SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EET204 -Electrical Machines II

II YEAR / IV SEMESTER

Unit 4 –STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

Topic 4: Speed Control of Induction motors

GUESS THE TOPIC NAME…

Introduction to Induction Motor Speed Control

Overview: Induction motors are widely used in industrial applications due to their robustness and simplicity. Controlling their speed is essential for energy efficiency and process optimization.

Common Methods

- V/f Control (Volts per Hertz)
- Stator Voltage Control
- Pole Changing (Dahlander Connection)
- Cascaded Connection

V/f Control (Volts per Hertz)

Principle: Maintains a constant ratio between the applied voltage and frequency to keep the magnetic flux constant, ensuring stable motor operation.

Diagram: Block diagram of open-loop V/f control system.

Advantages: Simple implementation Suitable for constant torque applications

Limitations: Not ideal for variable torque loads Open-loop system lacks feedback for speed regulation

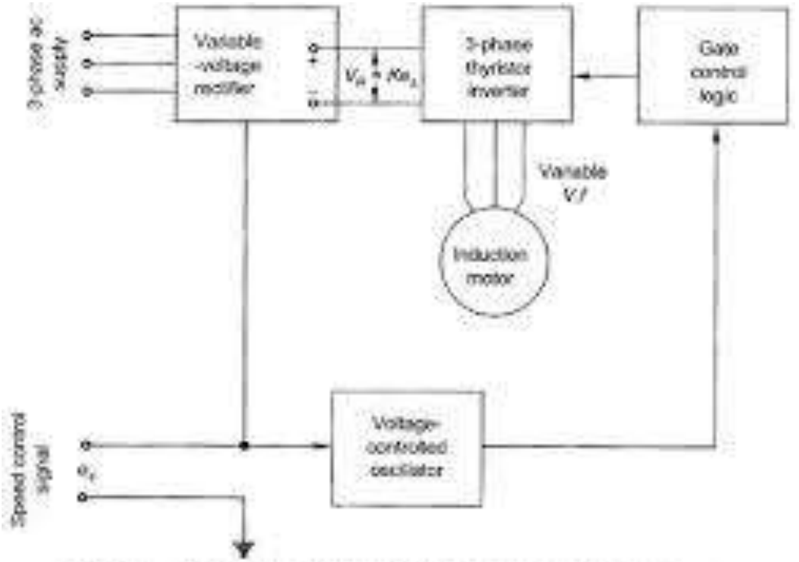
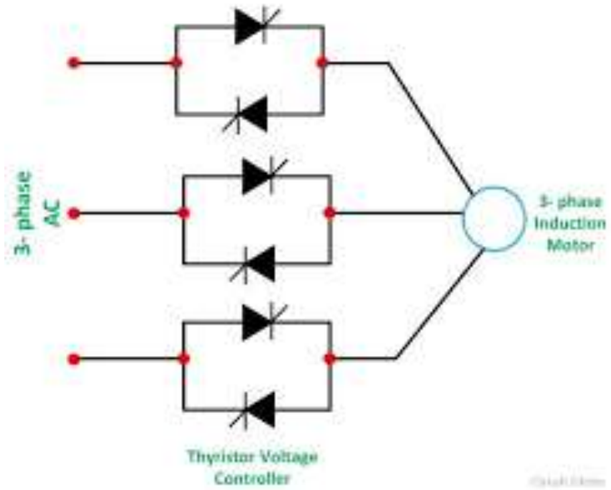


Fig. 11.38 *Frequency-control of induction motor speed; speed* $\propto e_c$, *flux/pole constant*

Stator Voltage Control

Principle: Adjusts the stator voltage to control the motor speed. The voltage is typically varied using thyristor-based controllers.

Diagram: Circuit diagram showing thyristor voltage controller.



Advantages: Simple and cost-effective

Provides smooth speed control

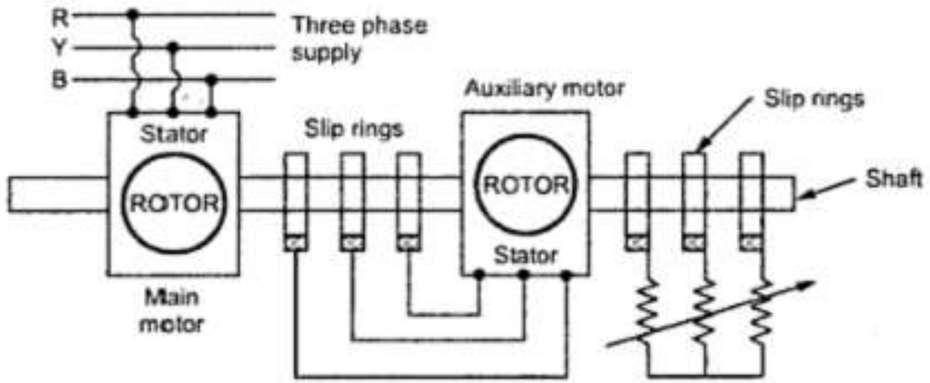
Limitations: Less efficient at low speeds

Torque decreases with speed reduction

Pole Changing (Dahlander Connection)

Principle: Changes the number of poles in the stator winding by altering the coil connections, resulting in different synchronous speeds.

Diagram: Winding diagram for pole changing.



Advantages:

Provides discrete speed options

Maintains constant torque across speeds

Limitations:

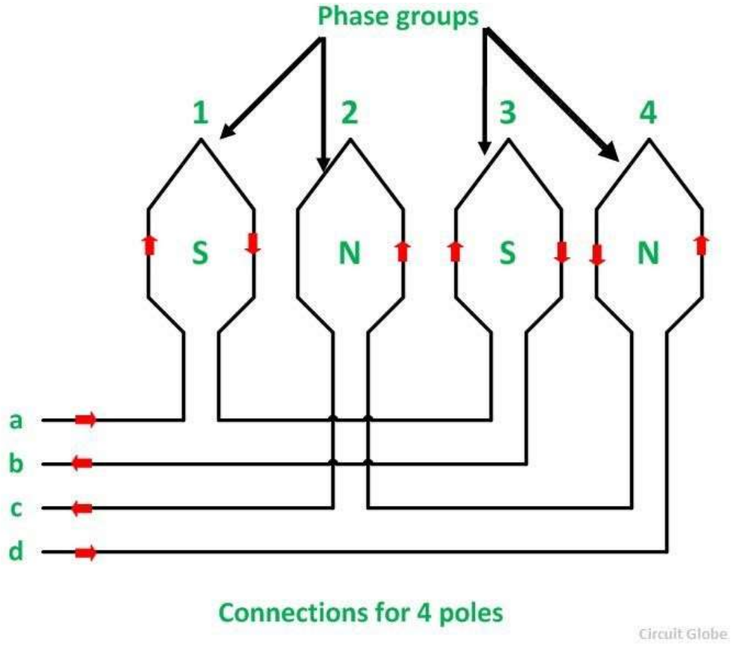
Requires complex switching mechanisms

Limited to specific speed ratios

Cascaded Connection

Principle: Uses multiple motors connected in series or parallel to achieve desired speed and torque characteristics.

Diagram: Illustration of cascaded motor connection.



Advantages:

Flexible speed and torque control

Reduces mechanical stress on individual motors

Limitations:

Complex control systems

Higher initial cost

Comparison Table

Method	Speed Control Type	Torque Behavior	Complexity	Cost
V/f Control	Continuous	Constant	Low	Low
Stator Voltage Control	Continuous	Decreases with speed	Medium	Medium
Pole Changing	Discrete	Constant	High	Medium
Cascaded Connection	Flexible	Variable	High	High

Conclusion

Summary: Each speed control method has its unique advantages and is suitable for specific applications. The choice depends on factors like required speed range, torque characteristics, system complexity, and cost.

Recommendation: For applications requiring precise speed control and variable torque, V/f control or cascaded connections are preferable. For simple, cost-effective solutions, pole changing or stator voltage control may be adequate.

KEEP
LEARNING..

Thank u

SEE YOU IN NEXT CLASS