unit inductance in coaxial line (Book "ElectroMagnetics" by John D. Kraus)

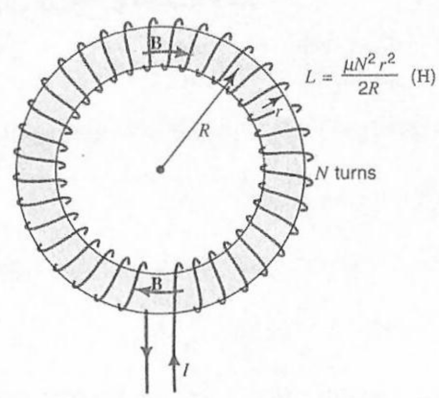

FIGURE 6-16
In a toroid, shown here, the magnetic flux is almost entirely confined to the interior of the winding.

The ***inductance of the toroid*** is then

$$\boxed{L = \frac{\Lambda}{I} = \frac{\mu N^2 r^2}{2R}} \tag{4}$$

where L = inductance of toroid, H
μ = permeability (uniform and constant) of medium inside coil, $\mathrm{H\,m^{-1}}$
N = number of turns of toroid, dimensionless
r = radius of coil (see Fig. 6-16), m
R = radius of toroid, m

Consider next a ***coaxial transmission line*** constructed of conducting cylinders of radius a and b, as in Fig. 6-17. The current on the inner conductor is I. The return current on the outer conductor is of the same magnitude. The flux density B at any radius r is the same as at this radius from a long straight conductor with the same current, or

$$B(\text{at } r) = \frac{\mu I}{2\pi r} \tag{5}$$

The total flux linkage for a length d of line is then d times the integral of (5) from

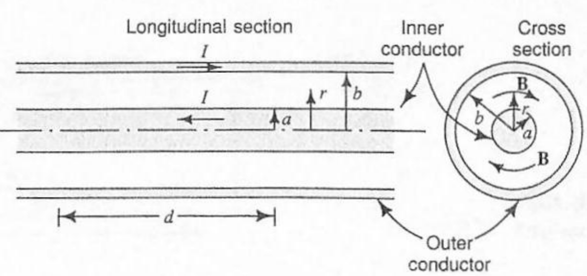

FIGURE 6-17
Coaxial transmission line.