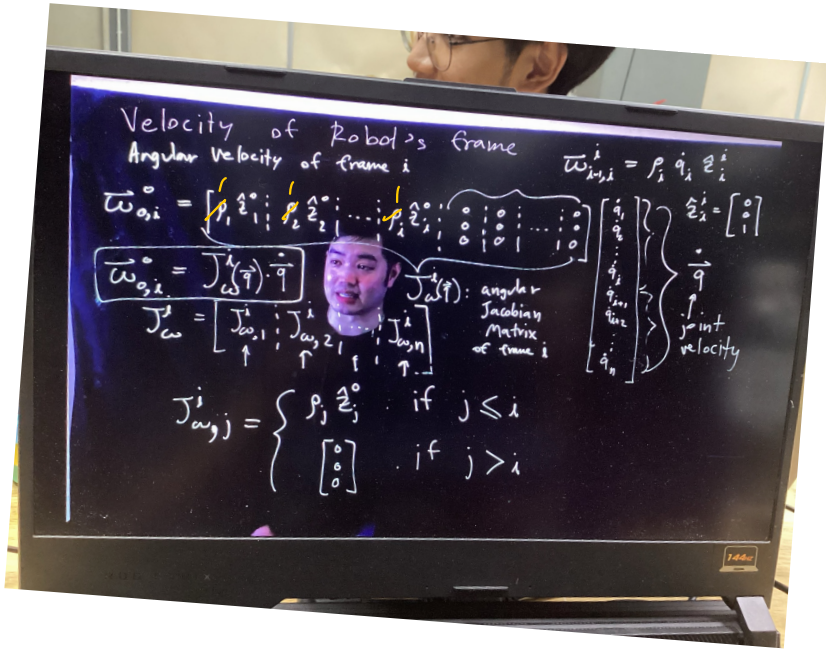
J_e ⇒ เมตริก ความสัมพันธ์ของตัวแปรปลายทาง

f_e

/ \

Angular linear

วิธีหาเวกเตอร์ Z (หลักๆคือ vo Rotation Matrix)



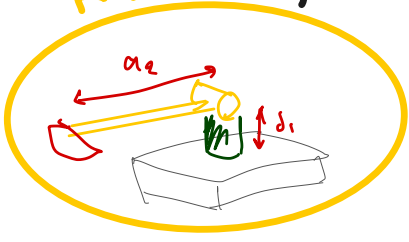
Angular Jacobian

$$\vec{\omega}^{\,0}_{B,C} = R^0_A \, \vec{\omega}^{\,A}_{B,C}$$

$$Z^{\,j}_{j} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$R^0_j \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = Z^0_j \rightarrow \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

RRR :: P=1



$$\text{Angular Jacobian} = \left[Z^0_0 \;;\; Z^0_1 \;;\; Z^0_2 \right]$$

linear Jacobian

RRR → $\rho = 1$

end-eff

$$J_{v,j} = (1-\rho_j)\hat{z}_j^0 + \rho_j \hat{z}_j^0 \times (\vec{P}_{o,i}^0 - \vec{P}_{o,j}^0)$$

$$\therefore J_{v,j} = z_j^0 \times (p\_e - \vec{P}_{o,j}^0)$$

$$J_1 = z_0^0 \times (p\_e - P[:,0])$$

$$J_2 = z_1^0 \times (p\_e - P[:,1])$$

$$J_3 = z_1^0 \times (p\_e - P[:,2])$$

Linear Jacobian = $[J_1 ; J_2 ; J_3]$