

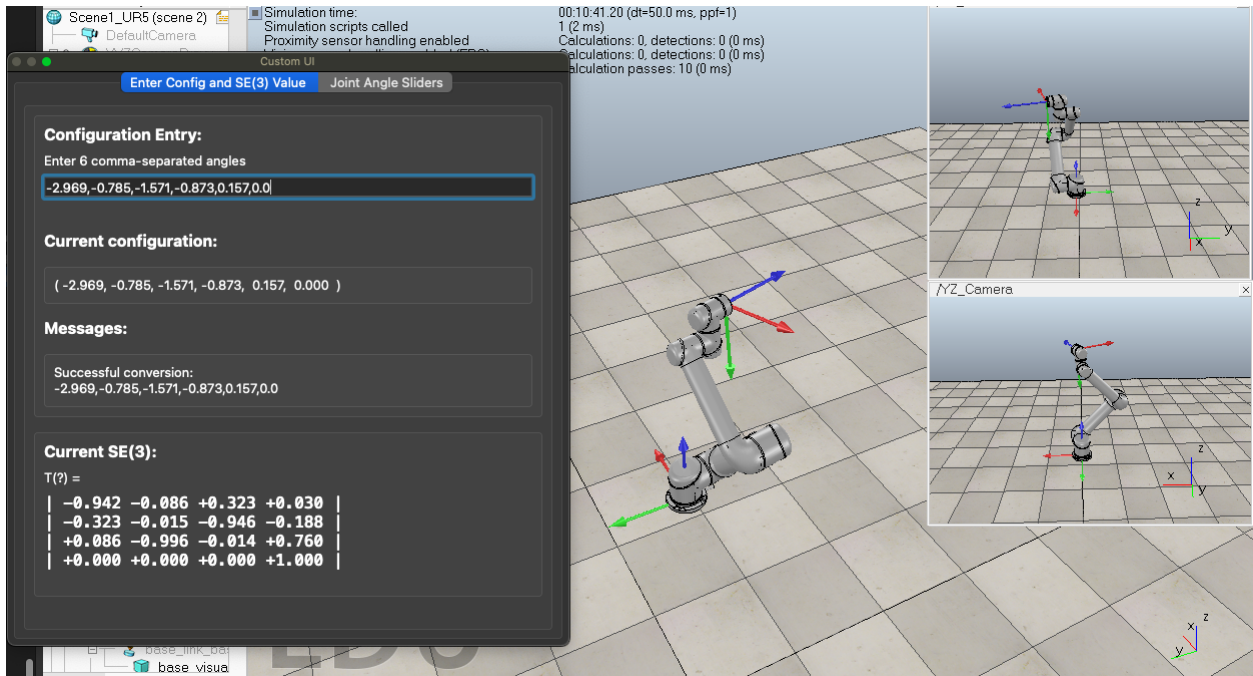
ME 449 Assignment 1, Christopher Luey

1b:

```
272 <!-- </group> -->
273 <label text="<big> Current SE(3):</big>" id="6008" wordwrap="false" style=
274 <!-- <button text="Calculate SE(3) transform:" on-click="calcSE3" id="1235
275 <label text="T(?) = " wordwrap="false" style="font-weight: normal;"/>
276 <label text="" id="1234" wordwrap="false" />
277 <!-- </group> -->
```

On line 275, I changed the font style from bold to normal, so T(?)= isn't bold on UI.

1b and 2:



Part 2:

Joint angles (considering orientation):

1: -2.969

2: -0.785

3: -1.571

4: -0.873

5: 0.157

6: 0.000

Method:

1. Solve for all rotation matrices using subscript cancellation rule, taking inverses of matrices when necessary
2. Take rotation matrix log, convert the so3 result to a vector, and convert vector to a rotation axis and rotation magnitude theta.

3. Determine direction of theta by examining the rotation axis orientation.
4. Calculate Rsb and cross verify with CopelliaSim

```
1 from modern_robotics import *
2 import numpy as np
3
4 R13 = np.array([[0.7071, 0, -0.7071], [0, 1, 0], [0.7071, 0, -0.7071]])
5 Rs2 = np.array([[0.6964, 0.1736, 0.6964], [-0.1228, -0.9848, 0.1228], [0.7071, 0, 0.7071]])
6 R25 = np.array([[0.7566, -0.1198, -0.6428], [-0.1564, 0.9877, 0], [0.6348, 0.1005, -0.7661]])
7 R12 = np.array([[0.7071, 0, -0.7071], [0, 1, 0], [0.7071, 0, 0.7071]])
8 R34 = np.array([[0.6428, 0, -0.7660], [0, 1, 0], [0.7660, 0, 0.6428]])
9 Rs6 = np.array([[0.9418, 0.3249, -0.0859], [0.3249, -0.9456, -0.0151], [-0.0861, -0.0136, -0.9962]])
10 R6b = np.array([[-1, 0, 0], [0, 0, 1], [0, 1, 0]])
11
12 Rs1 = Rs2 @ RotInv(R12)
13 R23 = RotInv(R12) @ R13
14 R45 = RotInv(R34) @ RotInv(R23) @ R25
15 R56 = RotInv(R25) @ RotInv(Rs2) @ Rs6
16 print(AxisAng3(so3ToVec(MatrixLog3(R34)))[0])
17 print(round(AxisAng3(so3ToVec(MatrixLog3(Rs1)))[1], 3))
18 print(round(AxisAng3(so3ToVec(MatrixLog3(R12)))[1], 3))
19 print(round(AxisAng3(so3ToVec(MatrixLog3(R23)))[1], 3))
20 print(round(AxisAng3(so3ToVec(MatrixLog3(R34)))[1], 3))
21 print(round(AxisAng3(so3ToVec(MatrixLog3(R45)))[1], 3))
22 print(round(AxisAng3(so3ToVec(MatrixLog3(R56)))[1], 3))
23 print(round(AxisAng3(so3ToVec(MatrixLog3(R6b)))[1], 3))
24
25 Rsb = Rs6 @ R6b
26 print(Rsb)
```

homeowrk

```
/Users/christopherluey/Desktop/449/venv/bin/python /Users/christopherluey/Desktop/449/homeowrk.py
[ 0. -1.  0.]
2.969
0.785
1.571
0.873
0.157
0.0
3.142
[0.  0.  0.]
[[-0.9418 -0.0859  0.3249]
 [-0.3249 -0.0151 -0.9456]
 [ 0.0861 -0.9962 -0.0136]]

Process finished with exit code 0
```