

Assignment 1

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1) Degrees of Freedom

(a) 2

(b) 3

(c) 5

2) Rotation Matrices

(a)

$$\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$$

(b)

$$\begin{bmatrix} 7.0711 \\ -7.0711 \end{bmatrix}$$

3) Inverting Homogeneous Transformations

$$H_i^j = \begin{bmatrix} R_i^j & d_i^j \\ (0)^\top & 1 \end{bmatrix}$$

$$\text{Now, } (H_i^j)^{-1} = H_j^i = \begin{bmatrix} R_j^i & d_j^i \\ (0)^\top & 1 \end{bmatrix}$$

$$\implies (H_i^j)^{-1} = \begin{bmatrix} (R_i^j)^{-1} & (R_i^j)^{-1} \times (-d_i^j) \\ (0)^\top & 1 \end{bmatrix}$$

$$\implies (H_i^j)^{-1} = \begin{bmatrix} (R_i^j)^\top & -(R_i^j)^\top d_i^j \\ (0)^\top & 1 \end{bmatrix}$$

4) Homogeneous Transformations

(a)

$$T_1 = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{bmatrix}$$

(b)

$$T_2 = \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

5) Picture

6) Feedback

`matlab_is_fun`