SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

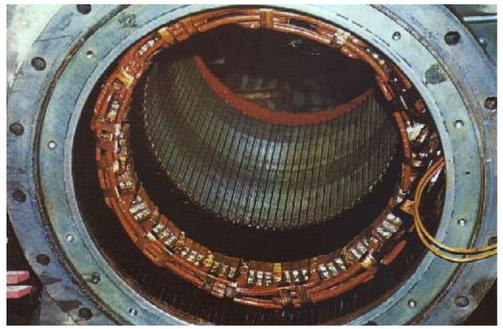
COURSE NAME: 23EET204/ ELECTRICAL MACHINES II

II YEAR / IV SEMESTER

Unit 2 – SYNCHRONOUS MOTOR

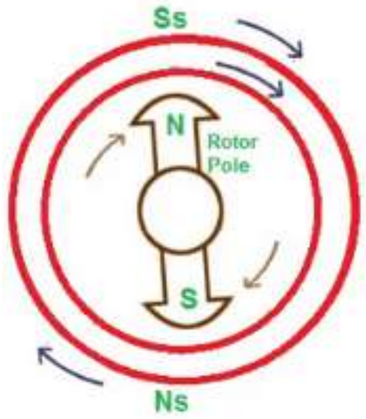
Topic 7: hunting –damper windings

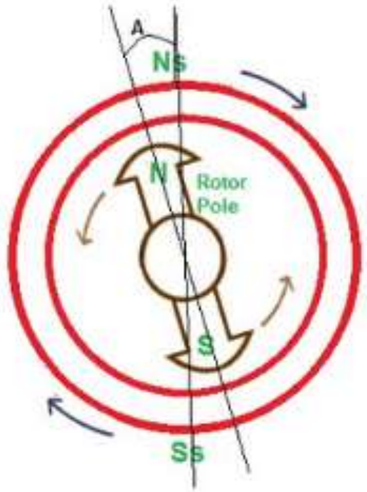
GUESS THE TOPIC NAME…

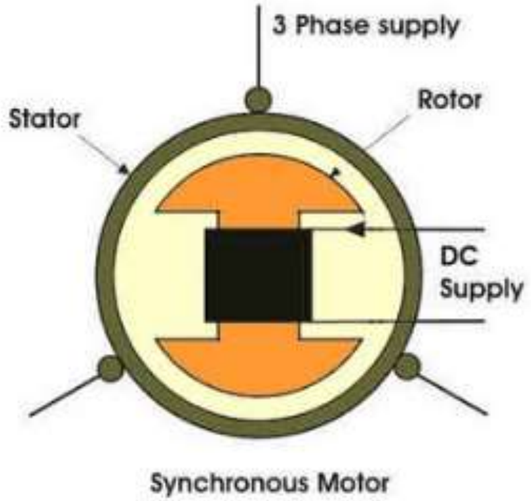


Hunting in Synchronous Motor

- The word hunting is used because after the sudden application of load the rotor has to search or ‘hunt’ for its new equilibrium position.
- That phenomenon is referred to as hunting in a synchronous motor. Now let us know what is the condition of equilibrium in synchronous motor.





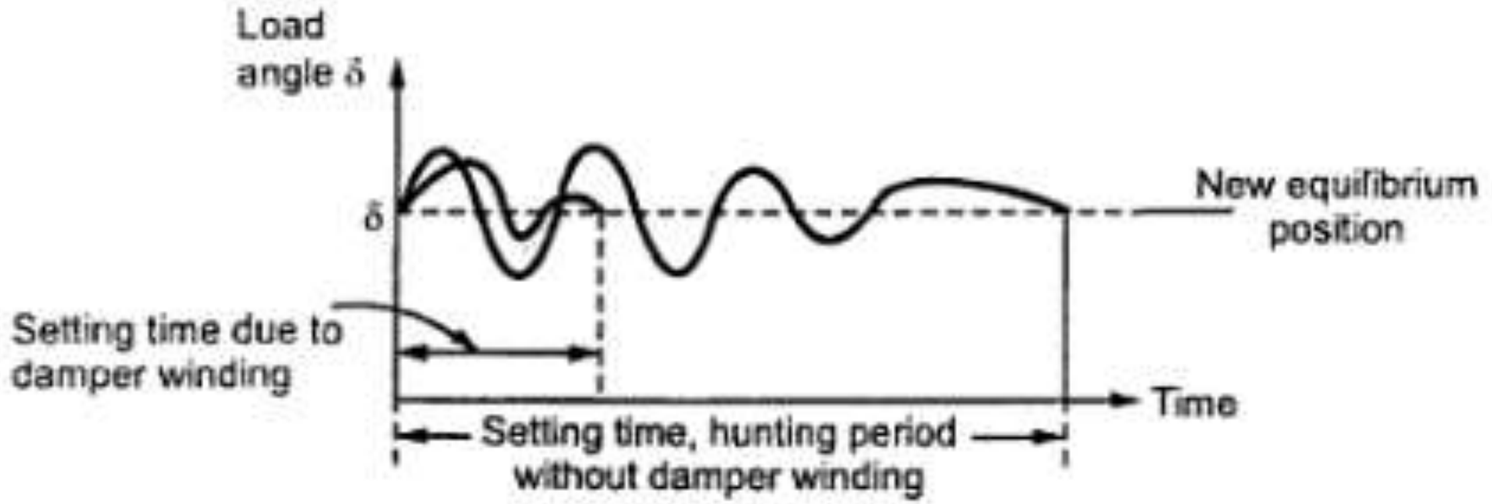


Synchronous Motor

Hunting in Synchronous Motor

- A steady state operation of synchronous motor is a condition of equilibrium in which the electromagnetic torque is equal and opposite to load torque.

- In steady state, rotor runs at synchronous speed thereby maintaining a constant value of torque angle (δ). If there is a sudden change in load torque, the equilibrium is disturbed and there is resulting torque which changes the speed of the motor.



Hunting in Synchronous Motor

Unloaded synchronous machine has zero degree load angle. On increasing the shaft load gradually load angle will increase. Let us consider that load P1 is applied suddenly to unloaded machine shaft so machine will slow down momentarily.

Also load angle (δ) increases from zero degree and becomes δ1. During the first swing electrical power developed is equal to mechanical load P1. Equilibrium is not established so rotor swings further. Load angle exceeds δ1 and becomes δ2. Now electrical power generated is greater than the previous one. Rotor attains synchronous speed. But it does not stay in synchronous speed and it will continue to increase beyond synchronous speed. As a result of rotor acceleration above synchronous speed the load angle decreases. So once again no equilibrium is attained. Thus rotor swings or oscillates about new equilibrium position. This phenomenon is known as hunting or phase swinging. Hunting occurs not only in synchronous motors but also in synchronous generators upon abrupt change in load.

Hunting in Synchronous Motor

Causes of Hunting in Synchronous Motor

- Sudden change in load.
- Sudden change in field current.
- A load containing harmonic torque.
- Fault in supply system.

Effects of Hunting in Synchronous Motor

- It may lead to loss of synchronism.
- Produces mechanical stresses in the rotor shaft.
- Increases machine losses and cause temperature rise.
- Cause greater surges in current and power flow.
- It increases possibility of resonance.

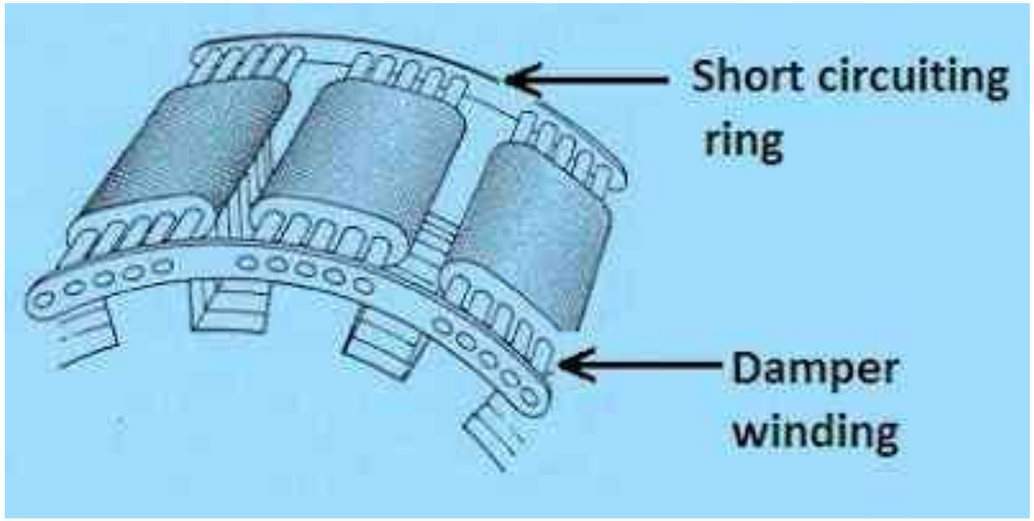
Hunting in Synchronous Motor

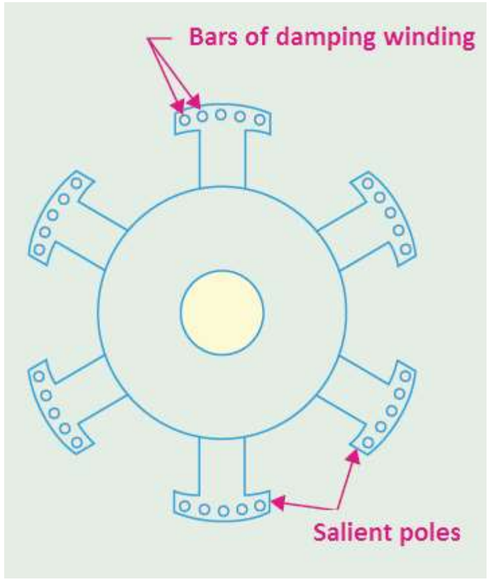
Reduction of Hunting in Synchronous Motor

- Use of Damper Winding: It consists of low electrical resistance copper / aluminum brush embedded in slots of pole faces in salient pole machine.
- Damper winding damps out hunting by producing torque opposite to slip of rotor. The magnitude of damping torque is proportional to the slip speed.
- Use of Flywheels: The prime mover is provided with a large and heavy flywheel. This increases the inertia of prime mover and helps in maintaining the rotor speed constant.
- Designing synchronous machine with suitable synchronizing power coefficients.

Damper Winding in Synchronous Motor

Synchronous motors have their pole-shoes slotted for placing copper bars. The copper bars are placed in these slots and short-circuited at both ends by heavy copper rings (like squirrel cage rotor of induction motors). This arrangement is known as damper winding in synchronous motor





Damper Winding in Synchronous Motor

The damper winding in synchronous motor performs two functions:

- Provides starting torque and prevents hunting in the synchronous motor
- When the rotor is rotating at synchronous speed, then the relative velocity between the RMF (rotating magnetic field of the stator) and the rotor is zero. Hence induced EMF in the damper winding is zero.
- Thus, under normal running conditions, damper winding in synchronous machine does not carry any current.

SUMMARY

hunting –damper windings

KEEP
LEARNING..

Thank u

SEE YOU IN NEXT CLASS