**Homework 7**

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MAE 150

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Happy 3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164 0628620899 8628034825 3421170679 Day

**Problem 2:**

A) Determine as a function of.



B) Plot the trajectory of Points A and B

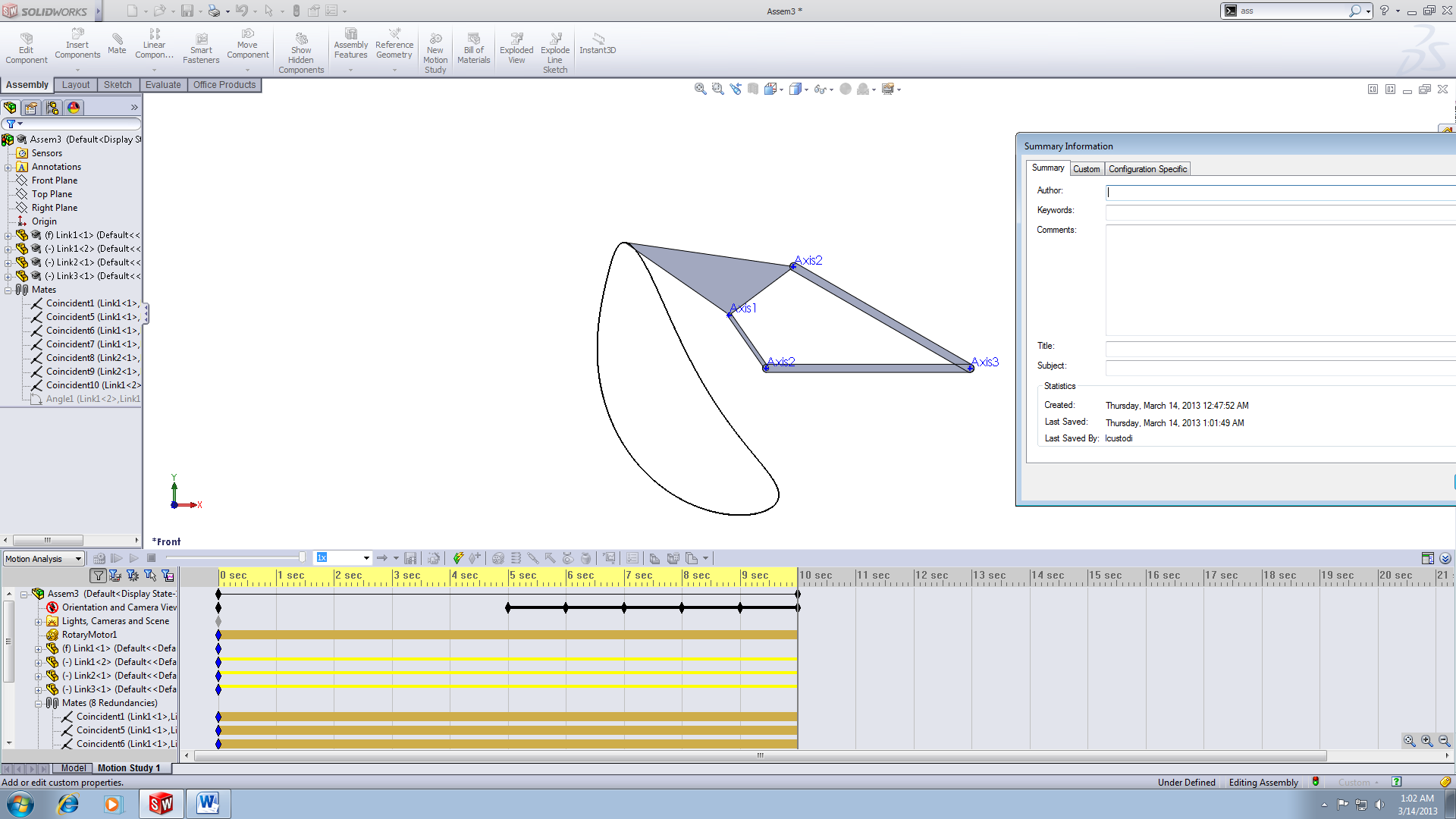


C) Calculate the angular velocities and as a function of

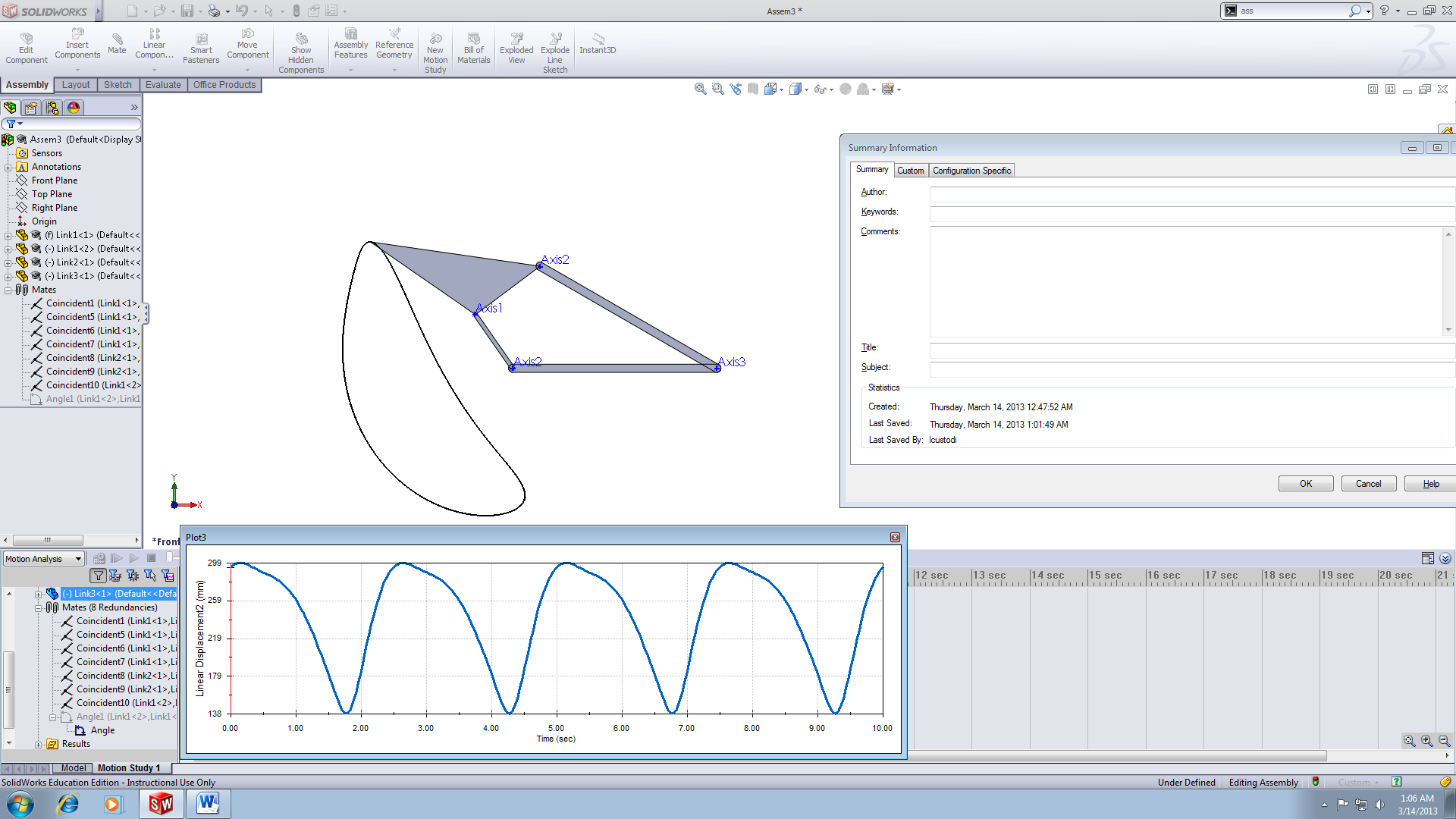


**Problem 3:**

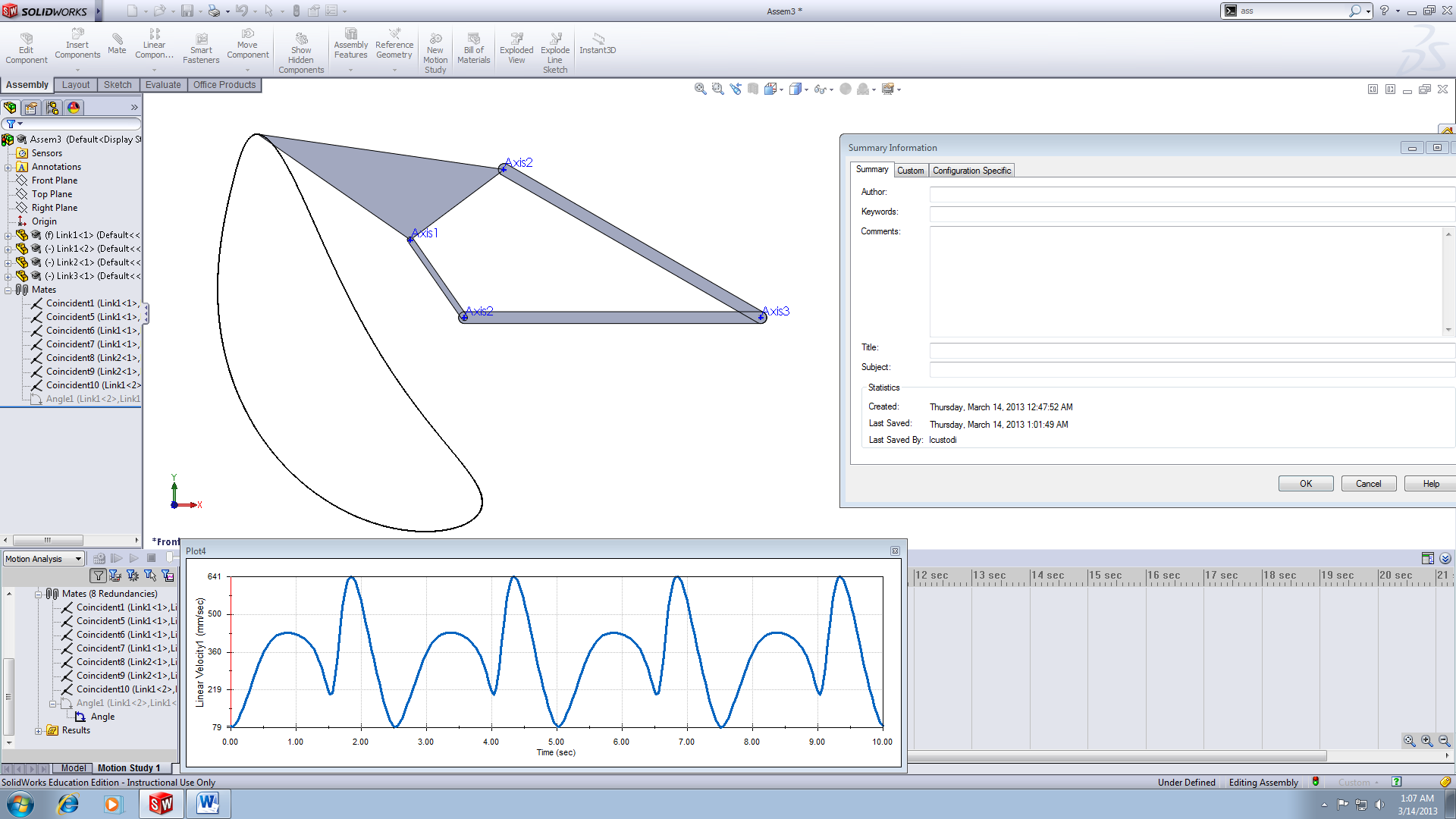
Trace Path



Displacement Magnitude



Velocity Magnitude



**Appendix:**  
Problem 2

clc;clear;close all;

%Lawrence Custodio

%HW 7 Problem 2

%Given Parameters:

l1 = 1; l2 = 1; l3 = 1.1; l4 = 0.9; l5 = 1;

t1 = 0.05; t2 = 0.08;

the = 60:.4:100; ta = 99.6:-.4:60;

theta2 = [the ta];

%Part A - Find theta3=f(theta2) and theta4=f(theta2)

L1 = l1/l4; L2 = l1/l2; L3 = (l2^2-l3^2+l4^2+l1^2)/(2\*l2\*l4); %dimensionless params

for j = 1:length(theta2)

error = .1; %set error valu

eps = 1;

theta4(1) = 40; %Set initial guess

%Freudenstein condition/equation to find theta4(j)

k = 1; %theta4 indexing for Freudenstein

while eps>error

theta4(k+1) = acosd((L2^-1)\*(L1\*cosd(theta2(j))-L3+cosd(theta2(j)-theta4(k))));

eps = abs(theta4(k+1)-theta4(k));

k = k+1;

end;

theta4(j)=theta4(k);

%Finding theta3(j)

theta3(j) = acosd((-l2\*cosd(theta2(j))+l4\*cosd(theta4(j))+l1)/l3);

end

plot(theta2(101:end),theta4(101:end),'r')

hold on

plot(theta2(101:end),theta3(101:end))

title('Freudenstein Approach: \theta\_3/\theta\_4 vs \theta\_2,')

legend('\theta\_4','\theta\_3')

xlabel('\theta\_2 [\circ]')

ylabel('\theta [\circ]')

%Part B - Plot trajectory of A and B, see handout

%Trajectory @ Pt.A:

for A=1:length(theta2)

h = t2;

hn = l5;

xA(A) = l2.\*cosd(theta2(A)) + h.\*cosd(theta3(A)) - hn.\*sind(theta3(A));

yA(A) = l2.\*sind(theta2(A)) + h.\*sind(theta3(A)) + hn.\*cosd(theta3(A));

end

%Trajectory @ Pt.B:

for B=1:length(theta2)

h = .5\*l3;

hn = t1;

xB(B) = l2.\*cosd(theta2(B)) + h.\*cosd(theta3(B)) - hn.\*sind(theta3(B));

yB(B) = l2.\*sind(theta2(B)) + h.\*sind(theta3(B)) + hn.\*cosd(theta3(B));

end

figure

plot(yA,xA,'r')

hold on

plot(yB,xB)

set(gca,'Xdir','reverse');

title('Trajectory of Points A and B')

legend('Point A','Point B')

xlabel('Y [m]')

ylabel('X [m]')

%Part C - Angular velocities

om2=5/pi;

for i=1:length(theta2)

om3(i)= om2\*(l2/l3)\*sind(theta2(i)-theta4(i))/sind(theta3(i)+theta4(i));

om4(i)= om2\*(l2/l4)\*sind(theta3(i)+theta2(i))/sind(theta3(i)+theta4(i));

end

figure

plot(theta2(101:end),om3(101:end),'r')

hold on

plot(theta2(101:end),om4(101:end))

title('Angular velocity of \theta\_3 and \theta\_4')

legend('\omega\_3','\omega\_4')

xlabel('\theta\_2 [\circ]')

ylabel('\omega [Rad/s]')