

**PARAMETRIC STUDY OF ELECTRIC
POWER GENERATOR SYSTEM**

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SUPERVISOR DECLARATION

“I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Automotive)”

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**This thesis is submitted in partial fulfillment of the requirement for Degree of
Bachelor in Mechanical Engineering (Automotive)**

**Faculty of Mechanical Engineering
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DECLARATION

“I hereby declare that the work in this thesis is on my own except for summaries and quotations which that been duly acknowledged.”

Signature :
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For my beloved mum, Pn Zaraha binti Abdul Rahman and my caring dad,
Mr Hamid bin Hashim

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ABSTRACT

The aim of the thesis is to study the vibration of the generator and analyse the value of torque and power of the generator. This project was proposed due to the presence of vibration of the generator and the relationship between value of torque and power with the performance of the generator. The vibration of the generator and value of torque and power was studied by going through previous journal and thesis in study the result of time domain and frequency domain from the vibration occurs when generator is run. In this project, the Matlab R2012b software was used to transform from time domain to the frequency domain or vice versa by using Finite Fourier Transform (FFT). The data result vibration from electric generator is collected during an experiment in laboratory. The experiment purpose is to make a test of vibration during an electric generator is run. Then, collect the data of time domain from DAQ sensor devices that show that the vibration amplitude happens during an experiment. Lastly, the time domain is transform to the frequency domain and analysis based on the graph.

ABSTRAK

Tujuan tesis ini adalah untuk mengkaji getaran penjana dan menganalisis nilai tork dan kuasa generator. Projek ini telah dicadangkan kerana kehadiran getaran penjana dan hubungan antara nilai tork dan kuasa dengan pelaksanaan generator. Getaran penjana dan nilai tork dan kuasa telah dikaji dengan melalui jurnal dan tesis dalam kajian sebelum ini, hasil daripada domain masa dan domain frekuensi (*time domain and frequency domain*) dari getaran penjana yang terhasil semasa eksperimen sedang dijalankan. Dalam projek ini, perisian Matlab R2012b digunakan untuk mengubah dari domain masa kepada domain frekuensi atau sebaliknya dengan menggunakan *Finite Fourier Transform* (FFT). Gegaran akibat penjana elektrik dikumpulkan semasa eksperimen dijalankan dalam makmal. Tujuan eksperimen ini adalah untuk membuat ujian getaran semasa penjana elektrik dikendalikan. Kemudian, mengumpul data domain masa daripada radas yang digunakan yang menunjukkan bahawa amplitud getaran yang berlaku semasa eksperimen. Akhir sekali, domain masa diubah kepada domain frekuensi dan dianalisis berdasarkan graf.

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LIST OF SYMBOL

k	=	Stiffness of spring
m	=	Mass
c	=	Stiffness of damper
I	=	Current
f	=	Frequency
P	=	Power
cm	=	Centimeter
kg	=	Kilogram
lbs	=	Pounds
Hz	=	Hertz
v	=	Volts
Amps	=	Amperes
CC	=	Cubic centimeter
W	=	Watts
V_{peak}	=	Voltage at peak
Emf	=	Electromotive force
mm	=	Millimeter
s	=	Seconds
kW	=	Kilo Watts
n	=	Number
2D	=	2 Dimensional
3D	=	3 Dimensional
Nm	=	Newton meter
Ftlb/min	=	Foot-pounds per minute
kW/h	=	Kilo Watts per hour
m/s^2	=	Meter per second square
rad/s	=	Radian per second

LIST OF ABBREVIATIONS

FFT	=	Finite Fourier Transformation
RPM	=	Revolution per Minute
DFT	=	Discrete Fourier Transform
FDTD	=	Finite Difference Time Domain
FT	=	Fourier Transform
PD	=	Partial Discharge
NG	=	Nano Generator
DCS	=	Distributed Control System
HP	=	Horse power
VSCF	=	Variable Speed Constant Frequency
AC	=	Alternating Current
DC	=	Direct Current
MATLAB	=	Matrix Laboratory
DAQ	=	Data acquisition
HP	=	Horsepower
EMF	=	Electromotive force
DAQ	=	Data acquisition sensors

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Electricity is one of the most important energy in daily life. Nowadays, in the era of technology, electricity is requirements for every individual person, regardless of ages, region, and gender to survive completely. Electricity gives a wide variety of well known effects, such as lightning, electromagnetic induction, electrical current, and static electricity. Electricity is the set of physical phenomena associated with the presence and flow of electric charge. In addition, the electricity also closely related to permits the creations and receptions of electromagnetic radiation. For example, the sound waves and light waves.

Apart from that, there are some of machines can generate an electricity such as a generator. The meaning of an electrical generator is a device that moves electrical energy from a mechanical energy source using an electromagnetic induction. The operation of electric generators is based on the electromagnetic

induction whenever a conductor moves relative to a magnetic field and electromotive force (EMF) are induced in this conductor. Especially, if a coil is spinning in a magnetic field, the two sides of the coil is moving in opposite directions. So the voltages are induced between its terminals.

Mostly in Malaysia the generator is used at night market. Usually when the generator is running, the machine will produce a vibration and its own parameters such as power, torque and RPM. The vibration motion of a whole body can be completely described as a combination of individual motions of six different types. These are translated in the three orthogonal directions of x , y , and z axis. For instance, it can rotate lengthwise (roll), rotate around the vertical axis (yaw), and rotate about the port-starboard axis (pitch) moment. Moreover, there are have many types of generator and their specifications. For example single phase power and three phase power. Other than that, the values of voltage, battery, frequency, and engine also closely related to the performance of the generator.

Besides that, generating machines are usually used for residential purposes to power a few domestic appliances during an outage or at construction sites that have no source of electrical power required to operate other machines. Generators also are useful appliances that supply electrical power to prevent discontinuity of daily activities or disruption of business operations. These devices are available in different electrical, physical configurations and specifications for use in different applications.

1.2 PROBLEM STATEMENT

The problem statement of this project is the generator produces a vibration when running and the value of torque, horsepower and RPM related to the waveforms of amplitude vibration occurs. Moreover, the generator is use a internal combustion engine which is pollution to the environment and green house effect.

1.3 OBJECTIVES

There are several objectives of this project which is to study the vibration of the generator. Then, to analyze the value of torque and RPM for generator and motor starter. Lastly, to determine the relation between torque and RPM of generator.

1.4 SCOPE

For this thesis, the scope of study to achieve the project objective is to understand about the concept of power generator system such as specifications, and the own parameters. Furthermore, to study the vibration of electric generator and to do a vibration experiment to get the output of results. Besides that, to analyze the value of torque and RPM of generator and motor starter. Next, determine the power of the motor starter. Then, used a Matlab R2012b software to transform from time domain to the frequency domain with Finite Fourier Transform (FFT)

1.5 THESIS OUTLINES

This report contains five chapters which are the Chapter 1: Introduction, Chapter 2: Literature review, Chapter 3: Methodology, Chapter 4: Analysis and Data Discussion and Chapter 5: Conclusion and Recommendation. In the first chapter, the background, problem statement, objectives of the project, scope and summary are described. In the second chapter, which is Chapter 2, the literature review of the this report is explained. The chapter generally explained about the vibration of generators, electric generator, air compressor, torque and power of the generator and Finite Fourier Transform (FFT). In the next chapter, which is a methodology, the project methods to achieve the objective of projects are discussed. The chapter starts with the flow chart of process and devices or apparatus are used in the laboratory during the test the vibration of the generator. The value of torque and power of the generator also was analyzed. Then, the Matlab R2012b software was used to transform from time domain to the frequency domain by using Finite Fourier Transform (FFT). In the next chapter, which is Chapter 4, all the data results and analysis of the project were determined and recorded. Lastly, the last chapter is Chapter 5 which is a conclusion and recommendation. In this chapter, there are concludes the entire thesis and several recommendations are proposed for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will go through all about the literature review related study of the project. This chapter are referring to the previous paper of research thesis, journal, conference paper and any media or bulletin to get more understanding about this project. This literature review was helps in finding the concept of electric generator, vibration of the generator, air compressor, power and torque of generator and Finite Fourier Transform (FFT) software. Besides that, this chapter also can define the theory and experiment closely related to all about the power generator system.

2.2 ELECTRIC GENERATOR

An electric generator is a device that that converts mechanical energy to electrical energy for use in an external circuit. The source of mechanical energy may vary widely from a hand crank to an internal combustion engine. Generators provide

nearly all of the power for electric power grids. There are so many brands and products of the electric generator that available in the market. **Figure 2.1** shows the sample of electric generator and **Table 2.1** shows the required specification which is Yamaha EF12000DE - 9,500 Watt Electric Start Portable Generator (Kevin (2002)).



Figure 2.1: The sample of electric generator in the market

(Source: Kevin, (2002))