

## 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  $\mu\text{m}$ . The voltage across the plates is  $V = 5 \cos \omega t$  where  $\omega = 2\pi \cdot 100 \text{ kHz}$ .

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