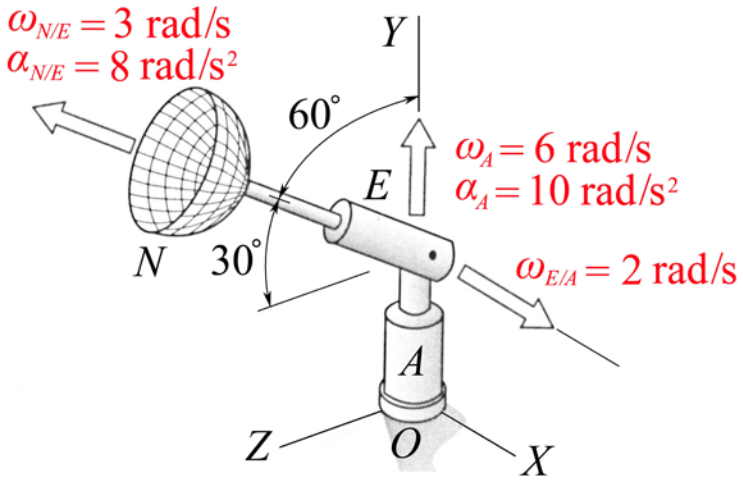
MEEG 4003 Quiz #19.m26.093

1. ⑤ Add the missing terms in the following equation

$$\boldsymbol{\alpha}_{A/B} = \boldsymbol{\alpha}_{A/P} + \boldsymbol{\alpha}_{P/Q} + \boldsymbol{\alpha}_{Q/R} + \boldsymbol{\alpha}_{R/B} + \ldots$$

so that it will become a correct formula representing the *addition theorem for angular accelerations* of rigid bodies *A*, *B*, *P*, *Q*, and *R* moving in three-dimensional space.

2. ⑩ At the instant shown, the antenna *N*, the body *E*, and the body *A* execute angular motions as labeled. Determine the angular velocity $\boldsymbol{\omega}_N$ and the angular acceleration $\boldsymbol{\alpha}_N$ of the antenna *N*.



1.

$$\boldsymbol{\alpha}_{A/B} = \boldsymbol{\alpha}_{A/P} + \boldsymbol{\alpha}_{P/Q} + \boldsymbol{\alpha}_{Q/R} + \boldsymbol{\alpha}_{R/B}$$
$$+ \boldsymbol{\omega}_{P/B} \times \boldsymbol{\omega}_{A/P} + \boldsymbol{\omega}_{Q/B} \times \boldsymbol{\omega}_{P/Q} + \boldsymbol{\omega}_{R/B} \times \boldsymbol{\omega}_{Q/R}$$ ⑤

2.

$$\boldsymbol{\omega}_N = \boldsymbol{\omega}_{N/E} + \boldsymbol{\omega}_{E/A} + \boldsymbol{\omega}_A$$

$$\boldsymbol{\omega}_N = 2\mathbf{I} + 7.5\mathbf{J} + 2.60\mathbf{K} \text{ rad/s}$$ ⑤

$$\boldsymbol{\omega}_E = \boldsymbol{\omega}_{E/A} + \boldsymbol{\omega}_A = 2\mathbf{I} + 6\mathbf{J} \text{ rad/s}$$

$$\boldsymbol{\alpha}_N = \boldsymbol{\alpha}_{N/E} + \boldsymbol{\alpha}_{E/A} + \boldsymbol{\alpha}_A + \boldsymbol{\omega}_E \times \boldsymbol{\omega}_{N/E} + \boldsymbol{\omega}_A \times \boldsymbol{\omega}_{E/A}$$
$$= 8(\cos 60°\mathbf{J} + \sin 60°\mathbf{K}) + \mathbf{0} + 10\mathbf{J}$$
$$+ (2\mathbf{I} + 6\mathbf{J}) \times 3(\cos 60°\mathbf{J} + \sin 60°\mathbf{K}) + 6\mathbf{J} \times 2\mathbf{I}$$

$$\boldsymbol{\alpha}_N = 15.59\mathbf{I} + 8.80\mathbf{J} - 2.07\mathbf{K} \text{ rad/s}^2$$ ⑤