

**DAMAGED IDENTIFICATION OF MECHANICAL SYSTEM VIA CHANGES
IN THEIR VIBRATION CHARACTERISTICS**

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AGREEMENT

“I agree that this report is my own work except for some summaries and information which I have already stated”

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DEDICATION

To My Beloved Family

Mansor B. Salleh

Hasmah Bt. Derani

Illy Hazwani Bt. Mansor

Mohd Hanuar Fitri B. Mansor

Mohd Hazwan B. Mansor

Illy Haryanie Bt. Mansor

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ABSTRAK

Projek ini dijalankan untuk mengenalpasti kerosakan sistem mekanikal melalui perubahan dalam kriteria getaran. Dengan demikian, tujuan daripada laporan ini adalah untuk menyemak sistem mekanikal menggunakan pengesanan, lokasi, dan Kriteria rosak melalui teknik pemantauan getaran selain menggunakan teknik yang tepat dalam mengukur sistem mekanikal. Kriteria getaran sangat berkaitan dengan pemantauan getaran analisis yang digolongkan dalam pemeliharaan ramalan (predictive maintenance) yang menjanjikan banyak kelebihan di dalam bidang industri. Untuk menyokong kajian ini, kajian kes dilakukan dengan kerjasama industri berat untuk menerapkan konsep (hands on) mahasiswa UTeM. Analisis Pemantauan Getaran akan diterapkan untuk melaksanakan tujuan kajian ini. Spesimen kajian ini iaitu mesin dipilih di CIMA (Cement Industries of Malaysia Berhad) berdasarkan prinsip operasinya. Kemudian, kajian dimulakan dengan mengambil bacaan getaran menggunakan Micro Log CMVA 60, Portable Data Collector / FFT Analyzer dan CSI 2130 FFT Analyzer. Kemudian ia dianalisis menggunakan software PRISM4 dan MHM. Sebelum itu, perbincangan mendalam mengenai analisis pemantauan getaran dilakukan seperti menetapkan parameter untuk memilih sensor atau bagaimana memilih lokasi pengukuran untuk memastikan bahawa kajian kes ini mengikuti piawaian analisa pemantauan getaran. Keputusan data akan diterjemahkan dalam satu gambarajah spektrum dan nilai keseluruhan terhadap masa. Kajian kes ini akan dihuraikan dengan lebih mendalam dengan menganalisis data mentah bergantung kepada kriteria getaran mereka sendiri sebagai langkah untuk menentukan keadaan mesin.

ABSTRACT

This project is carried out to identify damages of mechanical system via changes in their vibration characteristics. Thus, the objective of this report is to examine mechanical system using detection, location, and characterization damaged via vibration monitoring technique besides utilize appropriate technique in measured mechanical system. Vibration characteristics are closely related with vibration monitoring analysis that classified under predictive maintenance that promised a lot of advantages in industrials fields. To support this study, a real case study with cooperation heavy industry is setup to apply hands on concept that is influence UTeM to their student. Vibration Monitoring Analysis will be applied to implement the objective of this study. The specimens of this study are selected among of the machine at CIMA (Cement Industries of Malaysia Berhad) due to its operational usage. The process starts by taking vibration reading using Micro log CMVA 60, Portable Data Collector/FFT Analyzer and CSI 2130 FFT Analyzer. Then it will be analyze using software PRISM4 and MHM. Before that, detail discussions of vibration monitoring analysis are conduct such as parameter to select sensor, transducers, or how to choose measurement location to make sure that this experiment followed the standard of Monitoring analysis. Result data will be present in single spectrum plot and overall value versus time trending. This study will go deeper by analyzing the raw data depending to their own characteristic as a process to determine the health and condition of the machine.

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LIST OF SYMBOL

M	=	Mass
K	=	Stiffness
Hz	=	Hertz
C	=	Damping
μs	=	microsecond
CPM	=	Cycle per Minute
RPM	=	Rotation per Minutes
mm	=	millimeter
sec	=	second (time)
ft	=	feet
F _{max}	=	Maximum Force, N
t _{max}	=	Total sampling Period Setting
%	=	Percentage
dB	=	decibel
mV	=	millivolts
oz	=	Ounce
g	=	gram

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CHAPTER I

INTRODUCTION

1.1 Background of Study

Now days, the expenses on maintenance and repairing machine are among the most important features of any technical system operation more over at the factory based. We can conclude that when the system is maintainable, we need some technique or technical program such as condition monitoring. It refers to control and diagnostics especially for rotating machinery that will be the most common part that found at factory. Predictive maintenance through understanding the characteristic by vibration diagnostics is the most efficient way that rapidly used to reduce or decrease cost of repairing or avoid damaged. So, it is possible to begin the diagnostics by vibration any time even after several years of system operation when the expenses for maintenance and repair exceed the economically affordable value (Basim Al-Najjar and Imad Alsyouf 2003).

Consider of the benefits that show by vibration monitoring which is classified in predictive maintenances, this study aiming to identify damages of mechanical system via changes in their vibration characteristics. First of all, this study will discuss on the theory about the vibration study which contains introduction of vibrations such as vibration definition, the causes that due to vibration, why do we need to monitor vibration and anything that related to the vibration will be elaborate in details. Then, it will be followed up by how examine mechanical system using detection, location, and characterization damaged via vibration monitoring technique.

This report also been written to utilize appropriate technique that examines changes in measured structural and mechanical system. This study also carried out with the real case study which is had been done with industry that used vibration monitoring analysis in their principal of operating system which involved the usage of latest equipment that can collects vibration data and performs standard analysis functions, but also incorporates on-board intelligence to facilitate detection, analysis and correction of machine problems. Only selected machine will be tested to get the related data. Data will be present in single spectrum plot and overall value versus time trending. From the result, we will find out the characteristics of it whether that machine functioning well or not.

1.2 Problem Statement

Machine vibration can be unintended and lead to machine damage. Most times machine vibration is unintended and undesirable. The vibration of operating pump, the vibration of operating motor, vibrating belt and vibrating fan are a few examples to show undesirable machine vibration. Monitoring the vibration characteristics of a machine gives us an understanding of the 'health' condition of the machine. We can use this information to detect problems that might be developing. Vibration monitoring can avoid of lead to poor quality products being made, large yield losses, rework costs, or worse still, warranty returns by irate customers.

1.3 Objective of Study

Besides discuss about the theory of vibration monitoring analysis, this study are also contain a real case study which is been done at selected factory by using vibration sensor due to detect the characteristics of the tested machine to determine whether there are any undesirable vibration occurs. The objectives to accomplish this study are: