**function [Kx, Kr] = ObtainCartFeedback(m1,m2,R, Ts, MOS)**

**% m1 = 1; m2 = 4; R = 1;**

**[A,B] = linearizedCartPend(m1,m2,R) %#ok<NOPRT>**

**sig = getSigForTs(Ts);**

**[zeta, th, w] = getForOS(MOS,sig); %#ok<ASGLU>**

**dom\_poles = [sig+1j\*w, sig-1j\*w];**

**des\_poles = [dom\_poles, 5\*sig, 5\*sig-1] %#ok<NOPRT>**

**C1 = [1 0 0 0]; % Position of cart**

**C2 = [0 1 0 0]; % Angle of bar**

**C = C1;**

**% olPoles = flip(eig(A));**

**[Kx,Kr] = placePoles(A,B,C,des\_poles) %#ok<NOPRT>**

**G1 = ss(A-B\*Kx, B\*Kr, C1, 0);**

**G2 = ss(A-B\*Kx, B\*Kr, C2, 0);**

**G = G1;**

**U = ss(A-B\*Kx, B\*Kr, -Kx, Kr);**

**step(G);**

**hold on;**

**step(G2);**

**step(U);**

**legend('x(t)','\theta(t)','F(t)');**

**xlabel('Time (s)'); title('Linearized System Model: Step Response');**

**hold off;**

**end**

**% Cart and Pendulum**

**% EC 463 Lecture 7**

**% main calling routine**

**X = zeros(4,1);**

**dX = zeros(4,1);**

**Ref = 1;**

**dt = 0.01;**

**t = 0;**

**m1 = 1;**

**m2 = 4;**

**R = 1;**

**Ts = 8; MOS = 0.05;**

**[Kx, Kr] = ObtainCartFeedback(m1,m2,R,Ts,MOS);**

**% Kx = [-1.0714, -78.5964, -2.5230, -12.5230];**

**% Kr = -1.0714;**

**pause;**

**U = 0;**

**y = [];**

**dim = [0.3 0.6 0.2 0.15];**

**an = annotation('textbox', dim, 'String', '', 'FitBoxToText', 'on');**

**while(t < Ts\*2)**

**U = Kr\*Ref - Kx\*X;**

**dX = CartDynamics(X, U, m1, m2, R);**

**X = X + dX \* dt;**

**t = t + dt;**

**CartDisplay(X, Ref);**

**y = [y ; X(1), X(2), Ref];**

**str = sprintf('Time = %.2f s', t);**

**an.String = str;**

**drawnow;**

**end**

**t = linspace(0,Ts\*10,length(y));**

**plot(t,y);**

**xlabel('Time (s)'); title('Nonlinear System Model: Step Response');**