

[3.3절]

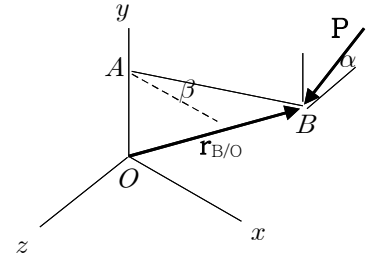
3.98 $P = 110 \text{ N}$, $\alpha = 15^\circ$, $\beta = 35^\circ$, $l_{AB} = 0.220 \text{ m}$, $l_{OA} = 0.150 \text{ m}$

S; known \mathbf{P} , unknown \mathbf{F} , \mathbf{M}_O

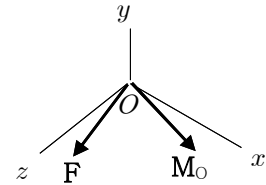
M; 자유물체도(F.B.D.)

\Rightarrow 3차원 등가 힘-우력 계

$$\begin{aligned} \text{A; } \Sigma \mathbf{F} ; \mathbf{F} &= \mathbf{P} = P (-\sin\alpha \mathbf{j} + \cos\alpha \mathbf{k}) \\ &= (110 \text{ N}) (-\sin 15^\circ \mathbf{j} + \cos 15^\circ \mathbf{k}) \\ &= (-28.47 \text{ N}) \mathbf{j} + (106.25 \text{ N}) \mathbf{k} \\ \Rightarrow \mathbf{F} &= (-28.5 \text{ N}) \mathbf{j} + (106.3 \text{ N}) \mathbf{k} \end{aligned}$$



$$\begin{aligned} \mathbf{r}_{B/O} &= l_{OA} \mathbf{j} + l_{AB} (\cos\beta \mathbf{i} + \sin\beta \mathbf{k}) \\ &= (0.150 \text{ m}) \mathbf{j} + (0.220 \text{ m}) (\cos 35^\circ \mathbf{i} - \sin 35^\circ \mathbf{k}) \\ &= 0.1802 \mathbf{i} + 0.1500 \mathbf{j} - 0.1262 \mathbf{k} \text{ (m)} \end{aligned}$$



$$\begin{aligned} \Sigma \mathbf{M}_O ; \mathbf{M}_O &= \mathbf{r}_{B/O} \times \mathbf{P} \\ &= [0.1802 \mathbf{i} + 0.1500 \mathbf{j} - 0.1262 \mathbf{k} \text{ (m)}] \times [-28.5 \mathbf{j} + 106.3 \mathbf{k} \text{ (N)}] \\ &= [(0.1500)(106.3) - (-0.1262)(-28.5)] \mathbf{i} + [0 - (0.1802)(106.3)] \mathbf{j} \\ &\quad + [(0.1802)(-28.5) - 0] \mathbf{k} \text{ (N} \cdot \text{m)} \\ &= 12.35 \mathbf{i} - 19.16 \mathbf{j} - 5.14 \mathbf{k} \text{ (N} \cdot \text{m)} \end{aligned}$$

R(과정의 타당성) ; 서술

(가령, $\Sigma \mathbf{M}_B$ 또는 $\Sigma \mathbf{M}_A$ 대신 $\Sigma \mathbf{M}_O$ 를 사용한 과정의 장점)

T(결과의 의미) ; 서술

(가령, $M_x > 0$, $M_y < 0$, $M_z < 0$, 각 좌표축에 관한 모멘트의 방향)