COMPARATIVE STUDY OF ENERGY-EFFICIENT FLUORESCENT LAMPS (COMPACT FLUORESCENT LAMP)

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—hereby declared that I have read through this report and found that it has comply
The partial fulfillment for awarding the degree of Bachelor of Electrical Engineering
(Power Electronics and Drives)."

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Supervisor's Name : EN. MD. HAIRUL NIZAM BIN TALIB
Date : .....

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

Signature : .....

Supervisor's Name : NAZRULHISHAM BIN ZAIDAN

Date : .....

To

Mom and Dad

Your prayers keep me moving forward

Lecturers

Fill my heart with the truth and knowledge

Beloved friends

Make my world happens

Every Muslims

May Allah bless you all here and hereafter

-Al-fatihah-

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful. Peace be upon the Messenger of Allah, Muhammad s.a.w, his companions (r.a) and followers until the Judgement Day. Thanks to Allah, with His blessing, this final project is successfully delivered.

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Finally, I would like to thank to my parent and friends for their support and help for me while doing this project. Thanks for all. Only Allah will pay for their contributions, Insya Allah.

ABSTRAK

The comparative study of energy-efficient fluorescent lamps is to prove that the energy-efficient fluorescent lamps products in the market can save energy and money as claimed. This project will achieve by 2 sections which is hardware and software simulation.

In hardware simulation, the model of basic home lighting is designed. All the data that is needed will take using the measuring equipment such as ammeter, Fluke Quality Analyzer and oscilloscope.

In software simulation, all data will taken by using PsPise software. To do this research, 3 brands of energy-efficient fluorescent lamps is selected. The 3 brands of energy-efficient fluorescent lamps is from:

- Philips
- Osram
- Best

At the end of the research, there will be one of the best energy-efficient fluorescent lamp among the selected brands. The reason why that brand is selected will be discuss using the calculation

ABSTRACT

Projek *Comparative study of energy-efficient fluorescent lamps* ini dijalankan adalah untuk membuktikan sama ada dapat menjimatkan tenaga dan kewangan seperti yang didakwa oleh setiap syarikat pembuat lampu . Projek ini akan dijalankan dalam 2 bahagian iaitu simulasi dan pengambilan data menggunakan instrumen tertentu.

Dalam bahagian perkakasan, model asas pendawaian lampu di rumah akan direka dan digunakan untuk pengambilan data menggunakan intrumen tertentu seperti ammeter, Fluke Quality Analyzer dan osiloskop.

Dalam bahagian perisian, semua data akan diambil menggunakan perisian *Pspice*. Dalam melaksanakan penyelidikan ini, tiga jenama dari berlainan syarikat pembuat dipilih. Tiga jenis lampu yang dipilih adalah:

- Philips
- Osram
- Best

Di akhir penyelidikan, satu jenama akan dipilih sebagai yang lampu penjimatan tenaga yang terbaik di antara tiga dan sebab-sebab pemilihan akan dibincangkan melalui pengiraan.

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DC	Direct Current
AC	Alternative Current
ANSI	American National Standard Institute
IC	Integrated Circuit
Im	Luminous Flux Unit

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CHAPTER I

INTRODUCTION

Electronic ballasts for fluorescent lamps have been extensively used in lighting systems because of their advantages over conventional magnetic ballasts, namely, reduced volume and weight, higher efficiency, higher lamp efficacy (lumens per watts ratio, due to the high operating frequencies), absence of audible noise, absence of stroboscopic effect [1]

1.1 Project Objectives

a. To obtain the design, construction and operation of the energy-efficient fluorescent lamp including all electronic parts/circuits for selected brand
b. To collect the main characteristic/data of the energy-efficient fluorescent lamps such as resistor, inductor, capacitor, efficiency, starting voltage and current and luminance
c. To make the comparison between the calculation and simulation results

1.2 Project Scope

Scopes of this project are:

a. Three brands of electronic ballast circuit including:

i. Philips
ii. Osram
iii. Best

b. Voltage fed half bridge ballast circuit

c. 4 mains circuit of electronic ballast including:

i. Rectifier Circuit
ii. Inverter Circuit
iii. Resonant Circuit

1.3 Problem Statements

Manufacturers of the lamp claim that the light produce by themselves are energy saving and there are no prove that can support this theory. There is nobody that makes a research individually to support that theory. May be this is because the costumer believe that the company always did the testing and developing for that product all the time at the factory.

The costumer also think that all energy-efficient fluorescent lamps can saving their money and energy without think maybe there are an effect by using it. In fact, not all the energy-efficient fluorescent lamps can provide all the terms that is claimed.

1.4 Report Outline

In this project report there are has 6 chapters altogether. Chapter 1 gives some introduction and the objectives about this project. Chapter 2 provides the literature

review of this project. This chapter reviews the related work that has been done by other people

Some theory of this project will be discussed including the electronic ballast circuit and some explanation about the circuit operation. is in chapter 3.. Chapter 5 is the main part of this report. It has four main sections which are:

a. Hardware implementation /Measurement Result
b. Simulation Result
c. Calculation Result

Chapter 6 brings further analysis about the result and last but not least, chapter 7 gives the conclusion and recommendation of this report.

CHAPTER II

LITERATURE REVIEW

2.1 Setting the Preheating and Steady-State Operation of Electronic Ballasts, Considering Electrodes of Hot-Cathode Fluorescent Lamps [5]

The thesis is present a new methodology of the pre-heat and steady-state operation electronic ballast by using hot-cathode fluorescent lamp. In this thesis, the circuit using is series-resonant half bridge inverter (voltage half bridge).

2.1.1 Theoretical Analysis Of The Preheating Process

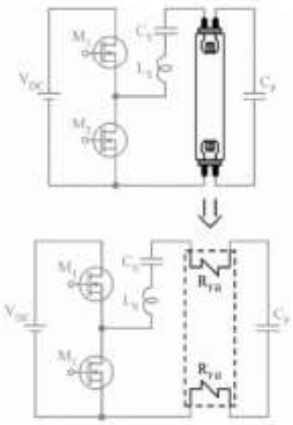

Figure 2.1: Fluorescent Lamp Model During Pre-heat Process

A new lamp model has been developed to represent the variation of the as a function of time, considering the injection of a current with constant rms value through the electrodes [6]. Figure 2.1 shows the graphic representation of the lamp model, during the preheating process.

During the preheating, the gas column of the lamp is considered as an open-circuit in agreement with the lamp model. Moreover, the equivalent resistances of the filaments are relatively low when compared to the total impedance of the circuit. Therefore, it is possible to neglect their values in the analysis of the circuit shown in Figure 2.1. This assumption is very important because it allows a significant simplification in the analysis of the circuit.

According to these assumptions, the equivalent circuit of the electronic ballast and fluorescent, during the preheating, can be represented by Figure 2.2.

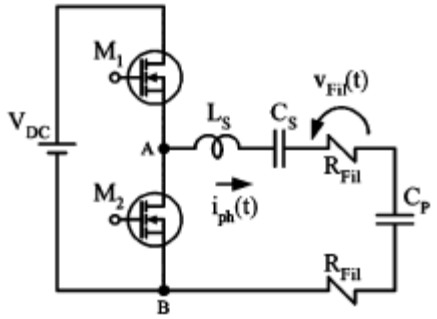

Figure 2.2: Complete Circuit During Preheat Process

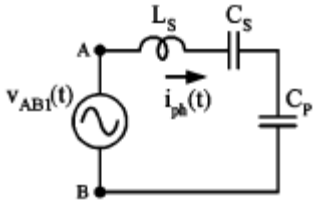

Figure 2.3: Simplified Circuit During Preheat Process

2.1.2 Theoretical Analysis Of The Steady-State Operation

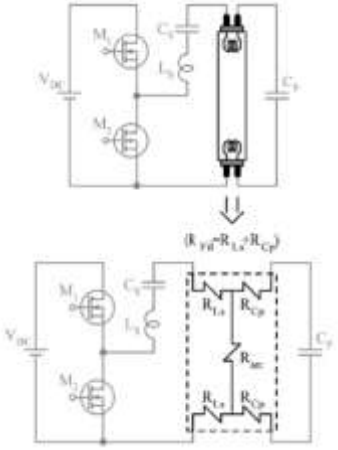

Figure 2.4: Fluorescent Lamp Model During Steady-State Operation

The analysis is the theoretical determination of the voltage which is applied to the lamp electrodes, during steady-state operation. Therefore, an accurate lamp model is required for the representation of the gas column, and especially the electrodes. Due to this fact, the lamp model presented based on the set of resistance shown in Figure 2.3, is considered suitable for this analysis, because it can provide good estimates of the equivalent resistances of the filament [7].

2.2 Self Oscillating Circuit for CFL 10W

2.2.1 Circuit & System Description

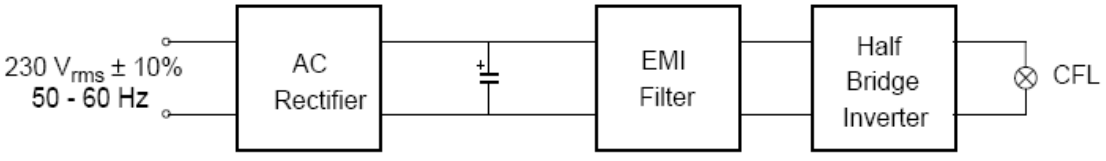

Figure 2.5 : Block Diagram of experiment circuit