
AC Induction Motor & Control Schemes

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1 Overview Of AC Drives

1.1. Types & Applications

Adjustable Speed Drives - ASDs, are a feature of practically every type of application and industry. Previously, such drives were realised by combining several electrical machines. An example of this is the Ward-Leonard drive. With the advent of power semiconductor devices, however, these systems have been rendered obsolete by motors controlled by static power converters.

The silicon controlled rectifier - **SCR** was the first power semiconductor device to be commercially available. As a result of this, the first converter controlled drive to find widespread application in industry was the **DC** motor drive fed by a line commutated converter. The outstanding feature of this type of drive is the simplicity of the power converter circuit and the straightforward control, for high performance applications such as servo drives and rolling mill drives. Drives up to a megawatt range have been satisfactorily performing in industry. The performance of these drives has become the standard by which performance of future drive types are to be judged.

However, it is well recognized that dc motors have a number of limitations:

- **DC** motor power rating is limited at high speeds due to commutation.
- The commutator and brushes require maintenance.
- **DC** motors are not suitable for hazardous environments such as mines, chemical plants, etc.
- The power to weight ratio of **DC** motors is not comparable to **AC** motors, especially the induction motor.

There has been a continuous effort to develop variable speed drives incorporating **AC** motors. A variety of power devices, power converter configurations, motor types and control techniques have emerged over the last two decades, resulting in the availability of a wide variety of **AC** motor drives suitable for different applications.

A number of gate turn-off power switches, such as the bipolar junction transistor - **BJT**, the power **MOSFET**, the Insulated Gate Bipolar Transistor **IGBT** and the gate turn-off thyristor **GTO** are now available for building power converters for feeding **AC** motor drives. Over the years, ratings have been continuously improved. These devices, together with the **SCR**, offer a wide choice of power switches for **AC** motor drives.

In addition to the different types of converters, various motor types are also available.

The motor machine types are:

- squirrel cage induction motors
- wound rotor induction motors
- permanent magnet synchronous motors
- wound field synchronous motors
- reluctance motors.

It appears that a large number of motor-converter combinations are possible. However it is recognized that certain converter/machine combinations are preferable for certain classes/ratings of drives.

In this manual, attention is focussed on **AC** motor drives operated from voltage source type of inverters. In particular, drives incorporating squirrel cage induction motors are considered. A large number of commonly used **AC** motor drives come under this category.

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