Tech Talk Notes

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1. Common Pose Operations:

$$P_C^A = P_C^B \cdot P_B^A$$
$$P_A^B = \left(P_B^A\right)^{-1}$$
$$v_B = T_B^A \cdot v_A$$

2. Position Operations:

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad \begin{bmatrix} x \\ y \end{bmatrix}$$

$$p_C^A = p_C^B + p_B^A$$
$$p_A^B = -p_B^A$$
$$p_B = p_B^A + p^A$$

3. commutative:
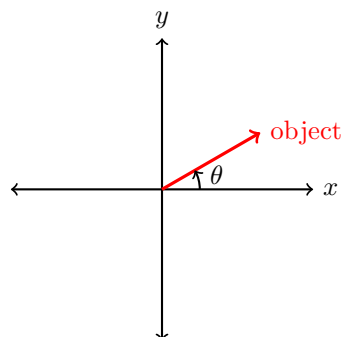
$$R_1 \cdot R_2 = R_2 \cdot R_1$$
$$R_1 \cdot R_2 \neq R_2 \cdot R_1$$

4. Rotation Matrix:

$$R = \begin{bmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{bmatrix}$$

$$z = a + bi, \quad \sqrt{a^2 + b^2} = 1$$

$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix}$$

$$R = \begin{bmatrix} \begin{bmatrix} r_{11} \\ r_{21} \\ r_{31} \end{bmatrix} & \begin{bmatrix} r_{12} \\ r_{22} \\ r_{32} \end{bmatrix} & \begin{bmatrix} r_{13} \\ r_{23} \\ r_{33} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} v_1 & v_2 & v_3 \end{bmatrix}^\top \cdot \theta$$

$$v \quad p \quad p_{\text{rot}}$$

$$\mathbf{q} = \begin{bmatrix} x & y & z & w \end{bmatrix}^\top = w + x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$$

$$\mathbb{S}^3$$

5. Pose Operations:

$$M = \begin{bmatrix} R & t \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & r_{13} & t_x \\ r_{21} & r_{22} & r_{23} & t_y \\ r_{31} & r_{32} & r_{33} & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M_1 M_2 = \begin{bmatrix} R_1 & t_1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} R_2 & t_2 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} R_1 R_2 & R_1 t_2 + t_1 \\ 0 & 1 \end{bmatrix}$$

$$P = (R, t)$$

$$(R_1, t_1) \cdot (R_2, t_2) = (R_1 \cdot R_2, R_1 \cdot t_2 + t_1)$$

$$(R, t) \cdot v = R \cdot v + t$$

$$(R, t)^{-1} = (R^{-1}, -R^{-1} t)$$

$$M_1 \cdot M_2 = M_1 M_2$$

$$M \cdot v = Mv$$

$$M^{-1} = M^{-1}$$

6. 2D diagrams: