

UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS *

JUDUL: **WELDING FAULT DETECTION USING ACOUSTIC EMISSION TECHNIQUE**

SESI PENGAJIAN: 2011/2012

Saya,

FAREEZ FARHAN BIN SULIMAN (891012-01-5907)
(HURUF BESAR)

mengaku membenarkan tesis (Sarjana Muda / Sarjana / Doktor Falsafah)* ini disimpan di perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Tesis ini adalah hak milik Universiti Malaysia Pahang (UMP).
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi / badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

(TANDATANGAN PENYELIA)

Alamat Tetap:

**No 16, Jalan Seri Impian 11,
Taman Impian Emas,
81300, Skudai, Johor.**

MIMINORAZEANSUHAILA BINTI LOMAN
(Nama Penyelia)

Tarikh: **20 JUN 2012**

Tarikh: **20 JUN 2012**

CATATAN: * Potong yang tidak berkenaan.

** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh tesis ini perlu dikelaskan sebagai SULIT atau TERHAD.

Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara Penyelidikan, atau disertasi bagi pengajian secara kerja kursus dan penyelidikan, atau
◆ Laporan Projek Sarjana Muda (PSM).

TABLE OF CONTENTS

	Page
SUPERVISOR'S DECLARATION	ii
STUDENT'S DECLARATION	iii
ACKNOWLEDGEMENTS	v
ABSTRACT	vi
ABSTRAK	vii
TABLE OF CONTENTS	viii
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF SYMBOL	xv
LIST OF ABBREVIATIONS	xvi

CHAPTER 1 INTRODUCTION

1.1 Introduction	1
1.2 Objective of the project	2
1.3 Scope of project	2
1.4 Problem statement	3

CHAPTER 2 LITERATURE REVIEW

2.1 M.I.G Welding	4
2.2 Mild steel	8
2.3 Mild Steel Properties And Uses	9
2.4 Mild steel Chemical Properties	10
2.5 Acoustic Emission	10
2.5.1 History of Acoustic Emission	10
2.5.2 Background of Acoustic Emission	11
2.5.3 Traditional Acoustic Emission Technique	12
2.6 Theory of Acoustic Emission Waves	15

2.6.1	Types of Acoustic emission	15
2.6.2	Attenuation	16
2.6.3	Wave Mode and Velocity	17
2.6.4	Linear Location	18
2.7	Theory of Acoustic Emission Sources	18
2.7.1	Source-Function and Waveform Analysis	20
2.7.2	Noise	21
2.8	Acoustic Emission Signal Features	22
2.8.1	Amplitude	22
2.8.2	Rise time	23
2.8.3	Duration	23
2.8.4	MARSE	23
2.8.5	Counts	23
2.9	Some Acoustic Emission Application	24
2.9.1	Crack Detection	24
2.9.2	Weld Analysis	24
2.9.3	Bridges	24
2.10	Frequency Range of Sound	25

CHAPTER 3 METHODOLOGY

3.1	Introduction	27
3.2	Flow Chart	28
3.3	Design the Experiment	29
3.4	Material Preparation	33
3.5	Welding Process	34
3.6	Analysis	35
3.7	Result	36
3.8	Conclusion	37

CHAPTER 4 RESULT AND DISCUSSION

4.1	Introduction	38
4.2	Determine The Location Of Acoustic Emission Source	39
4.3	Experiment 1	40
4.4	Experiment 2	44
4.5	Statistical Analysis	48
4.5.1	Experiment 1, First point	49
4.5.2	Experiment 1, Second point	51
4.5.3	Experiment 1, Third point	53
4.5.4	Experiment 1, Fourth point	55
4.5.5	Experiment 1, Fifth point	57
4.5.6	Experiment 2, First point	59
4.5.7	Experiment 2, Second point	61
4.5.8	Experiment 2, Third point	63
4.5.9	Experiment 2, Fourth point	66
4.5.10	Experiment 2, Fifth point	67
4.6	Conclusion	69
CHAPTER 5 CONCLUSION AND RECOMMENDATION		
5.1	Introduction	70
5.2	Conclusion	70
5.3	Recommendation	71
REFERENCE		72
APPENDIES		
A1	Gantt chart for FYP 1	74
A2	Gantt chart for FYP 2	75
B	Examples of AE signal view using Physical Acoustic Emission Software	76
C	Model setup for Matlab Software	77

LIST OF TABLES

Table No.		Page
2.1	Properties of Mild Steel	10
4.1	Statistical Analysis for experiment one first point	49
4.2	Statistical Analysis for experiment one second point	51
4.3	Statistical Analysis for experiment one third point	53
4.4	Statistical Analysis for experiment one fourth point	55
4.5	Statistical Analysis for experiment one fifth point	57
4.6	Statistical Analysis for experiment two first points	59
4.7	Statistical Analysis for experiment two second points	61
4.8	Statistical Analysis for experiment two third points	63
4.9	Statistical Analysis for experiment two fourth points	65
4.10	Statistical Analysis for experiment two fifth points	67
4.11	Summary of the result	69

LIST OF FIGURES

Figure No.	Page
2.1 The schematic of MIG Welding process	5
2.2 Welding Wire	6
2.3 Welding safety gear	7
2.4 MIG Welding Machine	8
2.5 The definitions for Acoustic Emission events	13
2.6 A typical Acoustic Emission system setup	14
2.7 Example of Acoustic Emission signal	16
2.8 Linear Location	18
2.9 Investigation of the source location of Acoustic Emission signals by the arrival times of several Acoustic Emission sensors in a cylindrical bar of Haynes HR-120	21
2.10 Acoustic Emission signal features	22
2.11 The Frequency Range of Sound	25
2.12 Approximate frequency ranges corresponding to ultrasound, with rough guide of some applications	26
3.1 Project Flow Chart	28
3.2 Dye penetration testing result for defect material	30
3.3 Dye penetration testing result for non-defect material	30
3.4 MIG welder	31
3.5 Experiment setup	32
3.6 Acoustic Emission Sensor	33
3.7 Couplant	33
3.8 Point for the sensor	34

3.9	MIG welding process	35
3.10	AE Node Physical Acoustic Instrument	36
3.11	Computer for analysis data	37
4.1	Defected material points.	40
4.2	Result for first point of defect material.	41
4.3	Result for second point of defect material	41
4.4	Result for third point of defect material	42
4.5	Result for fourth point of defect material	42
4.6	Result for fifth point of defect material	43
4.7	Non-defected material points.	45
4.8	Result for first point of non-defect material	45
4.9	Result for second point of non-defect material	46
4.10	Result for third point of non-defect material	46
4.11	Result for fourth point of non-defect material	47
4.12	Result for fifth point of non-defect material	47
4.13	Kurtosis value at 10 hits for first point at experiment 1	50
4.14	Skewness value at 10 hits for first point at experiment 1	50
4.15	Kurtosis value at 10 hits for second point at experiment 1	52
4.16	Skewness value at 10 hits for second point at experiment 1	52
4.17	Kurtosis value at 10 hits for third point at experiment 1	54
4.18	Skewness value at 10 hits for third point at experiment 1	54
4.19	Kurtosis value at 10 hits for fourth point at experiment 1	56
4.20	Skewness value at 10 hits for fourth point at experiment 1	56
4.21	Kurtosis value at 10 hits for fifth point at experiment 1	58

4.22	Skewness value at 10 hits for fifth point at experiment 1	58
4.23	Kurtosis value at 8 hits for first point at experiment 2	60
4.24	Skewness value at 8 hits for first point at experiment 2	60
4.25	Kurtosis value at 10 hits for second point at experiment 2	63
4.26	Skewness value at 10 hits for second point at experiment 2	63
4.27	Kurtosis value at 10 hits for third point at experiment 2	64
4.28	Skewness value at 10 hits for third point at experiment 2	64
4.29	Kurtosis value at 10 hits for fourth point at experiment 2	66
4.30	Skewness value at 10 hits for fourth point at experiment 2	66
4.31	Kurtosis value at 6 hits for fifth point at experiment 2	67
4.32	Skewness value at 6 hits for fifth point at experiment 2	68

LIST OF SYMBOL

A	Amplitude
R	Rise time
D	Duration
E	MARSE
N	Counts

LIST OF ABBREVIATIONS

AET	Acoustic Emission Testing
NDT	Non-Destructive Testing
MIG	Metal Inert Gas
GMAW	Gas Metal Arc Welding
D/C	Direct Current
TIG	Tungsten Inert Gas
UV	Ultra Violet
C	Carbon
Si	Silicon
Mn	Manganese
P	Phosphorus
S	Sulphur
PC	Personal Computer
RF	Radio Frequency
NDE	Non-Destructive Experiment
dB	Decibels
A	Amplitude
R	Rise time
D	Duration
E	MARSE
N	Counts
Hz	Hertz
USB	Universal Serial Bus