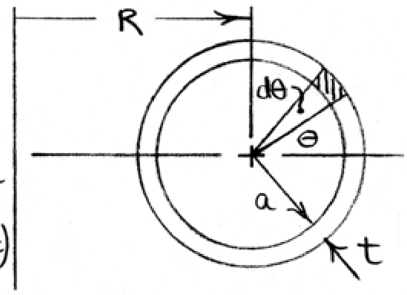
B/44



Let ρ = mass per unit surface area. For elemental ring of cross section $a\,d\theta(t)$ and circumference $2\pi(R + a\cos\theta)$:

$$dm = \rho(a\,d\theta)2\pi(R + a\cos\theta)$$

$$dI = (R + a\cos\theta)^2 dm = 2\pi\rho(R + a\cos\theta)^3 a\,d\theta$$

So $m = 2\pi\rho a \int_0^{2\pi} (R + a\cos\theta)\,d\theta = 4\pi^2 \rho a R$

$$I = 2\pi\rho a \int_0^{2\pi} (R^3 + 3R^2 a\cos\theta + 3Ra^2\cos^2\theta + a^3\cos^3\theta)\,d\theta$$

$$= 2\pi\rho a [① + ② + ③ + ④]$$

$$① = \int_0^{2\pi} R^3\,d\theta = 2\pi R^3$$

$$② = 3R^2 a \int_0^{2\pi} \cos\theta\,d\theta = 0$$

$$③ = 3Ra^2 \int_0^{2\pi} \cos^2\theta = 3Ra^2\left[\frac{\theta}{2} + \frac{\sin 2\theta}{4}\right]_0^{2\pi} = 3\pi R a^2$$

$$④ = a^3 \int_0^{2\pi} \cos^3\theta\,d\theta = \frac{a^3}{3}\left[\sin\theta(\cos^2\theta + 2)\right]_0^{2\pi} = 0$$

So $I = 2\pi^2\rho a R(2R^2 + 3a^2)\left(\dfrac{m}{4\pi^2\rho a R}\right)$

$$= \underline{\tfrac{1}{2} m (2R^2 + 3a^2)}$$