Prof. Yen-Chieh Huang
Dept of Electrical Engineering
National Tsing-Hua University
office: Delta 856
ext: 62340
email:ychuang@ee.nthu.edu.tw

EE214000 Electromagnetics, Fall 2020

Your name: _____ ID: _____ Oct. 26th, 2020

EE214000 Electromagnetics, Fall, 2020
Quiz #7-2, Open books, notes (15 points), due in class, Monday, Oct. 26st, 2020

1. What are the electrostatic boundary conditions between a dielectric/ideal conductor interface. Denote the dielectric and the ideal conductor as materials 1 and 2, respectively. (5 points)

$\hat{a}_{n2} \cdot (\vec{D}_1 - \vec{D}_2) = \rho_s$

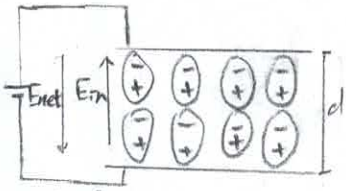
$\therefore \hat{a}_{n2} \cdot \vec{D}_1 = \rho_s$ #

2. Given S and d in the following expression for a parallel plate capacitor,

$$C = \frac{\varepsilon S}{d},$$

create a physical picture to explain the larger ε, the larger C. (5 points)

$\epsilon = \epsilon_r \epsilon_0$，當 $\epsilon \uparrow \Rightarrow \epsilon_r \uparrow \Rightarrow \chi_e \uparrow$
(其中 $\epsilon_r = 1 + \chi_e$)
χ_e越大表示介電質的極化程度越大
$\Rightarrow$產生更多 electric dipole moment
$\Rightarrow E_{in} \uparrow$
$\Rightarrow E_{net} \downarrow$
但為達到相同V $V = E_{net} \cdot d$
故會有更多電荷跑至導体板上(此時 E_{net}又會重新↑)
$\therefore C \uparrow$ #



3. An infinite long line charge along the z axis has a line charge density of ρ_l. Calculate the voltage difference $V_2(r_2,\phi_2,z_2) - V_1(r_1,\phi_1,z_1)$. (5 points)

無窮長線電荷 $\vec{E} = \frac{\rho_l}{2\pi\epsilon_0 r}\hat{a}_r$

$$V_2(r_2,\phi_2,z_2) - V_1(r_1,\phi_1,z_1) = \int_{r_1}^{r_2} dV = -\int_{r_1}^{r_2} \vec{E} \cdot d\vec{r} = -\int_{r_1}^{r_2} \frac{\rho_l}{2\pi\epsilon_0 r} dr$$

$$= \frac{\rho_l}{2\pi\epsilon_0} \ln\left(\frac{r_1}{r_2}\right)$$ #