Computational Electromagnetics and Applications
Professor Krish Sankaran
Indian Institute of Technology Bombay
Summary of Week 8

This week we introduced the method of moments which is also rightly called as the mother of all methods.

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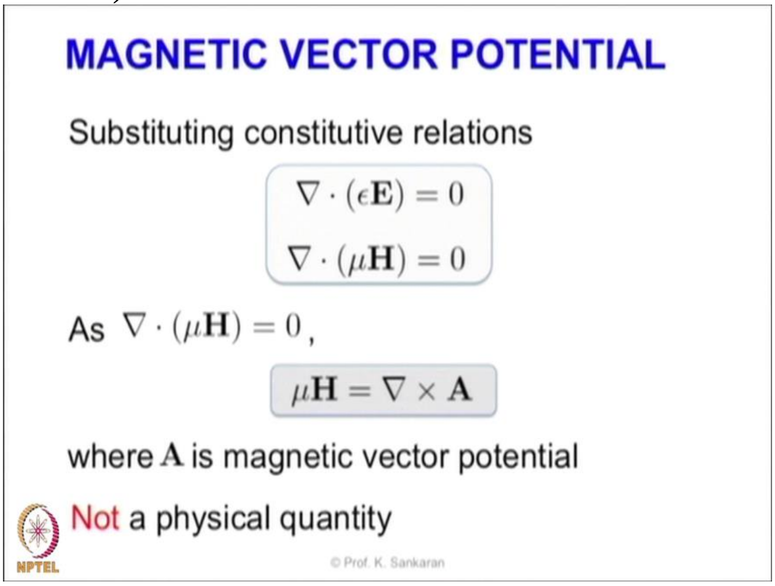

We presented the mathematical formulation using magnetic vector

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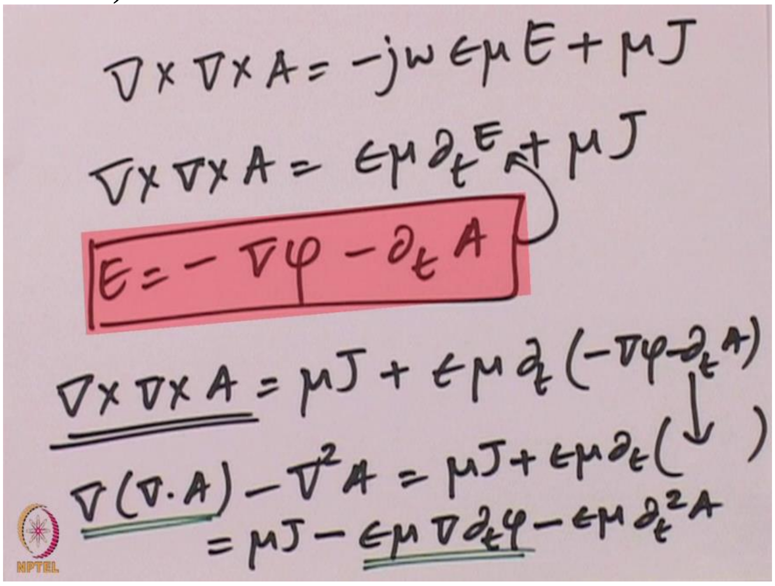

and electric scalar potential

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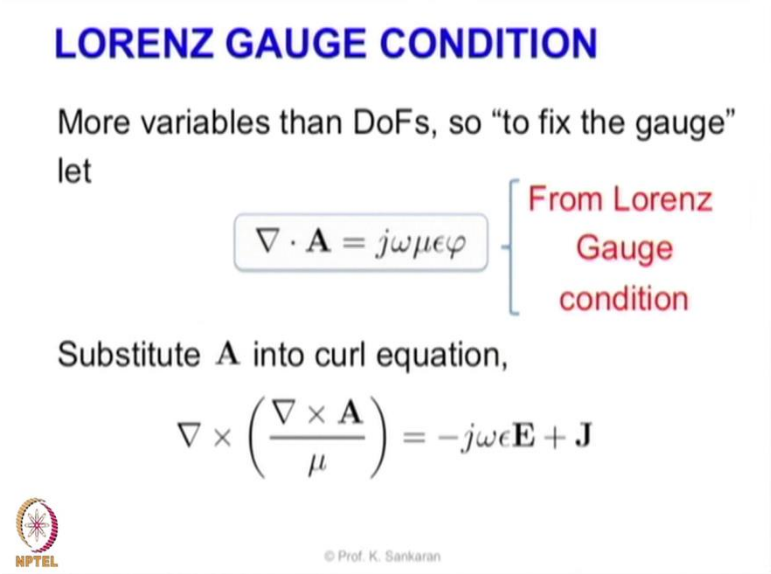

And we discussed the significance of Lorenz Gauge while modeling the method of moment problems.

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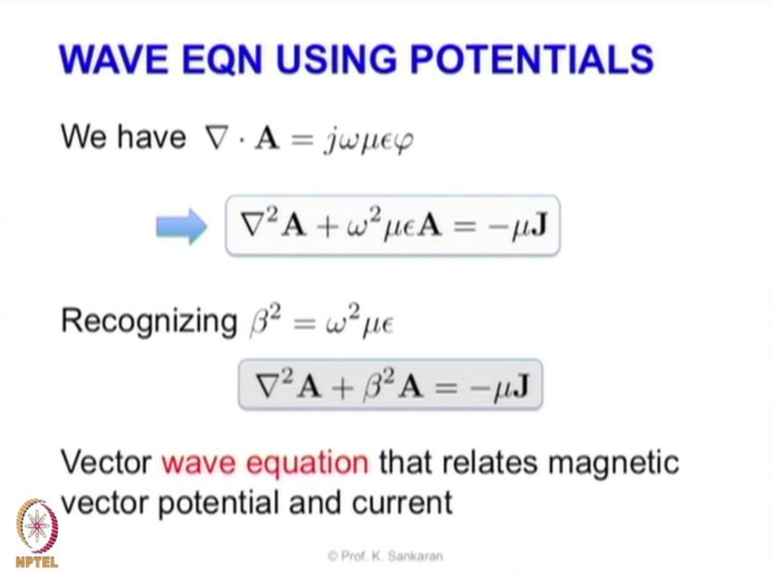

We described the wave equation using Vector and Scalar potentials;

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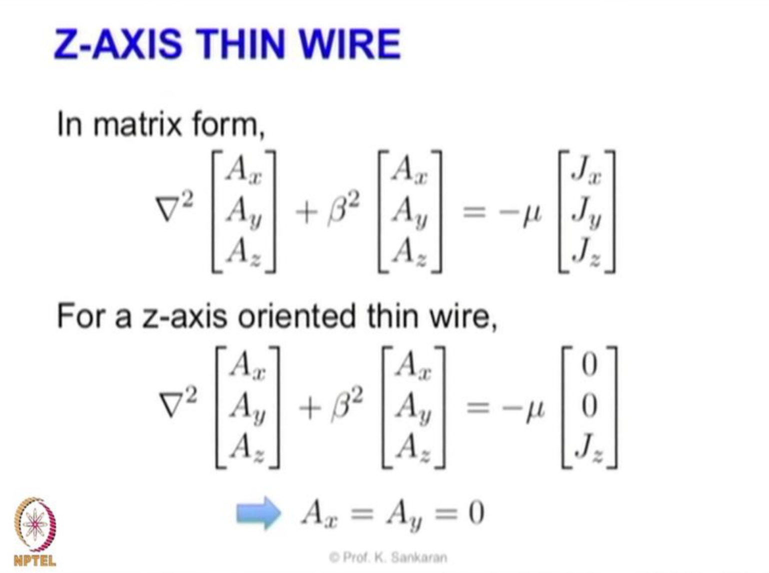

And discussed an application of a thin wire antenna

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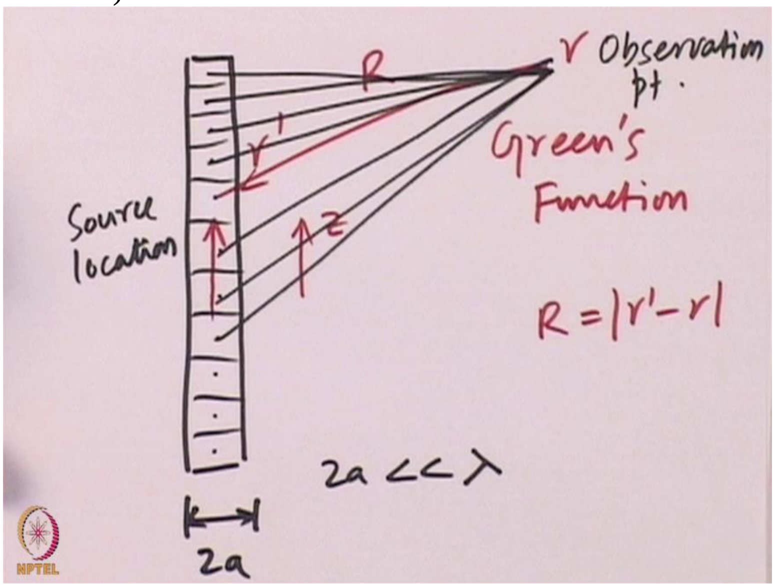

We explained how to compute the electirc field radiated by such thin wire antenna at a far waway point using the help of Green's function

We explained breifly the physical meaning of Green's function while solving such problems,

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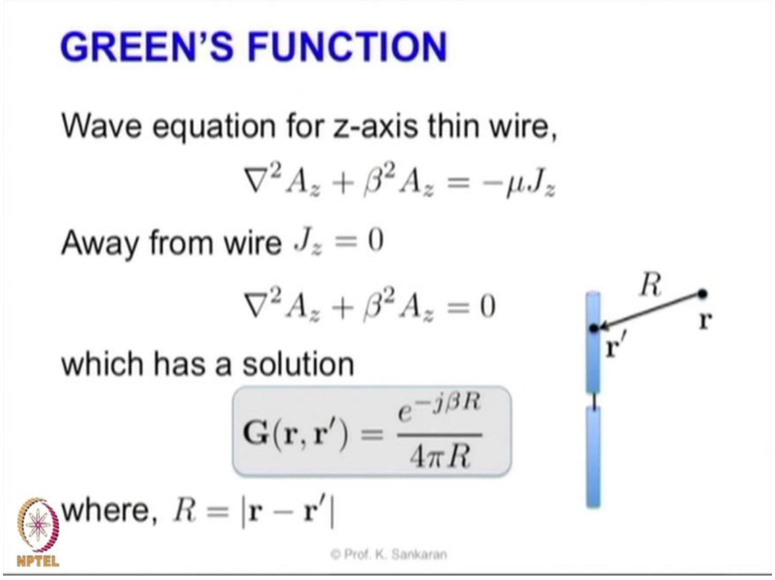

we later brought in some practical assumptions related to the geometry of the thin wire antenna to solve them using Matlab environment.

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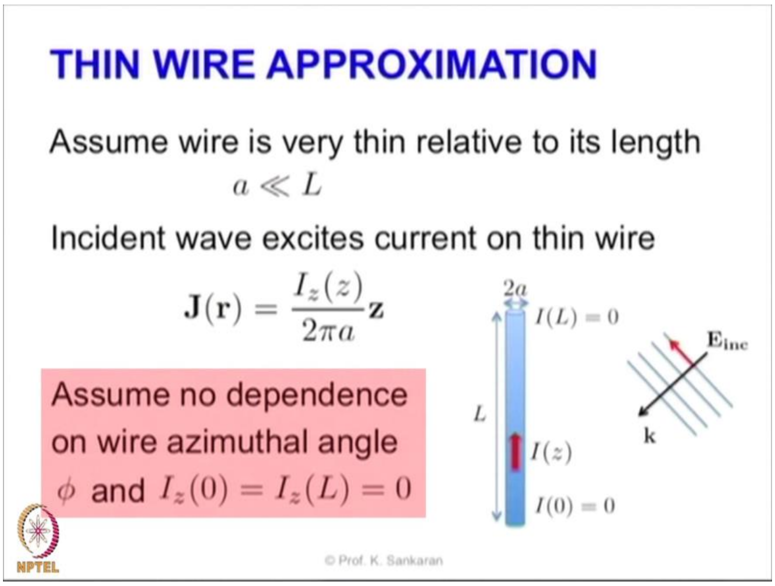

We also assumed that the electric field will be independent of the azimuthal angle and the electric current in the thin wire will go to zero at its 2n points.

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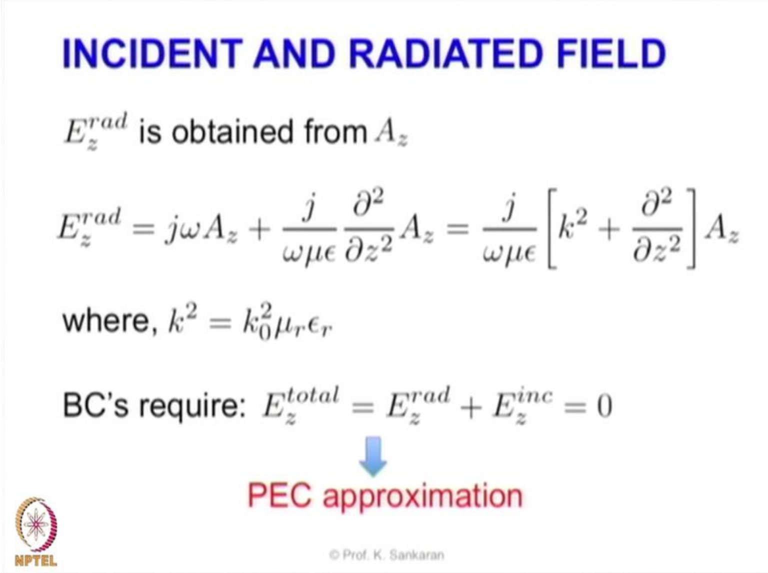

We later used the perfect electric conductor approximation to solve such problems.

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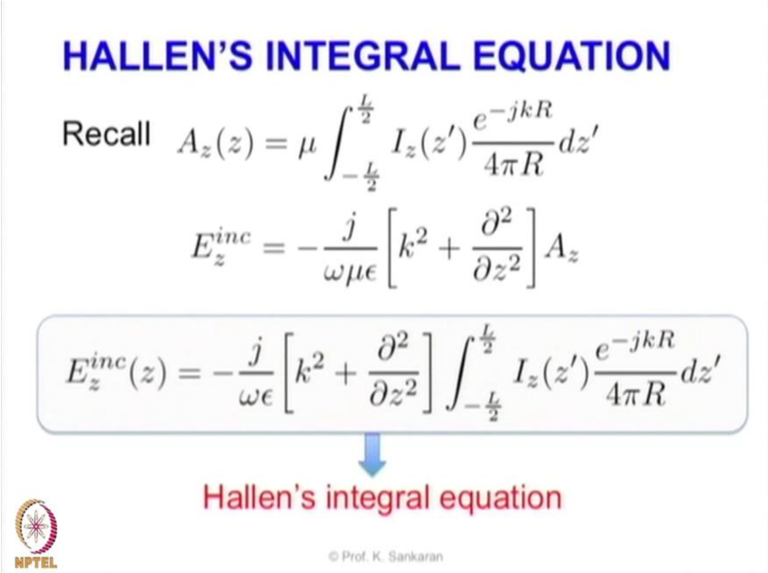

After that we discussed two important integral techniques namely the Hallen and

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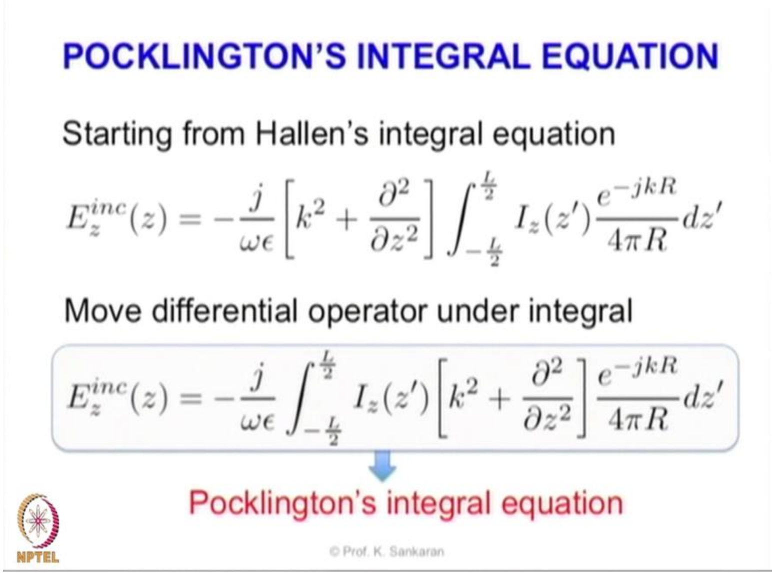

Pocklington integral equations used in the method of moments problems

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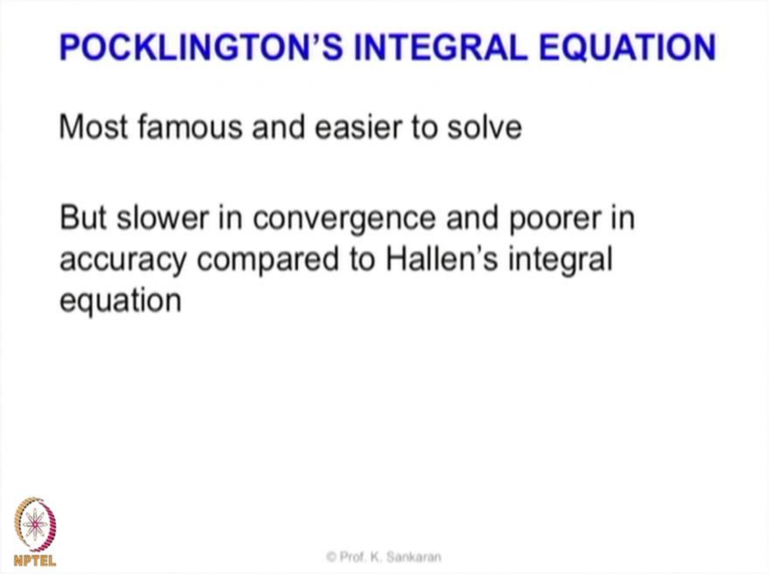

We also breifly mentioned a couple of pros and cons of these approaches.

In Hallen's approach resulted in a faster convergence way however it is normally difficult to solve them using computational methods. The Pocklingtons approach showed a slower convergence rate and poor accuracy compared to Hallens approach. However it is easier to solve in terms if numerical computation than in Hallen's approach.

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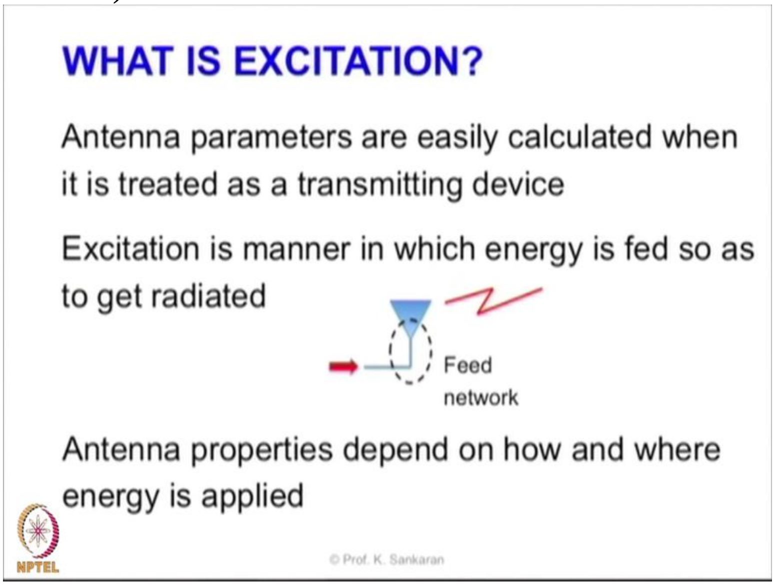

We highlighted a few techniques to model the source excitations in such problems.

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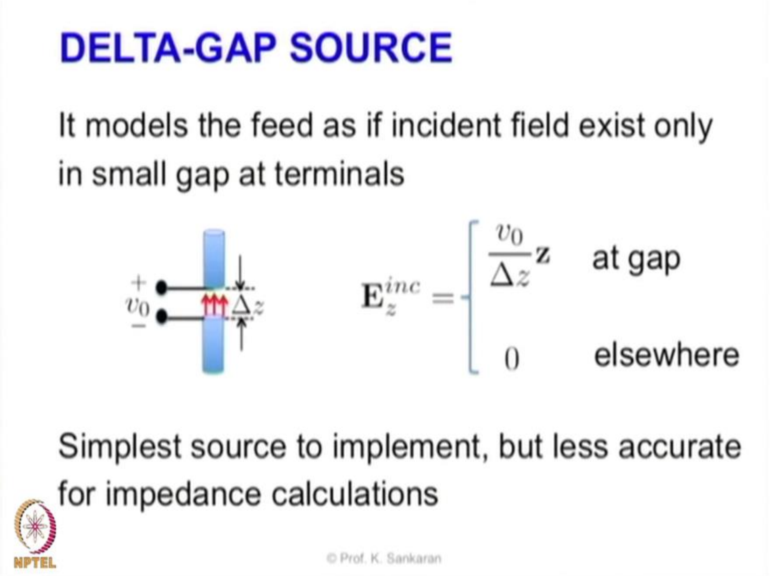

These techniques include the Delta Gap source techniques;

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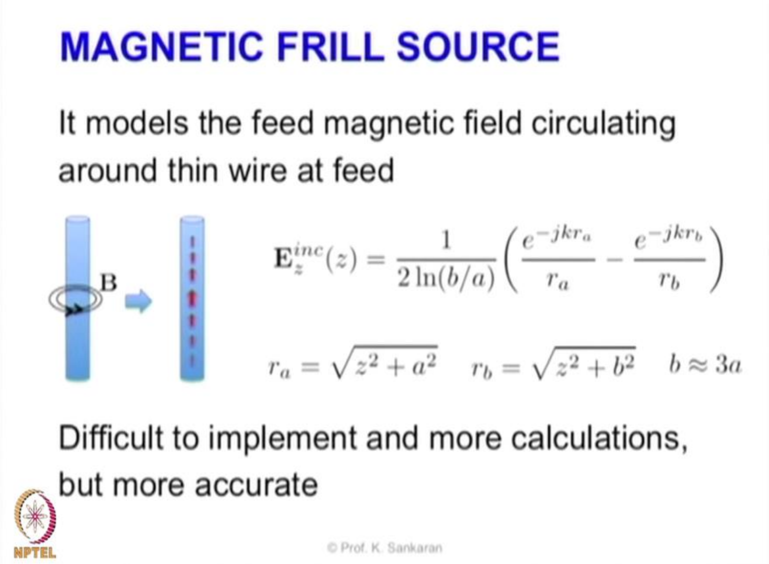

Magnetic Frill Source technique and

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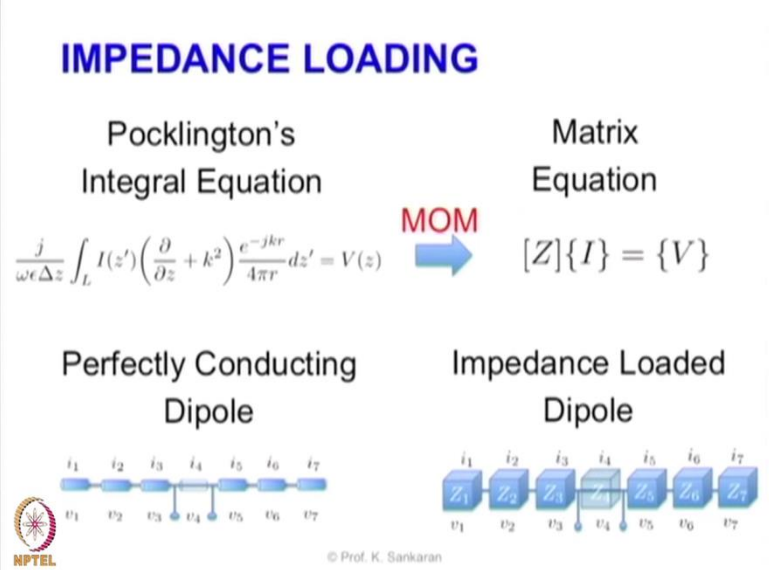

The Impedance loading technique

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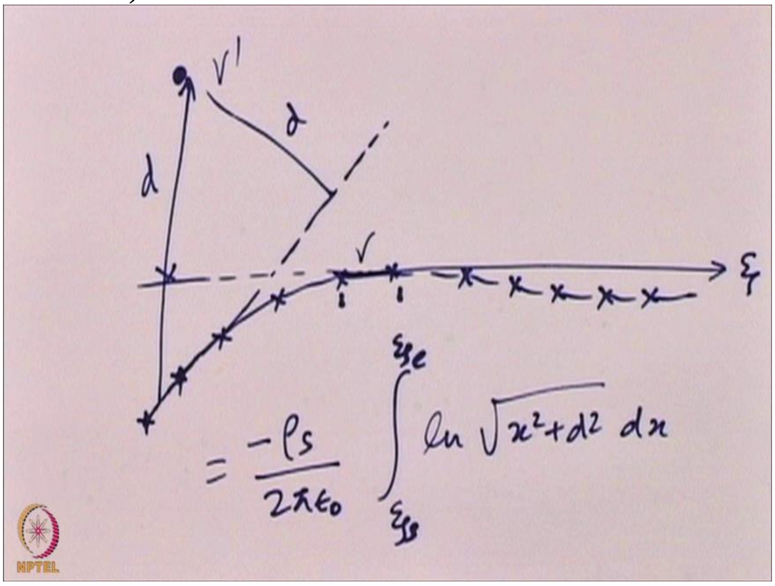

The first problem we modeled using the method of moments in the Matlab environment was that of arbitary shaped capacitor plates.

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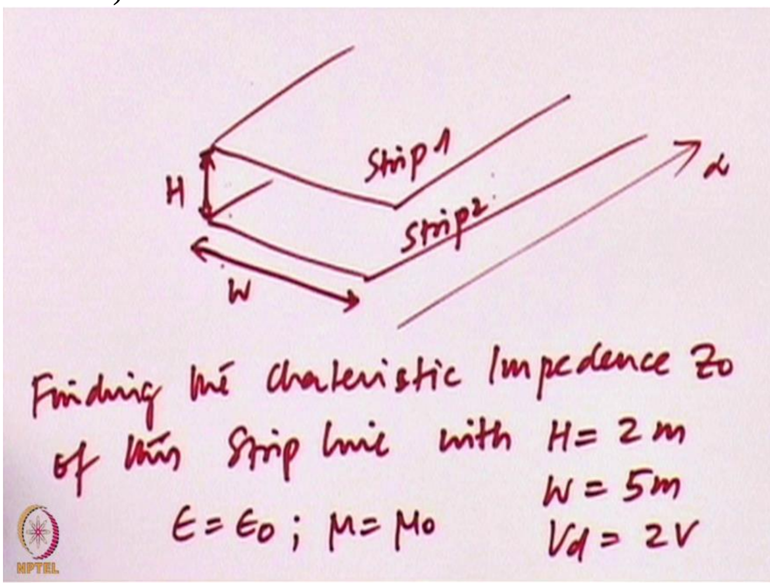

We also demonstrated using Matlab simulation How to compute the characteristic impedance of a metal strip modeled as a transmission line using method of moment.

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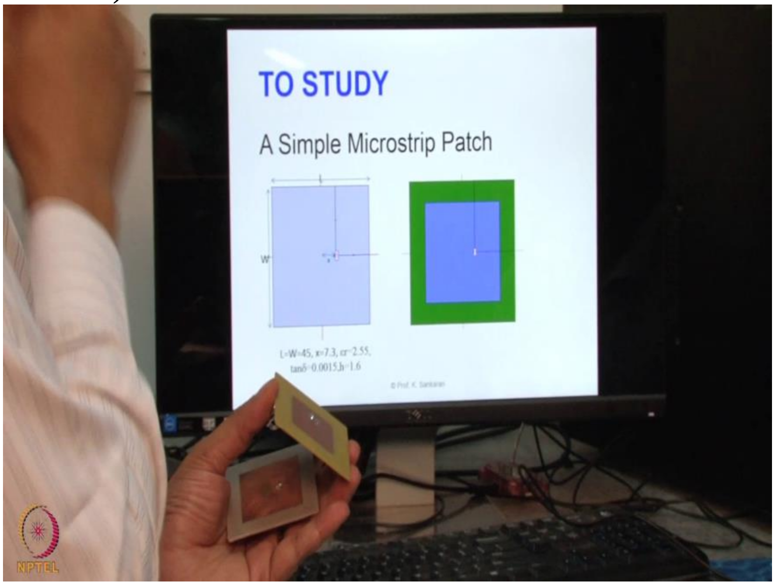

In the lab tour we discussed how to model a practical antenna using commercial solvers.

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We plotted the S11 parameter.

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Describing the reflection coefficient and computed the antenna gain and radiation pattern.

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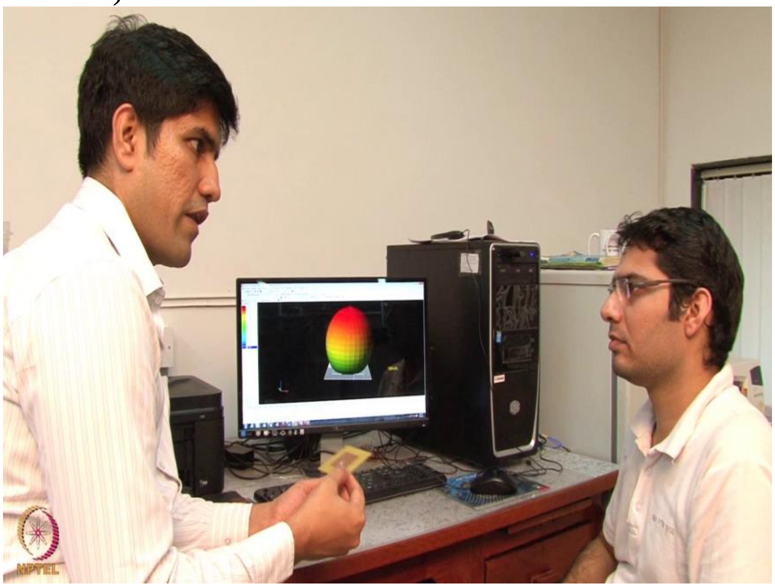

We also learned a thing or two about these antennas in terms of their physical aspects and application.

Please go through the concepts and examples that we discussed in this week and try coding simulating such problems yourself or in a group. We are more than happy to support you on the coarse forum to clarify your doubts and answer some of the questions that you might have. Get ready for the next week and until then Good Bye!