**HACETTEPE UNIVERSITY**
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**
**ELE401-402 GRADUATION PROJECT**

# DESIGN OF A SOFTWARE TOOL FOR MICROWAVE TRANSMISSION LINE ANALYSIS

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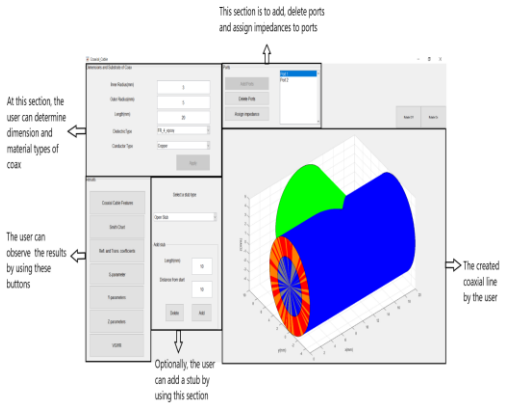
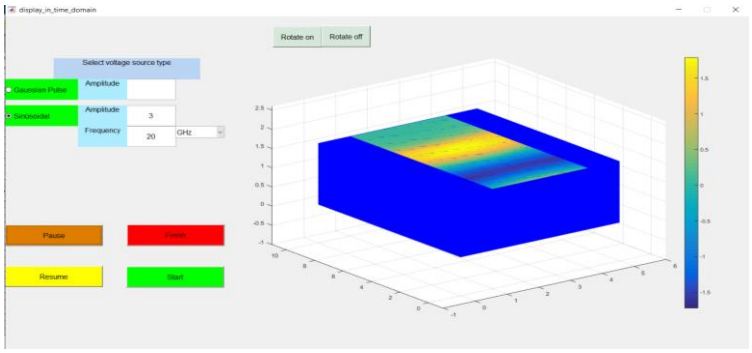
**Project Description: The aim of the project is to develop a software which is able to analyse the features of various transmission lines. The chosen transmission line types to analyse are coaxial lines, microstrip lines and waveguides. The software is created by using MATLAB tools.**

## The Software Structure for Coaxial Lines



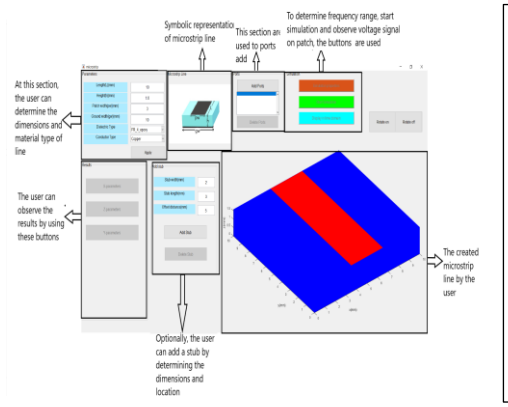

The GUI structure of coaxial line section of the software is shown in left figure. The user must enter the dimensions of the coaxial line and if needed, can add a stub (open or short stub) and define the ports and assign the values of RLC circuit, so that ports were defined as containing a RLC circuit. After then, the user can observe the results from result section of software. The results of software are calculated according to some formulas obtained for transmission lines.

## Display Voltage Values on Patch of Microstrip Line



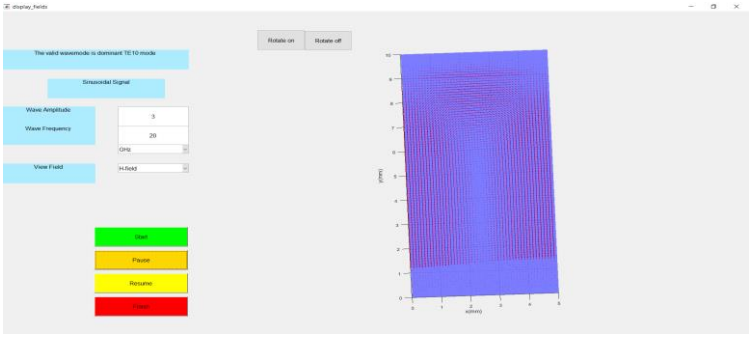

The software provides the opportunity which is to observe the change of voltage values on patch to the user. The voltage source may have sinusoidal or gaussian waveform.

## The Software Structure for Microstrip Lines



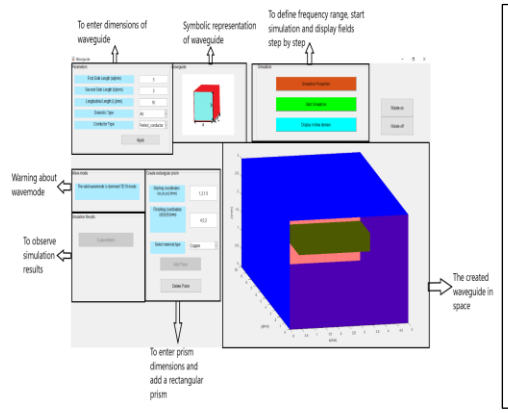

While developing the software for microstrip lines, Finite-Difference Time-Domain method was used. Hence that, the simulation operation take a long time. Furthermore, the software calculates the characteristic impedance of microstrip line and assign the value as port impedance. As the other feature of the software, the user can add a stub and create a microstrip filter.

## Display H- or E- Fields Inside of Waveguide



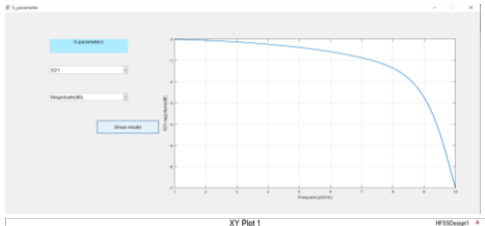

The software provides the opportunity which is to observe the change of H- or E- fields inside of waveguide in time.

## The Software Structure for Waveguides

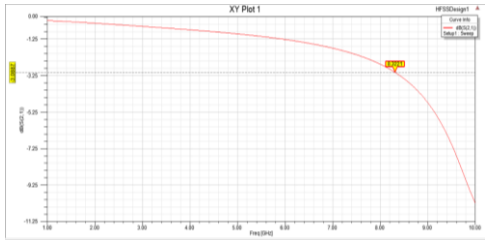



The FDTD method was used for waveguide section of the software. For waveguide, the used can create a rectangular prism inside of waveguide and can be observe S-parameters. However, the waveguide is working only in dominant wave mode ie. TE10 mode. Furthermore, the user can observe the cut off frequency of waveguide on simulation of free waveguide and by observing S-parameters.

## Compare HFSS Results with The Software for a Microstrip Line



S21 software result




S21 HFSS result