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FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-ii

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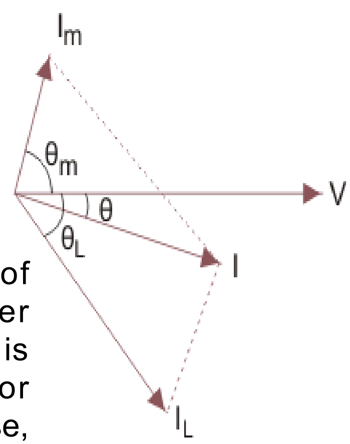
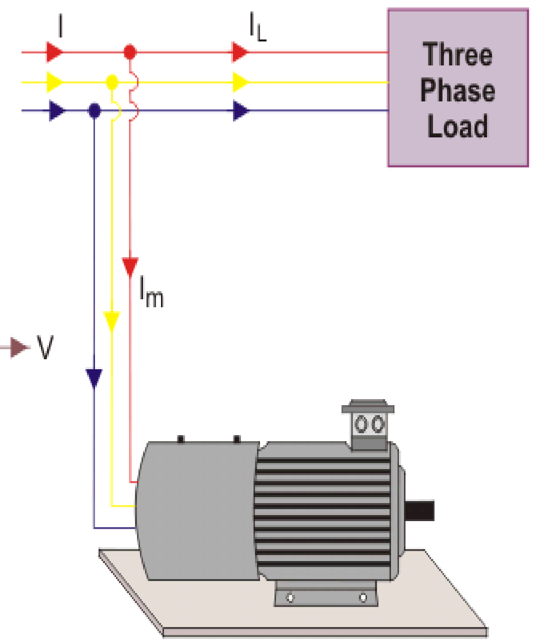
SYNCHRONOUS CONDENSER

Like capacitor bank, we can use an overexcited synchronous motor to improve the poor power factor of a power system. The main advantage of using synchronous motor is that the improvement of power factor is smooth.
When a synchronous motor runs with over-excitation, it draws leading current from the source. We use this property of a synchronous motor for the purpose.
Here, in a three-phase system, we connect one three-phase synchronous motor and run it at no load.

Suppose due to a reactive load of the power system the system draws a current I_L from the source at a lagging angle θ_L in respect of voltage. Now the motor draws a I_M from the same source at a leading angle θ_M. Now the total current drawn from the source is the vector sum of the load current I_L and motor current I_M. The resultant current I drawn from the source has an angle θ in respect of voltage. The angle θ is less than angle θ_L. Hence power factor of the system cosθ is now more than the power factor cosθL of the system before we connect the synchronous condenser to the system.





Three Phase Synchronous Motor

he synchronous condenser is the more advanced technique of improving power factor than a static capacitor bank, but power factor improvement by synchronous condenser below 500 kVAR is not economical than that by a static capacitor bank. For major power network we use synchronous condensers for the purpose, but for comparatively lower rated systems we usually employ capacitor bank.
The advantages of a synchronous condenser are that we can control the power factor of system smoothly without stepping as per requirement. In case of a static capacitor bank, this fine adjustments of power factor cannot be possible rather a capacitor bank improves the power factor stepwise.

HUNTING IN SYNCHRONOUS MOTOR

At no-load, the magnetic axis of the stator and rotor coincides as the load angle δ = 0. However, when the motor is loaded, the rotor axis lags the stator axis by an angle δ. If the load is suddenly changed, the rotor will not immediately attain its equilibrium position but pass beyond it producing more torque than required. The rotor will now swing in the opposite direction to reduce the load angle. This periodic swing of the rotor to either side before stopping at the equilibrium position is called *Hunting* of the rotor.

Causes of Hunting in Synchronous Motor

1. Sudden change in load
2. Sudden change in field current
3. A load containing harmonic torque
4. Fault in supply system.

Effects of Hunting in Synchronous Motor

1. It may lead to loss of synchronism.
2. It produces mechanical stresses.
3. Increases machine loss and causes temperature rise.
4. Causes greater surges in current and power flow.

Reduction of Hunting in Synchronous Motor

i) By using damper winding: Damper winding damps out hunting by producing torque opposite to slip of rotor. The magnitude of damping torque is proportional to the slip speed.

ii) By using Flywheels: By providing large and heavy flywheel to the prime mover, its inertia can be increased, which in turn, helps in maintaining the rotor speed constant.