<9.11~9.15절>

9.114 $m = \rho\ t\ A = \rho\, t\left(\frac{1}{2}\pi\, a\, b\right)$

$I^{mass} = \rho\, t\, I^{area} = \frac{2m}{\pi\, a\, b}\ I^{area}$

(a) $I^{area}_{BB'} = I^{area}_{x} - A\,\bar{y}^2$

$= \frac{1}{8}\pi\, a\, b^3 - \left(\frac{1}{2}\pi\, a\, b\right)\left(\frac{4b}{3\pi}\right)^2 = \pi\, a\, b^3\left(\frac{1}{8} - \frac{8}{9\pi^2}\right) = \frac{\pi}{8}\, a\, b^3\left(1 - \frac{64}{9\pi^2}\right)$

$I^{mass}_{BB'} = \frac{2\,m}{\pi\, a\, b}\ I^{area}_{BB'}$

$= \frac{2\,m}{\pi\, a\, b}\,\frac{\pi}{8}\, a\, b^3\left(1 - \frac{64}{9\pi^2}\right) = \frac{1}{4}\, m\, b^2\left(1 - \frac{64}{9\pi^2}\right) = 0.0699\ \ m\, b^2$

(b) Fig. 9.12에서, $I^{area}_{AA'} = \frac{1}{8}\pi\, a^3\, b$

$I^{mass}_{AA'} = \frac{2\,m}{\pi\, a\, b}\ I^{area}_{AA'}$

$= \frac{2\,m}{\pi\, a\, b}\ \frac{1}{8}\pi\, a^3\, b = \frac{1}{4}\, m\, a^2$

$\bar{I}^{mass}_{CC'} = I^{mass}_{AA'} + I^{mass}_{BB'}$

$= \frac{1}{4}\, m\, a^2 + \frac{1}{4}\, m\, b^2\left(1 - \frac{64}{9\pi^2}\right) = \frac{1}{4}\, m\left(a^2 + 0.279\, b^2\right)$

9.116 $m = \rho\ t\ A = \rho\, t\left[(2a)^2 - a^2\right] = \rho\, t\,(3\,a^2)$

$I^{mass} = \rho\, t\, I^{area} = \frac{m}{3\,a^2}\ I^{area}$

(a) $I^{area}_{BB'} = \frac{1}{3}(2a)(2a)^3 - \frac{1}{3}(a)(a)^3 = 5\ a^4$

$I^{mass}_{BB'} = \frac{m}{3\,a^2}\ I^{area}_{BB'}$

$= \frac{m}{3\,a^2}\ 5\ a^4 = \frac{5}{3}\, m\, a^2$

(b) 도심 $\overline{Y} = \frac{\Sigma(\bar{y}A)}{\Sigma A} = \frac{a\left[(2a)^2\right] + \frac{a}{2}(-a^2)}{(2a)^2 - a^2} = \frac{7}{6}a$

대칭성에 의해 $\overline{Z} = \overline{Y} = \frac{7}{6}a,$ $I^{mass}_{AA'} = I^{mass}_{BB'} = \frac{5}{3}\, m\, a^2$

$I^{mass}_{O} = I^{mass}_{AA'} + I^{mass}_{BB'}$

$= 2\ \left(\frac{5}{3}\, m\, a^2\right) = \frac{10}{3}\, m\, a^2$

$\bar{I}^{mass}_{CC'} = I^{mass}_{O} - m\, d^2 = I^{mass}_{O} - m\,(\overline{Y}^2 + \overline{Z}^2)$

$= \frac{10}{3}\, m\, a^2 - m\left[\left(\frac{7}{6}a\right)^2 + \left(\frac{7}{6}a\right)^2\right] = = \frac{11}{18}\, m\, a^2$

9.117 $m = \rho \ t \ A = \rho \, t \, (2 \, a \, b)$

$$I^{mass} = \rho \, t \, I^{area} = \frac{m}{2 \, a \, b} \ I^{area}$$

(a) $\bar{I}_x^{\,area} = 2\left[\frac{1}{12}(2b)(a)^3\right] = \frac{1}{3}a^3 b$

$$\bar{I}_x^{\,mass} = \frac{m}{2 \, a \, b} \ \bar{I}_x^{\,area}$$

$$= \frac{m}{2 \, a \, b} \ \frac{1}{3}a^3 b = \frac{1}{6}m \, a^2$$

(b) $\bar{I}_{z'}^{\,mass} = \frac{1}{6}m \, b^2$

$$I_{CC'}^{mass} = \bar{I}_x^{\,mass} + \bar{I}_{z'}^{\,mass} = \frac{1}{6}m \, a^2 + \frac{1}{6}m \, b^2$$

$$I_y^{mass} = I_{CC'}^{mass} + m \, b^2$$

$$= \frac{1}{6}m \, a^2 + \frac{1}{6}m \, b^2 + m \, b^2 = \frac{1}{6}m \, a^2 + \frac{7}{6}m \, b^2 = \frac{1}{6} \, m \left(a^2 + 7 \, b^2\right)$$