

كثية الهندسة	الكثية
الكهرباء	القسم
Electrical Drives	المادة باللغة الانجليزية
المسوقات	المادة باللغة العربية
الرابعة	المرحلة الدراسية
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AC and DC Drives	عنوان المحاضرة باللغة الانجليزية
محركات التيار المتردد والتيار المستمر	عنوان المحاضرة باللغة العربية
1	رقم المحاضرة
1) Mohummed Rashid" Power electronics circuits, Devices application" 4th edition, 2014 and	المصادر والمراجع
2)Gopal K.Dubey "power semiconductor controlled Drives" 1st edition, 1989	

Electrical Drives

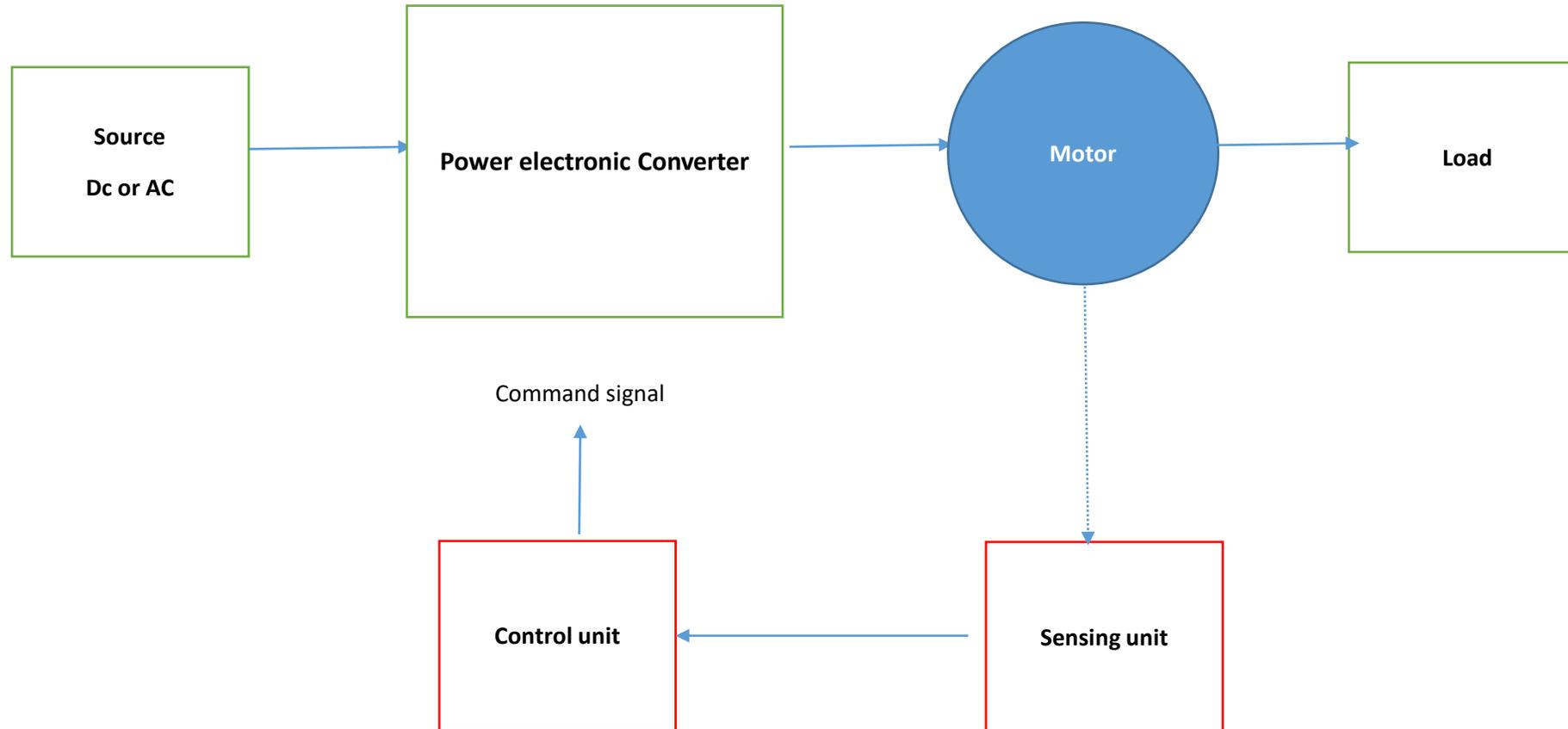
References :

- 1) Mohummed Rashid” Power electronics circuits, Devices and application” 4th edition, 2014
- 2) Gopal K. Dubey “ power semiconductor controlled Drives” 1st edition, 1989

Definition of Drives : A Drive is power electronics board or circuits, which used to control the speed of electrical motor.

Drive system

The block diagram of electrical drive is shown below :



The purpose of the drive is to drive the load (machinery) in such a manner that its able to accomplish the task assigned to it.

Load requirements

a) Related to starting and stopping and reversing

1. Natural and range of load torque. How does the load torque vary with speed
2. What is the inertia ---low or high
3. How much time allowed for these operations?
4. How frequently are these operation carried out
5. It's the smooth acceleration or deceleration necessary
6. It is an accurate stop required
7. Should there be provision for quick stop or reverse during emergency
8. Are these operation done manually or automatically

b) requirement related to the normal running

1. Natural and range of load torque
2. Will be required to run just one speed or a few discrete speed?
3. Its adjustable speed required, what is the desired range of speed?
4. What is the permissible speed regulation (2),(3).
5. Will the load be overhauling? (driving the motor as a generator).

c) requirement related to location and environment

1. Does the location allow easy access for maintenance?
2. It is going to be used in an environment consisting of dust? flammable gases and so on?
3. Is it is going to be submerged in water or any other liquid?

AC and DC Drives

AC Drives

1. Run by AC supply.
2. Have 3-phase low cost induction motor .
3. Less maintenance and prefer for mounted in any area.
4. Ac motor are smaller less expensive, lighter than dc motor.
5. AC are better for speed than 2500r.p.m
6. Operating in wet environment
7. Constant speed is available and many motor are mounted.
8. The drive circuits and control , generally required a complex control with fast switching power semiconductor switches which is expensive.
9. High dynamic response, good speed regulation ,produce high harmonic to the supply.

DC Drives

1. Run with DC supply
2. DC drives are less complex with single power conversion from AC to DC
3. DC motor have long tradition of use as adjustable speed machine and a wide range of options
4. High starting torque and acceleration about 400% of rated torque
5. The power electronics converters are simpler and inexpensive.

Types of Load Torque

1. Active load torque: these types of loads usually retained their sign when the direction of the drive rotation is change such as Torque of gravity, Tension, compression and torsion.
2. Passive load torque: these type of loads always oppose the motion and change their sign on the reversal of motion such as friction, cutting

Principle factor effecting the choice of the drive

1. rating and capital cost
2. speed range
3. efficiency
4. control ability torque, inertia ratio
5. braking requirement
6. reliability
7. power to weight ratio
8. power factor
9. load factor, duty cycle and temperature
10. availability of supply
11. effect of supply variation
12. environment

Electrical Drive

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graph TD; ED[Electrical Drive] --- SD[Special Drive]; ED --- DC[DC Drive]; ED --- AC[AC Drive]; SD --- L1[1. BDC motor]; SD --- L2[2. SR motor]; SD --- L3[3. Linear induction motor]; SD --- L4[4. Stepper Motor]; SD --- L5[5. PMSM drives];
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Special Drive

1. BDC motor
2. SR motor
3. Linear induction motor
4. Stepper Motor
5. PMSM drives

DC Drive

AC Drive

DC Drive

Hybrid control

Field and armature both or split

Field control

above rated speed

Armature control

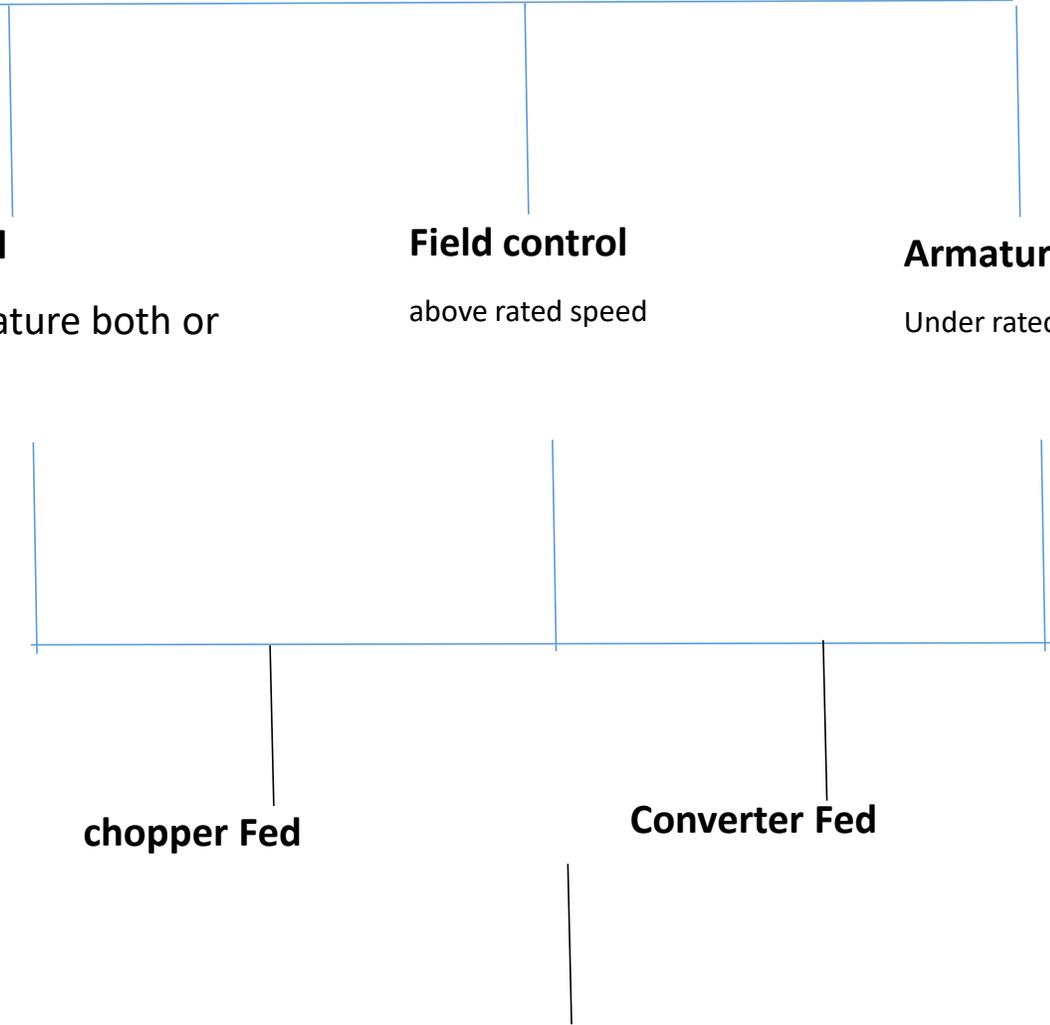
Under rated speed

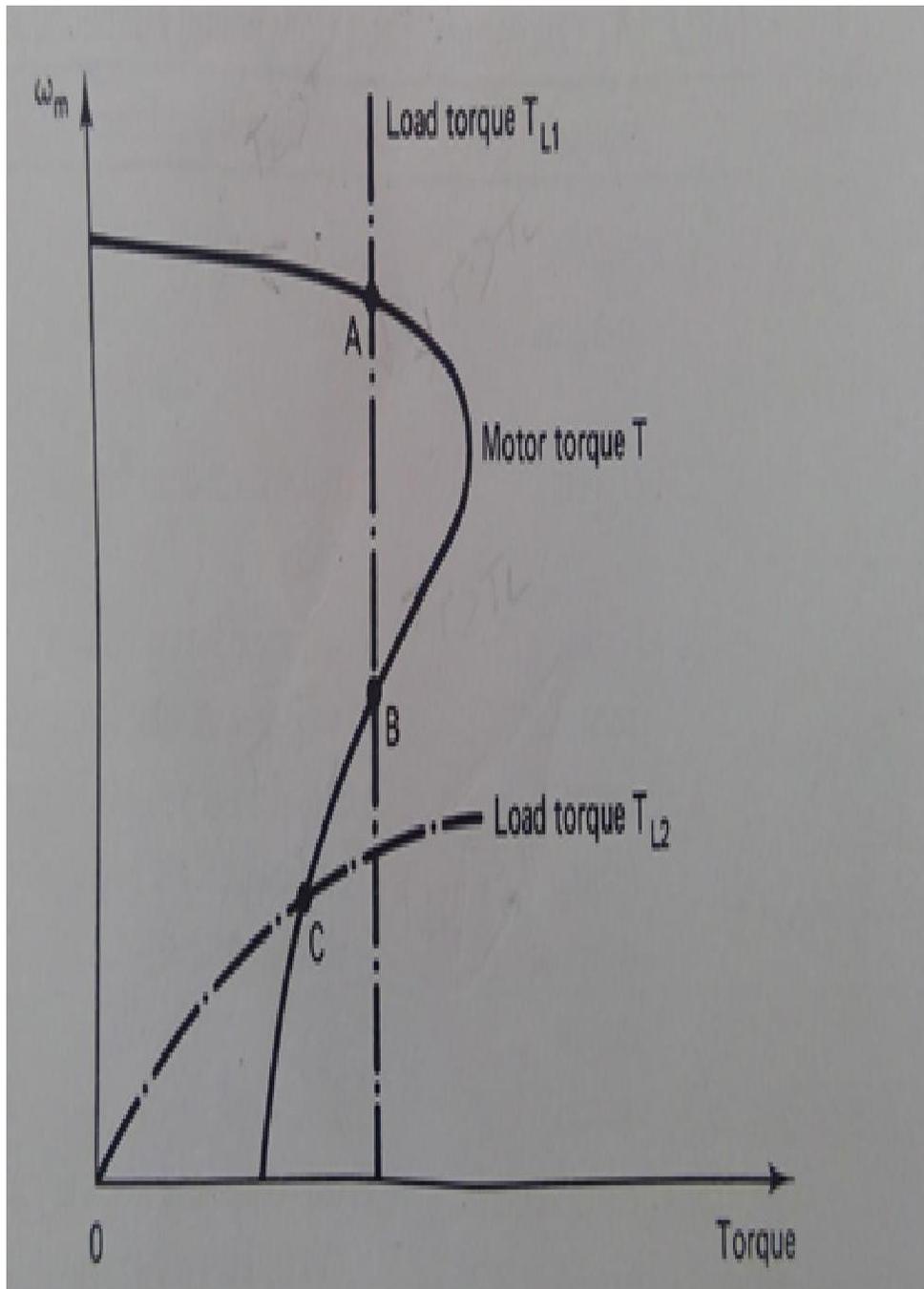
chopper Fed

Converter Fed

Two quadrant

four quadrant





At point A if the speed increase the load torque greater than motor torque $T_L > T$

Deceleration occurs and the operation is restored to point A

Similarly a small decrease in speed causes the motor torque to exceed the load torque, acceleration occur and restore to point A

At point B

A Small increase in speed causes the motor torque to exceed load torque, acceleration takes place and the operating point move away from B, similarly a small decrease in speed make the load torque grater than motor torque causing deceleration and the operation drift away from B.