The problem

the base frame of the work peice needs to be translated and rotated about the z axis to reflect the physical configuration of the workpeice with respect to the base frame of the robot arm as they are physically placed in the real world.

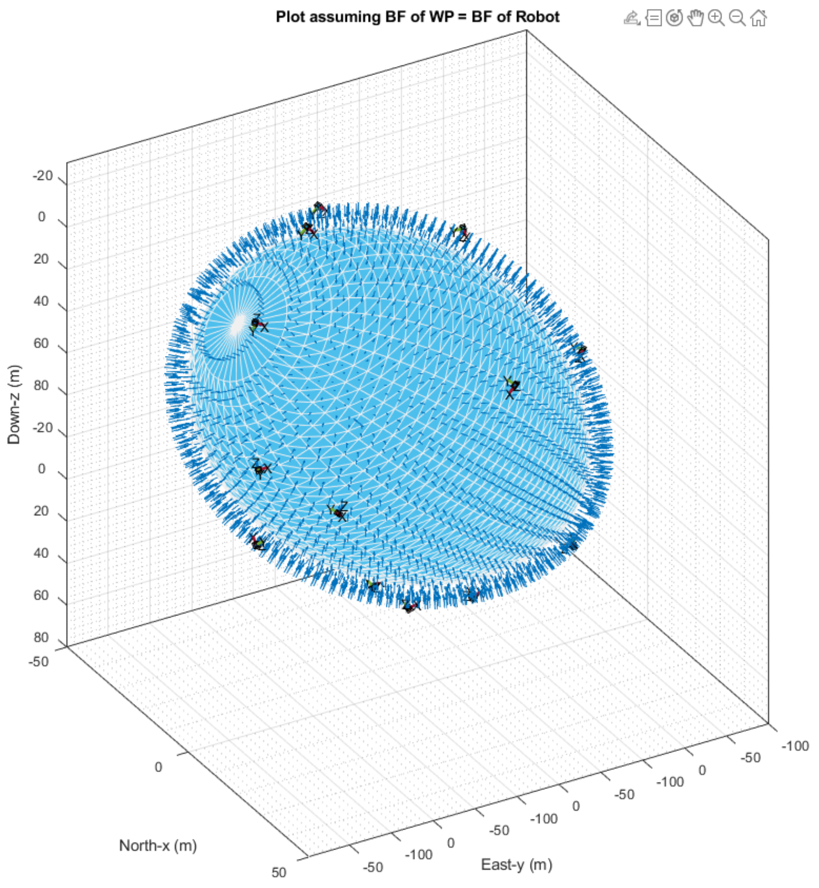
Assumptions

- The orientation of the workpeice will only differ from the orientation of the robot base by a rotation about the z axis, the yaw angle
- The position of the workpeice will be a constant offset away
- p = (x_displacement, y_displacement, z_displacement)
- We have the configuration frames of the offsets with respect to the base frame of the workpeice
- For the sake of this demo, p = (0, 5000, 0), and the yaw angle to rotate by is 50 degrees

Plan

- First we assume the base frame of the workpeice and base frame of the robot are the same
- We than rotate the workpeice frame (and all offset frames), by the correct yaw angle that will eventually match the actual physical configuration
- Finally we translate these frames to match the physical distance between the base from of the robot and the base frame of the work peice
- Assuming that the end effector position can be set by specifying a position with respect to the base frame of the robot, we can now reach the offsets on the workpeice

```
%%  Import the object to read
% [V F N name] = stlReadAscii("egg_x_50.stl");
[V F N name] = stlReadBinary("egg_x_50.stl");
```



Setting the Transformation Parameters

```
%% Set transformation parameters
x_displacement = 0;
y_displacement = 5000;
z_displacement = 0;
yaw_angle_rotate = 50;
% p = [x_displacement; y_displacement; z_displacement];
% T = [eye(3) p; 0 0 0 1]
```

Get triangle centroids and compute offsets

```
[t,c] = getTriangles(F,V); % get triangles and centroids to calculate poses
offsets = c + 5*N;
invertedNormals = -1*N;
```

Get Poses

```
poses = getPose(offsets,invertedNormals);
xyz= poses(:,4:6);
q = quaternion([xyz(:,1) xyz(:,2) xyz(:,3)],"eulerd","XYZ","frame");
```

1) Compute rotation matrix and a) rotate frames

```
rotms =quat2rotm(q);
rot_z = rotz(yaw_angle_rotate);
rotated_frames = pagemtimes(rot_z,rotms);
rotated_frames_q =  rotm2quat(rotated_frames);
rotated_frames_q = quaternion(rotated_frames_q);
```

b) rotate frame positions

```
rotated_offsets=pagemtimes(rot_z,offsets')';
```

c) rotate vertices and direction vectors for plotting patches and quivers (only for visual verification)

```
rot_v=pagemtimes(rot_z,V')';
rot_inverted_normal = pagemtimes(rot_z,invertedNormals')';
```

2) Translate frames

```
translated_rotated_offsets = [];
translated_rotated_offsets(:,1) = rotated_offsets(:,1)+x_displacement;
translated_rotated_offsets(:,2) = rotated_offsets(:,2)+y_displacement;
translated_rotated_offsets(:,3) = rotated_offsets(:,3)+z_displacement;
```

b) translate vertices for plotting patches (only for visual verification)

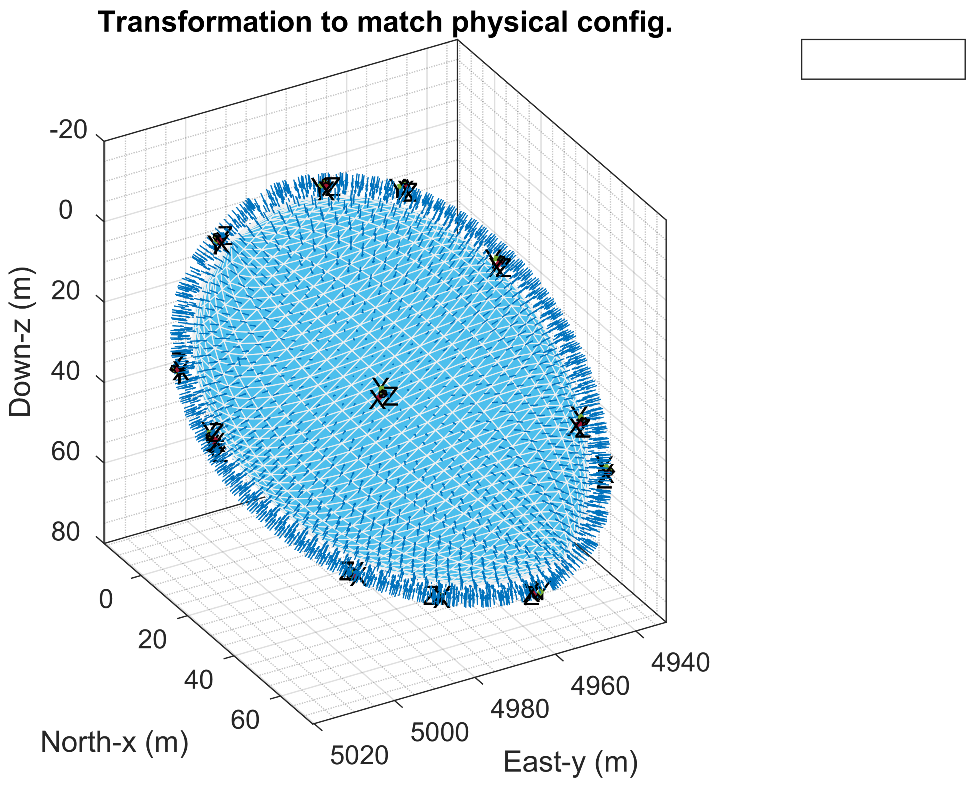
```
translated_rotated_V = [];
translated_rotated_V(:,1) = rot_v(:,1)+x_displacement;
translated_rotated_V(:,2) = rot_v(:,2)+y_displacement;
translated_rotated_V(:,3) = rot_v(:,3)+z_displacement;
```

Plotting

```
tp = theaterPlot();
op = orientationPlotter(tp);
hold on
xlabel("North-x (m)")
ylabel("East-y (m)")
zlabel("Down-z (m)");
h = patch("Faces",F,"Vertices",translated_rotated_V);
set(h,"FaceColor",[0.30,0.75,0.93],"EdgeColor",[0.94,0.94,0.94])
quiver3(translated_rotated_offsets(:,1),translated_rotated_offsets(:,2),translated_rotated_offs
for i=1:200:size(rot_inverted_normal,1)

    poseplot(rotated_frames_q(i),translated_rotated_offsets(i,:))
```

```
end
% title("Plot assuming BF of WP = BF of Robot")
title("Transformation to match physical config.")
```


Transformation to match physical config.
Down-z (m)
North-x (m)
East-y (m)
X
Y
Z