

**THE EFFECTS OF COUPLANT AND THE RELATION BETWEEN  
PROBE ANGLE AND DEFECT VARIATION IN ULTRASONIC  
INSPECTION.**

**ABDUL RAHMAN MD NOOR**

**Final Year Project Report Submitted In  
Partial Fulfillment Of The  
Requirements For The Degree Of  
Bachelor Of Science (Hons.)  
Industrial Physics  
In The Faculty Of Applied Sciences  
Universiti Teknologi MARA**

**MAY 2010**

## ACKNOWLEDGEMENTS

First of all, thanks to Allah S.W.T, the almighty because of His Blessings, this thesis was completed. My heartfelt thanks goes to my supervisor, Prof. Madya Dr. Mohd Salleh Mohd Deni because of his valuable comments and suggestions and precious advices, ideas and support during the process of preparing this thesis.

My appreciation also goes to all Physics lecturers, especially to my project coordinator, Encik Md Yusof Theeran, support and advices in conducting in good research and project. Thanks also extended to Head of Programmed, Tuan Haji Isa bin Yusuf for his support, and all lecturers that have given support in preparing of this study.

Also, I would like to express my special thanks to all my beloved friends and coursemates for their great support and encouragement throughout the completion of this thesis.

Abdul Rahman Md Noor

## TABLE OF CONTENTS

	Page
<b>ACKNOWLEDGEMENTS</b>	iii
<b>TABLES OF CONTENTS</b>	iv
<b>LIST OF TABLES</b>	vi
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS</b>	viii
<b>ABSTRACT</b>	ix
<b>ABSTRAK</b>	x
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background of study	1
1.2 Objective of the study	4
1.3 Problem statement	4
1.4 Significant of study	5
<b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Ultrasonic waves	6
2.2 Acoustic impedance	6
2.3 Type of mode of propagation	7
2.3.1 Longitudinal or compression waves	7
2.3.2 Transverse or Shear waves	8
2.4 Behavior of ultrasonic waves	9
2.4.1 Reflection and Transmission	9
2.4.2 Refraction and Mode conversion	11
2.4.2.1 Snell's Law	11
<b>CHAPTER 3 METHODOLOGY</b>	
3.1 Equipment	14
3.2 Before inspection	15
3.2.1 Time base calibration	15
3.2.1.1 Normal beam probes	15
3.2.1.2 Angle beam probes	15
3.3 Inspecting the defects	16
<b>CHAPTER 4 RESULTS AND DISCUSSION</b>	
4.1 Collected data	18
4.1.1 Data tables	18
4.1.2 Graphs	20
4.2 Discussions	25
4.2.1 Relation between probe angle and defect variation	25

## ABSTRACT

Couplant and defect variation plays a main role to the inspection process. In this study, the effects of couplant to the inspection have been investigated and the relation between the probe angles and defect variations has been studied. Using the pulse echo technique, inspection has been done to the high measurement block with angle probes and the type of couplant is varies. This height measurement block is a standard block which has several side drill holes in many variation of angle. These side drill holes will act as the defects in the sample. The best probe and couplant and is the probe and couplant which gives the highest maximum reflection with low gain consumed. As a result, the best couplant is the Krautkramer Gel couplant and the relation of probe angle and defect variation is concluded. When the best probe is  $45^\circ$ , the range of variation of defect is about from  $40^\circ$  to  $50^\circ$ . When the best probe is  $60^\circ$ , the range of variation of defect is about from  $25^\circ$  to  $35^\circ$ . When the best probe is  $70^\circ$ , the range of variation of defect is about from  $15^\circ$  to  $25^\circ$ .

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of the study

The frequency of sound impression (tone) is a direct measure for the pitch of a tone. As the frequency is increase, the tone will be higher. As the frequency goes higher and higher, a limit will be attained beyond the pitch of the tone which cannot be received by human ear. Sound wave having the frequency higher than the human ear can hear is called the ultrasound. Generally, the frequency range for the audible sound is 20 Hz to 20 kHz. Whereas any sound which have the frequency higher than 20 kHz are considered as the ultrasound.

The ultrasonic inspection is a type of inspection where we make use of the ultrasound that been introduced into the material. This ultrasonic inspection can be used in:

1. Defect detection
2. Thickness measurement of materials
3. To determine the elastic modulus of materials
4. To study the metallurgical structure of materials