```
%centrodes.m
%hemh Oct 2001
%for IA Mechanics lectures

clear
D=3;   %cm
L=8.7;
R=6;

al=[-90:5:90]*pi/180;
th=acos((D-L*cos(al))/R);
y=R*sin(th)+L*sin(al);
oy=ones(size(y));ny=length(y);
r=R*exp(i*th)-D;
Y=i*[max(y) min(y)];

z=[-D*oy ; R*exp(i*th) ; L*exp(i*al)];
z=cumsum(z);    %positions of the mechanism

I=(-D+y./tan(th) + i*y);
I1=(I-y*i).*exp(-i*al);

%pick a reference position for plotting the moving frame

figure(1)
y0=8;
j0=sum(y<y0);
y0=y(j0);al0=al(j0);
I1p=I1*exp(i*al0)+i*y0;

plot(z),hold on
plot(I,'o'),plot(I,'b')
plot(I1p,'x'),plot(I1p,'r')
plot(r,':')
plot(Y,':')
plot(-D,0,'*')
```

```
text(-10,0,'fixed centrode','fontsize',16)
text(-9,7,'moving centrode','fontsize',16)
hold off
width=26;height=19;    %cm
ax=[-14+[0 width] -4+[0 height]];
axis(ax);
set(gcf,'units','centim','position',6/6.3*[0 0 2+[width height]],'units','pixels')
set(gca,'units','centim','position',6/6.3*[1 1 [width height]],'units','normal')
set(gcf,'paperorientation','landscape')
set(gcf,'paperunits','centim','paperposition',[0 0 2+[width height]],'paperunits','inches')

figure(3)    %for printing fixed centrode
plot(I,'o'),hold on
plot(I,'b')
plot(r,':')
plot(Y,':')
plot(-D,0,'*')
text(-10,0,'fixed centrode','fontsize',16)
axis('off')
hold off

width=26;height=19;    %cm
ax=[-14+[0 width] -4+[0 height]];
axis(ax);
set(gcf,'units','centim','position',6/6.3*[0 0 2+[width height]],'units','pixels')
set(gca,'units','centim','position',6/6.3*[1 1 [width height]],'units','normal')
set(gcf,'paperorientation','landscape')
set(gcf,'paperunits','centim','paperposition',[0 0 2+[width height]],'paperunits','inches')

figure(4)     %for printing moving centrode
plot(z(2:3,j0),'linewidth',2),hold on
plot(I1p,'x'),plot(I1p,'r')
text(-9,7,'moving centrode','fontsize',16)
axis('off')
hold off
```

```
width=26;height=19;    %cm
ax=[-14+[0 width] -4+[0 height]];
axis(ax);
set(gcf,'units','centim','position',6/6.3*[0 0 2+[width height]],'units','pixels')
set(gca,'units','centim','position',6/6.3*[1 1 [width height]],'units','normal')
set(gcf,'paperorientation','landscape')
set(gcf,'paperunits','centim','paperposition',[0 0 2+[width height]],'paperunits','inches')

%return

%now animate
nplots=12;
dj=max([floor(ny/nplots) 1]);
jyp=1:dj:ny;
nyp=length(jyp);
figure(2)
set(gcf,'position',[10 10 500 300])
clf
M = moviein(nyp);
for jp=1:nyp
  jj=jyp(jp);
  y0=y(jj);al0=al(jj);
  I1p=I1*exp(i*al0)+i*y0;
  plot(z(:,jj),'linewidth',2),hold on
  plot(I,'o')
  plot(I,'b')
  plot(I1p,'x')
  plot(I1p,'r')
  plot(r,'w')
  plot(Y,'w')
  hold off
  axis([-14 12 -5 15])
  axis('off')
  M(:,jp) = getframe;
end
movie(M,-5,10)
```

```
%MM=[M fliplr(M)];
%movie2avi(MM,'centrodes','FPS',5,'compression','indeo5');
%now print out at full size
```