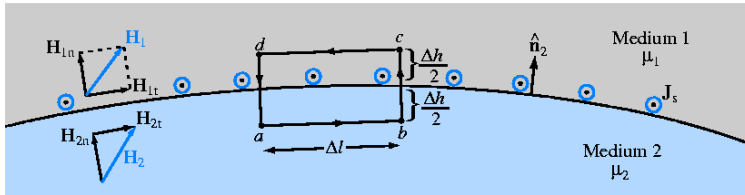


Engineering 6813 Tutorial 4 (Boundary Conditions and Time-Varying Fields) Fall, 2009

1. With reference to the given figure, determine the angle between \vec{H}_1 and $\hat{n}_2 = \hat{z}$ if $\vec{H}_2 = \hat{x}3 + \hat{z}2$ A/m, the relative permeabilities of media 1 and 2 are 2 and 8, respectively, and the surface current density is 0.



2. Given that a current sheet with a surface current density of $\hat{x}4$ A/m exists at $y = 0$, the interface between two magnetic media, and $\vec{H}_1 = \hat{z}8$ A/m in medium 1 ($y > 0$), determine \vec{H}_2 in medium 2 ($y < 0$).

3. A coaxial capacitor has the parameters $a = 5$ mm, $b = 30$ mm, $\ell = 20$ cm, $\epsilon_R = 8$ and $\sigma = 10^{-6}$. If the conduction current density in the capacitor is $(2/\rho)\sin 10^6 t \hat{\rho}$ A/m², find: (a) the total conduction current I_σ through the capacitor; (b) the maximum instantaneous value of the displacement current density; (c) the total displacement current I_d ; and (d) the Q ($= \omega CR = I_d/I_c$) of the capacitor.

4. The displacement current density is $5 \cos(2 \times 10^8 t - kz) \hat{x} \mu\text{A}/\text{m}^2$ in a perfect dielectric in which the relative permittivity is 5 and the relative permeability is 4. (a) Use the definition of the displacement current density to find \vec{D} and \vec{E} . (b) Find \vec{B} and \vec{H} . (c) Find k .