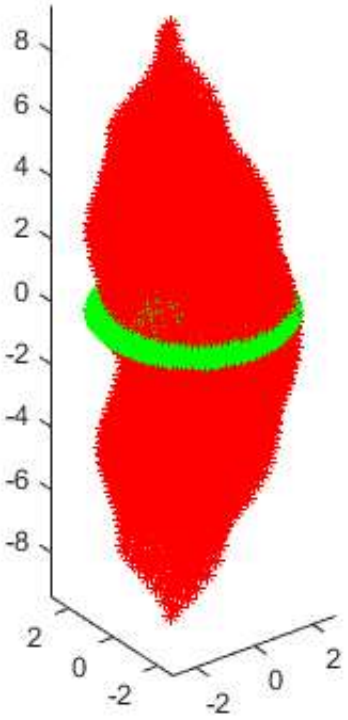
HW #7

Submitted by Jesse Austin Stringfellow, Due Nov. 13, 2019

Contents

Problem #1

```
planar_r3(1.5,1,.3)
```



Problem #2

a)

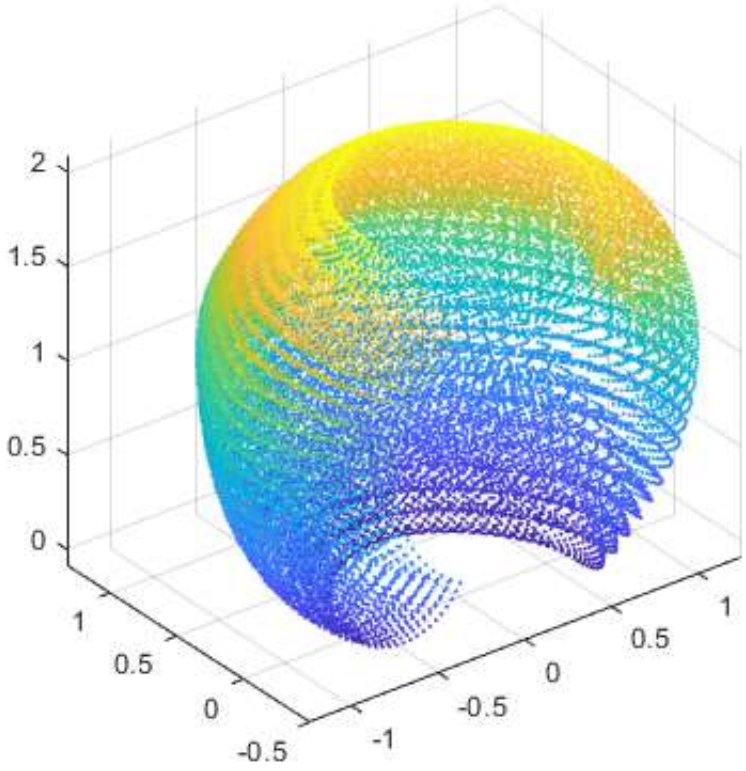
```
syms a1 a2 a3 l0 l1 l2
g1 = SE3([0;0;l0],[cos(a1) -sin(a1) 0; sin(a1) cos(a1) 0; 0 0 1])
g2 = SE3([0;0;0],[1 0 0; 0 cos(a2) -sin(a2); 0 sin(a2) cos(a2)])
g3 = SE3([0;l1;0],[cos(a3) -sin(a3) 0; sin(a3) cos(a3) 0; 0 0 1])
```

```
g4 = SE3([0;l2;0],eye(3))
ge = g1*g2*g3*g4
getRotationMatrix(ge)
getTranslation(ge)
```

```
[ cos(a1), -sin(a1), 0,  0]
[ sin(a1),  cos(a1), 0,  0]
[       0,        0, 1, l0]
[       0,        0, 0,  1]

[ 1,       0,        0, 0]
[ 0, cos(a2), -sin(a2), 0]
[ 0, sin(a2),  cos(a2), 0]
[ 0,       0,        0, 1]

[ cos(a3), -sin(a3), 0,  0]
[ sin(a3),  cos(a3), 0, l1]
[       0,        0, 1,  0]
[       0,        0, 0,  1]

[ 1, 0, 0,  0]
[ 0, 1, 0, l2]
[ 0, 0, 1,  0]
[ 0, 0, 0,  1]

[ cos(a1)*cos(a3) - cos(a2)*sin(a1)*sin(a3), - cos(a1)*sin(a3) - cos(a2)*cos(a3)*sin(a1),  si
n(a1)*sin(a2), - l2*(cos(a1)*sin(a3) + cos(a2)*cos(a3)*sin(a1)) - l1*cos(a2)*sin(a1)]
[ cos(a3)*sin(a1) + cos(a1)*cos(a2)*sin(a3),   cos(a1)*cos(a2)*cos(a3) - sin(a1)*sin(a3), -co
s(a1)*sin(a2),   l1*cos(a1)*cos(a2) - l2*(sin(a1)*sin(a3) - cos(a1)*cos(a2)*cos(a3))]
[                          sin(a2)*sin(a3),                              cos(a3)*sin(a2),
      cos(a2),                                  l0 + l1*sin(a2) + l2*cos(a3)*sin(a2)]
[                                        0,                                           0,
            0,                                                                     1]


ans =

[ cos(a1)*cos(a3) - cos(a2)*sin(a1)*sin(a3), - cos(a1)*sin(a3) - cos(a2)*cos(a3)*sin(a1),  si
n(a1)*sin(a2)]
[ cos(a3)*sin(a1) + cos(a1)*cos(a2)*sin(a3),   cos(a1)*cos(a2)*cos(a3) - sin(a1)*sin(a3), -co
s(a1)*sin(a2)]
[                          sin(a2)*sin(a3),                              cos(a3)*sin(a2),
      cos(a2)]


ans =

 - l2*(cos(a1)*sin(a3) + cos(a2)*cos(a3)*sin(a1)) - l1*cos(a2)*sin(a1)
   l1*cos(a1)*cos(a2) - l2*(sin(a1)*sin(a3) - cos(a1)*cos(a2)*cos(a3))
                                l0 + l1*sin(a2) + l2*cos(a3)*sin(a2)
```

b)

```
reachpartc(1,3/4,1/2) %Modified planar_r3 that reflects the
                      %joint limits and the translation matrix
```



c)

```
a1 = pi/3;a2=pi/3;a3=-pi/4;
l0 = 1; l1 = 3/4; l2 = 1/2;
g1 = SE3([0;0;l0],[cos(a1) -sin(a1) 0; sin(a1) cos(a1) 0; 0 0 1]);
g2 = SE3([0;0;0],[1 0 0; 0 cos(a2) -sin(a2); 0 sin(a2) cos(a2)]);
g3 = SE3([0;l1;0],[cos(a3) -sin(a3) 0; sin(a3) cos(a3) 0; 0 0 1]);
g4 = SE3([0;l2;0],eye(3));
ge = g1*g2*g3*g4
```

```
    0.6597    0.0474    0.7500   -0.3011
    0.4356    0.7891   -0.4330    0.5821
   -0.6124    0.6124    0.5000    1.9557
         0         0         0    1.0000
```

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