

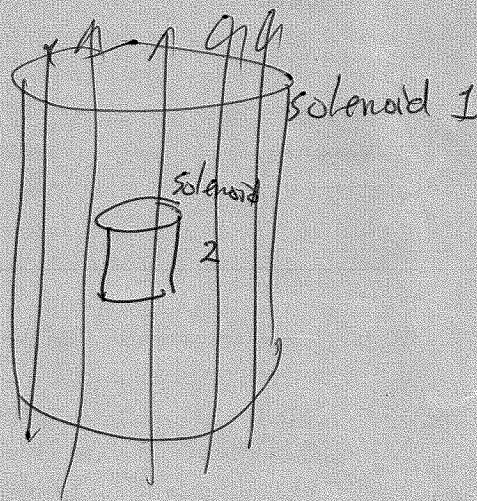
Ch. 14 Prob. 34

Solenoid N_1 turns
 l_1 length
 R_1 radius

Smaller
solenoid N_2 turns
 l_2 length
 R_2 radius

Find the mutual inductance

$$\begin{aligned} M &= \frac{N_2 \Phi_{21}}{I_1} = \frac{N_2 A B_1}{I_1} \\ &= \frac{N_2 A (N_1 \mu_0 I_1)}{I_1 l_1} \\ &= \frac{N_1 N_2 \mu_0 A}{l_1} \end{aligned}$$



only the smaller area is capturing the magnetic field lines for the 2nd solenoid

$$\therefore A = \pi R_2^2$$

Then

$$M = \frac{\mu_0 \pi R_2^2 N_1 N_2}{l_1}$$

I'm assuming that solenoid #1 is generating the magnetic field.