Project

Project Part 1

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A MEGN544A Project

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Problem 1

What Scaling factor you needed to resize the font correctly.

Solution.

```
scale_diff_world = position_final_world-position_init_world;
scale_diff_points = position_final_points-position_init_points;
magnitude_scale = norm(scale_diff_world)0>/norm(scale_diff_points)0>;

```

- *scale_diff_world* is the difference vector between the final position in the world coordinate system and the initial position in the world coordinate system.
- *scale_diff_points* is the difference vector between the final position in the local coordinate system and the initial position in the same local coordinate system.
- *magnitude_scale* is the scaling factor, calculated as the ratio of the magnitude (Euclidean norm) of *scale_diff_world* to the magnitude of *scale_diff_points*. This scaling factor can be used to scale points between the world-frame system and local coordinate system.

Problem 2

What transform you need to project the scaled-letter frame into the world frame.

Solution.

- I rotated the points in z-x plane as they are x-y plane and for that I used rotation matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$, this rotates the plane along x. I did this to get the first rotated point for calculating displacement vector in next step.
- After that I created a transformation matrix with the above rotation matrix and a displacement vector between the start of letter 'C' in world-frame coordinates and rotated start of the letters in 'z-x' plane $\begin{bmatrix} 1 & 0 & 0 & -0.06 \\ 0 & 0 & -1 & -0.3 \\ 0 & 1 & 0 & 0.4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$. I then used this transformation matrix to transform all the scaled points to project them in world frame.

Problem 3

A plot of the final point placements with the point coordinate systems drawn (X in red, Y in green, and z in blue) using the quiver3 plot for each letter in a rectangle of appropriate sizing and placement. ('hold on' and 'hold off' is your friend)

Solution.