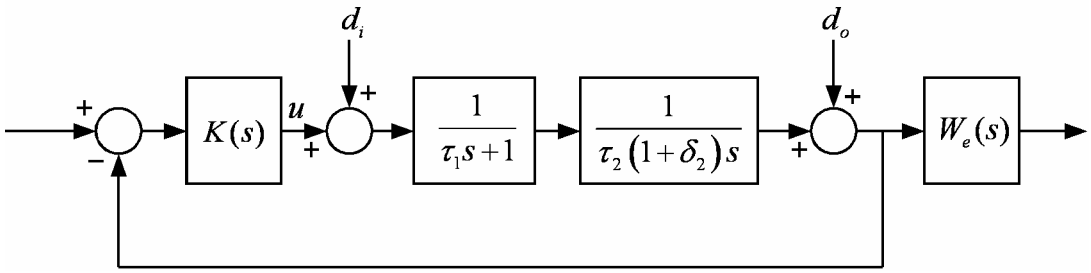
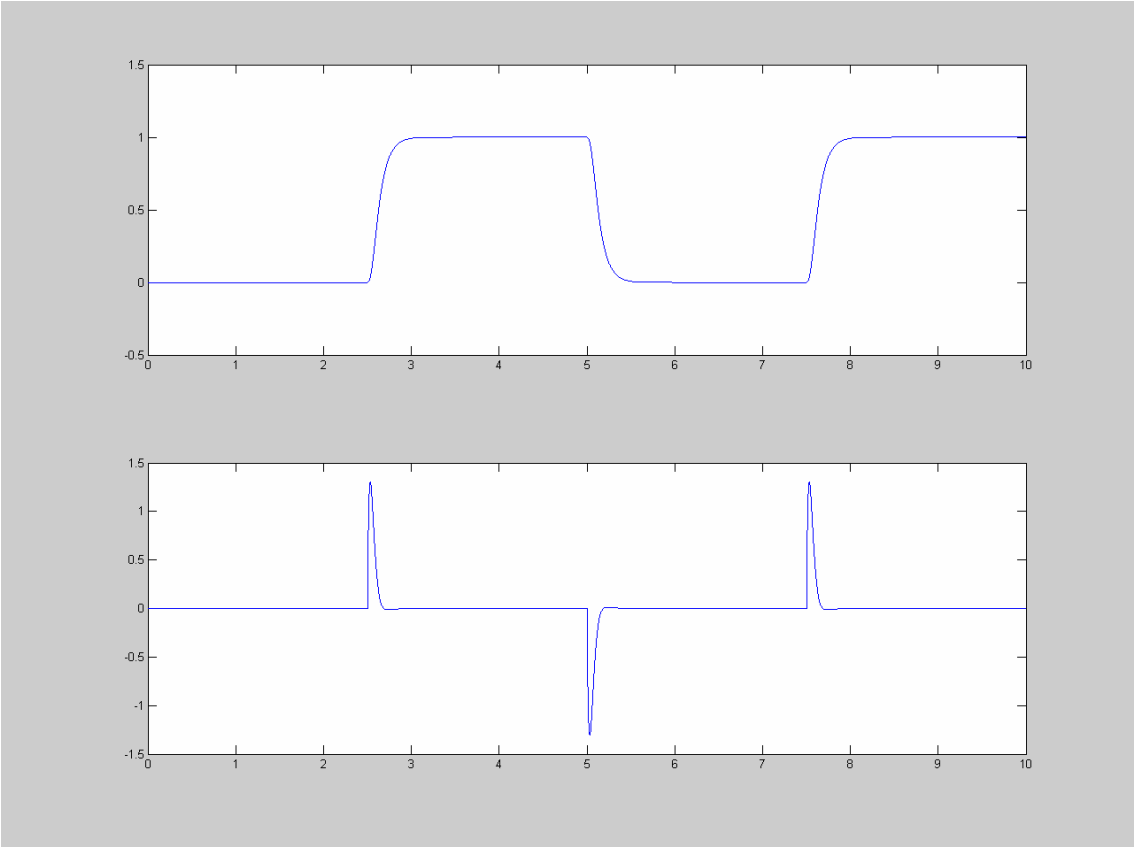
LQG Control Example



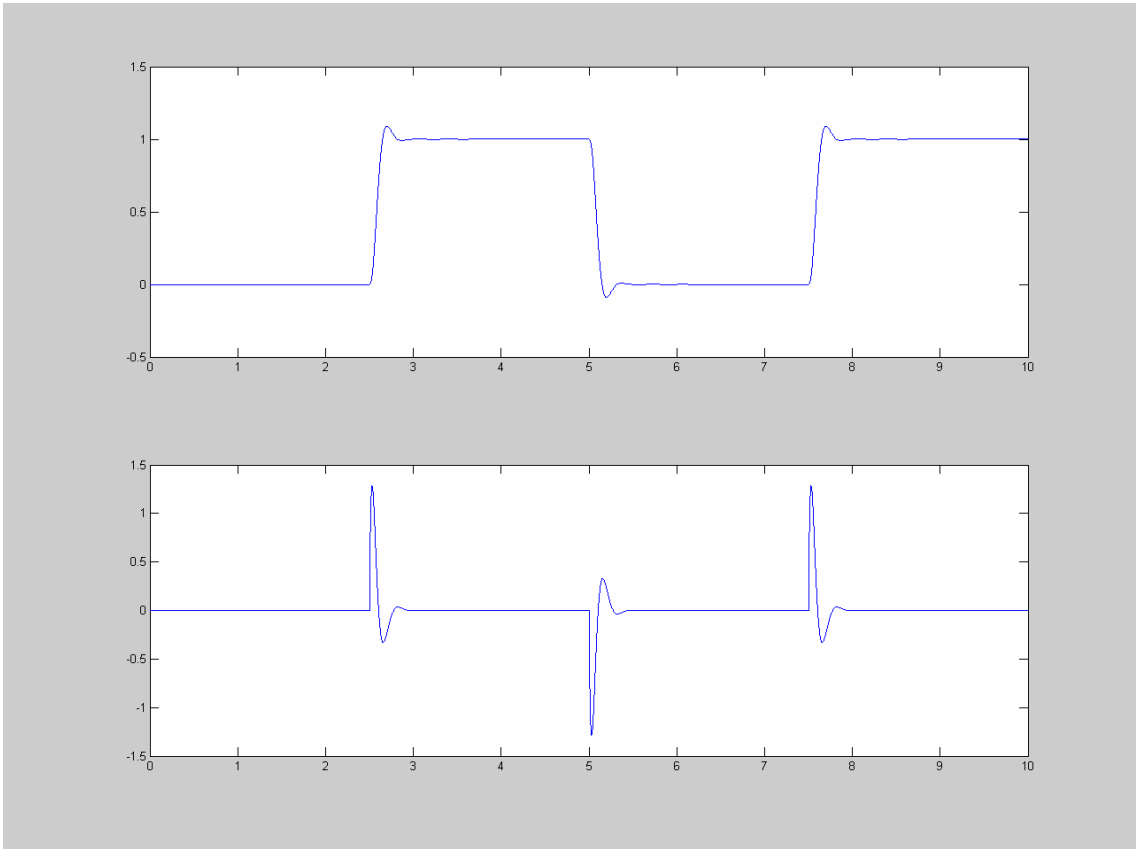

```
% LQG control example for Robust Control Course
% model uncertainty
% limdj 2004.5.22
clear;

delta1=-0.;
delta2=-0.5;
tau1=0.1*(1+delta1);
tau2=0.1*(1+delta2);
a0=[0 1/tau2;0 -1/tau1]
b0=[0;1/tau1]
c0=[1 0]
d0=0

a=[0    10;0 -10]
b=[0;10]
c=[1 0]
d=0

q=[100 0;0 10];r=1;
k=lqr(a,b,q,r);
l=lqr(a',c',q,r)'

K=pck(a-b*k-l*c,l,k,0);
P=pck(a0,b0,c0,d0);
KP=mmult(K,P);
[akp,bkp,ckp,dkp]=unpck(KP);
[gm,pm]=margin(ss(akp,bkp,ckp,dkp))

% closed-loop system %
systemnames = 'P K';
inputvar = '[ref]';
outputvar = '[P;K]';
input_to_P = '[K]';
input_to_K = '[ ref-P ]';

sysoutname = 'KG';
cleanupsysic = 'yes';
sysic;

[acl,bcl,ccl,dcl]=unpck(KG);
h=ss(acl,bcl,ccl,dcl);
zpk(h)

t = 0:0.001:10;                    % vector of time samples
ref = (rem(t,5)>=2.5)*1;     % square wave values
[ys ts xs]=lsim(h,ref,t,[0;0;0;0]);
```

```
% plot states
subplot(2,1,1);
plot(ts,ys(:,1),'-');
axis([0 10 -0.5 1.5])

%plot control
subplot(2,1,2)
plot(ts,ys(:,2),'-');
```

$$Q = \begin{bmatrix} 100 & 0 \\ 0 & 10 \end{bmatrix}, \delta_2 = 0.0$$



$$Q = \begin{bmatrix} 100 & 0 \\ 0 & 10 \end{bmatrix}, \delta_2 = -0.5$$



$$Q = \begin{bmatrix} 100 & 0 \\ 0 & 10 \end{bmatrix}, \delta_2 = -0.875$$