

E-LEARNING ON THREE PHASE INDUCTION MOTOR

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MAY 2009

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“Saya akui bahawa telah membaca karya ini pada pandangan saya karya ini adalah memadai dari skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektrik (Kuasa Industri).”

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Dedicated to my beloved parents...

ACKNOWLEDGMENTS

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allah, The Beneficent, The Merciful.

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ABSTRACT

This project is a software base which contains a learning course on three phase induction motor. As we know that three phase induction motors are widely used in industrial and commercial applications. But students have are facing problems for understanding about the basic of three phase induction motor because they cannot see physical phenomena inside the induction motor such as squirrel cage rotor and wound rotor of induction motor. This courseware contains the characteristic of three phase induction motor. This courseware will provide a wonderful experience with the matter being studied and the users can't understand three phase induction motor easily. This courseware also uses the Macromedia Flash 8 software in order to design and create the slide, animation, illustration and some examples related to this subject. So, by following the methodology and some steps in this software, the result will be successfully and the objectives in this project is achieved.

ABSTRAK

Tujuan projek ini dijalankan adalah untuk membuat satu perisian pembelajaran yang berkaitan dengan motor induksi tiga fasa. Sepertimana yang diketahui, kini motor jenis ini amat biasa digunakan dan diaplikasi dalam pelbagai industri yang besar atau pun industri kecil. Walau bagaimanapun, pelajar ataupun pengguna menghadapi masalah dalam memahami konsep asas tentang motor induksi tiga fasa ini kerana mereka tidak dapat melihat ciri fizikal dan fenomena sebenar yang berlaku dalam motor jenis ini seperti rotor sangkar tupai dan rotor jenis 'slip ring'. Oleh yang demikian, objektif utama projek ini ialah untuk membuat satu perisian pembelajaran tentang motor induksi tiga fasa dan juga menjelaskan tentang spesifikasi dan karakter rotor jenis rotor sangkar tupai dan rotor jenis 'slip ring' ini. Selain itu, perisian ini juga akan menjelaskan tentang karakter dan spesifikasi bagi motor induksi tiga fasa tersebut. Di samping itu, perisian ini akan menyediakan animasi dan ilustrasi motor yang menarik yang mana sebenarnya ianya amat sukar difahami oleh pengguna. Perisian ini telah menggunakan jenis perisian 'Macromedia Flash 8' dalam membina slaid, membuat animasi, dan juga contoh yang berkaitan dengan subjek ini. Dengan merujuk kepada metodologi dan arahan yang diberikan dalam perisian ini, maka ianya akan mendapatkan suatu hasil yang baik dan berjaya serta objektif projek ini akan tercapai.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

This project is based on an E-Learning software which contains more about of learning on three phase induction motor. As we know, E-learning is a type of education in interactive way by using the computer as a medium of learning. Its also means the delivery of learning with the assistance of interactive, electronic technology, whether offline or online. E-learning is used interchangeably in a wide variety of contexts. It is usually use an interactive way of teaching student such as simulation and example to make student understanding the subject. So, by using this software, it can show the real operation and phenomenon of Squirrel Cage and Wound rotor in the Induction Motor. Its also will make the users or students easy to understand about this project which is the physical phenomenon in three phase induction motor.

1.2 Project Objectives

There are three objectives that need to be accomplished in order to make this project successful which are:

- (a) To create a courseware of three phase induction motor by using Flash Macromedia 8.
- (a) To explain the characteristic of squirrel cage rotor of induction motor.
- (a) To explain the characteristic of wound rotor of induction motor.

1.3 Project Scope

There are three scopes in doing this project:

- (a) Study about the basic constructions, principle operations and characteristic of squirrel cage induction motor.
- (b) Study about the basic constructions, principle operations and characteristic of Wound Induction Moto

1.4 Problem Statement

Nowadays, three phase induction motors are widely used in industrial and commercial applications. But students or users have a problem in understanding about the basic principle operation of three phase induction motor because they cannot see physical phenomena inside the induction motor such as squirrel cage rotor and wound rotor of induction motor. However, study by using the article, references book and others not enough to help them in order to more understand the real phenomenon inside the three phase induction motor. So, this courseware which contains about of three phase induction motor will developed to behave as natural seen in actual condition. So, users

will have direct experience with the matter being studied and understanding in three phase induction motor.

1.5 Report Outline

Chapter 1 briefly summarizes the project background and problems statements as well as elaborates the objective and scope of the project. The project methodology which is the most important part that describes the flow of the project is also discussed in detail in this chapter.

Chapter 2 explains about the literature review. In this chapter it contains information about the definition of E-Learning, history of E-Learning, advantages of E-Learning and the disadvantages of E-Learning.

Chapter 3 discusses more about the theory of three phase induction motor. In this chapter, we will study about the introduction of three phase induction motor, basic constructions and component inside induction motor, stator and rotor design, types of rotor, magnetic field and the characteristics of squirrel cage rotor and wound rotor.

Chapter 4 details the result and analyzing to get in the end of this project .Finally, in Chapter 5 are conclusion and recommendation in order to get the conclusion of the project after it is completed.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of E – Learning

E-learning is a very broad term. It is used to describe any type of learning environment that is computer enhanced. There are multiple technologies that can be employed in E-learning. It has become one of those types of words that are so general as to have lost some of its meaning. Distance learning is something that has evolved from E-learning. It is used to describe a learning environment that takes place away from the actual traditional classroom and campus [5].

E-learning began at just about the same time that a computer was developed that was practical for personal use. In fact, the concept and practice of distance learning predates the computer area by almost 100 years. In England, in 1840, shorthand classes were being offered by correspondence courses through the mail. The improvements to the postal service made this method of distance learning popular in the early part of the last century. This led to a large number of “through the mail” type of educational programs. The computer only made distance learning easy and better. Television, video recorders, and even radio have all made a contribution to distance learning [5].

E-learning and distance learning are not quite the same thing. The basic thing that distinguishes distance education is the physical separation of the student from the

instructor and the class room. E-learning, however, became part of the classroom environment from the beginning. The early use of computers was geared to help the classroom instructor. Gradually, as more and more personal computers became available, the idea of online classes was explored by some pioneering Colleges and Universities. The early attempts at distance education were hampered by resistance from traditionalist within the education field [5].

Some writer writes about learning and technology. E-learning is a very broad term. It is used to describe any type of learning environment that is computer enhanced. There are multiple technologies that can be employed in E-learning. It has become one of those types of words that are so general as to have lost some of its meaning. Distance learning in virtual classrooms is something that has evolved from E-learning. It is used to describe a learning environment that takes place away from the actual traditional classroom and campus [5].

2.2 History of E-Learning

At year 1940s, the first modern learning technology emerged during World War II when the United States used film to train millions of service people around the world. These military training films covered such topics as personal hygiene and weapons maintenance. The success of these films, and their later use through television, led the military to partner with universities to conduct research into modern learning techniques [6].

At year 1960s, in the 1960s, the first types of teaching machines were developed, while instructional film became more creative and broadened its reach to children in schools [6].

At year 1980s, then came television as a new learning delivery method. But, because the expense was too great and the delivery of the information too dry, there

were only a few successes. What evolved from this were videotapes, which were produced for use in corporate and school classrooms [6].

At year 1990s, it was the learners' need for interactivity that steered learning professionals towards computer-based training (CBT). The increased use of computers at home and in businesses opened a whole new world of learning possibilities. This world also brought with it its own set of technological issues that learners now had to deal with, such as incompatibilities between hardware and software, slow system performance and not enough memory space. This was a technological learning curve for both the learning industry who made the products and the learners who used them. Many of these problems have been addressed by the rapid advances in systems and networking and the standard provision of online help features [6].

Until today, internet technologies are an integral part of our lives. Instructional designers have new and more flexible technologies at their disposal and learners have a multitude of choices. The Internet has opened the way for courses, seminars, discussion forums and other approaches to learning to be delivered online with innovative ways to interact with instructors and other students [6].

2.3 Advantages of E-Learning

Some of the most outstanding advantages to the trainer or organization are most e-learning courses are available fully online, meaning they can be accessed from work, home or both. This is because e-learning courses are self paced - it allows individuals to work to a speed that is appropriate to their existing knowledge, and individual learning capabilities. Often learners can skip the topics they already know so they can focus on the topics that are new to them [6].

E-learning is a 'pay as you go' option, ideal for small to medium sized businesses with no training department. Reduced overall cost is the single most influential factor in

adopting e-learning. The elimination of costs associated with instructor's salaries, meeting room rentals, and student travel, lodging, and meals are directly quantifiable. The reduction of time spent away from the job by employees may be the most positive offshoot [6].

Besides, learning times reduced, an average of 40 to 60 percent, as found by Brandon Hall (*Web-based Training Cookbook*, 1997, p. 108). Increased retention and application to the job averages an increase of 25 percent over traditional methods, according to an independent study by J.D. Fletcher (*Multimedia Review*, Spring 1991, pp.33-42). Consistent delivery of content is possible with asynchronous, self-paced e-learning and expert knowledge is communicated, but more importantly captured, with good e-learning and knowledge management systems [6].

Along with the increased retention, reduced learning time, and other for mentioned benefits to students, particular advantages of e-learning include on demand availability enables students to complete training conveniently at off-hours or from home. Self-pacing for slow or quick learners reduces stress and increases satisfaction, interactivity engages users, pushing them rather than pulling them through training and confidence that refresher or quick reference materials are available reduces burden of responsibility of mastery [6].

2.4 Disadvantages to the Trainer or Organization

E-learning is not, however, the be all and end all to every training need. It does have limitations, among them which are up-front investment required of an e-learning solution is larger due to development costs. So, the budgets and cash flows will need to be negotiated. Technology issues that play a factor include whether the existing technology infrastructure can accomplish the training goals, whether additional tech expenditures can be justified, and whether compatibility of all software and hardware can be achieved. Inappropriate content for e-learning may exist according to some

experts, though are limited in number. Even the acquisition of skills that involve complex. Physical or motor or emotional components (for example, juggling or mediation) can be augmented with e-learning. Cultural acceptance is an issue in organizations where student demographics and psychographics may predispose them against using computers at all, let alone for e-learning [6].

2.5 Disadvantages to the Learner

The ways in which e-learning may not excel over other training include the technology issues of the learners are most commonly technophobia and unavailability of required technologies. Portability of training has become strength of e-learning with the proliferation of network linking points, notebook computers, PDAs, and mobile phones, but still does not rival that of printed workbooks or reference material. Reduced social and cultural interaction can be a drawback. The impersonality, suppression of communication mechanisms such as body language, and elimination of peer-to-peer learning that are part of this potential disadvantage are lessening with advances in communications technologies [6].

CHAPTER 3

THEORY OF THREE PHASE INDUCTION MOTOR

3.1 Introduction

The three-phase induction motor, also called an asynchronous motor, is the most commonly used type of motor in industrial applications and the industrial motion control systems, as well as in main powered home appliances. Simple and rugged design, low-cost, low maintenance and direct connection to an AC power source are the main advantages of three phase induction motors. Different motors are suitable for different applications.

Although three-phase induction motors are easier to design than DC motors, the speed and the torque control in various types of three-phase induction motors require a greater understanding of the design and the characteristics of these motors. So, this project discusses the basics of three-phase induction motor; the different types of rotor, their characteristics, the selection criteria for different applications and basic control techniques. Three-phase induction motor has the same physical stator as synchronous machine, with different rotor construction.

There are two difference types of induction motor rotors that can be placed inside the stator. One is called a squirrel-cage rotor or simply a cage rotor while the

other is called a wound rotor. In particular, the squirrel-cage rotor design is the most widely used electric motor in industrial applications. [4]

Its characteristic features are:

- (a) Simple and rugged construction
- (b) Low cost and minimum maintenance
- (c) High reliability and sufficiently high efficiency
- (d) Needs no extra starting motor and need not be synchronized



Figure 3.1: Three Phase Induction Motor

3.2 Component and Basic Construction

3.2.1 Stator

The stator core and stator windings of a three-phase induction machine are exactly like those of a synchronous machine. The only difference in construction between the two machines is in the rotor. Induction machine rotors are of two types, wound and squirrel-cage. In the wound rotor type, the rotor windings are contained in slots in a laminated iron case, which is mounted on the shaft.

The winding of a wound rotor is a polyphase winding. It is quite similar to stator winding of a synchronous machine. It is almost always three phase, and wyes-connected. The three terminal leads are brought to slip rings, mounted on the shaft. Carbon brushes riding on these slip rings are shorted together for normal operation. [4]

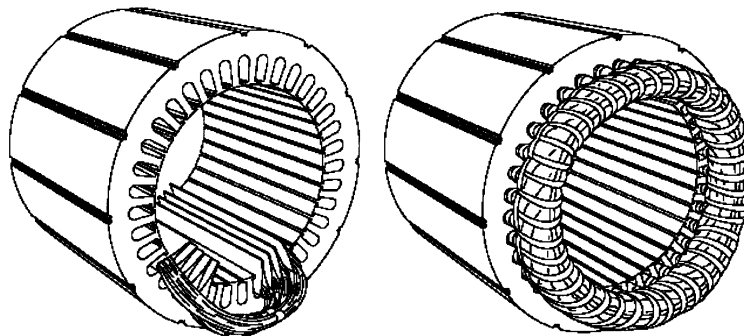


Figure 3.2: Stator

3.2.2 Stator Design

The stator is the stationary electrical part of the motor. Stator laminations are stacked together forming a hollow cylinder. Coils of insulated wire are inserted into slots of the stator core. Each grouping of coils, together with the steel core it surrounds, form an electromagnet. Electromagnetism is the principle behind motor operation. The stator