Pearson BTEC Level _ Higher Nationals in Engineering (RQF)

Unit: 43 Further Electrical Machines and Drives

Unit Workbook 4

in a series of 4 for this unit

Learning Outcome 4

AC Drives and their Industrial Applications

Table of Contents

GUIDANCE

This document is prepared to break the unit material down into bite size chunks. You will see the learning outcomes above treated in their own sections. Therein you will encounter the following structure.

Purpose

Explains *why* you need to study the current section of material. Quite often learners are put off by material which does not initially seem to be relevant to a topic or profession. Once you understand the importance of new learning or theory you will embrace the concepts more readily.

Theory

Conveys new material to you in a straightforward fashion. To support the treatments in this section you are strongly advised to follow the given hyperlinks, which may be useful documents or applications on the web.

Example

The examples/worked examples are presented in a knowledge-building order. Make sure you follow them all through. If you are feeling confident then you might like to treat an example as a question, in which case cover it up and have a go yourself. Many of the examples given resemble assignment questions which will come your way, so follow them through diligently.

Question

Questions should not be avoided if you are determined to learn. Please do take the time to tackle each of the given questions, in the order in which they are presented. The order is important, as further knowledge and confidence is built upon previous knowledge and confidence. As an Online Learner it is important that the answers to questions are immediately available to you. Contact your Unit Tutor if you need help.

Challenge

You can really cement your new knowledge by undertaking the challenges. A challenge could be to download software and perform an exercise. An alternative challenge might involve a practical activity or other form of research.

Video

Videos on the web can be very useful supplements to your distance learning efforts. Wherever an online video(s) will help you then it will be hyperlinked at the appropriate point.

Introduction to AC Drives and their Industrial Applications

It is important at this point to highlight the distinction between what we refer to as a motor and a drive.

Put simply, a motor is the mechanical or electrical device that generates the rotational or linear force used to power a machine. A drive on the other hand is the electronic device that harnesses and controls the electrical energy sent to the motor.

Types of AC Drives

AC motor drives are classified based on the type of AC motor being used. The most common types include induction, synchronous, sensorless vector, and servo drives.

Induction motors derive their name from the fact that current is induced into the rotor windings without any physical connection with the stator windings (which are directly connected to an AC power supply); adaptable to many different environments and capable of providing considerable power as well as variable speed control. Typically, there is "slip," or loss of exact speed tracking with induction motors.

Synchronous motors operate at constant speed up to full load. The rotor speed is equal to the speed of the rotating magnetic field of the stator; there is no slip. Reluctance and permanent magnet are the two major types of synchronous motors. A synchronous motor is often used where the exact speed of a motor must be maintained.

Sensorless vector drives employ independent control of both the voltage and frequency supplied to the motor for good speed control, and low-speed torque output approaching that of DC motors. Sensorless indicates that no feedback sensor such as an encoder or resolver is used.

Servo motors are typically permanent magnet synchronous motors that can often have low torque-to-inertia ratios for high acceleration ratings. They frequently employ brushless commutation with feedback provided by Hall Effect sensors, and sinusoidal winding excitation.

Fig, 1. Typical examples of AC drive units