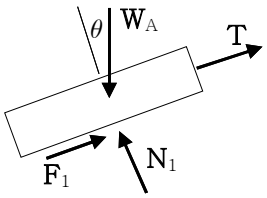
[8.1절]

8.12　W_A = 50 N,　W_B = 25 N,　μ_s = 0.15

S; 힘의 평형방정식, 최대 정지마찰력　　M;

A;



블럭 A

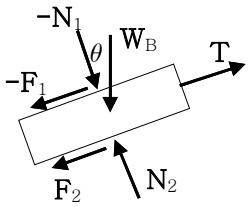
$\nwarrow \Sigma F_n = 0$;　$N_1 - W_A \cos\theta = 0$

$\Rightarrow$　$N_1 = W_A \cos\theta$

$F_1 = \mu_s N_1 = \mu_s W_A \cos\theta$

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

$\Rightarrow$　$T = W_A \sin\theta - \mu_s W_A \cos\theta$



블록 B

$\nwarrow \Sigma F_n = 0$;　$N_2 - N_1 - W_B \cos\theta = 0$

$\Rightarrow$　$N_2 = N_1 + W_B \cos\theta$

$= W_A \cos\theta + W_B \cos\theta$

$\nearrow \Sigma F_t = 0$;　$T - F_1 - F_2 - W_B \sin\theta = 0$

$\Rightarrow$　$T = W_B \sin\theta + F_1 + F_2$

$= W_B \sin\theta + \mu_s W_A \cos\theta + \mu_s (W_A + W_B) \cos\theta$

$W_A \sin\theta - \mu_s W_A \cos\theta = W_B \sin\theta + \mu_s (2W_A + W_B) \cos\theta$

$\Rightarrow$　$(W_A - W_B) \sin\theta = \mu_s (3W_A + W_B) \cos\theta$

$$\Rightarrow \tan\theta = \frac{\mu_s (3W_A + W_B)}{W_A - W_B} = \frac{(0.15)[3(50\text{ N}) + (25\text{ N})]}{(50\text{ N}) - (25\text{ N})} = 1.05$$

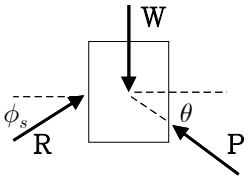
$\Rightarrow$　$\theta = \tan^{-1}(1.05) = 46.40°$　$\Rightarrow$　$\theta = 46.4°$

R; (과정의 타당성 검토) (가령, 마찰력 방향)

T; (결과의 의미 검토) (가령, θ가 커짐에 따라 A가 ↙방향으로 움직이려 하고 B가 ↗방향으로 움직이려 함)

8.10 P = 100 N, m = 7.5 kg, μ_s = 0.45, μ_k = 0.35

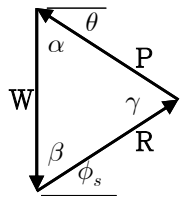
S; 최대 마찰력의 마찰각, 힘 삼각형 M;



A; $W = m\,g$ = (7.5 kg)(9.806 m/s^2) = 73.54 N

마찰각 $\phi_s = \tan^{-1}\mu_s = \tan^{-1}(0.45) = 24.23°$

내려가려 할 때



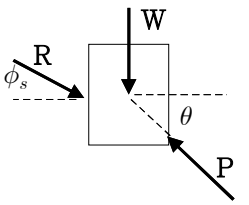
$\beta = 90° - \phi_s = 90° - 24.23° = 65.77°$

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

$$\Rightarrow \sin\gamma = \frac{W}{P}\sin\beta = \frac{73.54\text{ N}}{100\text{ N}}\sin 65.77° = 0.6706$$

$$\Rightarrow \gamma = \sin^{-1}0.6706 = 42.11°$$

$\theta = \gamma - \phi_s = 42.11° - 24.23° = 17.88°$



올라가려 할 때

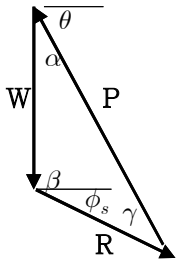
$\beta = 90° + \phi_s = 90° + 24.23° = 114.23°$

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

$$\Rightarrow \sin\gamma = \frac{W}{P}\sin\beta = \frac{73.54\text{ N}}{100\text{ N}}\sin 114.23° = 0.6706$$

$$\Rightarrow \gamma = \sin^{-1}0.6706 = 42.11°$$

$\theta = \gamma + \phi_s = 42.11° + 24.23° = 66.34°$



$\Rightarrow$ $17.88° \le \theta \le 66.3°$

R; (과정의 타당성 검토) (가령, 마찰력 방향)

T; (결과의 의미 검토) (가령, ϕ=0 일 때 θ = 42.11°)