{8.3~8.4절}

8.8 $\mu_s = 0.30, \quad \mu_k = 0.25$

$\theta = 65°, \quad \alpha = 35°, \quad W = 500$ N

$\phi_s = \tan^{-1}0.30 = 16.70°$

(a) 위로 움직이려 할 때

$\beta = \alpha + \phi_s = 35° + 16.70° = 51.70°$

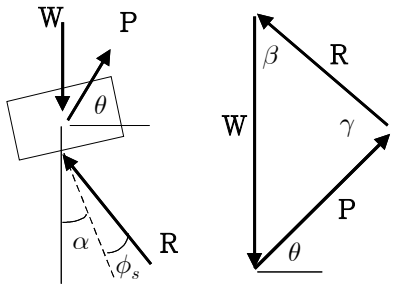
$\gamma = (90°-\beta) + \theta$

$= (90° - 51.70°) + 65° = 103.3°$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma}$$

$$P = W\,\frac{\sin\beta}{\sin\gamma}$$

$$= (500\text{ N})\,\frac{\sin 51.70^\circ}{\sin 103.3^\circ} = 403.2\text{ N} \quad \Rightarrow \quad P = 403\text{ N}$$



(b) 아래로 움직이려 할 때

$\beta = \alpha - \phi_s = 35° - 16.70° = 18.30°$

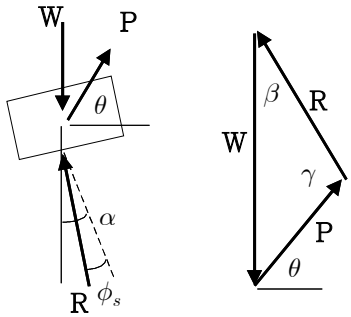
$\gamma = (90°-\beta) + \theta$

$= (90° - 18.30°) + 65° = 136.7°$

$$\frac{P}{\sin\beta} = \frac{W}{\sin\gamma}$$

$$P = W\,\frac{\sin\beta}{\sin\gamma}$$

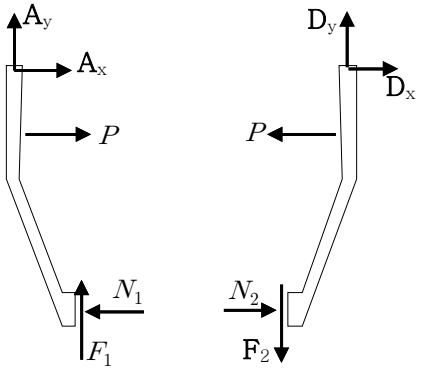
$$= (500\text{ N})\,\frac{\sin 18.30^\circ}{\sin 136.7^\circ} = 228.9\text{ N} \quad \Rightarrow \quad P = 229\text{ N}$$



8.22 $\mu_s = 0.40$, $\mu_k = 0.30$, $M = 100$ N·m

최소 P ⇒ 최대 마찰력

$F_1 = \mu_s N_1$, $F_2 = \mu_s N_2$



AB에서 $\circlearrowleft \Sigma M_A = 0$;

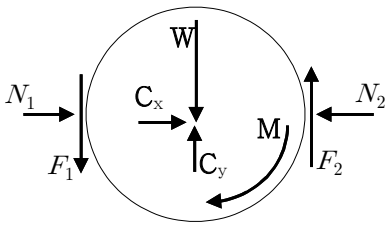
$$(0.150\text{ m})\,P + (0.150\text{ m})\,\mu_s N_1 - (0.450\text{ m})\,N_1 = 0$$

$$\Rightarrow \quad N_1 = \frac{0.150\text{ m}}{(0.450\text{ m}) - (0.150\text{ m})(0.40)}\,P = 0.3846\,P$$

DE에서 $\circlearrowleft \Sigma M_D = 0$;

$$-(0.150\text{ m})\,P + (0.150\text{ m})\,\mu_s N_2 + (0.450\text{ m})\,N_2 = 0$$

$$\Rightarrow \quad N_2 = \frac{0.150\text{ m}}{(0.450\text{ m}) + (0.150\text{ m})(0.40)}\,P = 0.2941\,P$$



드럼에서 $\circlearrowleft \Sigma M_C = 0$;

$$(0.250\text{ m})\,(F_1 + F_2) - M = 0$$

$$\Rightarrow \quad (0.250\text{ m})\,(\mu_s N_1 + \mu_s N_2) - M = 0$$

$$\Rightarrow \quad (0.250\text{ m})\,\mu_s\,(0.3846 + 0.2941)\,P = M$$

$$\Rightarrow \quad P = \frac{100\text{ N}\cdot\text{m}}{(0.250\text{ m})(0.40)(0.3846+0.2941)} = 1473\text{ N} = 1.473\text{ kN}$$