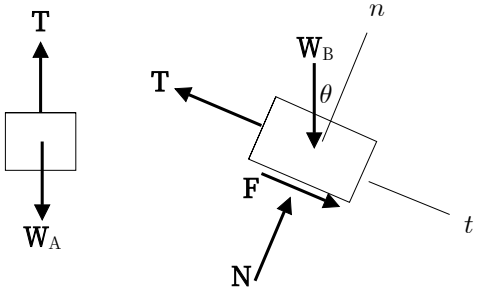
정 역 학　　연습문제 풀이　　제8장　　(2010년)

{8.1~8.2절}



8.2　$\mu_s = 0.35$,　$\mu_k = 0.25$,

$W_A = 40$ N,　$W_B = 52$ N,　$\theta = 25°$

(a) A에서

$\Sigma F_y = 0$;　$T - W_A = 0$

$\Rightarrow$　$T = W_A = 40$ N

B에서

$\nearrow \Sigma F_n = 0$;　$N - W_B \cos\theta = 0$

$\Rightarrow$　$N = W_B \cos\theta = (52\text{ N}) \cos 25° = 47.13$ N

$F_{\max} = \mu_s N = (0.35)(47.13\text{ N}) = 16.49$ N

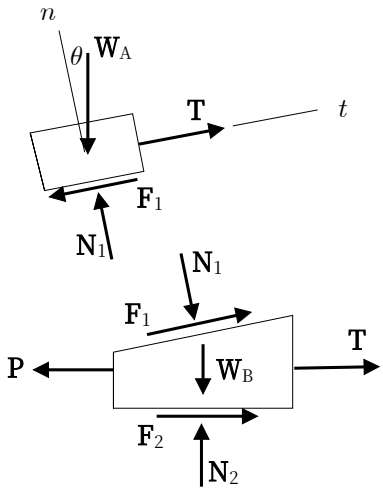
$\nwarrow \Sigma F_t = 0$;　$T - F - W_B \sin\theta = 0$

$\Rightarrow$　$F = T - W_B \sin\theta = (40\text{ N}) - (52\text{ N}) \sin 25° = 18.02$ N

$F > F_{\max}$　$\Rightarrow$　불가능　$\Rightarrow$　평형 아님

(b) 미끄러져 올라감

$F = \mu_k N = (0.25)(47.13\text{ N}) = 11.78$ N　　$\Rightarrow$　　**F** = 11.78 N $\searrow 25°$



8.12　$m_A = 20$ kg,　$m_B = 30$ kg,　$\theta = 15°$

$\mu_s = 0.40$,　$\mu_k = 0.30$

$W_A = m_A g = (20\text{ kg})(9.81\text{ m/s}^2) = 196.2$ N

$W_B = m_B g = (30\text{ kg})(9.81\text{ m/s}^2) = 294.3$ N

(a) 위 블럭

$\nwarrow \Sigma F_n = 0$;　$N_1 - W_A \cos\theta = 0$

$\Rightarrow$　$N_1 = W_A \cos\theta = (196.2\text{ N}) \cos 15° = 189.5$ N

$F_1 = \mu_s N_1 = (0.40)(189.5\text{ N}) = 75.8$ N

$\nearrow \Sigma F_t = 0$;　$T - F_1 - W_A \sin\theta = 0$

$\Rightarrow$　$T = F_1 + W_A \sin\theta$

$= (75.8\text{ N}) + (196.2\text{ N}) \sin 15° = 126.6$ N

아래 블럭

$\uparrow \Sigma F_y = 0$;　$N_2 - W_B - N_1 \cos\theta + F_1 \sin\theta = 0$

$\Rightarrow$　$N_2 = W_B + N_1 \cos\theta - F_1 \sin\theta$

$= (294.3\text{ N}) + (189.5\text{ N}) \cos 15° - (75.8\text{ N}) \sin 15° = 457.7$ N

$F_2 = \mu_s N_2 = (0.40)(457.7\text{ N}) = 183.1$ N

$\rightarrow \Sigma F_x = 0$;　$-P + T + F_2 + F_1 \cos\theta + N_1 \sin\theta = 0$

$\Rightarrow$　$P = T + F_2 + F_1 \cos\theta + N_1 \sin\theta$

$= (126.6\text{ N}) + (183.1\text{ N}) + (75.8\text{ N}) \cos 15° + (189.5\text{ N}) \sin 15 = 432.0$ N

P = 432 N$\leftarrow$

(b) $\uparrow \Sigma F_y = 0$; $N - (W_A + W_B) = 0$

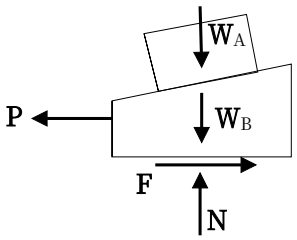
$\Rightarrow \quad N = W_A + W_B = (196.2\ \text{N}) + (294.3\ \text{N}) = 490.5\ \text{N}$

$F = \mu_s N = (0.40)\ (490.5\ \text{N}) = 196.2\ \text{N}$

$\rightarrow \Sigma F_x = 0$; $-P + F = 0$

$\Rightarrow \quad P = F = 196.2\ \text{N}$

P = 196.2 N←



8.19 $P = 600\ \text{N}, \quad \mu_s = 0.40, \quad \mu_k = 0.30$

$F = \mu_k N$ (∵ The drum is rotating.)

(a) clockwise rotation

⟩$\Sigma M_A = 0$;

$$(0.150\ \text{m})\ P + (0.150\ \text{m})\ F - (0.450\ \text{m})\frac{F}{\mu_k} = 0$$

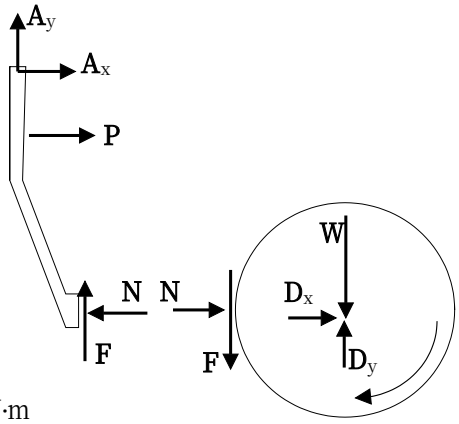
$$\Rightarrow \quad F = P\frac{(0.150\ \text{m})}{\dfrac{(0.450\ \text{m})}{\mu_k} - (0.150\ \text{m})}$$

$$= (600\ \text{N})\frac{(0.150\ \text{m})}{\dfrac{(0.450\ \text{m})}{0.30} - (0.150\ \text{m})}$$

$$= 66.67\ \text{N}$$

$M = (0.250\ \text{m})\ F = (0.250\ \text{m})\ (66.67\ \text{N}) = 16.67\ \text{N·m}$

M = 16.67 N·m⟩



(b) counterclockwise rotation

⟩$\Sigma M_A = 0$;

$$(0.150\ \text{m})\ P - (0.150\ \text{m})\ F - (0.450\ \text{m})\ \frac{F}{\mu_k} = 0$$

$$\Rightarrow \quad F = P\frac{(0.150\ \text{m})}{\dfrac{(0.450\ \text{m})}{\mu_k} + (0.150\ \text{m})}$$

$$= (600\ \text{N})\frac{(0.150\ \text{m})}{\dfrac{(0.450\ \text{m})}{0.30} + (0.150\ \text{m})}$$

$$= 54.54\ \text{N}$$

$M = -(0.250\ \text{m})\ F = -(0.250\ \text{m})\ (54.54\ \text{N}) = -13.64\ \text{N·m}$

M = 13.64 N·m⟨