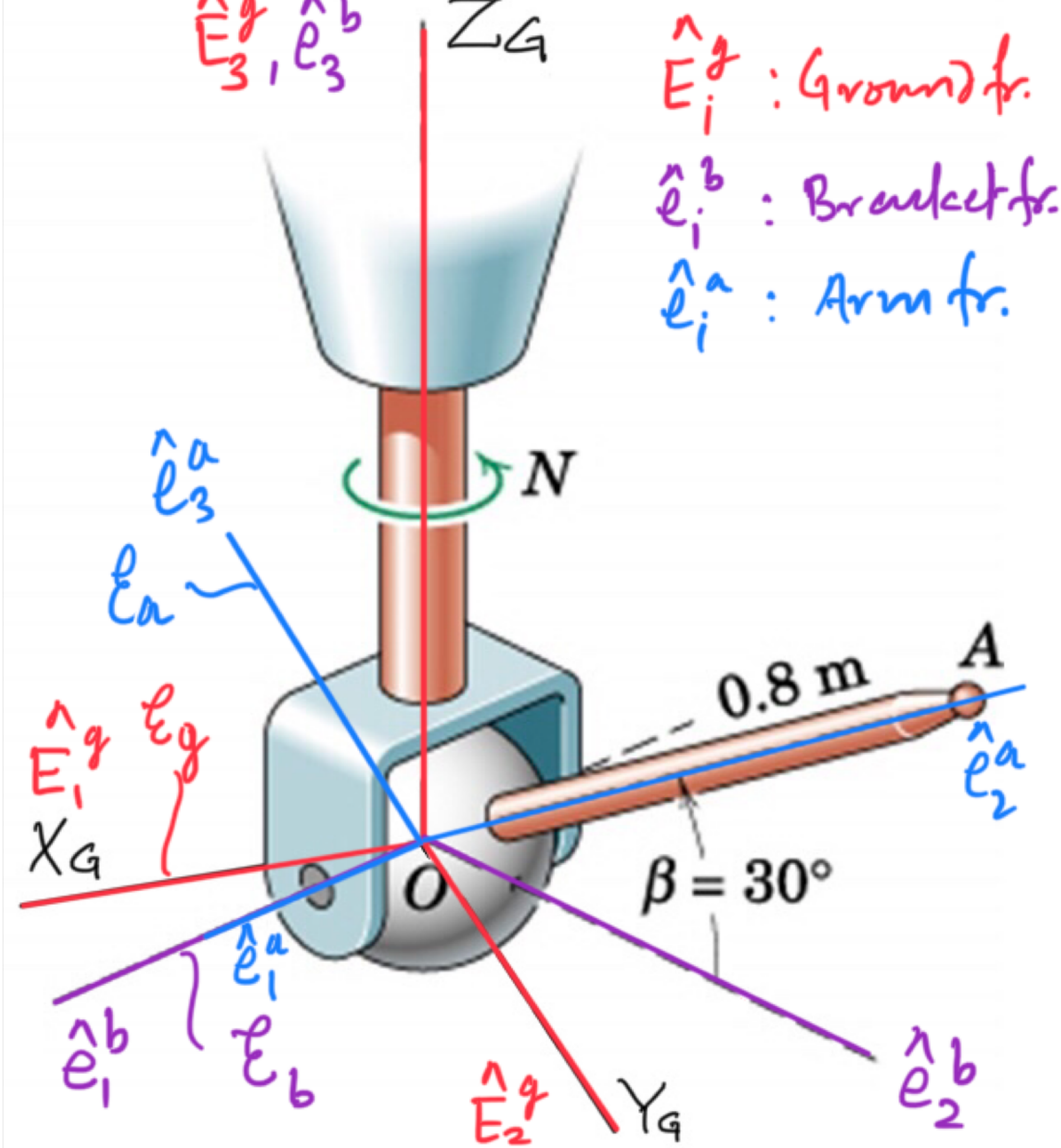

Z_G
$\hat{E}_3^g, \hat{e}_3^b$
$\hat{E}_i^g$: Ground fr.
$\hat{e}_i^b$: Bracket fr.
$\hat{e}_i^a$: Arm fr.
$\hat{e}_3^a$
ℓ_a
N
A
0.8 m
$\hat{e}_2^a$
$\hat{E}_1^g$
ℓ_g
X_G
O
$\beta = 30°$
$\hat{e}_1^a$
$\hat{e}_1^b$
ℓ_b
$\hat{E}_2^g$
Y_G
$\hat{e}_2^b$

We have already computed the angular velocity in Tutorial 05. However, let us revisit it.

$$\underline{\omega}^{\mathcal{E}_a/\mathcal{E}_g} = \underline{\omega}^{\mathcal{E}_a/\mathcal{E}_b} + \underline{\omega}^{\mathcal{E}_b/\mathcal{E}_g}$$

$$= \dot{\beta}\,\hat{e}_1^a + \frac{2\pi N}{60}\,\hat{e}_3^b$$

$$= \dot{\beta}\,\hat{e}_1^b + \frac{2\pi N}{60}\,\hat{e}_3^b$$

At the instant when $\mathcal{E}_g$ and $\mathcal{E}_b$ coincide

$$\boxed{\underline{\omega}^{\mathcal{E}_a/\mathcal{E}_g} = \dot{\beta}\,\hat{E}_1^g + \frac{2\pi N}{60}\,\hat{E}_3^g}$$

<u>Angular acceleration of the arm</u>:

In the bracket frame $\mathcal{E}_b$ the arm frame has the constant angular velocity $= \dot{\beta}\,\hat{e}_1^b$

Employing

$$\dot{\underline{u}}(t) = \overset{\circ}{\underline{u}}(t) + \underline{\omega}_{\mathcal{E}^b/\mathcal{E}^g} \times \underline{u}(t)$$

Time rate of change of $\underline{u}(t)$ observed in $\mathcal{E}^g$

Time rate of change of $\underline{u}(t)$ observed in $\mathcal{E}^b$

In the present case $\underline{u}(t) = \underline{\omega}_{\mathcal{E}^a/\mathcal{E}^b}$

$$\therefore \ \overset{\circ}{\underline{u}}(t) = \underline{0}$$

$$\dot{\underline{u}}(t) = \frac{d}{dt}\underline{\omega}_{\mathcal{E}^a/\mathcal{E}^b} = \underline{\omega}_{\mathcal{E}^b/\mathcal{E}^g} \times \underline{\omega}_{\mathcal{E}^a/\mathcal{E}^b}$$

or $$\underline{\alpha}(t) = \underline{\frac{2\pi N}{60}\hat{e}_3^b} \times \underline{\dot{\beta}\,\hat{e}_1^b}$$

$$\boxed{\underline{\alpha}(t) = \frac{2\pi N\dot{\beta}}{60}\hat{e}_2^b}$$

When $\mathcal{E}^b$ and $\mathcal{E}^g$ coincide

$$\boxed{\underline{\alpha}(t) = \frac{2\pi N\dot{\beta}}{60}\hat{E}_2}$$