

Maxwell's Equations

Reading assignment

Ulaby, 6-7, 6-8

Problem 1 - Displacement current

A parallel plate capacitor with circular plates and an air dielectric has a plate radius of 5 mm and a plate separation of 10 μm . The voltage across the plates is $V = 5 \cos \omega t$ where $\omega = 2\pi \cdot 100 \text{ kHz}$.

- a. Find \mathbf{D} between the plates.
- b. Determine the displacement current density, $\partial\mathbf{D}/\partial t$.
- c. Is there any free charge motion in the gap between the plates?
- d. Compute the total displacement current, $\int \partial\mathbf{D}/\partial t \cdot d\mathbf{s}$, and compare it with the capacitor current, $I = C dV/dt$.
- e. What is \mathbf{H} between the plates?