Load-Commutated-Inverter (LCI) Supplied Synchronous Motor Drives

- Block Diagram
- Synchronous Generators
- Per-Phase Model and Power-Angle Characteristics
- Adjusting Reactive Power and Power Factor

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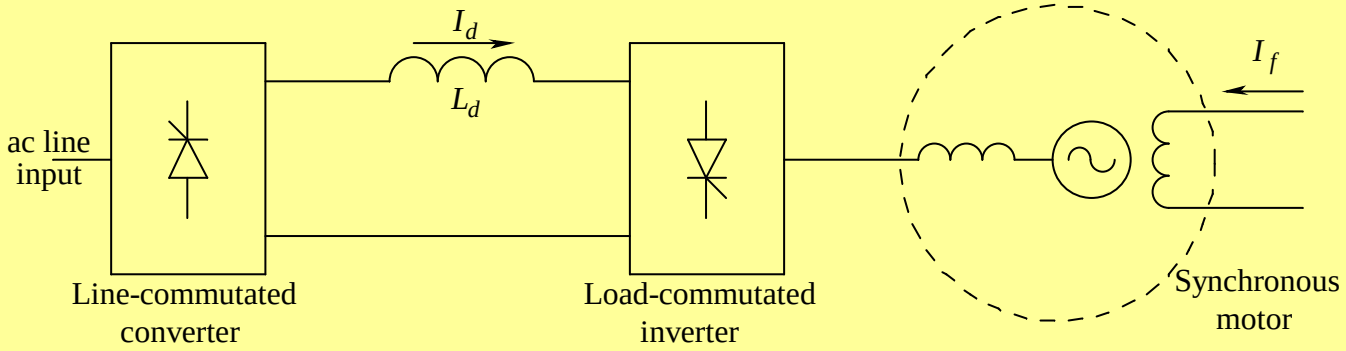
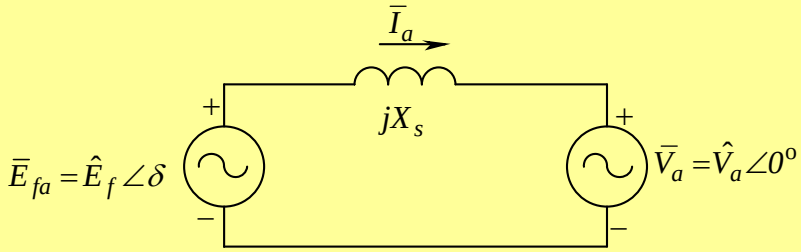


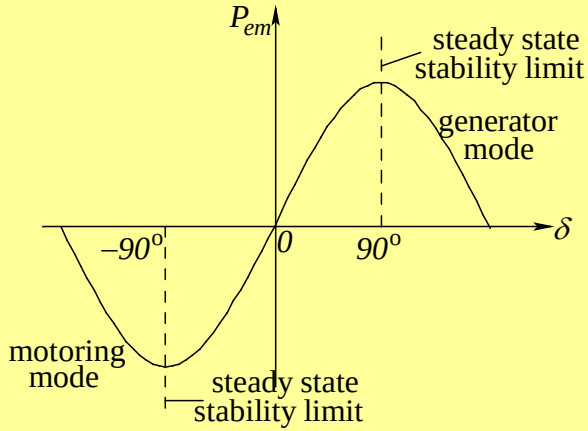
- High power levels
- Field windings on rotor carrying a dc current
- Thyristor PPU needed at these power levels
- DC-link between utility and inverter is a nearly constant current (I_d) rather than a constant voltage (V_d) as in previous circuits
- Inverter thyristors commutated by load (synchronous motor)

Synchronous Generators

- Generally larger sizes
- Directly connected to utility without PPU
- Three-phase winding on stator - DC field winding on rotor
- Angle between rotor flux and stator flux not necessarily 90^o allowing generator to sink or source VARS

Per-Phase Model and Power-Angle Characteristics



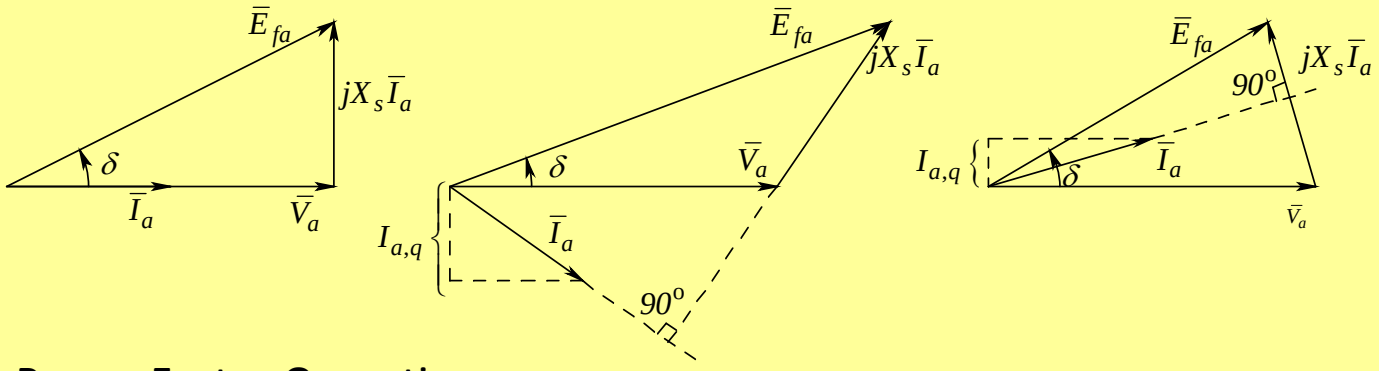


- Total 3-phase power

$$P_{em} = \frac{3}{2}\frac{\hat{E}_f \hat{V}}{X_s}\sin\delta$$

- For angles between -90^o and +90^o rotor speed remains locked to line frequency
- When the machine is asked to either supply or absorb to much power the angle will move outside the $\pm 90^o$ range. In this situation the rotor will no longer be synchronized to the line and will either speed up out of control or slow down. In either case excessive currents should trip the circuit breakers.

Adjusting Reactive Power and Power Factor



- Unity Power Factor Operation
  For every operating condition there is one value of field current that will cause the generator to deliver only real power.
- Over-excitation
  Increasing field current causes generator to supply more reactive power.
- Under-excitation
  When field current is decreased below the value for Unity Power Factor operation, the generator will absorb reactive power.

Summary

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