

# 8-4 平面および立体図形の諸量

## (1) 平面図形の諸量

図形	断面積 $A$	図示の軸より線に至る距離 $y$	図示の軸にかんする断面二次モーメント $I$	図示の軸にかんする断面係数 $W$	図示の軸にかんする回転半径 $r$
長方形 	$bh$	$y_0 = \frac{h}{2}$	$\frac{bh^3}{12}$	$\frac{bh^2}{6}$	$\frac{h}{\sqrt{12}} = 0.289h$
中空長方形 	$BH - bh$	$y_0 = \frac{H}{2}$	$\frac{BH^3 - bh^3}{12}$	$\frac{BH^3 - bh^3}{6H}$	$\sqrt{\frac{BH^3 - bh^3}{12(BH - bh)}}$
円 	$\frac{\pi}{4} d^2 = 0.785 d^2$	$y_0 = \frac{d}{2}$	$\frac{\pi d^4}{64} = 0.0491 d^4$	$\frac{\pi d^3}{32} = 0.0982 d^3$	$\frac{d}{4}$
中空円 	$\frac{\pi}{4} (D^2 - d^2)$	$y_0 = \frac{D}{2}$	$\frac{\pi}{64} (D^4 - d^4) = 0.0491 (D^4 - d^4)$	$\frac{\pi}{32} \frac{D^4 - d^4}{D} = 0.0982 \frac{D^4 - d^4}{D} \approx 0.8D^2 t$ <small><math>t/D</math> が小さいとき</small>	$\frac{\sqrt{D^2 + d^2}}{4}$
半円 	$\frac{\pi}{8} d^2 = 0.393 d^2$	$y_1 = \frac{(3\pi - 4)}{6\pi} d = 0.288 d$ $y_2 = \frac{2}{3\pi} d = 0.212 d$	$\frac{9\pi^2 - 64}{1,152\pi} d^4 = 0.00686 d^4$	$W_1 = \frac{I}{y_1} = \frac{9\pi^2 - 64}{192(3\pi - 4)} d^3 = 0.0239 d^3$ $W_2 = \frac{I}{y_2} = \frac{9\pi^2 - 64}{768} d^3 = 0.0325 d^3$	$\frac{\sqrt{9\pi^2 - 64}}{12\pi} d = 0.132 d$
中空半円 	$\pi r_0 t$	$y_1 = \left(1 - \frac{2}{\pi}\right) r_0 + \frac{t}{2}$ $y_2 = \frac{2}{\pi} r_0$	$\left(\frac{\pi}{2} - \frac{4}{\pi}\right) r_0^3 t = 0.298 r_0^3 t$	$W_1 = \frac{I}{y_1}$ $W_2 = \frac{I}{y_2}$	$\sqrt{\frac{1}{2} - \frac{4}{\pi^2}} r_0 = 0.308 r_0$
楕円 	$\frac{\pi ab}{4} = 0.785 ab$	$y_0 = \frac{a}{2}$	$\frac{\pi}{64} a^3 b = 0.0491 a^3 b$	$\frac{\pi}{32} a^2 b = 0.0982 a^2 b$	$\frac{a}{4}$
中空楕円 	$\frac{\pi}{4} (HB - hb) = 0.785 (HB - hb)$	$y_0 = \frac{H}{2}$	$\frac{\pi}{64} (H^3 B - h^3 b) = 0.0491 (H^3 B - h^3 b)$	$\frac{\pi}{32} \frac{H^3 B - h^3 b}{H} = 0.0982 \frac{H^3 B - h^3 b}{H}$	$\frac{1}{4} \sqrt{\frac{H^3 B - h^3 b}{HB - hb}}$
小判形 	$\frac{\pi}{4} d^2 + hd$	$y_0 = \frac{1}{2} (h + d)$	$\frac{\pi d^4}{64} + \frac{hd^3}{6} + \frac{\pi h^2 d^2}{16} + \frac{h^3 d}{12}$	$W = \frac{I}{y_0}$	$r = \sqrt{\frac{I}{A}}$