Input Output Feedback Linearization Example

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| Matlab code for symbolic manipulations |
| clear all,close all,clc;  %%  syms x1 x2 x3 u  %%  x1dot=(x1)^2+x2  x2dot=x3  x3dot=u  %%  y=x1;  y\_dot=jacobian([y],[x1 x2 x3])\*[x1dot;x2dot;x3dot]; y\_dot=expand(y\_dot)  y\_ddot=jacobian([y\_dot],[x1 x2 x3])\*[x1dot;x2dot;x3dot]; y\_ddot=expand(y\_ddot)  y\_dddot=jacobian([y\_ddot],[x1 x2 x3])\*[x1dot;x2dot;x3dot]; y\_dddot=expand(y\_dddot)  T=6\*x1^4 + 8\*x1^2\*x2 + 2\*x3\*x1 + 2\*x2^2;  uu=-T-2\*y\_ddot-2\*y\_dot-y  % uu=-x1-2\*x2-2\*x3-4\*x1\*x2-2\*x1\*x3-8\*x1^2\*x2-2\*x1^2-4\*x1^3-2\*x2^2-6\*x1^4; |

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| Matlab simulation | Simulation Results |
| fig1=figure(1);fig1.Color=[1,1,1];  ax1=axes('Parent',fig1);  set(0,'CurrentFigure',fig1);  set(fig1,'currentaxes',ax1);  for ii=1:1:10  tspan=[0:0.01:10]; x0=randi([-10,10],3,1)\*0.1;  wt=tspan;  % f=randi([1,20],1,1); w=sin(2\*pi\*f\*tspan);  w=square(tspan);  [t,x]=ode45(@(t,x) odefcn(t,x,wt,w),tspan,x0);  x1\_vec=x(:,1);x2\_vec=x(:,2);x3\_vec=x(:,3);  plot(t,x1\_vec,'r-','LineWidth',[2],"Parent",ax1);hold on;  plot(t,x2\_vec,'g-','LineWidth',[2],"Parent",ax1);hold on;  plot(t,x3\_vec,'b-','LineWidth',[2],"Parent",ax1);hold on;  hold on;yline(1);yline(-1);  end  function xdot=odefcn(t,x,wt,w)  w=interp1(wt,w,t);  xdot=zeros(3,1);  x1=x(1);x2=x(2);x3=x(3);  u=-x1-2\*x2-2\*x3-4\*x1\*x2-2\*x1\*x3-8\*x1^2\*x2-2\*x1^2-4\*x1^3-2\*x2^2-6\*x1^4;  xdot(1)=(x1^2)+x2;  xdot(2)=x3;  xdot(3)=u;  end |  |