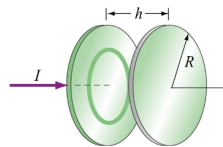


Exercise sheet #14

Problem 1. A longitudinal \mathbf{E} field inside a wire causes a current $\mathbf{J} = \sigma\mathbf{E}$. Since the curl of \mathbf{E} is zero, this same longitudinal \mathbf{E} component must also exist right outside the surface of the wire. Show that the Poynting vector flux through a cylinder right outside the wire is equal to IV , where I the current and V is the electric potential (resistance heating).

Problem 2. The intensity of sunlight, at the earth, is roughly 1 kilowatt /m². How large is the magnetic field strength? Assume that the EM radiation from the sun is a plane sinusoidal wave.

Problem 3. A parallel-plate capacitor with circular plates of radius R and separated by a distance h is charged through a straight wire carrying current I , as shown in the figure below:



- (a) Show that as the capacitor is being charged, the Poynting vector $\vec{\mathbf{S}}$ points radially inward toward the center of the capacitor.
- (b) By integrating $\vec{\mathbf{S}}$ over the cylindrical boundary, show that the rate at which energy enters the capacitor is equal to the rate at which electrostatic energy is being stored in the electric field.