Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HSB
Hochschule Bremen
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Master 2019

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Time-Domain Signal tracing of RF Signals on a Planar Circuit.

ABSTRACT - Masterthesis

This thesis aims to develop a time-domain tracing algorithm for planar circuit boards for the Microwave Lab, Bremen for measuring the near field time signals. The transmitted and reflected signal is measured in time domain, so a signal is traced in along the traces of planar Printed Circuit Board (PCB). The objective of this thesis is to develop an algorithm for transformation of two- dimensional array of signal in time domain. The traces that we see on the circuit board connecting components are none other than two parallel running conducting trails called as transmission line. These traces are often a cause of disturbance and interference in today's world, as the operating range of frequency is increased reducing the wavelength of the signal.

In order to check the behavior of these traces (transmission line), the two parameters voltage and current of the line is analyzed by using different computation techniques. The process involved focused on implementation and designing of program in python language. Initially, a python program is developed to convert signal from frequency-domain to time-domain along the transmission line. The most efficient algorithm of analyzing in time domain i.e. Fast Fourier Transform (FFT) and Inverse Fast Fourier Transform (IFFT) is used. In this report, the propagation of wave along the line is implemented in python by using three techniques beginning with analyzing the transfer function of the line, then with the help of ABCD parameters and by applying Kirchoffs Current law or Nodal Analysis also termed as Node Voltage Analysis, depending on the distance and time taken for a pulse to travel from source to load and taking into account matched and unmatched conditions. The basic nature of algorithm is same in all three techniques, where "N" blocks of two port networks are cascaded. Firstly, all the calculations are done in Frequency domain and then later correlation is established between signals which means it is converted to time domain. The input signal used in this thesis, is a time dependent gaussian signal, which is converted in frequency domain and this signal in frequency domain is sent as an input to the cascaded blocks of transmission lines for further analysis in time domain.

Thus, a python circuit simulator is designed for the above mentioned conditions. This makes possible to trace signal in two dimensional. A 2D circuit simulator is developed which reads the 2D node voltages of data structures and trail of travelling pulses through the structure is realized.