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 $S_2$?

Magnetic Field (B) Lines

Two Surfaces S1 and S2 are Bounded by the Same Field Lines
Problem 2 - Flux and magnetic vector potential

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

\[
\begin{align*}
\mu_0 J_0 (b - a) a_z & \quad \text{for } r \leq a \\
\mu_0 J_0 (b - r) a_z & \quad \text{for } a \leq r \leq b \\
0 & \quad \text{for } b \leq r.
\end{align*}
\]

a. Calculate the flux of \( B \) through a circle of radius \( a \) using \( \psi = \int B \cdot ds \).

b. Show that \( B = \nabla \times A \) if the magnetic vector potential, \( A \) is given by:

\[
\begin{align*}
A = \mu_0 J_0 & \left( r b/2 - \frac{r^2}{3} - \frac{a^3}{6r} \right) a_\phi & \quad \text{for } a \leq r \leq b \\
\mu_0 J_0 & \left( \frac{b^3 - a^3}{6r} \right) a_\phi & \quad \text{for } b \leq r.
\end{align*}
\]

c. Calculate \( \oint A \cdot dl \) around a circle of radius \( a \).

Compare your answer with part a.