

[3.2절]

3.59 S; $T_{AE} = 55 \text{ N}$, $M_{DB} = ?$

⇒ 축 DB 에 관한 모멘트

$$M_{DB} = \lambda_{DB} \cdot (\mathbf{r}_{A/D} \times \mathbf{T}_{AE})$$

A; ① $\mathbf{r}_{A/D} = 0\mathbf{i} + (0.6 - 0.7)\mathbf{j} + (0.2)\mathbf{k} \text{ (m)}$
 $= -0.1\mathbf{j} + 0.2\mathbf{k} \text{ (m)}$

② $\mathbf{T}_{AE} = T_{AE} \lambda_{AE}$
 $= (55 \text{ N}) \frac{(0.9 \text{ m})\mathbf{i} - (0.6 \text{ m})\mathbf{j} + (0.4 \text{ m} - 0.2 \text{ m})\mathbf{k}}{\sqrt{(0.9 \text{ m})^2 + (-0.6 \text{ m})^2 + (0.2 \text{ m})^2}}$
 $= \frac{55 \text{ N}}{1.1} (0.9 \mathbf{i} - 0.6 \mathbf{j} + 0.2 \mathbf{k})$
 $= 45.0 \mathbf{i} - 30.0 \mathbf{j} + 10.0 \mathbf{k} \text{ (N)}$

①② $\mathbf{M}_D = \mathbf{r}_{A/D} \times \mathbf{T}_{AE} = [-0.1 \mathbf{j} + 0.2 \mathbf{k} \text{ (m)}] \times [45.0 \mathbf{i} - 30.0 \mathbf{j} + 10.0 \mathbf{k} \text{ (N)}]$
 $= [(-0.1) \times (+10.0) - (0.2) \times (-30.0)]\mathbf{i} + (0.2 \times 45.0)\mathbf{j} + [-(-0.1) \times 45.0]\mathbf{k} \text{ (N}\cdot\text{m)}$
 $= 5.0 \mathbf{i} + 9.0 \mathbf{j} + 4.5 \mathbf{k} \text{ (N}\cdot\text{m)}$

③ $\lambda_{DB} = \frac{(0.9 + 0.3 \text{ m})\mathbf{i} - (0.7 - 0.35 \text{ m})\mathbf{j}}{\sqrt{(1.2 \text{ m})^2 + (-0.35 \text{ m})^2}} = 0.96 \mathbf{i} - 0.28 \mathbf{j}$

④ $M_{DB} = \lambda_{DB} \cdot \mathbf{M}_D = \lambda_{DB} \cdot (\mathbf{r}_{A/D} \times \mathbf{T}_{AE})$
 $= (0.96 \mathbf{i} - 0.28 \mathbf{j}) \cdot [5.0 \mathbf{i} + 9.0 \mathbf{j} + 4.5 \mathbf{k} \text{ (N}\cdot\text{m)}]$
 $= (0.96)(5.0) + (-0.28)(9.0) + 0 = 2.28 \text{ (N}\cdot\text{m)}$

R(과정의 타당성) : (가령 \mathbf{M}_D 계산에 사용될 수 있는 위치벡터 $\mathbf{r}_{A/D}$, $\mathbf{r}_{E/D}$, $\mathbf{r}_{A/B}$, $\mathbf{r}_{E/B}$)

T(결과의 의미) : (가령, $M_{DB} > 0$, 선 DB 에 관한 모멘트의 방향)

M; 자유물체도(F.B.D.)

