Computational Electromagnetics

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Applications of Computational Electromagnetics
Lecture - 14.13
Antennas - Source Modeling

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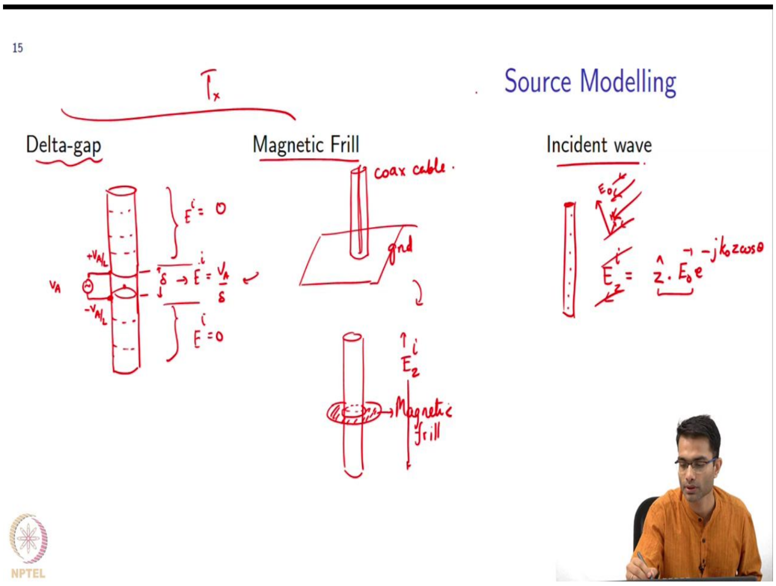

So, in the literature there are three popular ways of doing this. So, one I have already sort of indicated to you that here is your sort of wire, I am just going to split it by a small gap delta and I am going to connect this to a generator which puts some voltage V_A. So, this is at $+V_A/2$ you can say and $-V_A/2$ and this distance is δ. So, that is one take your RF generator and plug it into the middle of this wire so, that is going to generate a V_A; now remember this is not DC V_A right this is going to be a voltage that is fluctuating at the frequency you want to radiate at right.

So, over here do I know incident field inside this segment? Yes right it is just what is it?

Student: (Refer Time: 01:17).

Yeah, that is it V_A/δ and what is E_i over here (outside the delta gap). So, I am chopping it, so, you are going to chop this sub into segments right when you do (Refer Time: 01:30). So, what is incident field over here? There is no voltage source there is 0 right because, I did not connect the voltage generator across that segment it is going to be, it is going to generate this incident field only across the voltage is only across one part of the wire not everywhere else. So, E_i over here is 0.

Student: (Refer Time: 02:03).

So, I mean you have your conductor like this ok. So, don't think that I have split the conductor its one conductor and in the middle as connected one RF generator both the leads to it plus and minus.

Student: (Refer Time: 02:18) that (Refer Time: 02:20).

Yeah, we take two points and across those two points you connect this and so, that is why that is I have shown the leads like this one is connecting here the other is connecting over here right across some gap delta.

Student: (Refer Time: 02:35).

Student: (Refer Time: 02:36).

There is no break in the current yeah.

Student: e i 0 on the (Refer Time: 02:43).

On the upper segments.

Student: (Refer Time: 02:47).

Yeah, well that is again should we say that is the statics approximation.

Student: (Refer Time: 02:57).

Well this is the sort of a this is our model remember it is not going to it is not exact, but it is a model that gives you close enough results over here.

Student: It want be.

The length say that again.

Student: The length.

Student: The other is to.

Then.

Student: Then (Refer Time: 03:19).

Then it is not the equipotential, if yeah then you have to take recourse to your transmission line theory. But, the point is that there is due to this induced voltage over here, I mean due to this applied voltage over here, there is now going to be a current that is going to flow in the wire right and that wire current induced in the wire is going to produce another scattered field which is what we have been calculating and together they are 0 in the conductor ok. So, this is your delta gap which is this easiest one to apply because, is just we can see the values V_A/δ in the gap and 0 everywhere else.

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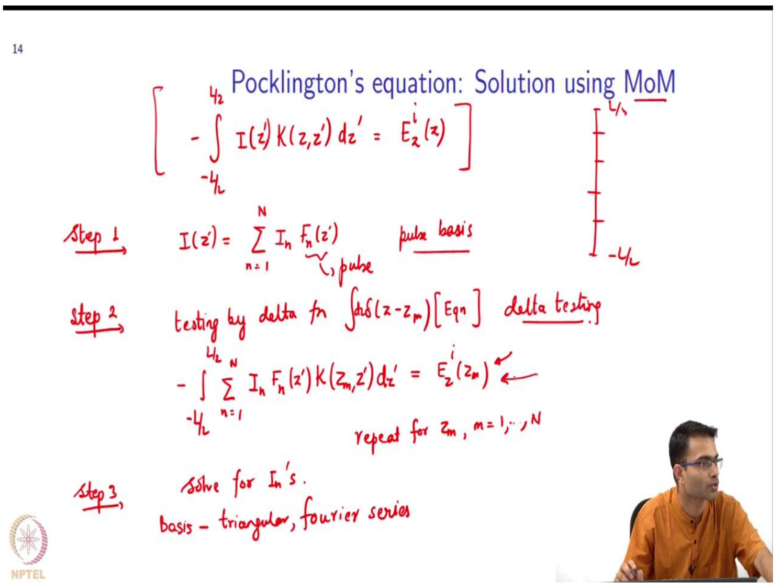

So, this column vector that you have this is the column vector at all different z_m's right. So, that z_m which is the centre of this segment you put in this value all other places you put 0 that is it very simple to apply ok. The second thing is what is called this magnetic frill which it is like a ground plane and a coaxial cable sitting on top of it like a monopole.

And, then what happens by image theory is, I replace the ground by the reflection of this, but there is one thing I mean we will not go into the detail, but as a result of doing this, I am left with a small magnetic current over here ok. So, this thing is called a magnetic frill right. So, this is ground and this is coaxial cable and this magnetic frill there are some equations for it which give you some E_z^i over the entire length ok.

We will not be using this in this discussion, but I mean there is enough literature all that you can look up magnetic frill. And finally, the third thing so, these are both for a transmitting antenna, for a receiving antenna also there is an induced voltage I mean induced there is a incident wave that will produce an equivalent of a source. So, here is my antenna over here and there is some plane wave falling on it over here. So, in that case what will I write, E_z^i equal to, just the value of the electric field.

This plane wave is falling over the entire thing right. So, there is a field that is already there at every point of this conductor and its value is going to just be equal to the value of the.

Student: (Refer Time: 06:09).

Value of the field at that point with one small modification, remember we are talking about electric field and I have drawn these arrows correspond to.

Student: (Refer Time: 06:18).

These arrows correspond to the wave vector which way will the electric field be in general, E will be like this right and H will be into the board right. So, this is going to be the z component of it because remember we are enforcing this along we started by say along the surface or on the interior and along the z axis only we are only looking at the z component.

So, this became $\hat{z}.\vec{E}_0 e^{-jk_0 z \cos\theta}$, that is your plane wave without the ωt term. Yeah, I mean if you have different polarization, yeah if you have different polarization this dot product will be different. And, this is going to be non-zero at every point inside this, right every of your z (Refer Time: 07:12) to be the case.

Student: We got e naught (Refer Time: 07:15).

E_0 is the amplitude of this incident wave that is coming to you, whatever it is given to you in the problem that in.

Student: (Refer Time: 07:22).

Yeah you just have to take the z component of it and in your column vector over here this guy, put in the values because, that is the extra incident extra electric field that is coming over here, in addition to the scattered field due to induced current those are the two fields which are present in the conductor which should together sum to 0 ok. So, this was for the transmission case and this is for the receiving case.