

{3.12~3.16절}

3.73 [우력 모멘트, 우력 벡터 합성]

$$M = 12 \text{ N}\cdot\text{m}$$

$$M = d F \Rightarrow F = \frac{M}{d}$$

(a) $d_{AB} = 0.450 \text{ m}$

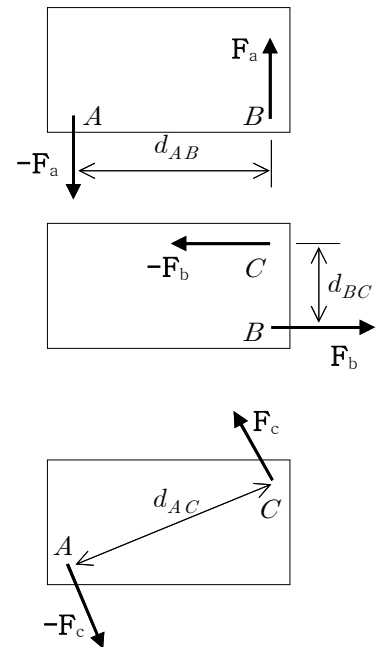
$$F_a = \frac{M}{d_{AB}} = \frac{12 \text{ N}\cdot\text{m}}{0.450 \text{ m}} = 26.7 \text{ N}$$

(b) $d_{BC} = 0.240 \text{ m}$

$$F_a = \frac{M}{d_{BC}} = \frac{12 \text{ N}\cdot\text{m}}{0.240 \text{ m}} = 50.0 \text{ N}$$

(c) $d_{AC} = \sqrt{d_{AB}^2 + d_{BC}^2} = \sqrt{0.450^2 + 0.240^2} = 0.510 \text{ m}$

$$F_a = \frac{M}{d_{AC}} = \frac{12 \text{ N}\cdot\text{m}}{0.510 \text{ m}} = 23.5 \text{ N}$$



3.82 [2차원 등가 힘-우력]

$$P = 30 \text{ N}, \quad \mathbf{P} = 30 \text{ N} \downarrow$$

$$d_{ABx} = 0.05 \text{ m}, \quad d_{BC} = 0.03 \text{ m}$$

(a) $\Sigma \mathbf{F} : P_B = P = 30 \text{ N}$

$$\uparrow \Sigma M_A : M_B - P_B d_{ABx} = 0$$

$$\Rightarrow M_B = P_B d_{ABx} = (30 \text{ N})(0.05 \text{ m}) = 1.50 \text{ Nm}$$

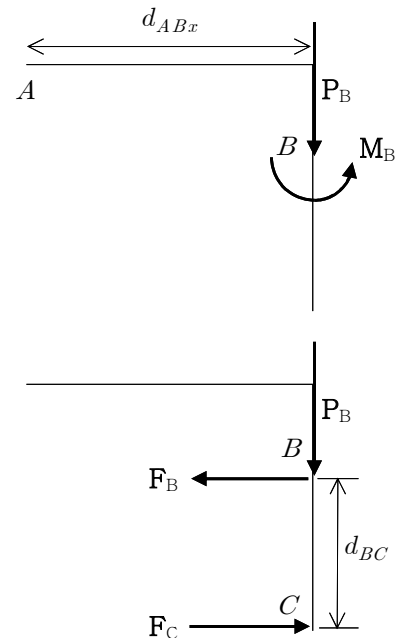
$$\Rightarrow \mathbf{P}_B = 30.0 \text{ N} \downarrow, \quad \mathbf{M}_B = 1.500 \text{ N}\cdot\text{m} \uparrow$$

(b) $\mathbf{F}_B = F \leftarrow, \quad \mathbf{F}_C = F \rightarrow$

$$\uparrow \Sigma M_B : M_B = F d_{BC}$$

$$\Rightarrow F = \frac{M_B}{d_{BC}} = \frac{1.500 \text{ N}\cdot\text{m}}{0.03 \text{ m}} = 50.0 \text{ N}$$

$$\Rightarrow \mathbf{F}_B = 50.0 \text{ N} \leftarrow, \quad \mathbf{F}_C = 50.0 \text{ N} \rightarrow$$



3.97 [3차원 등가 힘-우력]

$$F_{AB} = 175 \text{ N}$$

$$\begin{aligned} \mathbf{r}_{B/C} &= (0.750 - 0.067) \mathbf{i} + (0.990 - 1.850) \mathbf{j} \text{ (m)} \\ &= 0.683 \mathbf{i} - 0.860 \mathbf{j} \text{ (m)} \end{aligned}$$

$$d_{ABx} = (0.100 - 0.067) \text{ m} = 0.033 \text{ m}$$

$$d_{ABy} = 0.990 \text{ m}, \quad d_{ABz} = -0.594 \text{ m}$$

$$\begin{aligned} d_{AB} &= \sqrt{d_{ABx}^2 + d_{ABy}^2 + d_{ABz}^2} \\ &= \sqrt{0.033^2 + 0.990^2 + (-0.594)^2} \text{ m} = 1.155 \text{ m} \end{aligned}$$

$$\begin{aligned} \lambda_{AB} &= \frac{1}{d_{AB}} (d_{ABx} \mathbf{i} + d_{ABy} \mathbf{j} + d_{ABz} \mathbf{k}) \\ &= \frac{1}{1.155} [0.033 \mathbf{i} + 0.990 \mathbf{j} + (-0.594) \mathbf{k}] \end{aligned}$$

$$\begin{aligned} \mathbf{F}_{AB} &= F_{AB} \lambda_{AB} \\ &= \frac{175 \text{ N}}{1.155} [0.033 \mathbf{i} + 0.990 \mathbf{j} + (-0.594) \mathbf{k}] \\ &= 5.00 \mathbf{i} + 150.0 \mathbf{j} + (-90.0) \mathbf{k} \text{ (N)} \end{aligned}$$

$$\mathbf{F}_C = \mathbf{F}_{AB} = 5.00 \mathbf{i} + 150.0 \mathbf{j} + (-90.0) \mathbf{k} \text{ (N)}$$

$$\begin{aligned} \mathbf{M}_C &= \mathbf{r}_{B/C} \times \mathbf{F}_{AB} = [0.683 \mathbf{i} - 0.860 \mathbf{j} \text{ (m)}] \times [5.00 \mathbf{i} + 150.0 \mathbf{j} + (-90.0) \mathbf{k} \text{ (N)}] \\ &= [(-0.860)(-90.0) + 0] \mathbf{i} + [0 - (0.683)(-90.0)] \mathbf{j} \\ &\quad + [(0.683)(150.0) - (-0.860)(5.00)] \mathbf{k} \text{ (N}\cdot\text{m)} \\ &= 77.4 \mathbf{i} + 61.5 \mathbf{j} + 106.8 \mathbf{k} \text{ (N}\cdot\text{m)} \end{aligned}$$

