COMPUTER AIDED DESIGN AND CHARACTERISATION OF MICROSTRIP LOW-PASS FILTER

Presented in partial fulfilment for the award of

Bachelor of Engineering (Hons.) (Electrical)

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ABSTRACT

The aim of the project is to design, simulate, fabricate and measure the characteristics of a low-pass filter having a cut-off frequency of 4 GHz with a stopband attenuation of 60 dB and a return loss of 20 dB.

This project presents the synthesis and design of a generalised Chebyshev low-pass prototype microwave filter. The synthesis of prototype network is done by using Maple V mathematical software and is then simulated and optimized with the aid of a commercially available software called HP-EEsof Libra. It is then fabricated locally in our Fabrication Laboratory on a microstrip circuit. The microstrip laminate has a thickness of 0.8 mm and a dielectric permittivity of 2.35. The filter response is then measured using Wiltron 562 Scalar Network Analyzer.

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1.1 Objective and introduction to project

The aim of the project is to design, simulate, fabricate and measure the characteristics of a low-pass filter having a cut-off frequency of 4 GHz with a stopband attenuation of 60 dB and a return loss of 20 dB.

This project presents the synthesis and design of a Generalised Chebyschev low-pass prototype microwave filter using alternating pole synthesis technique by insertion loss method [1]. The synthesis of prototype networks is done using Maple V mathematical software and is simulated using a commercially available software called HP-EEsof Libra. The circuit performance is simulated and optimized using this software prior to the intended circuit fabrication. The circuit is then fabricated (in ITM) on a microstrip laminate with a substrate thickness of 0.8 mm and a dielectric permittivity of 2.35. A scalar network analyser is then used to measure the filter characteristics.

The main function of filter is to pass only those frequencies in the assigned operating range and rejects all others. The lumped element prototype filters are used as a basis for the realisation of distributed commensurate transmission line filters. The lumped element prototype filters are converted into distributed transmission line filters by using Richard's Transformations. Microwave filters can be designed by approximation equations or by exact synthesis method.