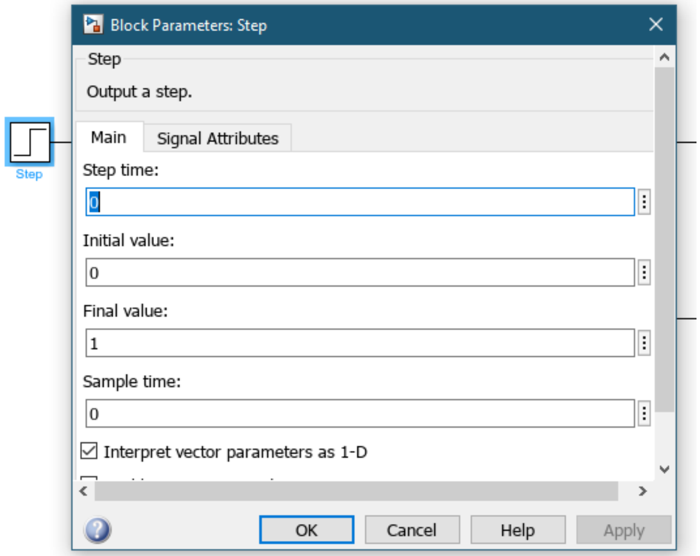
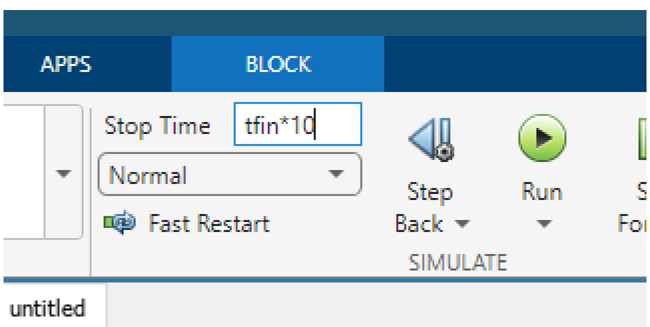
Laboratory 9

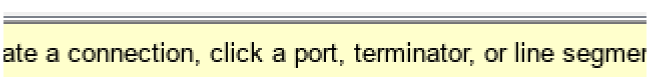


We set the Step Time to zero instead of using the default value of 1 second (which is a huge delay for the rapid systems)

From lab6 (stability analysis using simplifie Nyquist) for a time delay (td=0.015, the closed loop system result stable for k in (0, 0.123))

```
k = 0.1233;
td = 0.015;
```

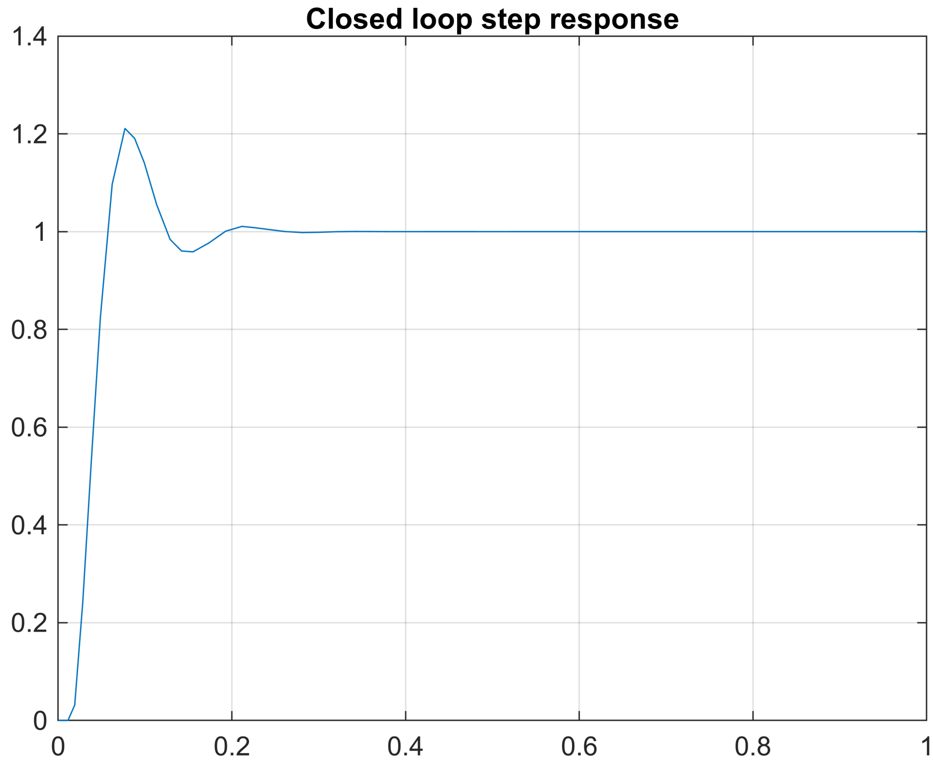




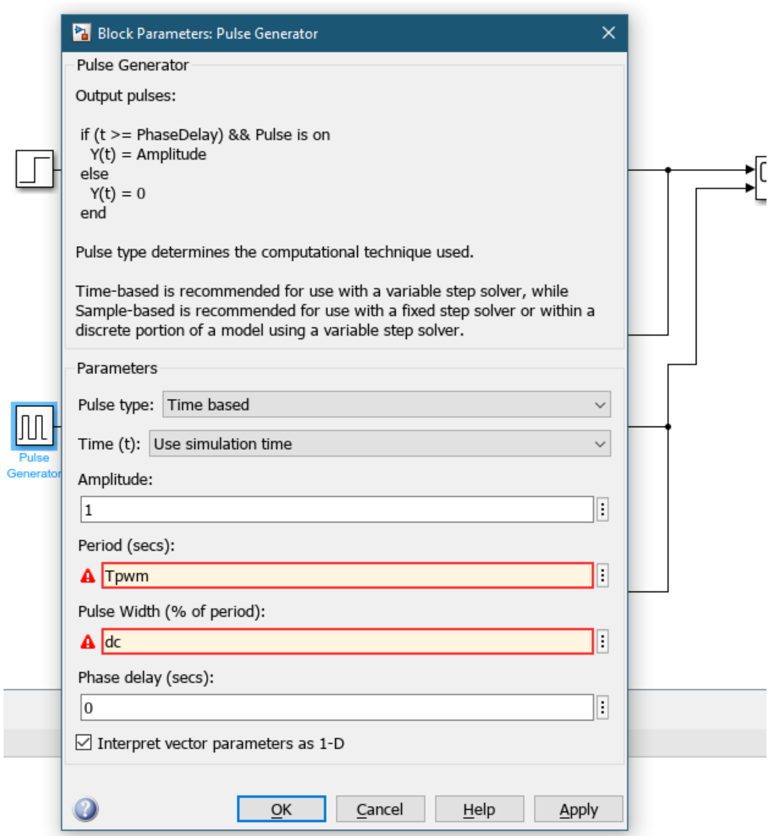

```
tfin = 1/135*4;
```

```
k=0.05; %the overshoot from lab 8, sigma=20%
tfin = 1; % reduce the stop time
sim('l9_s1'); %run the simulink model
t = ans.tout;
```

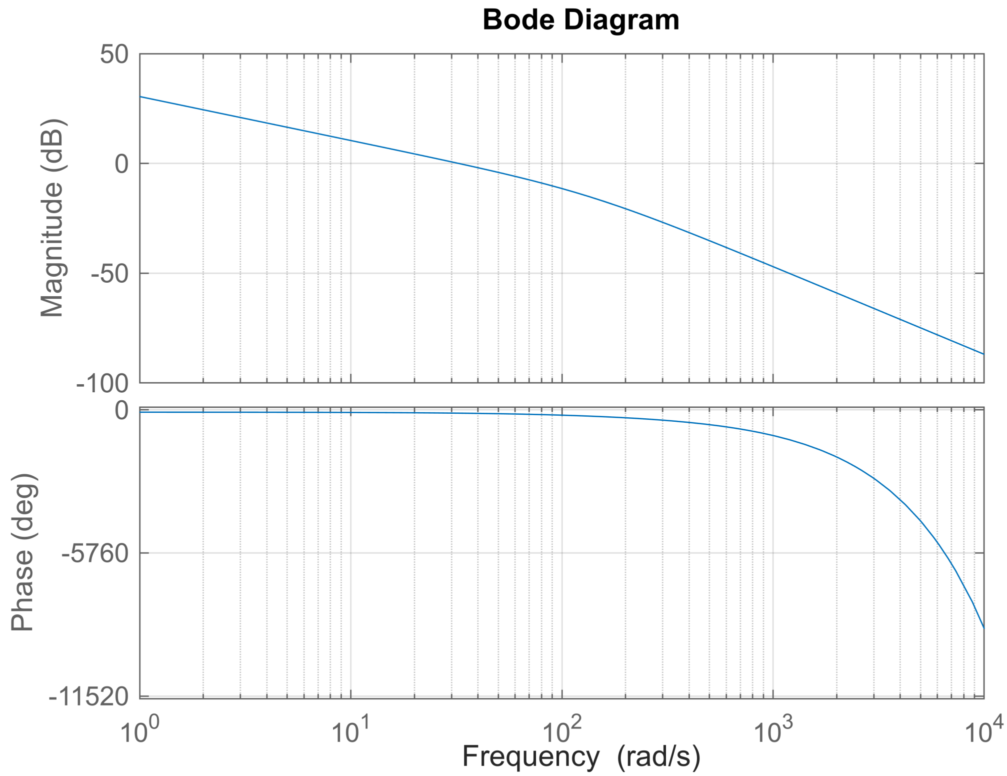
```
y = ans.data.signals.values;
plot(t,y); title('Closed loop step response'); shg; grid
```



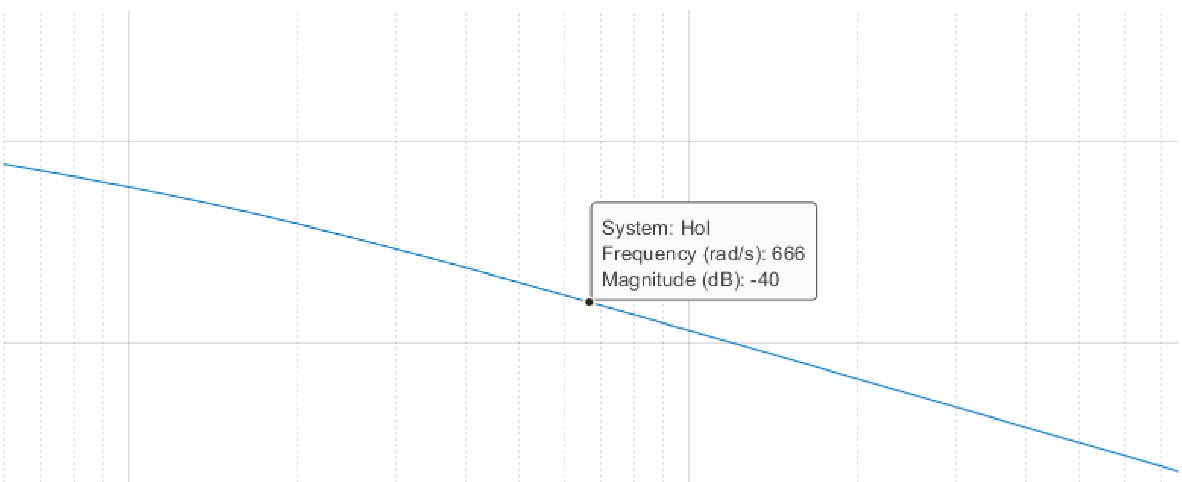

```
% Replace the step reference signal by a PWM signal
% Pulse width modulated signal
```




```
Hol = tf(k*9e4,[1 135 0],'iodelay',td);
bode(Hol);grid
```




```
%we will read the frequency for an attenuation of -40dB
```




```
w_40 = 666;
Tpwm = 1/w_40; % the period (in seconds) for the PWM reference
dc =  50; % the duty cycle instead of Pulse Width in percetentage
% setting up a new sampling period for simulation
Ts = Tpwm/10;
sim("l9_s1.slx");
t = ans.tout;
ya = ans.data.signals(1).values;
ypwm = ans.data.signals(2).values;
plot(t,ya,t,ypwm); title('Closed loop step response'); shg; grid;
```

```
legend('unit step reference','pwm reference, DC = 50%');
```