Quiz Chapters 3.3 and 3.4

Rigid-Body Motions

```
addpath('C:\Users\Lenovo\Documents\MATLAB\Modern Robotics\mr')
```

Q8 - Calculate θ from T_{sa}

```
Tsa=[   0,  -1, 0,  0;
        0,  0,  -1, 0;
        1,  0,  0,  1;
        0,  0,  0,  1];
expT = MatrixLog6(Tsa)
```

```
expT = 4×4
         0   -1.2092   -1.2092    0.7364
    1.2092         0   -1.2092    0.4728
    1.2092    1.2092         0    0.7364
         0         0         0         0
```

```
% expc6 = [w1;w2;w3;v1;v2;v3]
expc6 = [expT(3,2);expT(1,3);expT(2,1);expT(1,4);expT(2,4);expT(3,4)]
```

```
expc6 = 6×1
    1.2092
   -1.2092
    1.2092
    0.7364
    0.4728
    0.7364
```

```
[S, theta] = AxisAng6(expc6)
```

```
S = 6×1
    0.5774
   -0.5774
    0.5774
    0.3516
    0.2257
    0.3516
theta = 2.0944
```

```
rad2deg(theta)
```

```
ans = 120.0000
```

Q10 - Change the representation of wrench

```
Fb = [1;0;0;2;1;0];

Tbs = [ 1,  0,  0,  0;
        0,  0,  -1, 0;
        0,  1,  0,  -2;
        0,  0,  0,  1];
```

```
AdT_bs = Adjoint(Tbs);
Fs = AdT_bs*Fb
```

```
Fs = 6×1
     1
     0
     0
     2
    -2
     1
```

Q11 - Inverse of the homogeneous transformation matrix

```
T = [   0,  -1, 0,  3;
        1,  0,  0,  0;
        0,  0,  1,  1;
        0,  0,  0,  1];

invT = TransInv(T)
```

```
invT = 4×4
     0     1     0     0
    -1     0     0     3
     0     0     1    -1
     0     0     0     1
```

Q12 - se(3) matrix of the twist

```
V = [1;0;0;0;2;3];
se3mat = VecTose3(V)
```

```
se3mat = 4×4
     0     0     0     0
     0     0    -1     2
     0     1     0     3
     0     0     0     0
```

Q13 - Normalized screw axis representation S

```
q = [0; 0; 2];
s = [1; 0; 0];
h = 1;
S = ScrewToAxis(q, s, h)
```

```
S = 6×1
     1
     0
     0
     1
     2
     0
```

Q14 - Homogeneous transformation matrix

```
se3mat = [  0,      -1.5708,    0,  2.3562;
            1.5708, 0,          0,  -2.3562;
            0,      0,          0,  1;
            0,      0,          0,  0];

T = MatrixExp6(se3mat)
```

```
T = 4×4
   -0.0000   -1.0000         0    3.0000
    1.0000   -0.0000         0    0.0000
         0         0    1.0000    1.0000
         0         0         0    1.0000
```

Q15 - Matrix Logarithm

```
T=[ 0,  -1, 0,  3;
    1,  0,  0,  0;
    0,  0,  1,  1;
    0,  0,  0,  1];

expmat = MatrixLog6(T)
```

```
expmat = 4×4
         0   -1.5708         0    2.3562
    1.5708         0         0   -2.3562
         0         0         0    1.0000
         0         0         0         0
```