



HACETTEPE UNIVERSITY

2021-2022 FALL

GMT 225 REFERENCE COORDINATE SYSTEMS

ASSIGNMENT 2

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Explanation of My Function

First, I constructed a rotation function and took the position vector inputs X_p , Y_p , and Z_p individually. Then, in order to achieve a prettier display with NumPy, ".array," I turned the provided coordinate values into a 3x1 matrix and printed the initial position vector. Then I transformed this matrix to a 1x3 matrix to make the multiplication process faster and more smooth. Second, I obtained the rotation angle in degrees as well as the rotation axis input. The rotation matrices with respect to the rotation axes were then defined again with NumPy. I used "math.radians" to convert the provided degree values to radians. Finally, I wrote an if-elif-else statement in which I specified the appropriate operations with the relevant matrix for the supplied rotation axis and displayed the new position vector and coordinates as X_p' , Y_p' , and Z_p' .

Solution of The Problem Given in Item#3 of Part I of The Assignment

1. First Rotation

```
In [6]: rotation()

Please Enter 'Xp' Value: 100
Please Enter 'Yp' Value: 120
Please Enter 'Zp' Value: 200

The Position Vector You Entered Is Below
[[100. 120. 200.]]
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Please Enter The Rotation Angle In Degrees: -20
Please Enter The Rotation Axis: 2

#####

New Position Vector Of Point P:
P ---> [[162.37329074 120.          153.73650982]]

Xp' ---> [162.37329074]
Yp' ---> [120.]
Zp' ---> [153.73650982]
```

Since its rotation is in Y-axis through an angle $\lambda=20^\circ$ clockwise, the angle input should be negative and the axis should be 2

2. Second Rotation

```
In [7]: rotation()

Please Enter 'Xp' Value: 162.37329074
Please Enter 'Yp' Value: 120
Please Enter 'Zp' Value: 153.73650982

The Position Vector You Entered Is Below
[[162.37329074 120.          153.73650982]]
-----

Please Enter The Rotation Angle In Degrees: 25
Please Enter The Rotation Axis: 3

#####

New Position Vector Of Point P:
P ---> [[197.87436921  40.13501656 153.73650982]]

Xp' ---> [197.87436921]
Yp' ---> [40.13501656]
Zp' ---> [153.73650982]
```

Since its rotation is in Z-axis through an angle $\delta=25^\circ$ counter-clockwise, the angle input should be positive and the axis should be 3.

3. Third Rotation

```
In [8]: rotation()

Please Enter 'Xp' Value: 197.87436921
Please Enter 'Yp' Value: 40.13501656
Please Enter 'Zp' Value: 153.73650982

The Position Vector You Entered Is Below
[[197.87436921  40.13501656 153.73650982]]
-----

Please Enter The Rotation Angle In Degrees: 7
Please Enter The Rotation Axis: 2

#####

New Position Vector Of Point P:
P ---> [[177.66367616  40.13501656 176.70540064]]

Xp' ---> [177.66367616]
Yp' ---> [40.13501656]
Zp' ---> [176.70540064]
```

Since its rotation is in Y-axis through an angle $\beta=7^\circ$ counter-clockwise, the angle input should be positive and the axis should be 2.

It seems that the final coordinates of point P in the new coordinate system are:

$X_{p'}$: [177.66367616]

$Y_{p'}$: [40.13501656]

$Z_{p'}$: [176.70540064]