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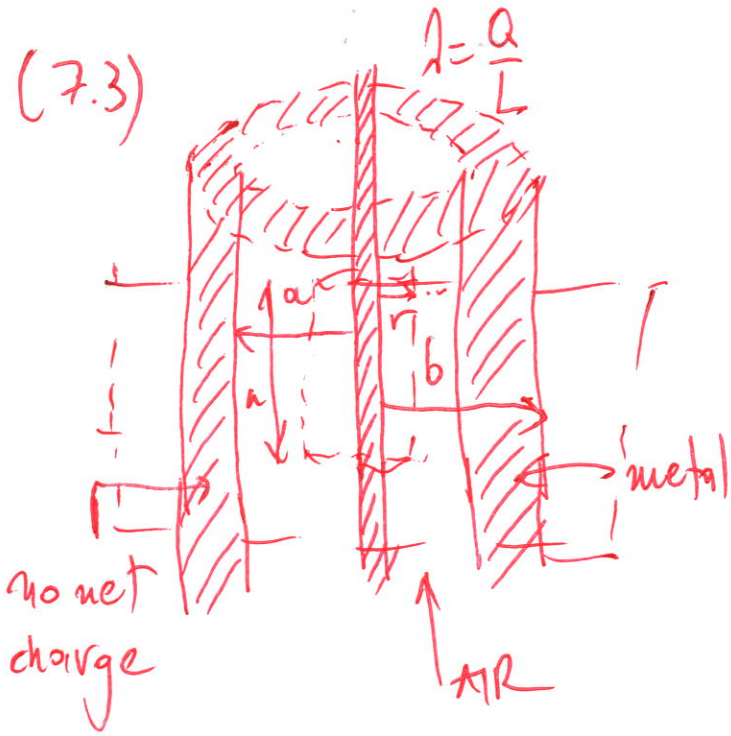
Why the ground → minimization of capacitevely coupled noise

(7.2) Skin depth definition:

$$\delta = \sqrt{\frac{2}{\omega\mu\sigma}} = \frac{1}{\sqrt{\pi\nu\mu\sigma}}$$, where: $\nu \to$ freq. $\mu \to$ permeability $\sigma \to$ conductivity

$$= \ldots\ldots =$$

(7.3)




a → inner radius
b → outer radius

$E: a > r$

We can draw the Gaussian cylinder with height h: (field lines are radially outward)

$$\frac{q_{en}}{\epsilon_0} = \oint \vec{E} \cdot d\vec{A}$$

$$\frac{\lambda \cancel{h}}{\epsilon_0} = E 2\pi r \cancel{h} \Rightarrow$$

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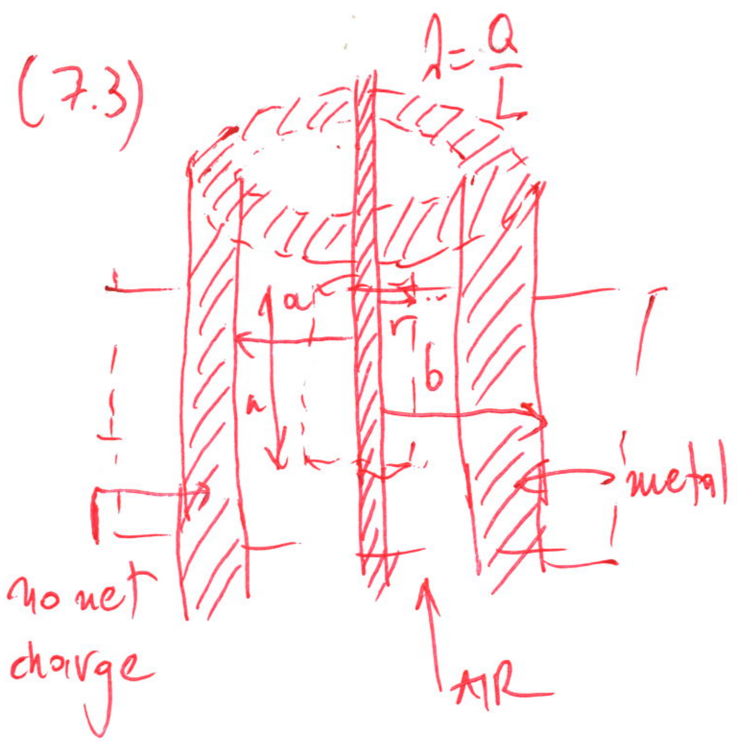


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c: $a<r<b$ ?

$E=0$, because its metal at electrostatic equilibrium

E when you are outside:

Draw a Gaussian cylinder

$$\frac{\lambda \cancel{h}}{\epsilon_0} = E\, 2\pi r \cancel{h} \Rightarrow$$

$$E = \frac{\lambda}{2\pi r \epsilon_0}$$

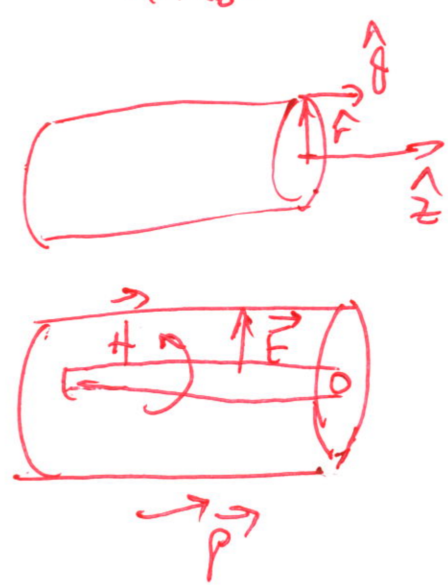
Then, Stokes law in a coaxial cable: $H = \frac{I}{2\pi r}$

So, $\vec{P} = \vec{E} \times \vec{H} = \frac{q_{en}}{2\pi \epsilon_0 r} \hat{r} \times \frac{I}{2\pi r} \hat{\theta} = \frac{QI}{4\pi^2 \epsilon_0 r^2} \hat{z}$

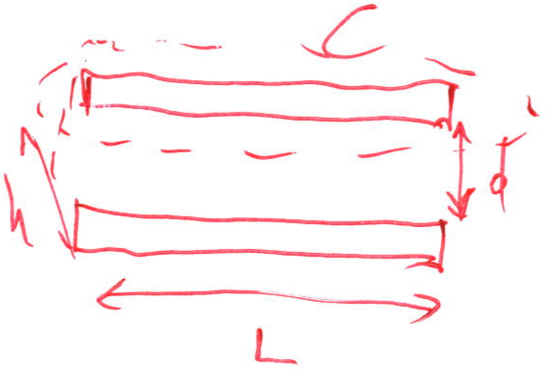
$W = \int_S \vec{P} \cdot d\vec{A} = \int_S \vec{E} \times \vec{H}\, d\vec{A} =$

$= \int_{r_i}^{r_o} \int_0^{2\pi} \left(\frac{Q}{2\pi \epsilon r} \hat{r}\right) \times \left(\frac{I}{2\pi r} \hat{\theta}\right) r\, d\theta\, dr =$

$= \ldots\ldots =$



(7.4)




Capacitance:

$$C = \frac{\epsilon L}{d}$$

$$\Downarrow$$

magenetic fulx;

$$\Phi = \int \vec{B}\, d\vec{A} = \int \mu \frac{I}{L} d = \mu \frac{I}{L} h d \Rightarrow$$

inductance, $L = \frac{\Phi}{I h} =$

But from Stokes law around the amperian loop for one plate;

$$I = \int_C \vec{H}\, d\vec{l} = H h \Rightarrow H = \frac{I}{h}$$

Substituting:

$$L = \frac{\Phi}{I h} = \frac{\mu \frac{I}{L} h d}{I h} = \boxed{\mu \frac{d}{L}}$$

$$Z = \sqrt{\frac{L}{C}} = \sqrt{\frac{\mu\, d/L}{\epsilon\, L/d}}$$

$$n = \frac{1}{\sqrt{LC}} = \dots = \frac{1}{\sqrt{\mu \epsilon_0}}$$

(7.5) $\epsilon_r = 2.26$

$a = 0.406\ mm$

$\beta = 1.48\ mm$

a) From (6.43);

$$L = \frac{\phi}{2I} = \frac{\mu_0}{2\pi} \ln \frac{r_0}{r_i} \left( H/m \right)$$

From (6.48);

$$C = \frac{Q}{V} = \frac{2\pi \epsilon}{\ln(r_0/r_i)} \left( F/m \right)$$

$$Z = \sqrt{\frac{L}{C}} = \ldots\ldots$$

(b) $v = \frac{1}{\sqrt{LC}} = \ldots\ldots$

(c) $s = v \cdot t = \ldots\ldots$

and $s \leq v \cdot t$

d) Use equation from a.

(e) $\lambda = \beta \cdot 2 = \ldots$

$f = \frac{v}{\lambda} = \ldots \simeq Hz$

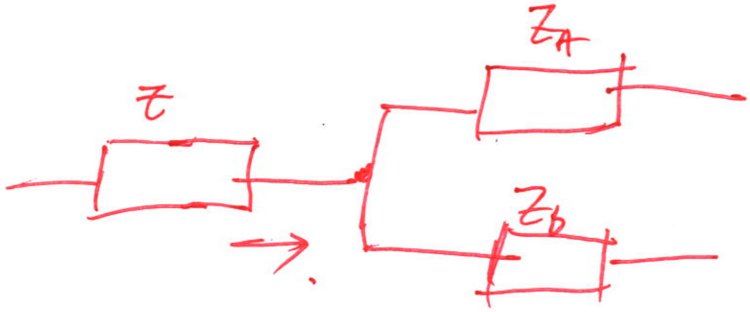
(7.6) 

$Z = 100\ \Omega$

delay $= 4.6\ ns/m$

a) 64 byte frame

b)




$$\frac{1}{Z_L} = \frac{1}{Z_A} + \frac{1}{Z_B} \Rightarrow Z_L = \frac{Z_A Z_B}{Z_A + Z_B}$$

$$|R| = \left| \frac{Z_L - Z}{Z_L + Z} \right| =$$