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```
clear all;
```

parameters

```
m=0.15;
Mc=0.4;
l=0.2;
g=9.81;
```

matrices

```
Aa=[0,0,1,0;0,0,0,1;0,-m*g/Mc,0,0;0,g*(Mc+m)/(l*Mc),0,0];
Ba=[0;0;1/Mc;-1/(l*Mc)];
Ca=eye(4);
Da=zeros(4,1);
```

continuous-time state-space model

```
sysc=ss(Aa,Ba,Ca,Da);
```

discrete-time state-space model

```
T_s=0.03;
sysdzoh=c2d(sysc,T_s,'zoh');
```

eigenvalues

```
Pa_c=[-3,-4,-5,-6];
Pa_d= exp(T_s*Pa_c);
```

controllability

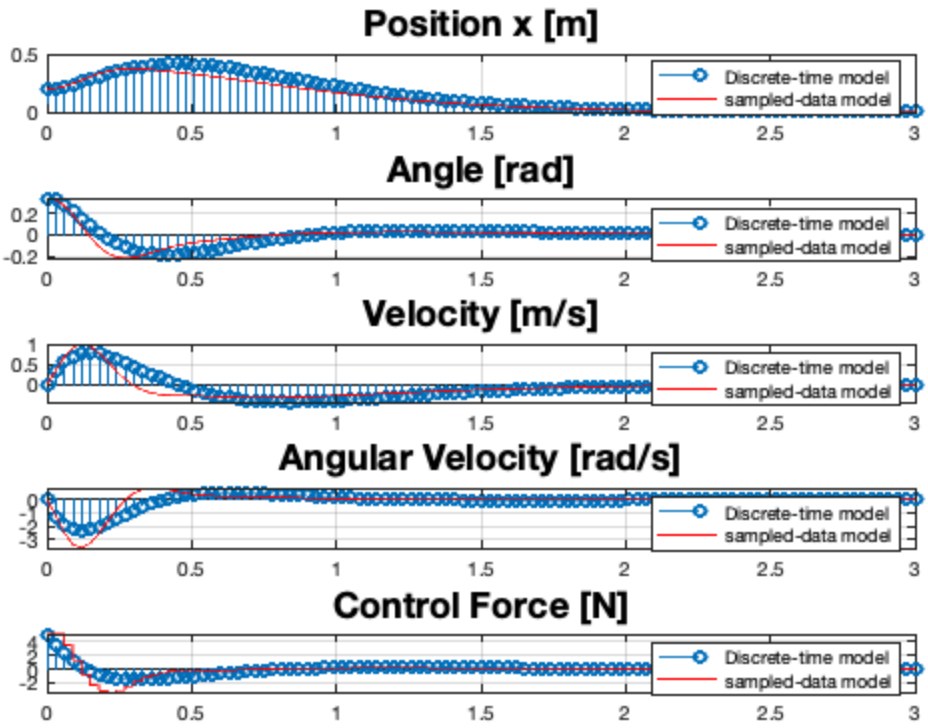
```
K_da = place(sysdzoh.A,sysdzoh.B,Pa_d);
K_a=K_da;
```

simulation

```
x10=0.2; %initial condition position
x20=deg2rad(20); %initial condition angle
x30=0; %initial condition velocity
x40=0; %initial condition angular velocity¸ç
sim('CP_DTSFC_Lin_a_MainFile_9558292') % Discrete-time model
sim('CP_SD_SFC_Lin_a_n9558292' )%Sampled-data model
```

plot

```
figure
subplot(5,1,1)
stem(tda,x1da)
hold on
plot(ta,x1a,'r')
legend('Discrete-time model','sampled-data model')
title('Position x [m]','FontSize',18)
grid on
subplot(5,1,2)
stem(tda,x2da)
hold on
plot(ta,x2a,'r')
legend('Discrete-time model','sampled-data model')
title('Angle [rad]','FontSize',18)
grid on
subplot(5,1,3)
stem(tda,x3da)
hold on
plot(ta,x3a,'r')
legend('Discrete-time model','sampled-data model')
title('Velocity [m/s]','FontSize',18)
grid on
subplot(5,1,4)
stem(tda,x4da)
hold on
plot(ta,x4a,'r')
legend('Discrete-time model','sampled-data model')
title('Angular Velocity [rad/s]','FontSize',18)
grid on
subplot(5,1,5)
stem(tda,Fda)
hold on
plot(ta,Fa,'r')
legend('Discrete-time model','sampled-data model')
title('Control Force [N]','FontSize',18)
grid on
```



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