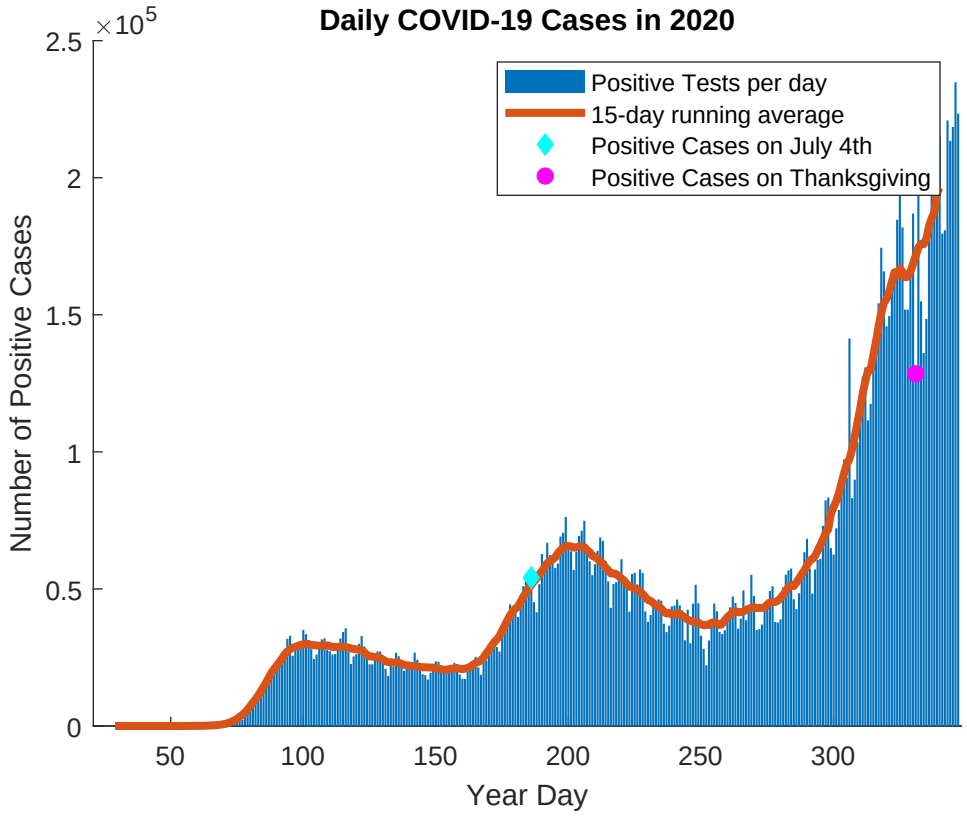

Daily COVID-19 Cases in 2020
×10^5
2.5
2
1.5
1
0.5
0
Number of Positive Cases
50
100
150
200
250
300
Year Day
Positive Tests per day
15-day running average
Positive Cases on July 4th
Positive Cases on Thanksgiving

Natalie Ratcliff

MAE 150 Problem 2

$$\begin{bmatrix} X(i) \\ Y(i) \\ 1 \end{bmatrix} = \begin{bmatrix} \cos(\theta_z) & -\sin(\theta_z) & t_x \\ \sin(\theta_z) & \cos(\theta_z) & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x(i) \\ y(i) \\ 1 \end{bmatrix} \rightarrow \begin{aligned} X(i) &= x(i)\cos\theta_z - y(i)\sin\theta_z + t_x \\ Y(i) &= x(i)\sin\theta_z + y(i)\cos\theta_z + t_y \\ 1 &= 1 \end{aligned}$$

these are the same!

vs

(rotation first)

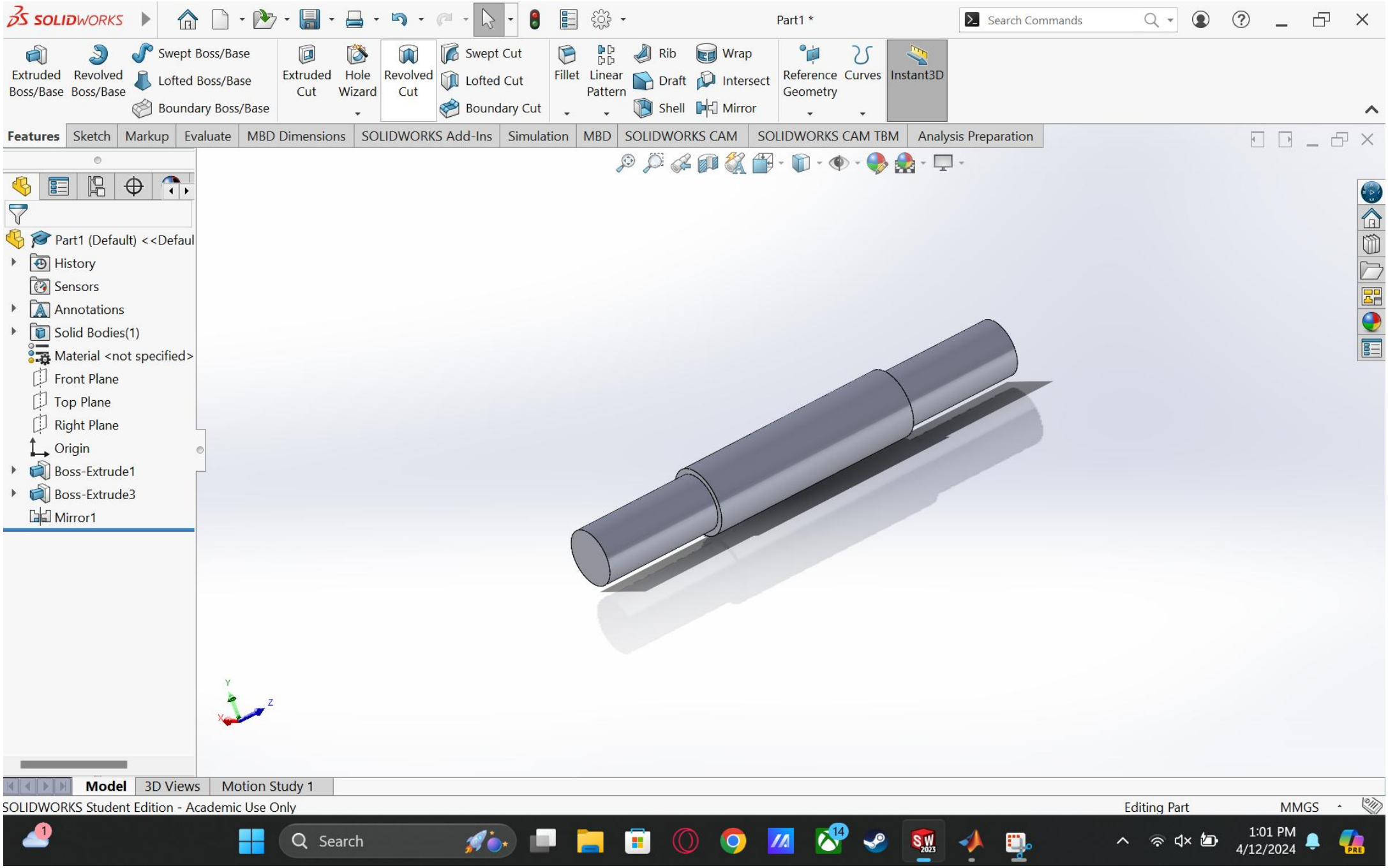
$$\begin{bmatrix} X(i) \\ Y(i) \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta_z & -\sin\theta_z & 0 \\ \sin\theta_z & \cos\theta_z & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x(i) \\ y(i) \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x(i)\cos\theta_z - y(i)\sin\theta_z \\ x(i)\sin\theta_z + y(i)\cos\theta_z \\ 1 \end{bmatrix} \rightarrow \begin{aligned} X(i) &= x(i)\cos\theta_z - y(i)\sin\theta_z + t_x \\ Y(i) &= x(i)\sin\theta_z + y(i)\cos\theta_z + t_y \\ 1 &= 1 \end{aligned}$$

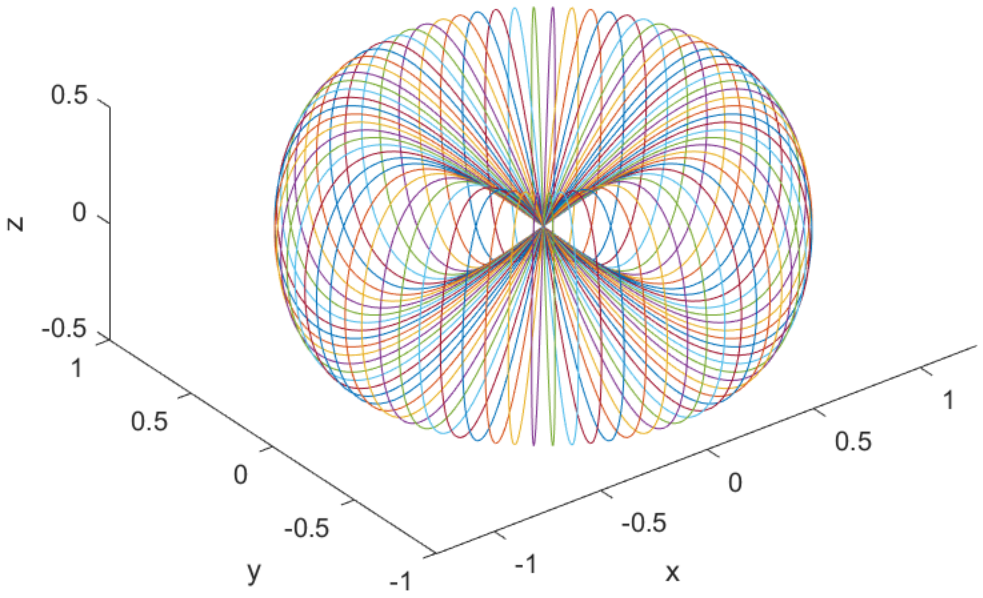
vs

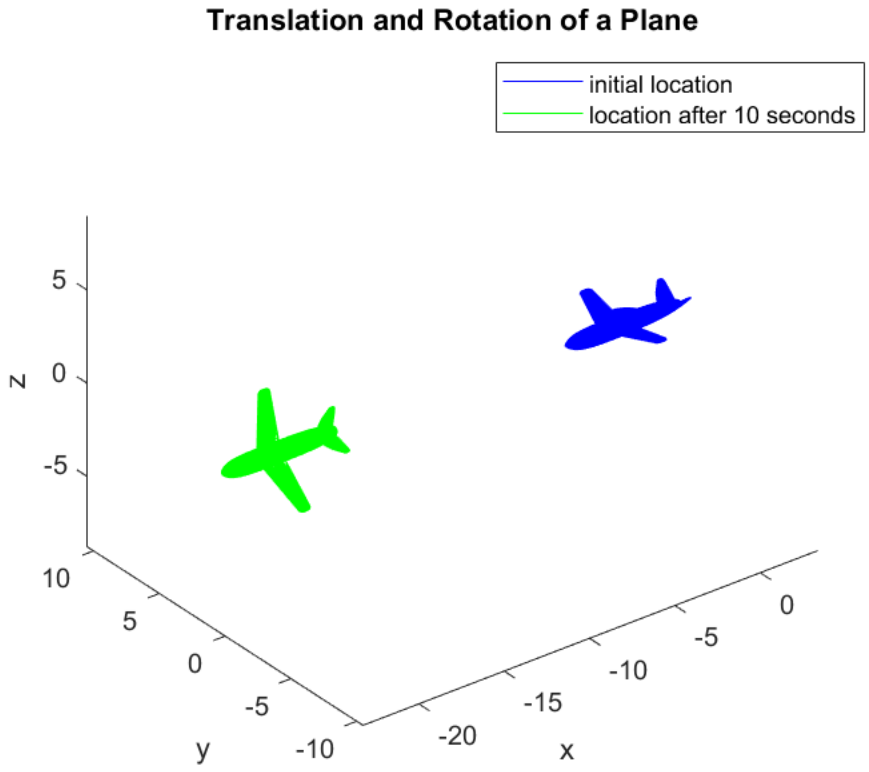
(translation first)

$$\begin{bmatrix} X(i) \\ Y(i) \\ 1 \end{bmatrix} = \begin{bmatrix} \cos\theta_z & -\sin\theta_z & 0 \\ \sin\theta_z & \cos\theta_z & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x(i) \\ y(i) \\ 1 \end{bmatrix} = \begin{bmatrix} \cos\theta_z & -\sin\theta_z & 0 \\ \sin\theta_z & \cos\theta_z & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x(i) + t_x \\ y(i) + t_y \\ 1 \end{bmatrix} \rightarrow \begin{aligned} X(i) &= [x(i) + t_x]\cos\theta_z - [y(i) + t_y]\sin\theta_z \\ Y(i) &= [x(i) + t_x]\sin\theta_z + [y(i) + t_y]\cos\theta_z \\ 1 &= 1 \end{aligned}$$

→ The suggestion is valid, and corresponds to performing the rotation prior to the translation.


SOLIDWORKS
Part1 *
Search Commands
Extruded Boss/Base
Revolved Boss/Base
Swept Boss/Base
Lofted Boss/Base
Boundary Boss/Base
Extruded Cut
Hole Wizard
Revolved Cut
Swept Cut
Lofted Cut
Boundary Cut
Fillet
Linear Pattern
Rib
Draft
Shell
Wrap
Intersect
Mirror
Reference Geometry
Curves
Instant3D
Features
Sketch
Markup
Evaluate
MBD Dimensions
SOLIDWORKS Add-Ins
Simulation
MBD
SOLIDWORKS CAM
SOLIDWORKS CAM TBM
Analysis Preparation
Part1 (Default) <<Defaul
History
Sensors
Annotations
Solid Bodies(1)
Material <not specified>
Front Plane
Top Plane
Right Plane
Origin
Boss-Extrude1
Boss-Extrude3
Mirror1
Model
3D Views
Motion Study 1
SOLIDWORKS Student Edition - Academic Use Only
Editing Part
MMGS
Search
1:01 PM
4/12/2024

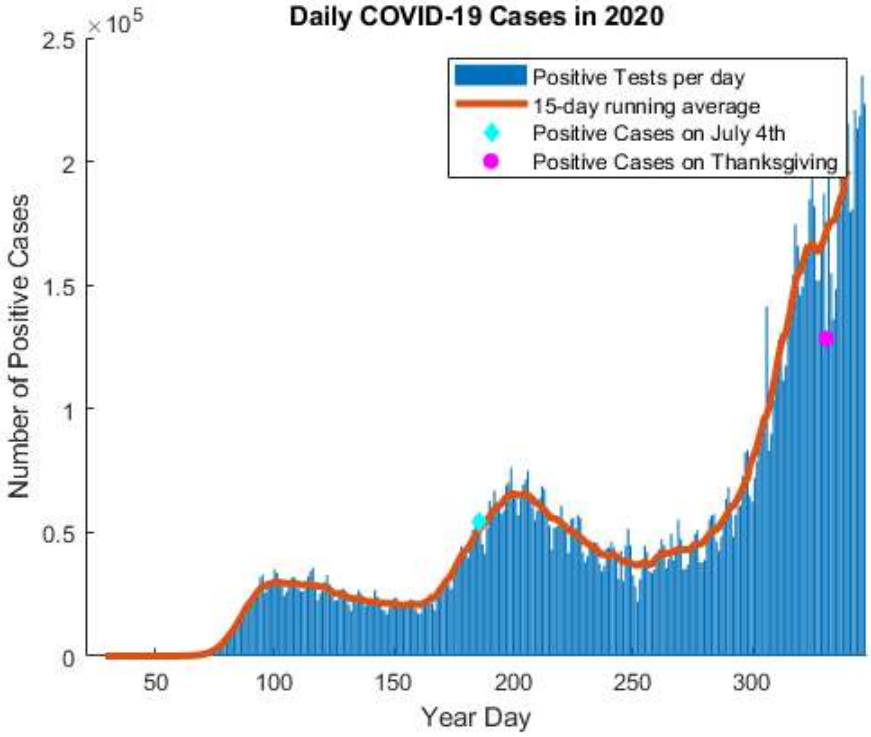

Rotation of a curve about Z-axis
0.5
0
-0.5
z
1
0.5
0
-0.5
-1
y
-1
-0.5
0
0.5
1
x


Translation and Rotation of a Plane
initial location
location after 10 seconds
z
5
0
-5
y
10
5
0
-5
-10
x
-20
-15
-10
-5
0

```
clear all;
close all;
clc;
format long;

name = 'Natalie Ratzlaff';
id = 'A170911327';
hw_num = 1;

data = readmatrix("US_COVID19.txt");
date = data(:,2);

p1a = data(find(date == 20200704),4)

p1b = data(find(date == 20201126),4)

for i = 8:1:319
    data(i,6) = 0;
    for j = -7:7
        data(i,6) = data(i,6) + data(i+j,4);
    end
    data(i,6) = data(i,6)/15;
end

data(1:7,6) = NaN;
data(320:326,6) = NaN;

hold on;
figure(1);
xlabel('Year Day');
ylabel('Number of Positive Cases');
bar(data(:,1),data(:,4));
plot(data(:,1),data(:,6),'LineWidth',3);
plot(186,p1a,'cdiamond','MarkerFaceColor','c');
plot(331,p1b,'mo','MarkerFaceColor','m');
title('Daily COVID-19 Cases in 2020');
legend('Positive Tests per day','15-day running average','Positive Cases on July 4th','Positive Cases on Thanksgiving');

p1c = 'See figure 1'

t = 0:360;
x = cosd(t);
y = 0*t;
z = sind(t).*cosd(t);

m = [x;y;z;1+t*0];
R = @(theta) [cosd(theta) -sind(theta) 0 0; sind(theta) cosd(theta) 0 0; 0 0 1 0; 0 0 0 1];

figure(2);
hold on;
plot3(x,y,z);
for i = 5:5:175
    M = R(i)*m;
    plot3(M(1,:),M(2,:),M(3,:));
end
xlabel('x');
ylabel('y');
zlabel('z');
title('Rotation of a curve about Z-axis');
axis equal;
view(3);
```

```
p3 = 'See figure 2'

figure(3);
hold on;
plane = stlread("aircraft.stl");
trimesh(plane,'FaceColor','none','EdgeColor','b');

Rx = @(rad) [1 0 0; 0 cos(rad) -sin(rad); 0 sin(rad) cos(rad)];
pfinal = Rx(1)*((plane.Points).');
pfinal(1,:) = pfinal(1,:) - 20;
final = triangulation(plane.ConnectivityList,pfinal.');
trimesh(final,'FaceColor','none','EdgeColor','g');
xlabel('x');
ylabel('y');
zlabel('z');
legend('initial location','location after 10 seconds');
title('Translation and Rotation of a Plane');
axis equal;
view(3);

p4a = pfinal(:,find(pfinal(3,:) == max(pfinal(3,:)))).'
p4b = 'See figure 3'
```

```
p1a =

       54144


p1b =

      128439


p1c =

    'See figure 1'


p3 =

    'See figure 2'


p4a =

 -20.024535119533539   1.412572869860626   2.650511116873443


p4b =

    'See figure 3'
```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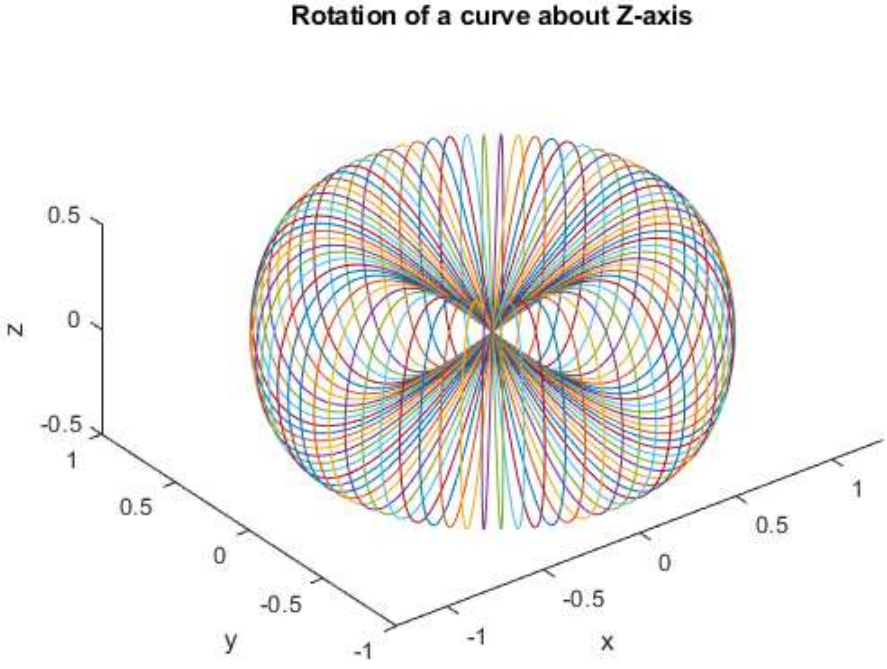
Rotation of a curve about Z-axis
0.5
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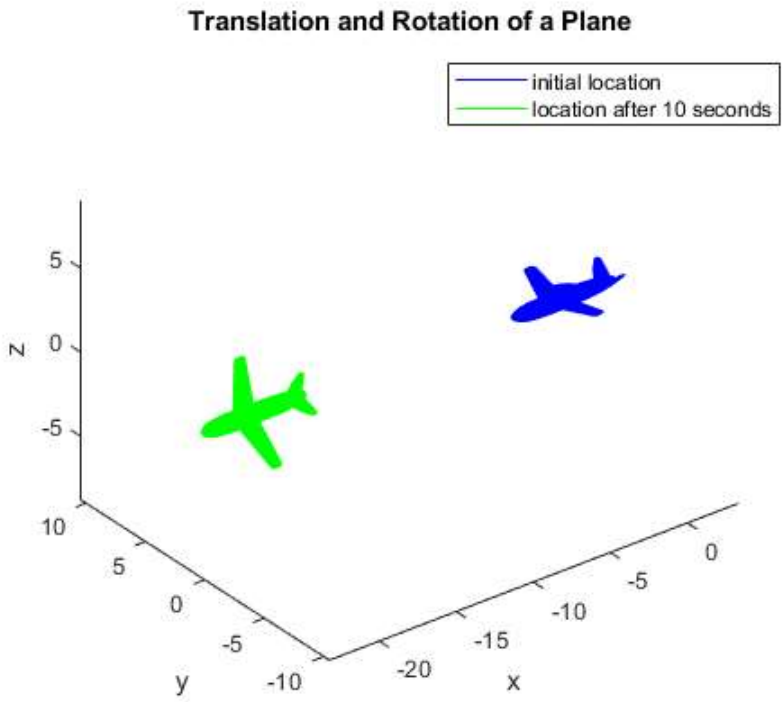
-0.5
z
1
0.5
0
-0.5
-1
y
-1
-0.5
0
0.5
1
x



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