



Transmission Lines and Lumped Circuits: Fundamentals and Applications (Electromagnetism)

Giovanni Miano, Antonio Maffucci

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The theory of transmission lines is a classical topic of electrical engineering. Recently this topic has received renewed attention and has been a focus of considerable research. This is because the transmission line theory has found new and important applications in the area of high-speed VLSI interconnects, while it has retained its significance in the area of power transmission. In many applications, transmission lines are connected to nonlinear circuits. For instance, interconnects of high-speed VLSI chips can be modelled as transmission lines loaded with nonlinear elements. These nonlinearities may lead to many new effects such as instability, chaos, generation of higher order harmonics, etc. The mathematical models of transmission lines with nonlinear loads consist of the linear partial differential equations describing the current and voltage dynamics along the lines together with the nonlinear boundary conditions imposed by the nonlinear loads connected to the lines. These nonlinear boundary conditions make the mathematical treatment very difficult. For this reason, the analysis of transmission lines with nonlinear loads has not been addressed adequately in the existing literature. The unique and distinct feature of the proposed book is that it will present systematic, comprehensive, and in-depth analysis of transmission lines with nonlinear loads.

- * A unified approach for the analysis of networks composed of distributed and lumped circuits
- * A simple, concise and completely general way to present the wave propagation on transmission lines, including a thorough study of the line equations in characteristic form
- * Frequency and time domain multiport representations of any linear transmission line
- * A detailed analysis of the influence on the line characterization of the frequency and space dependence of the line parameters
- * A rigorous study of the properties of the analytical and numerical solutions of the network equations
- * The associated discrete circuits and the associated resistive circuits of transmission lines
- * Periodic solutions, bifurcations and chaos in transmission lines connected to nonlinear lumped circuits

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