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Transmission Lines and Antennas (2016503)
Groups 1-2, 2012-1
Activities for the period 20-30 April.

1 Friday, April 20: LINKS BETWEEN IDEAL AND PHYSICAL TRANSMISSION LINES

- Computation of (R, L, G, C) parameters of ideal transmission lines in terms of fields [1, p.52].
- Power flow in physical transmission lines/waveguides in terms of transverse fields (deduce from integration of the Poyinting vector over the transverse section of the line assuming knowledge of the total fields $\mathbf{E} = \mathbf{E}_t + \mathbf{E}_z$, $\mathbf{H} = \mathbf{H}_t + \mathbf{H}_z$ and the known relation $\mathbf{E}_t = (\mathbf{H}_t \times \hat{z})Z_\dagger$, where $Z_\dagger$ is the impedance of the mode considered.
- Perturbation method to compute attenuation in transmission lines [1, p.83]. Formulation and how it allows to compute attenuation constant from fractional per-length lost power on a transmission line.
- Attenuation due to dielectric loss [1, p.97], how a portion of the attenuation constant in a Transmission line/waveguide can be computed directly from the loss tangent of the dielectric and the phase constant obtained under the assumption of no loss.
- Surface impedance concept [1, p.32]. How it is formulated, and how it allows computing power dissipated by good conductors in presence of an EM field from tangential E or H alone.

2 Monday, April 23: WAVEGUIDES/TRANSMISSION LINES FOR HIGH POWER

- Rectangular waveguide [1, p.106]: TE and TM modes, fundamental and higher order modes, operation bandwidth. Attenuation constant.
- Coaxial Line [1, p.126]: TEM mode, voltage, current and characteristic impedance. Formula for attenuation constant. Higher order modes and operation bandwidth. Coaxial connectors.

3 Friday, April 27: CHEAP AND SIMPLE TRANSMISSION LINES: PRINTED LINES

- Stripline [1, p.137]: physical construction and parameters. Formulas for characteristic impedance, and phase and attenuation constants.Check the steps involved in an approximate electrostatic solution without delving into the details and notice the quality of the approximation.
- Microstrip line [1, p.143]: generalities, physical construction and parameters. Formulas for the characteristic impedance and propagation constant. Relative accuracy of the electrostatic approximation.
- Design of printed lines with CAD tools (check how QUCS has a TX line calculator in tools-¿ line calculator).

4 Monday, April 30: INTRODUCTION TO THE SIMULATION OF EM SYSTEMS

Full-wave simulation of physical transmission lines. There will be a practical session in a computer lab to show how to design and simulate and validate a sytem composed of printed transmission lines.

References

[1] D. M. Pozar, *Microwave Engineering*. John Wiley & sons, 1998.