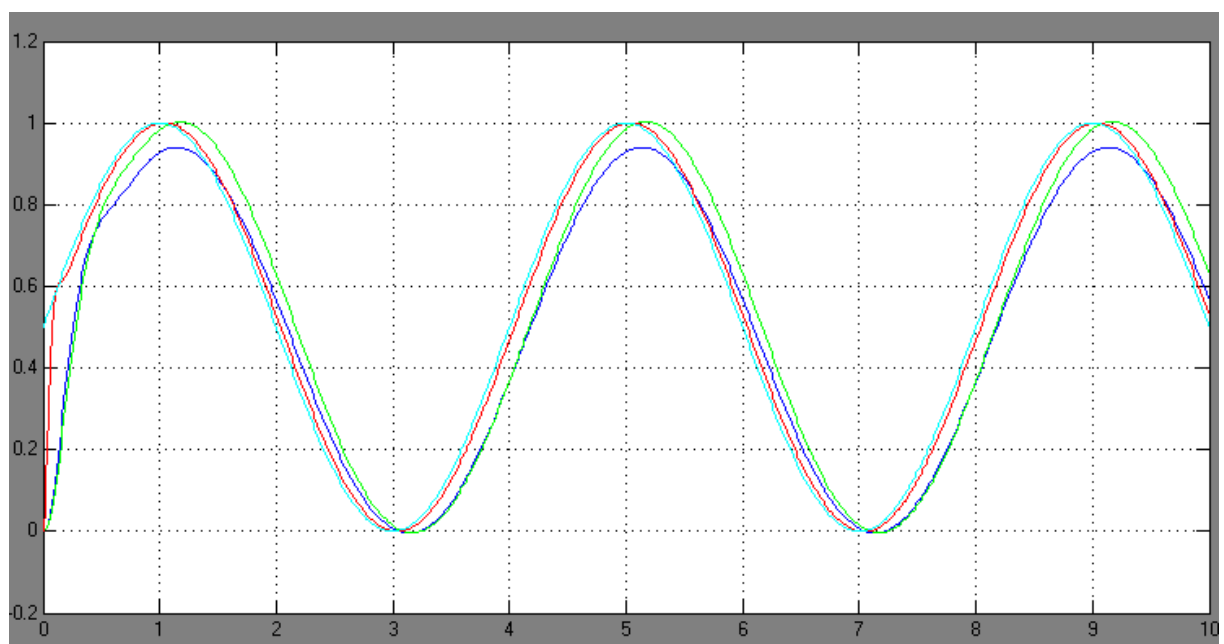
Rechteck (Sprung) als Führungsgröße (rot=PID-Regler, blau=P-Regler, grün=PI-Regler)



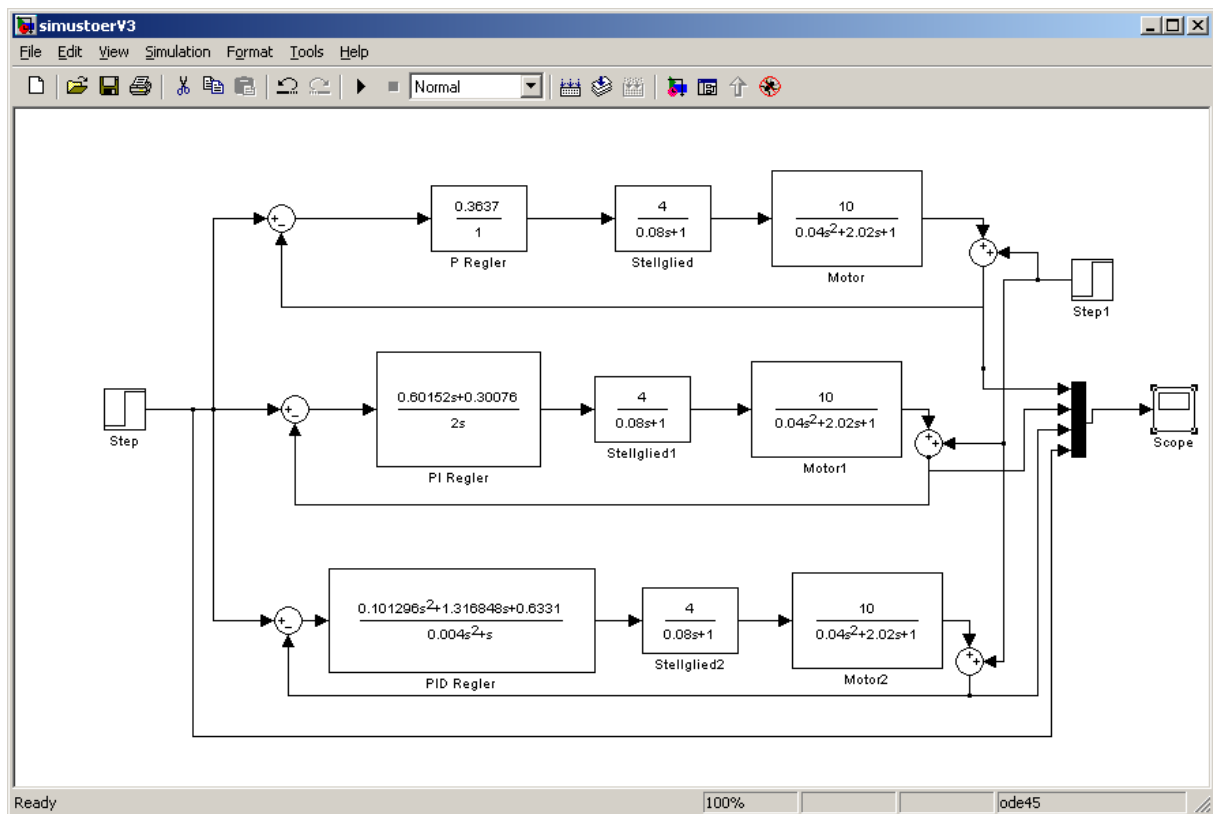
Rampe als Führungsgröße



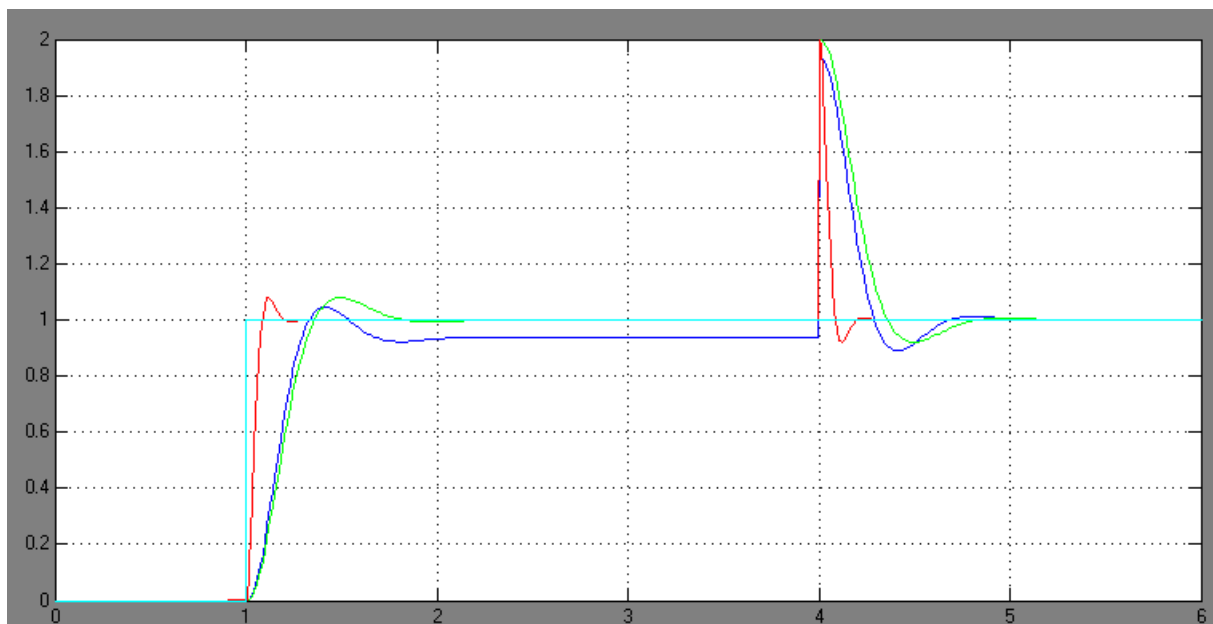
Sinus als Führungsgröße



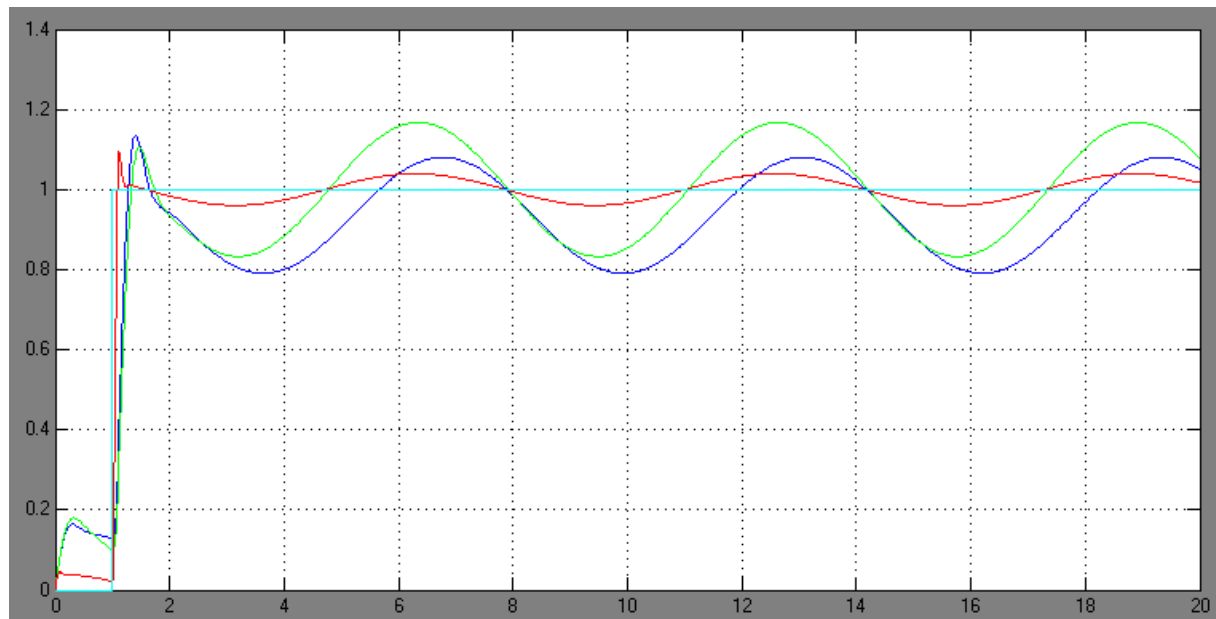
Aufgabe 4.7.3



Störsprung Amplitude 1 nach 4 sec



Sinusstörung (Ampl=1, 1rad/s, bias=0)



→ PID-Regler regelt Sinusstörung am Besten aus