DESIGN & TESTING OF REFLECTORS FOR MICROWAVE INTERFEROMETER USING FREE-SPACE MICROWAVE MEASUREMENT SYSTEM

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ABSTRACT

The main objective of this project is to design and testing of reflectors for microwave interferometer using free-space microwave measurement system at the microwave frequencies in the range of 7.5 to 14.5 GHz. Throughout this experiment, different composite material samples with different thicknesses are used to obtain resonant frequency response. The sample had to be sandwiched between these two reflectors. This free-space measurement system is used to measure the reflection coefficient, S_{11}. The measurement system consists of transmit and receive horn lens antennas, a vector network analyser, mode transitions and a computer. Diffraction effects at the edges of the samples are minimized by using spot-focusing lens antennas. Errors due to multiple reflections between antennas via the surface of the sample are corrected by using a free-space LRL (line, reflect, line) calibration technique.

LIST OF CHAPTERS

CHAPTER 1

1.0 INTRODUCTION [1]

1.1 What Are Microwaves?

Microwaves is a descriptive term used to identify electromagnetic waves in the frequency spectrum ranging approximately from 1 Giga Hertz (10^9 Hertz) to 30 Giga Hertz. This corresponds to wavelengths from 30 cm to 1 cm. Sometimes higher frequencies (extending up to 600 GHz) are also called 'microwaves'. These waves present several interesting and unusual features not found in other portions of the electromagnetic frequency spectrum. These features make "microwaves' uniquely suitable for several useful applications.

1.2 Characteristics Feature of Microwaves

The main characteristics features of microwaves originate from the small size of wavelengths (1 cm to 30 cm) in relation to the sizes of components or devices commonly used. Since the wavelengths are small, the phase varies rapidly with distance; consequently the techniques of circuit analysis and design, of measurements and of power generation, and amplification at these frequencies are distinct from those at lower frequencies. For dealing with these small wavelengths, methods of circuit representation and analysis need to be modified. The phase difference caused by the interconnection between various components or various parts of a single component is not negligible. Consequently, analyses based on Kirchhoff's laws and voltage-current concepts are not adequate to describe the circuit behaviour at microwaves frequencies. It is necessary to analyse the circuit or the component in terms of electric and magnetic fields