

**MICROWAVE NONDESTRUCTIVE MEASUREMENT OF
CONCRETE USING AN OPEN-ENDED WAVEGUIDE**

**This is presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Honours)
UNIVERSITI TEKNOLOGI MARA**



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OKT 1999

ABSTRACT

This project work involves a testing of several samples of composite materials by using microwave nondestructive testing technique. The technique used is an open-ended waveguide technique, which make it possible for the measurement of concrete as a sample. The frequency range is from 8.0 GHz to 12.5 GHz . This testing proposes to measure the complex permittivity of composite materials. The main equipment for testing is *WILTRON 37269B* Vector Network Analyzer. A computer program using *Fortran 77* were develops for calculation of complex permittivity. Data measurement from the analyzer is applied to this program to get the result needed.

ACKNOWLEDGEMENT

In name of ALLAH, the most Gracious and the most Merciful.

I wish to express my sincere gratitude and appreciation to my supervisor, Dr Deepak Kumar Ghodgoankar for providing the support and invaluable guidance towards success of this project. All the regular discussion sessions that we had throughout period of study have contributed to the success of this project.

I must also acknowledge the excellent services provided by the Faculty of Civil Engineering. Appreciation is given to all school staff and colleagues in helping in the writing-up of the thesis and also to my family who gives me encourage during my study in the Shah Alam

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Composite materials are widely used in many field of application such as telecommunication, electronic parts, radar, and industrial microwave heating system and aerospace materials [6]. It is necessary to characterize these materials for absorption, transmission, reflection, dielectric properties and magnetic properties.

The microwave nondestructive testing is one of the methods to measure the dielectric properties of materials. Microwaves are very sensitive to the dielectric properties of materials. The knowledge of the complex permittivity allows one to measure the primary physical properties of the materials, such as its moisture content.

The microwave nondestructive testing method are also widely used for geometrical sizes and quality control of different materials such as composite materials, polymers, fiberglass, ceramic, woods etc. The control may be performed either during the fabrication of product with a view to change some technological parameters or after the fabrication with a view to reject bad quality product.

Microwaves have a broad range of application in the numerous forms of “communication of information”. Testing with microwaves is dominated by the basic properties of microwaves. Since their penetration in good conducting materials is minimal, they are mainly used to test nonconducting materials. Testing and measurement on conducting material are limited to dimensional were testing such as thickness gaging and surface measurement such as testing for surface breaking flaws. Microwaves are affected by a large number of material properties. In lossy dielectric