THE EFFECT OF TEMPERATURE AGAINST NONLINEAR EFFECT IN VIBRO-ACOUSTIC METHOD ON SOLID STRUCTURE

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KESAN SUHU TERHADAP KESAN NONLINEAR DALAM KAEDAH VIBRO-ACOUSTIC PADA STRUKTUR SOLID

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Laporan ini dikemukakan sebagai
memenuhi sebahagian daripada syarat penganugerahan
Ijazah Sarjana Muda Kejuruteraan Mekanikal

Fakulti Kejuruteraan Mekanikal

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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I declare that this project report entitled “The Effect Of Temperature Against Nonlinear Effect In Vibro-Acoustic Method On Solid Structure.” is the result of my own research except as cited in references.

Signature :……

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Date : .....

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APPROVAL

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PENGESAHAN PENYELIA

Saya akui bahawa telah membaca laporan ini dan pada pandangan saya laporan ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Mekanikal

Tandatangan :.....

Nama Penyelia : Dr. Ruztamreen Bin Jenal

Tarikh :.....

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DEDICATION

Special Dedication to my family members,

my friends, my fellow colleague and

all faculty members

For all your care, support and believe in me.

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DEDIKASI

Dedikasi Khas kepada ahli keluarga saya,

kawan saya, rakan sekerja saya dan

semua ahli fakulti

Untuk semua penjagaan anda, sokongan dan percayalah kepada saya.

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ABSTRACT

The purpose of this research is to define the relationship of effect of temperature against nonlinear affect in Vibro-acoustic method on solid structure. Every structure on the machine that was running will be crack because of vibration. How the size of crack we don't know and it is not easy to find it plus with the certain type of temperature. Therefore, nonlinear vibro-acoustic technique will be used to find or analyse the crack detection. This method is convenient and effective non-destructive detecting approach. It can be applied to various types of materials and can even be used to detect various types of defects. Mostly the researcher used this method to detect the crack. The method considered in this study is based on a combined vibro-acoustic modulation of an intensive low-frequency (modal) vibration (Low frequency) and a weaker high-frequency ultrasonic wave (High frequency). Non-linear acoustic modulation is caused by the crack opening or closing. But it also may be possible that a cracking occurs by heat dissipation that may affect a material structure. So that, an experiment will be setup to analyse and identify the relation of the heat dissipation on solid structure with the intensity of the non-linear acoustic modulation. Modal test and vibro-acoustic test was performed on the aluminium plate to find the frequency and intensity. Finally, the contribution of the heat dissipation against the non-linear acoustic effect for crack detection will be explain and show the result of the research. The result from the experiment show that the heat dissipation does not affect to the

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intensity of the experiment. There is no distortion of the wave when propagate through the aluminium plate.

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ABSTRAK

Tujuan kajian ini adalah untuk menentukan hubungan kesan suhu terhadap kesan tak linear dalam kaedah Vibro-akustik pada struktur pepejal. Setiap struktur pada mesin yang sedang bergerak akan menjadi retak kerana getaran. Bagaimana saiz keretakan kita tidak tahu dan tidak mudah untuk mencarinya ditambah dengan jenis suhu tertentu. Oleh itu, teknik vibro-akustik bukan linear akan digunakan untuk mencari atau menganalisis pengesanan keretakan. Kaedah ini mudah dan pendekatan berkesan yang tidak merosakkan. Ia boleh digunakan untuk pelbagai jenis bahan dan boleh digunakan untuk mengesan pelbagai jenis kecacatan. Kebanyakan penyelidik menggunakan kaedah ini untuk mengesan keretakan. Kaedah ini dipertimbangkan dalam kajian ini berdasarkan modulasi vibro-akustik gabungan getaran frekuensi rendah (modal) intensif (frekuensi rendah) dan gelombang ultrasonik frekuensi tinggi yang lebih lemah (frekuensi tinggi). Modulasi akustik bukan linear disebabkan oleh pembukaan atau penutupan retak. Tetapi juga mungkin keretakan berlaku oleh pelesapan haba yang boleh menjejaskan struktur material. Jadi, eksperimen akan menjadi persediaan untuk menganalisis dan mengenal pasti hubungan pelesapan haba pada struktur pepejal dengan intensiti modulasi akustik bukan linear. Ujian modal dan ujian vibro-akustik dilakukan pada plat aluminium untuk mencari kekerapan dan keamatan. Akhir sekali, sumbangan pelesapan haba terhadap kesan akustik bukan linear untuk pengesanan retak akan dijelaskan dan menunjukkan hasil penyelidikan. Hasil

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daripada eksperimen menunjukkan bahawa pelesapan haba tidak mempengaruhi keamatan eksperimen. Tidak ada penyelewengan gelombang apabila disebarkan melalui plat aluminium.

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TABLE OF CONTENTS

PAGE

DECLARATION
DEDICATION
ABSTRACT **i**
ABSTRAK **iii**
ACKNOWLEDGEMENTS **v**
TABLE OF CONTENTS **vii**
LIST OF ABBREVIATION **x**
LIST OF NOMENCLATURE **xi**
LIST OF TABLE **xii**
LIST OF FIGURES **xiii**
LIST OF APPENDIX

CHAPTER

1. INTRODUCTION **1**
1.0 Introduction 1
1.1 Backgrounds of study 1
1.2 Problem Statement 2
1.3 Objective 3
1.4 Scope of Project 4
1.5 Advantages of Project 4

2. **LITERATURE REVIEW** **5**
2.0 Introduction 5
2.1 Modal Analysis 5
2.2 Nonlinear vibro-acoustic wave modulation 6
2.3 Nonlinear Vibro-acoustic effect 8
2.3.1 Resonant frequency shifting 8
2.3.2 Harmonic generation 10
2.3.3 Sideband generation and amplitude modulation 11
2.4 Crack detection method 11
2.5 Nonlinear acoustic mechanism 13
2.5.1 Open-close of crack faces 14
2.5.2 Nonlinear elasticity 15
2.5.3 Temperature 16

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3. METHODOLOGY 18
3.1 Methodology Flow Chart 18
3.2 Literature Review 20
3.3 Experimental 21
3.3.1 Experiment conduct 21
3.3.2 Equipment and specimen 22
3.3.3.1 Equipment 22
3.3.2.2 Specimen 28
3.3.3 Experiment design 29
3.4 Experiment Test 32
3.4.1 Experimental Modal Analysis 33
3.4.2 Nonlinear Vibro-Acoustic Modulation Test 34
3.4 MATLAB 36

4. RESULT AND DISCUSSION 37
4.0 Introduction 37
4.1 Modal Test 37
4.1.1 Result for Uncrack Modal Test 38
4.1.2 Result for Crack Modal Test 39
4.2 Vibro Acoustic Test 40
4.2.1 Result for Uncrack Vibro acoustic Test 40
4.2.1.1 Determine the relation between R-value and Different Temperature for uncrack plate 55
4.2.2 Result for Crack Vibro acoustic Test 57
4.2.2.1 Determine the relation between R-value and Different Temperature for crack plate 62

5. CONCLUSION AND RECOMMENDATION 65
5.0 Introduction 65
5.1 Conclusion 65
5.2 Recommendations 66
5.2.1 Low frequency excitation 66
5.2.2 The effects of excitation position 68

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REFERENCES **70**
APPENDICES **75**

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ABREVIATION

HF	High-frequency
LF	Low-frequency
USB	Upper Side Band
LSB	Lower Side Band
IM	Impact-Modulation
NEWS	Nonlinear Elastic Wave Spectroscopy
NRUS	Nonlinear Resonant Ultrasound Spectroscopy
NWMS	Nonlinear Wave Modulation Spectroscopy
VAM	Vibro-Acoustic Method

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NOMENCLATURE

A_0	Fundamental frequency amplitude
A_1	First sideband amplitude
A_2	Second sideband amplitude
R value	Ratio of first sidebands amplitude over fundamental frequency amplitude

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LIST OF TABLE

NO. **TITLE** **PAGE**

Table 3.1: Material properties of the aluminium plate……28

Table 3.2 Comparison between modal experiment test and vibro-acoustic experiment test……..33

Table 3.3: Input parameters for the modal test experiment……34

Table 3.4: Input parameters for the vibro acoustic method experiment……..35

Table 4.1: Sideband amplitude and Modulation Intensity, R at different temperature for 1st frequency mode (65.2Hz)…….....49

Table 4.2: Sideband amplitude and Modulation Intensity, R at different temperature for 2nd frequency mode (116.5 Hz) ……..50

Table 4.3: Sideband amplitude and Modulation Intensity, R at different temperature for 3rd frequency mode (194.5 Hz)…….....51

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Table 4.4: Sideband amplitude and Modulation Intensity, R at different temperature for 4th frequency mode (235 Hz)……...52

Table 4.5: Sideband amplitude and Modulation Intensity, R at different temperature for 5th frequency mode (338 Hz)……..….53

Table 4.6: Sideband amplitude and Modulation Intensity, R at different temperature for 6th frequency mode (381 Hz)……...54

Table 4.7: Sideband amplitude and Modulation Intensity, R at different temperature for 1st frequency mode (66 Hz)…….....57

Table 4.8: Sideband amplitude and Modulation Intensity, R at different temperature for 2nd frequency mode (115 Hz)……..58

Table 4.9: Sideband amplitude and Modulation Intensity, R at different temperature for 3rd frequency mode (132 Hz)…….....59

Table 4.10: Sideband amplitude and Modulation Intensity, R at different temperature for 4^{th} frequency mode (195 Hz)……60

Table 4.11: Sideband amplitude and Modulation Intensity, R at different temperature for 5^{th} frequency mode (217 Hz)……61

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LIST OF FIGURES

NO. **TITLE** **PAGE**

Figure 2.1: Schematic layout demonstrating the principle of nonlinear acoustic used for damage detection [1]……....7

Figure 2.2: Resonant frequency versus drive amplitude. (a) Undamaged sample (b) Damaged sample. [15]…….....9

Figure 2.3: An example of (a) resonance peaks shifting and (b) ratio of the resonance shifting against strain level for sandstone material [19]……..10

Figure 2.4: Setup of the Vibro Acoustic Method (VAM) testing using impact hammer [25]……...12

Figure 2.5: Setup of vibro-acoustic method (VAM) by using a shaker [25]……13

Figure 3.1: Flow chart of the project……19

Figure 3.2: The principle of vibro–acoustic modulations……..….....22

Figure 3.3: Digital Phosphor Oscilloscope…….....22

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Figure 3.4: Power Amplifier Type BAA 60…….23

Figure 3.5: Ray-JrMALL Pyrometer……24

Figure 3.6: AFG3252C Function Generator…….....24

Figure 3.7: Electromagnetic Shaker…….25

Figure 3.8: XH-W3001 Digital Control Temperature…….....26

Figure 3.9: Rectangular Alumina metallic ceramic heating element (HTCC)….....26

Figure 3.10: Laser Doppler vibrometer (LDV)…….....27

Figure 3.11: Setup of vibro-acoustic method (VAM) by using a shaker as exciter on an aluminium plate……...29

Figure 3.12: Schematic diagram of the experimental setup…….....30

Figure 3.13: Experimental setup and arrangement for the experimental modal test [1]…….....33

Figure 3.14: Experimental setup and arrangement for the convectional vibroacoustic test [1]…….....35

Figure 4.1: The graph of Amplitude (Amp) Versus Frequency (Hz) for Modal test of Uncrack Aluminium Plate…….....49

Figure 4.2: The graph of Amplitude (Amp) Versus Frequency (Hz) for Modal test of Crack Aluminium Plate…….....50

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Figure 4.3: Amplitude-frequency domain for aluminium plate at 25˚C with 1st vibration mode……..51

Figure 4.4: Amplitude-frequency domain for aluminium plate at 27˚C with 1st vibration mode……..52

Figure 4.5: Amplitude-frequency domain for aluminium plate at 29˚C with 1st vibration mode……..53

Figure 4.6: Amplitude-frequency domain for aluminium plate at 31˚C with 1st vibration mode……..54

Figure 4.7: Amplitude-frequency domain for aluminium plate at 33˚C with 1st vibration mode……..44

Figure 4.8: Amplitude-frequency domain for aluminium plate at 35˚C with 1st vibration mode……..45

Figure 4.9: Amplitude-frequency domain for aluminium plate at 37˚C with 1st vibration mode…….....46

Figure 4.10: Amplitude-frequency domain for aluminium plate at 39˚C with 1st vibration mode……..47

Figure 4.11: Comparison of R-value by using shaker and without shaker versus Temperature at 1st frequency mode (65.2 Hz)…….....45

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