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FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-ii

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SERVO MOTOR

Introduction

- They are also called control motors and have high-torque capabilities
- Basic principle of operation is the same as that of other electromagnetic motors. However, their construction, design and mode of operation are different.
- Their power ratings vary from a fraction of a watt up to a few 100 W.
- Both **DC** and **AC** (2-phase and 3-phase) servomotors are used.

Application

- In radar , tracking and guidance systems, process controllers, computers and machine tools

DC Servomotors

- These motors are either separately-excited dc motors or permanent- magnet dc motors.
- The schematic diagram of a separately-excited DC motor along with its armature and field MMFs and torque/speed characteristics is shown in Fig. 39.26. The speed of DC servomotors is normally controlled by varying the armature voltage. Their armature is deliberately designed to have large resistance so that torque-speed characteristics are linear and have a large negative slope as shown in Fig. 39.26 (c). The negative slope serves the purpose of providing the viscous damping for the servo drive system.
- As shown in Fig. 39.26 (b), the armature mmf. and excitation field mmf are in quadrature. This fact provides a fast torque response because torque and flux become decoupled.
- Accordingly, a step change in the armature voltage or current produces a quick change in the position or speed of the rotor

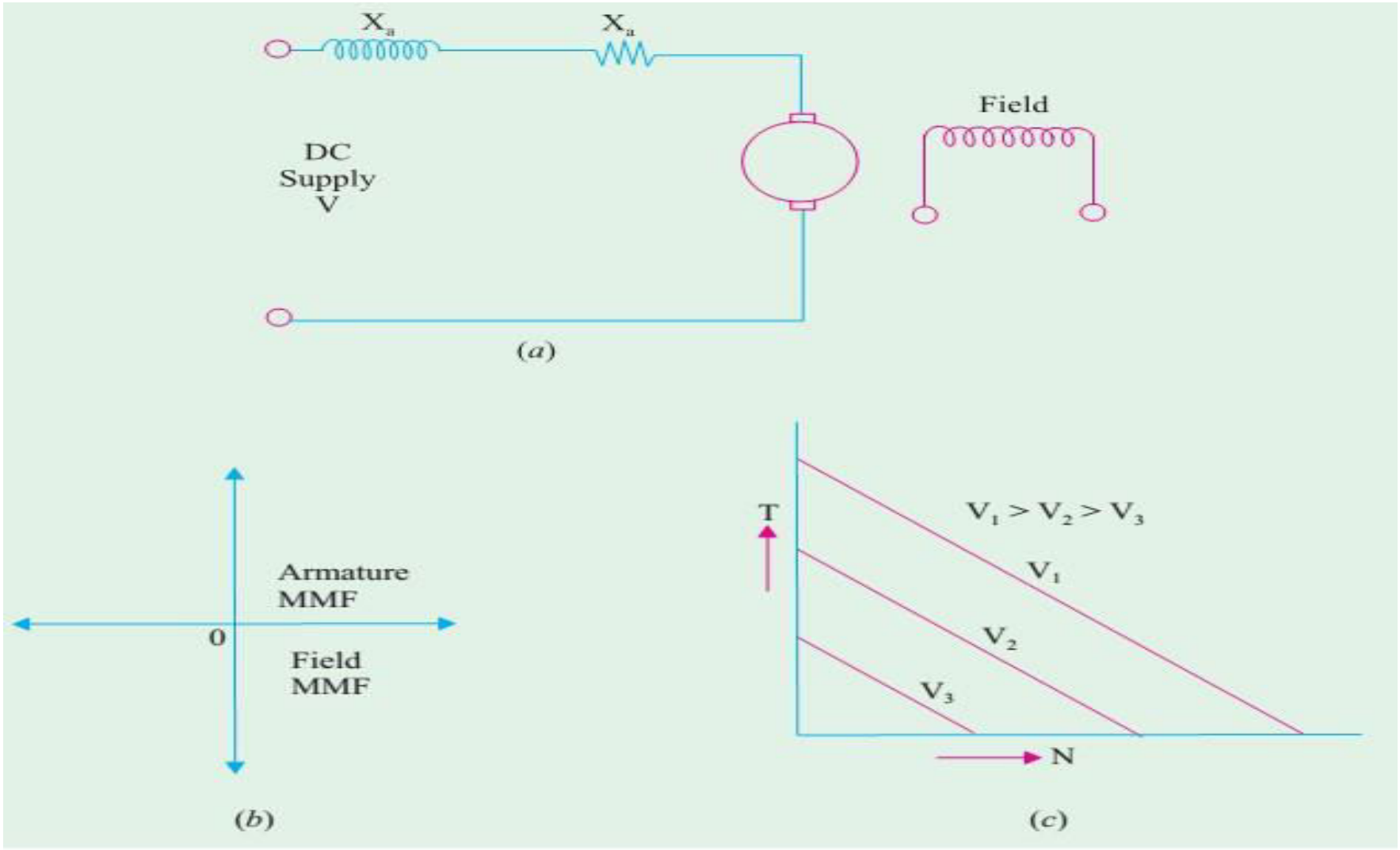
X_a
X_a
Field
DC
Supply
V
(a)
Armature
MMF
0
Field
MMF
(b)
T
$V_1 > V_2 > V_3$
V_1
V_2
V_3
N
(c)

Fig. 39.26

AC Servomotors

- Such motors normally run on a frequency of 60 Hz or 400 Hz (for airborne systems). The stator has two distributed windings which are displaced from each other by 90º (electrical).
- The main winding (also called the reference or fixed phase) is supplied from a constant voltage source, Vm ∠ 0º (Fig. 39.27). The other winding (also called the control phase) is supplied with a variable voltage of the same frequency as the reference phase but is phase- displaced by 90º (electrical).
- The control phase voltage is controlled by an electronic controller. The speed and torque of the rotor are controlled by the phase difference between the main and control windings. Reversing the phase difference from leading to lagging (or vice-versa) reverses the motor direction.

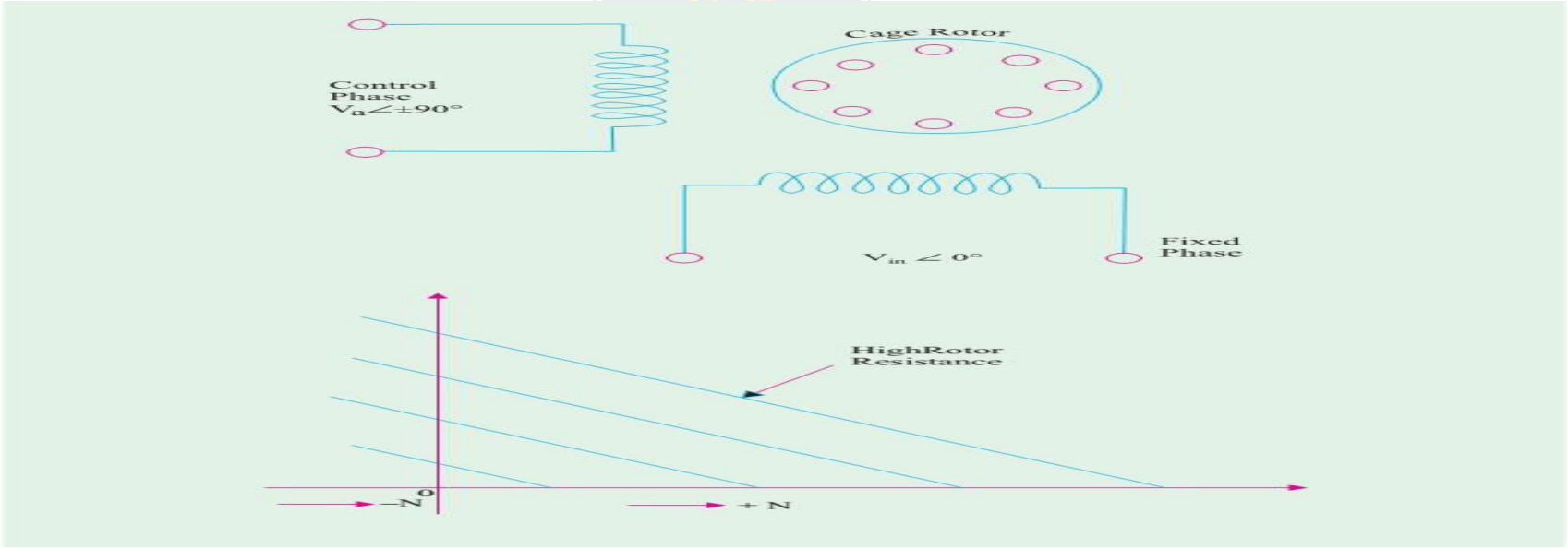

Fig. 39.27