

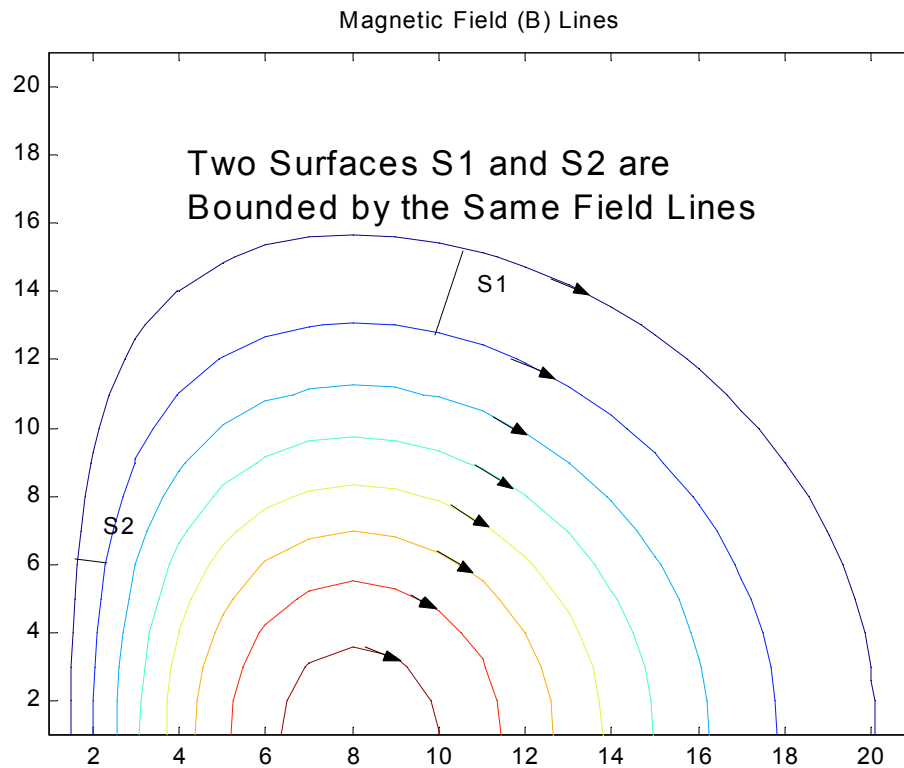
Flux and magnetic vector potential, \mathbf{A} **Reading assignment**

Ulaby, 5-5

Connor and Salon VI-13 6 VI-17, VII-19 6 VII-21

Problem 1 - Flux

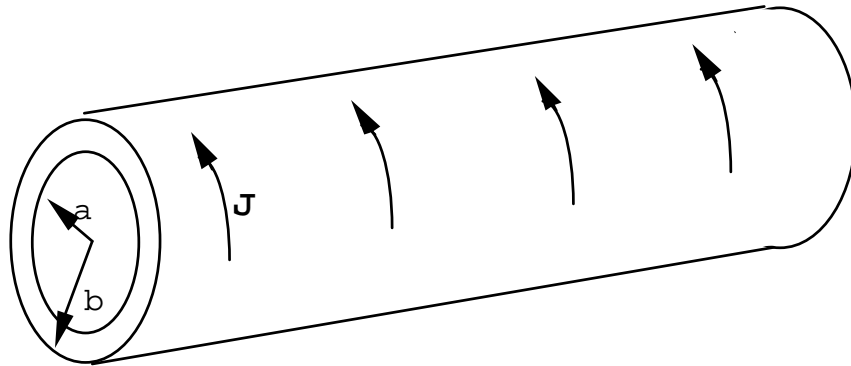
If the flux through surface S_1 in the figure below is 10^{-5} Webers, what is the flux through surface S_2 ?



Flux and magnetic vector potential, \mathbf{A} **Problem 2 - Flux and magnetic vector potential**

Take the same solenoid as used last class. The current density, $\mathbf{J} = J_0 \mathbf{a}_\phi$ for $a < r < b$ and is 0 everywhere else. In the previous class, we found that

$$\mathbf{B} = \begin{cases} \mu_0 J_0 (b - a) \mathbf{a}_z & \text{for } r \leq a \\ \mu_0 J_0 (b - r) \mathbf{a}_z & \text{for } a \leq r \leq b \\ 0 & \text{for } b \leq r. \end{cases}$$



- Calculate the total flux of \mathbf{B} through a circle of radius a using $\psi = \int \mathbf{B} \cdot d\mathbf{s}$.
- Check that $\mathbf{B} = \nabla \times \mathbf{A}$ if the magnetic vector potential, \mathbf{A} is given by:

$$\mathbf{A} = \begin{cases} \mu_0 J_0 (b - a) r / 2 \mathbf{a}_\phi & \text{for } r \leq a \\ \mu_0 J_0 (r b / 2 - r^2 / 3 - a^3 / 6r) \mathbf{a}_\phi & \text{for } a \leq r \leq b \\ \mu_0 J_0 (b^3 - a^3) / 6r \mathbf{a}_\phi & \text{for } b \leq r \end{cases}$$
- Calculate $\oint \mathbf{A} \cdot d\mathbf{l}$ around a circle of radius a . Compare your answer with part a.