Computational Electromagnetics
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Application of Computational Electromagnetics
Lecture – 14.15
Antennas – MoM details

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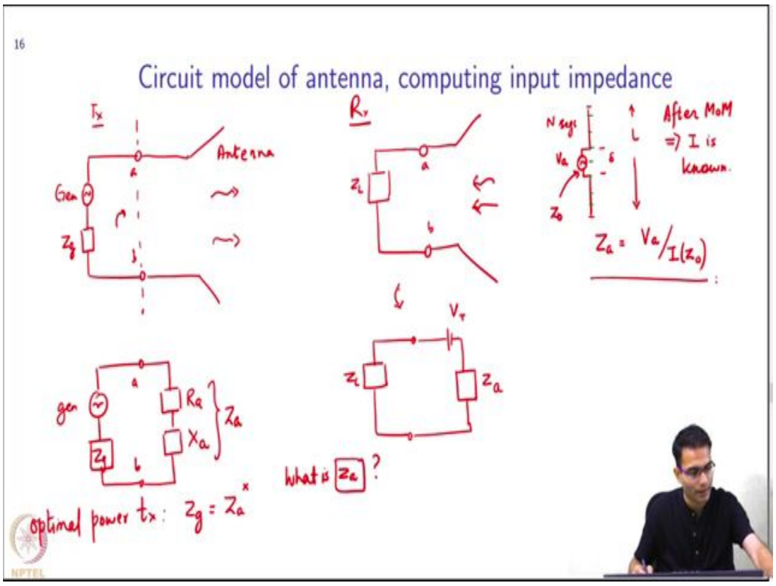

So, now let us and what procedure did we use for finding solving this MoM? We use this pulse basis and delta testing ok.

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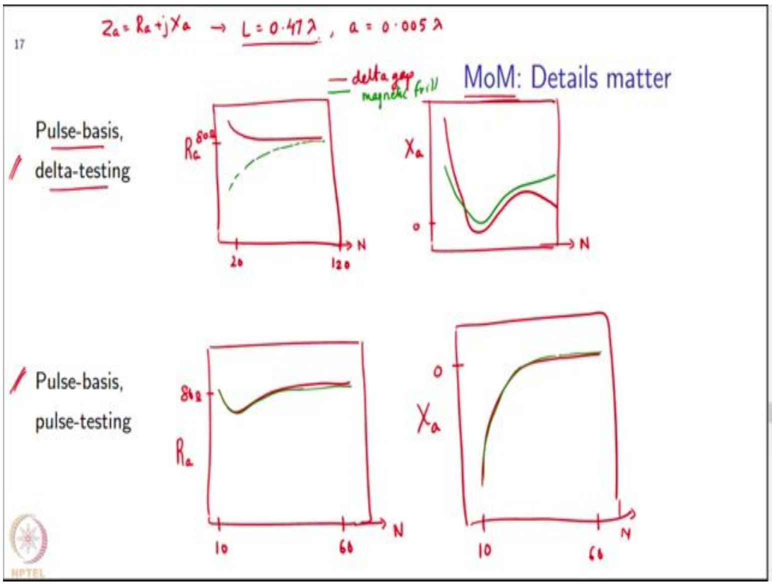

So, I am going to show you some results of simulations now, to tell you that how you implement the MoM also makes a huge difference in your calculations and therefore, what is your interpretation. So, let us look at in one case and another case over here ok. So, typically what how will you get more accurate results in your MoM?

Student: Increase the number of segments.

Increase the number of segments right. So, in other words you increase this N right. N segments, you increase this N right. So, I want to study for example, this Z_a which I am going to write as $Z_a = R_a + jX_a$. So, let me look at what happens to R_a and X_a as I increase the number of segments right. So, I would expect some kind of numerical convergence to happen. So, what I am and the antenna length I am going to choose a very popular antenna length, which is roughly half a wavelength and I will become clear why I am going to choose half a wavelength, and I am going to choose a very thin radius. So, I am going to choose right. So, it is basically a very thin wired almost half a wavelength, but slightly less ok. So, yeah, it will become clear why I am chosen supposing I choose the delta testing functions ok. So, with delta testing functions what happens is, you get something like this, it begins to converge for you know that I am this is say 120 you can start with something as crude let say 20 right it begins to converge over here right. So, this is your. So, this is with a delta gap right you may ask how do I if I use this procedure over here to find out the input impedance, I will get different answers I may get different answers depending on whether I choose the delta gap input source or magnetic frill because the linear algebra the matrix and the vectors are different, you may you will get different answers right.

But the answer should not really depend too much on that, I there is input impedance and that should that is what I should get. So, this is what I get when I look at the right; and this value is roughly about 75 to 80 Ohms let say. It is close to 75 to 80 Ohms and what happens to this reactance? So, it has a strange I mean interesting behavior. So, 0 right. It does not really show very great signs of converging ok.

So, you wonder what is going on over here. So, this is with delta gap then you can say these results are not satisfactory, may be the magnetic frill is little bit more accurate as an input. So, you can say that the take the magnetic frill. Interestingly what you observe now is something like this for the reactance. So, there seems to be a good convergence, but you need to have at least about 100 to 120 segments to get the same value of resistance right and you have some confidence that it's about 75 to 80 Ohms.

And what happens over here is right the reactance does not seem to converge. So, if you saw these results what would you conclude? As an antenna designer if you are given these parameters right you do not know CEM you have given the results of CEM looking at this what will you say?

Student: (Refer Time: 04:30).

These results may not inspire too much confidence right. You can say it seems that the real part I mean the resistance is around 75 to 80 Ohms, this reactance I do not know right it's sometime I mean both the results both the methods are giving slightly different results not slightly different results. So, as an antenna designer I am may not fix what I have to make my matching network, I need to know the value of X_a right. So, what value of X_a do I choose?

So, this person may come back at you and say your CEM is useless right and will almost be correct except that, as I am the point I am trying to make here is that the choice of MoM makes a huge difference right. So, this is what we did the simplest way of doing MoM pulse basis delta testing, then you get a little you know you are your CEM course, you feel a little of ended they are what is this my results are not looking good.

So, you see let me do something a little bit more accurate. So, I will do pulse basis and pulse testing right. So, it is Galerkin’s method. So, what kind of results do I get over here? So, again this is my figure around 80 Ohms, this is what you get over here and mind you this is around 60 and this is around 10. What do you get with this magnetic frill? Ok that is alright the more interesting thing happens over here when I look at the reactive parts. So, this was R_a and then this X_a. N 60 and this is about 0.

That is what you get with delta testing function, I mean with the delta excitation and with the magnetic frill what you get is. Now, when you show these results to an antenna engineer, there is some satisfaction because both methods have converged right. So, you have reactive I mean the resistance part is about you know as I mentioned 80 Ohms 75 80 Ohms, and the input the reactance part is almost exactly 0 and both methods are giving the same answers. So, this tells us that the choice of excitation is not so crucial as the vein which you are solving MoM. So, usually when student learns CEM for the first time they think pulse basis delta testing.

If you have done that good enough right, but this is telling you that you know you have done all the hard work getting till they just go all the way and do something a little bit more accurate, you will get this. You will get even faster convergence for example, in the pulse basis delta testing you have to go nearly 120 N in order to get the resistive part to match to converge, here within half the number of elements within 60 you are able to get convergent result may be even less than that right.

So, you are saving on computational time, but you have to do a little bit more work to calculate Amn the matrix elements right and you get the answer right. So, this is something to always keep in mind pulse basis delta testing is very good for understanding a problem, it is not good foRactual calculations and yeah. So, the choice of this 0.47 a is I mean why would you choose something like that is because you are getting a reactive part of nearly 0 right and the R_a comes out to be as 75 to 80 Ohms which is easy enough to match in a regular RF circuit. Is it fine?