UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A STUDY ON VIBRATION BEHAVIOR ON VERTICAL WASHING MACHINE VIA VIBRATION METER

This report submitted in accordance with requirements of the University Technical

Malaysia Melaka (UTeM) for the Bachelor's Degree in Mechanical Engineering Technology (Maintenance) (Hons.)

by

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Analisis getaran menggunakan statistik (VSA) adalah salah satu teknik pemantauan keadaan (CM) dan diagnosis mesin yang bergerak maju dan berputar seperti mesin pencuci pakaian. Pemantauan keadaan boleh meningkatkan keboleharapan mesin dan mengurangkan kos penyelenggaraan. Dengan melakukan CM, kesalahan dalam mesin pencuci pakaian dapat dikesan dengan lebih awal. Penyerap hentakan yang tidak normal digunakan sebagai percubaan dalam mesin pencuci pakaian. Objektif penyelidikan ini adalah menumpukan perhatian khusus untuk mengukur isyarat yang dihasilkan oleh kerosakan penyerap hentakan yang ada pada mesin pencuci menggunakan sensor pecutan dan menganalisis ia menggunakan MatLab. Keputusan eksperimen dan analisis menunjukkan bahawa MatLab adalah kaedah yang berkesan untuk menentukan isyarat getaran dari spring yang tidak normal yang berada pada masin pencuci pakaian.

Hasilnya menunjukkan kaedah yang digunakan berkesan dalam mengurangkan getaran pada mesin pencuci pakaian.

ABSTRAK

Vibration statistical analysis (VSA) is one of technique for condition monitoring (CM) and diagnosis of reciprocating and rotating machines such as Vertical Washing Machine. Condition monitoring can improved machine reliability and decrease maintenance cost. By perform CM, fault in Vertical Washing Machine can be detect early. Abnormal absorbance was used as the experimental set-up in Vertical Washing Machine. The objective of this research is focused specifically on measuring vibration signal produce by exhaust absorber in Vertical Washing Machine using accelerometer sensors and analysis it using MatLab. The experimental results and analysis showed that MatLab is an effective method to determine vibration signal of abnormal spring in the Washing Machine. The results indicated the proposed statistical technique is effective in reducing the Vibration in Vertical Washing Machine.

DEDICATION

To my beloved mother Fadzillah Binti Mahiddin and my father Mohd Zaini Bin Mohd Saleh and all my friends

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Praise to Allah SWT the Almighty for his blessing in giving me the strength, ideas, determination and patience in completing this last semester project report with the title “A STUDY ON VIBRATION BEHAVIOR ON VERTICAL WASHING MACHINE VIA VIBRATION METER” in which to graduation requirement of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In this era globalization, there are many machines that used to produce human demands. Industries are divided into many hundreds sub sections which is agricultures, animations, robotics, oil and gas, electrics, electronics, food manufacturing, furniture's, hospitalities, automotive, and others. Almost of them are involves with machinery as the primary gear things to produce their products. Some of problem can be expected from the high vibration. The common event that occurs in mechanical system is vibration. Every moving object especially that have rotation have a vibration. However, the high vibration can show the machine probably have a failure. Occasionally, vibration is formed when the effects of movement clearances, rolling between a parts and tolerances. Vibration as well can detect the kind of damage that occurs on the system.

In washing machine, there are many sources of vibration. There are many types of washing machine. Most of semi-auto washing machine are vertical and top – loads machine. While the auto machine has top-load and front load. In view of vibration,

frontload machines generate high vibration compares with the top loads mechanism which rotates and dry the clothes are faster than top loads. However, the front loads machine controls the save energy, but the direction of spin is causing more vibrations and noise. Therefore, investigate and reduce these faults, a few technique are used to diagnose the behaviours and specific aspects condition of washing machine.

1.1 Background Study

This research was focusing on the investigation of vertical washing machine's behaviour from view of vibration analysis. All of the washing machine have a spinner which helps to dry their washes. Due to high speed during the process, users easily hear the vibrations sound generates from motors and shaft. During the water extraction phase, the instability forces occur on the system are causing the vibrations problems in vertical washing machine. This unbalance force is generates from the combination of high turning speed, uneven, erratic and mass dispersion of the garments (clothing) in the machine bin.

Consequently, to improve the performances of the washing machine, the best way is reducing system response to unbalance. It is also can improve the customer satisfaction. In this research, the investigation is focus on the source of vibrations inside the washing machine system. By finding the root cause of the problems, it can be eliminated or reducing from suggesting a solution and best way to overcome the source of vibration. This study is important to the manufacturing industries where can be references while designing the feature washing machine. Perhaps, the manufacturer is able to making a product with minimizes vibrations.

1.2 Problem Statement

In this industry, there are many washing machine with the latest design and technologies. *LG, Haier, Midea, Samsung* and others manufacturer are competed each other to produce electronic machine and devices that can fulfil customer desired. Washing machine is the one of the thousand product that be must produce by this type of manufacturer. This is happened due nowadays people are demanding the product to easier their life routines. However, noise of vibrations are the familiar topics and problems that always occur on the washing machine especially to the long term used. therefore, this research is carried out to investigate the behaviour and the root cause of this problem. The outcomes of this investigations, it can help the manufacturer to reducing and designing the washing machine without or reducing the high vibrations.

1.3 Objectives

1. To analyse the vertical washing machine by using vibration meter and SO Analyzer.
2. To reduce the vibration occur on the vertical washing machine.

1.4 Scope

1. Perform an analysis on automatic vertical washing machine.
2. To measure the performance of vibration behaviour on the machine.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction of Vibration

Vibration is a mechanical wonder whereby motions happen about a harmony point. The word originates from Latin *vibrationem* ("shaking, wielding"). The motions might be intermittent, for example, the movement of a pendulum or arbitrary, for example, the development of a tire on a rock street. Vibration can be alluring for instance, the movement of a tuning fork, the reed in a woodwind instrument or harmonica, a cell phone, or the cone of an amplifier. Anything that moves or any equipment that operates (whether with a high or a low velocity) will vibrate (Bambang Daryanto, 2014).

Much of the time, be that as it may, vibration is unfortunate, squandering vitality and making undesirable sound. For instance, the vibrational movements of motors, electric engines, or any mechanical gadget in activity are commonly undesirable. Such vibrations could be brought about by awkward nature in the pivoting parts, uneven contact, or the lattice of apparatus teeth. Cautious plans normally limit undesirable vibrations.

The investigations of sound and vibration are firmly related. Sound, or weight waves, are created by vibrating structures (for example vocal strings); these weight

waves can likewise prompt the vibration of structures (for example ear drum). Thus, endeavours to diminish commotion are frequently identified with issues of vibration.

2.0.1 Types of Vibration

Vibration divides into three categories which is free vibration, force vibration and damped vibration. Free vibration is defined when a body or subject is set in movement with a beginning input and it permitted to vibrate openly (free). Instances of this sort of vibration are pulling a child back on a swing and releasing it, or hitting a turning fork and giving it a chances to ring. The mechanical establishment vibrates at least one of its common frequencies and damps down to calmness.

Next, force vibration is the point at which a periodic fluctuating unsettling influence (velocity, displacement and load) is connect to mechanical framework. The unsettling influences can be occasional and relentless state input, transient data or random data. The harmonic or non-harmonic can be resulted from the input of periodic. Instances of these kinds of vibrations incorporate a clothes washer shaking because of an unbalance, uneven based or vibrations from rotating motors, or the vibration of a structure amid (earthquake). In linear system, the recurrence of the unfaltering state vibration reaction coming about because of the use of an intermittent, symphonious information is equivalent to the recurrence of the connected power or movement, with the response magnitude being reliant on the genuine mechanical framework.

Lastly, is damped vibration. At the point when the vitality of a vibrating system is progressively dispersed by friction and other protections, the vibration is said to be damped. The vibration steadily lessens or change in recurrence or power or stop and

the system in its balance position. A case of this sort of vibration is the vehicular suspension hosed by the safeguard.

2.0.2 Application of Vibration Analysis

Vibration analysis is a procedure of searching for abnormalities and checking the change from the set-up vibration mark of a framework. The vibration of any item in movement is described by the varieties of frequency, amplitude and intensity. In vibration monitoring, the occurrence of occasional transient disturbances makes the recorded signal nonstationary, especially during the start-up of an engine (Stefanos K. Goumas,2002). These can associate to physical occurrence, making it conceivable to utilize vibration data to glean the information of the equipment health. This kind of analysis can be utilized to:

1. Find a developing issue that can be fixed to prolong the machine lifetime.
2. Detect and screen the critical issue that can't be fixed and will just deteriorate.
3. Established acknowledgement testing criterion to guarantee the installation / fixed are appropriate conducted.
4. Predict failure in predictive maintenance with continuous monitoring of vibrations.
5. Able to monitor the hand-to-reach parts of the equipment.