```
function twomass

%2-mass
%--------------------
%for analysing impact of two-mass model
%Hugh Hunt    Cambridge University Engineering Department
%www.hughhunt.com
%
% ===
% ===  m1  being dropped
%
%
%  +
%  +   k1  and damping c1
% ===
% ===  m2   platform
%  +
%  +   k2    and damping c2
% xxx     rigid base
%

figure(1)
[k1,k2,m1,m2,c1,c2,g,h]=param;
y20=-m2*g/k2;
v0=0;
Y0=[h;y20;v0;0];
tf=1.5;    %duration for the calculation
[t,Y]=ode45(@dropfun,[0 tf],Y0);

y1=Y(:,1);y2=Y(:,2);y1d=Y(:,3);y2d=Y(:,4);
y1dd=gradient(y1d',t)';y2dd=gradient(y2d',t)';
fs1=k1*(y1-y2)+c1*(y1d-y2d);      %compute force in spring 1
fs1=fs1.*(fs1<0);
fs2=k2*y2+c2*y2d;                %compute force in spring 2

clf
axes('position',[0.15 0.52 0.8 0.4])
plot(t*1000,1000*Y(:,1:2),'linewidth',2)              %this plots the position
of the two masses
title('Two-mass impact simulation','fontsize',14)
ylabel('displacement (mm)'),grid
set(gca,'xticklabel','')
axes('position',[0.15 0.1 0.8 0.4])
plot(t*1000,[fs1 fs2]/1000,'linewidth',2)     %this plots the forces in the
springs
ylabel('force (kN)'),grid
set(gca,'xticklabel','')
xlabel('time (ms)')

figure(2)
plot(t*1000,1000*Y(:,3:4))        %this plots the velocities
title('velocities of the two masses - useful for checking what''s going on
during loss of contact')
xlabel('time (ms)'),ylabel(' velocity (mm/s)'),grid

figure(3)
animate(t,Y(:,1:2))
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%-------------------------------------
%dropfun.m
function Yd=dropfun(t,Y)
[k1,k2,m1,m2,c1,c2,g]=param;    %get the parameters
y1=Y(1);y2=Y(2);y1d=Y(3);y2d=Y(4);         %displ and vel of the two masses
fspring=k1*(y1-y2)+c1*(y1d-y2d);         %compute the force in the contact
spring

if (y1-y2)>0 k1=0;c1=0;end    %This deals with loss of contact

M=[m1 0;0 m2];
K=[k1 -k1;-k1 k1+k2];
C=[c1 -c1;-c1 c1+c2];
f=-[m1;m2]*g;
A=[zeros(2,2) eye(2,2);-M\K -M\C];
F=[0;0;M\f];
Yd=A*Y+F;   %this matrix method computes the velocities and accelerations to
pass back
%this part of the code can have non-linear stiffness elements if desired.

%-------------------------------------
%param.m
function [k1,k2,m1,m2,c1,c2,g,h]=param
k1=10e6;  %contact pad stiffness
k2=5e6; %  %platform stiffness
m1=2000; %drop weight mass
m2=500; %platform mass
eta1=0.1; %loss factor for contact pad
eta2=0.1; %loss factor for platform spring
c1=sqrt(k1*m1)*eta1;
c2=sqrt(k2*m2)*eta2;
g=9.81;
h=0.02;   %drop height
%-------------------------------------

function animate(t,Y)
set(gcf,'position',[220   260   340   420])
[k1,k2,m1,m2,c1,c2,g,h]=param;    %get the parameters
   a=0.02;b=0.01;c1=2*a;c2=c1;
   dt=0.01;
      ti=(0:dt:max(t));
      y1=interp1(t,Y(:,1),ti);
    y2=interp1(t,Y(:,2),ti);
for jj=1:length(ti)
   drawbox(y2(jj)+c2,a,b,'r')
   hold on
   drawbox(y1(jj)+c1+c2,a/2,b,'b')
   drawspring(0,y2(jj)+c2-b,a/5,'r')
   drawspring(y1(jj).*((y1(jj)-y2(jj))>0)+y2(jj).*((y1(jj)-
y2(jj))<0)+c2+b,y1(jj)+c1+c2-b,a/5,'b')
   plot([-a a],[0 0],'r','linewidth',6)
   hold off
   axis([-1.2*a 1.2*a -b h+c1+c2+b])
   text(0,-b,[num2str(ti(jj),'%5.3f') ' s'],'horizontalalign','center')
   text(0,-1.7*b,['drop height = ' num2str(h,'%5.3f') '
m'],'horizontalalign','center','fontsize',12)
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   text(0,y1(jj)+c1+c2,[num2str(m1) '
kg'],'horizontalal','center','fontsize',18)
   text(0,y2(jj)+c2,[num2str(m2) ' kg'],'horizontalal','center','fontsize',18)
   axis('off')
    MOV(jj)=getframe(gcf);
end
   movie2avi(MOV,['twomass.avi'],'fps',8,'compression','Indeo5','quality',65)
   print -f1 -djpeg twomass

function drawbox(y,a,b,col)
plot([-1 1 1 -1 -1]*a,[-1 -1 1 1 -1]*b+y,col,'linewidth',4)

function drawspring(y1,y2,a,col)
plot([0 0 -1 1 -1 1 0 0]*a,[0 1 2 4 6 8 9 10]/10*(y2-y1)+y1,col,'linewidth',4)
```