

[2.5절]

2.123 $W = 376 \text{ N}$, $\mathbf{P} = P \mathbf{i}$, $\mathbf{Q} = Q \mathbf{k}$

S; known W , $T_{AB} = T_{AC} (= T)$, 좌표들

unknown P , Q

⇒ 공간에서 힘의 직각성분 (좌표 이용), 평형

A; $\mathbf{W} = -W \mathbf{j}$

$$d_{AB} = \sqrt{(-130 \text{ mm})^2 + (400 \text{ mm})^2 + (160 \text{ mm})^2} \\ = 450 \text{ mm}$$

$$\lambda_{AB} = \frac{1}{450}(-130 \mathbf{i} + 400 \mathbf{j} + 160 \mathbf{k}) \\ = -0.2889 \mathbf{i} + 0.8889 \mathbf{j} + 0.3556 \mathbf{k}$$

$$\mathbf{T}_{AB} = T \lambda_{AB} = T(-0.2889 \mathbf{i} + 0.8889 \mathbf{j} + 0.3556 \mathbf{k})$$

$$d_{AC} = \sqrt{(-150 \text{ mm})^2 + (400 \text{ mm})^2 + (-240 \text{ mm})^2} = 490 \text{ mm}$$

$$\lambda_{AC} = \frac{1}{490}(-150 \mathbf{i} + 400 \mathbf{j} - 240 \mathbf{k}) = 0.3061 \mathbf{i} + 0.8163 \mathbf{j} - 0.4898 \mathbf{k}$$

$$\mathbf{T}_{AC} = T \lambda_{AC} = T(-0.3061 \mathbf{i} + 0.8163 \mathbf{j} - 0.4898 \mathbf{k})$$

$$\Sigma \mathbf{F} = 0 \Rightarrow \mathbf{T}_{AB} + \mathbf{T}_{AC} + \mathbf{P} + \mathbf{Q} + \mathbf{W} = 0$$

$$\Sigma F_x = 0 ; -0.2889 T - 0.3061 T + P = 0 \quad \dots \textcircled{1}$$

$$\Sigma F_y = 0 ; 0.8889 T + 0.8163 T - W = 0 \quad \dots \textcircled{2}$$

$$\Sigma F_z = 0 ; 0.3556 T - 0.4898 T + Q = 0 \quad \dots \textcircled{3}$$

$$\textcircled{2} \Rightarrow (0.8889 + 0.8163) T = W \quad \Rightarrow \quad T = \frac{376 \text{ N}}{1.7052} = 220.5 \text{ N}$$

$$\textcircled{1} \Rightarrow P = (0.2889 + 0.3061) T = 0.5950 (220.5 \text{ N}) = 131.20 \text{ N}$$

$$\textcircled{3} \Rightarrow Q = (-0.3556 + 0.4898) T = 0.1342 (220.5 \text{ N}) = 29.59 \text{ N} \\ \Rightarrow P = 131.2 \text{ N}, Q = 29.6 \text{ N}$$

R; 과정의 타당성 (가령, 공간에서 힘의 직각성분)

T; 결과 검토 (가령, 두 줄이 A에 가하는 힘의 합력의 x, y, z 성분)

