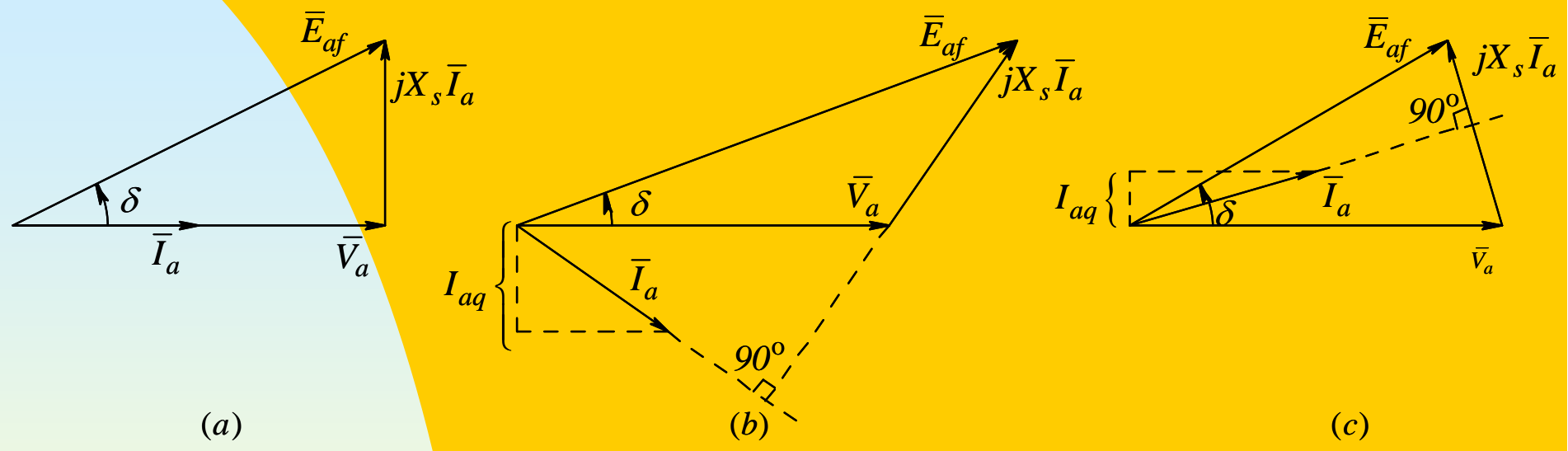


Reactive Power Control by Field Excitation



$$Q = 3V_a I_{aq}$$

Synchronous Condenser

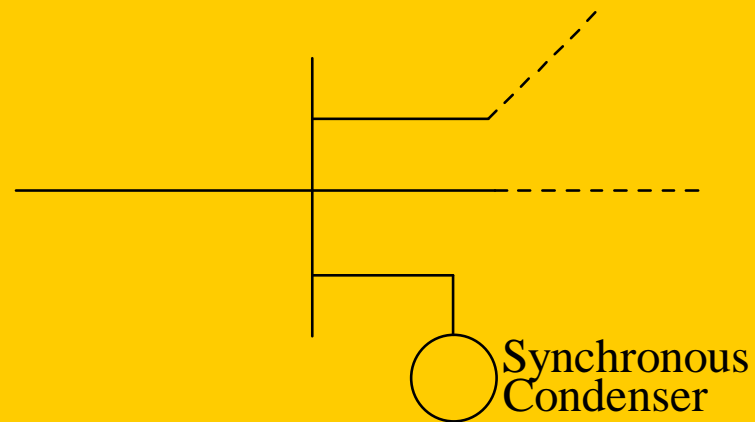


Fig. 9-14 Synchronous Condenser.

Automatic Voltage Regulation (AVR)

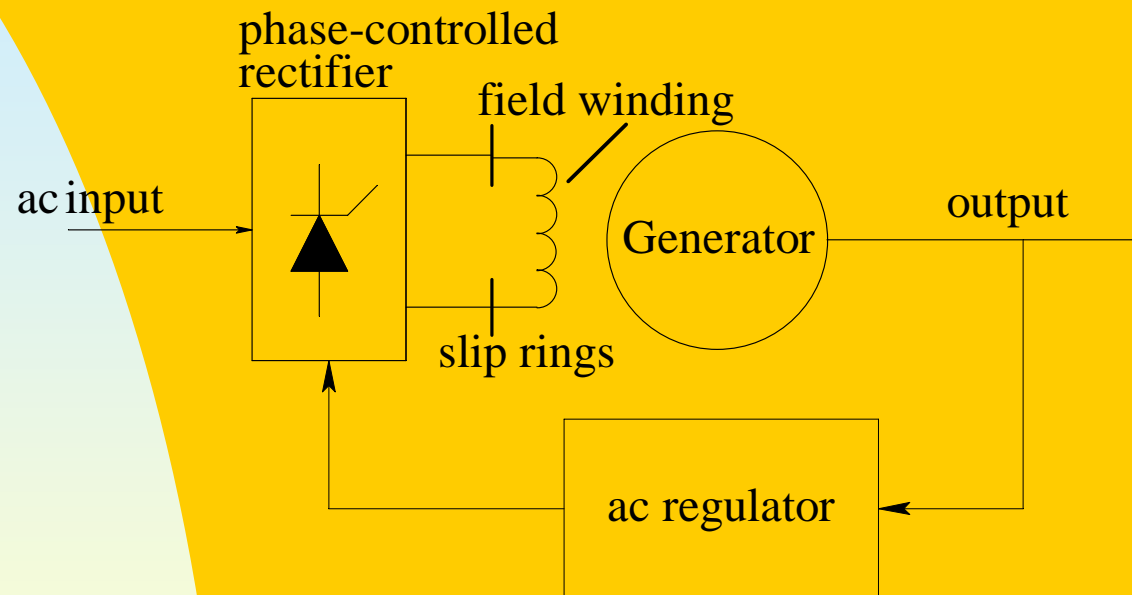


Fig. 9-15 Field exciter for automatic voltage regulation (AVR).

Armature Reaction Flux in Steady State Leading to Synchronous Reactance

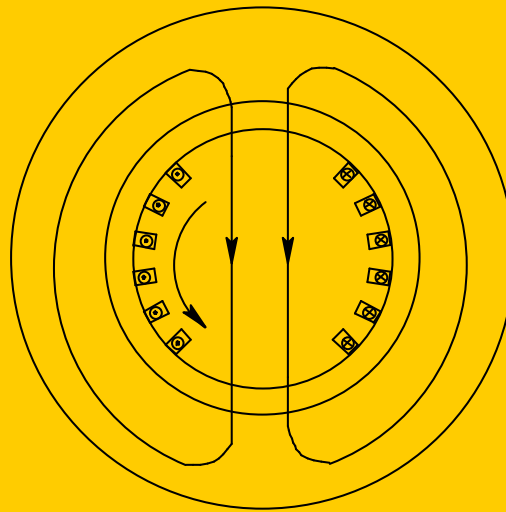


Fig. 9-16 Armature reaction flux in steady state.

Simulation of a Short-Circuit Assuming a Constant-Flux Model

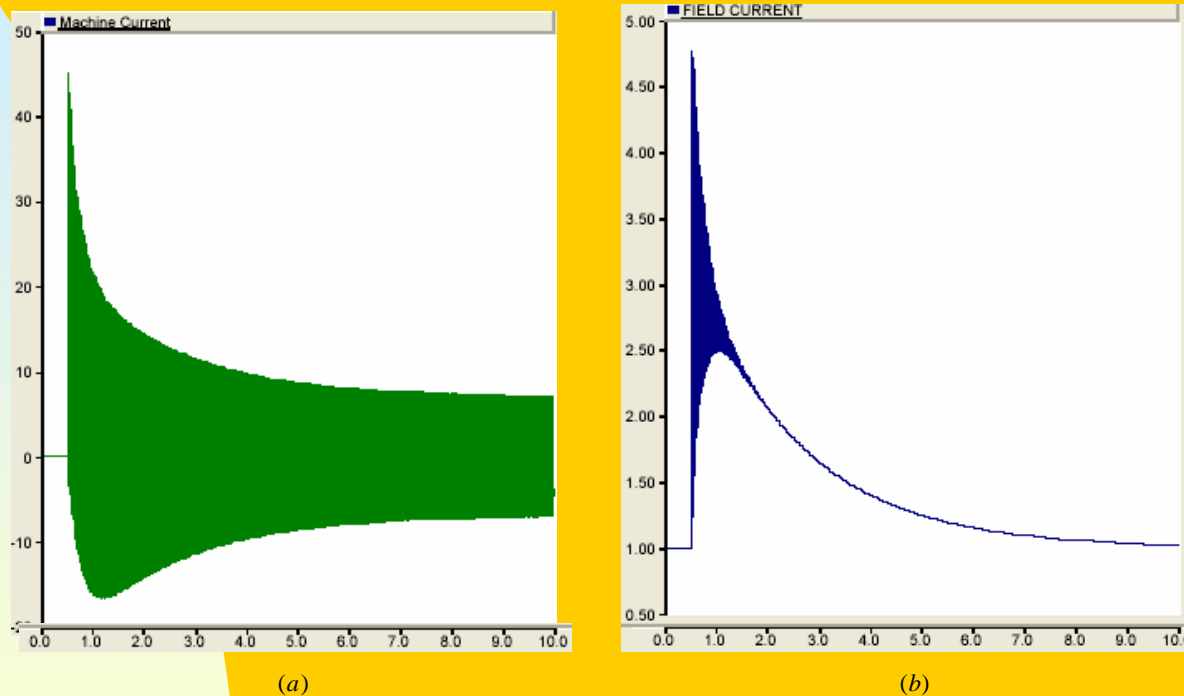


Fig. 9-17 Armature (a) and field current (b), after a sudden short circuit [source: 4].

$$X_s'' < X_s' < X_s$$

Representation for Steady State, Transient Stability and Fault Analysis

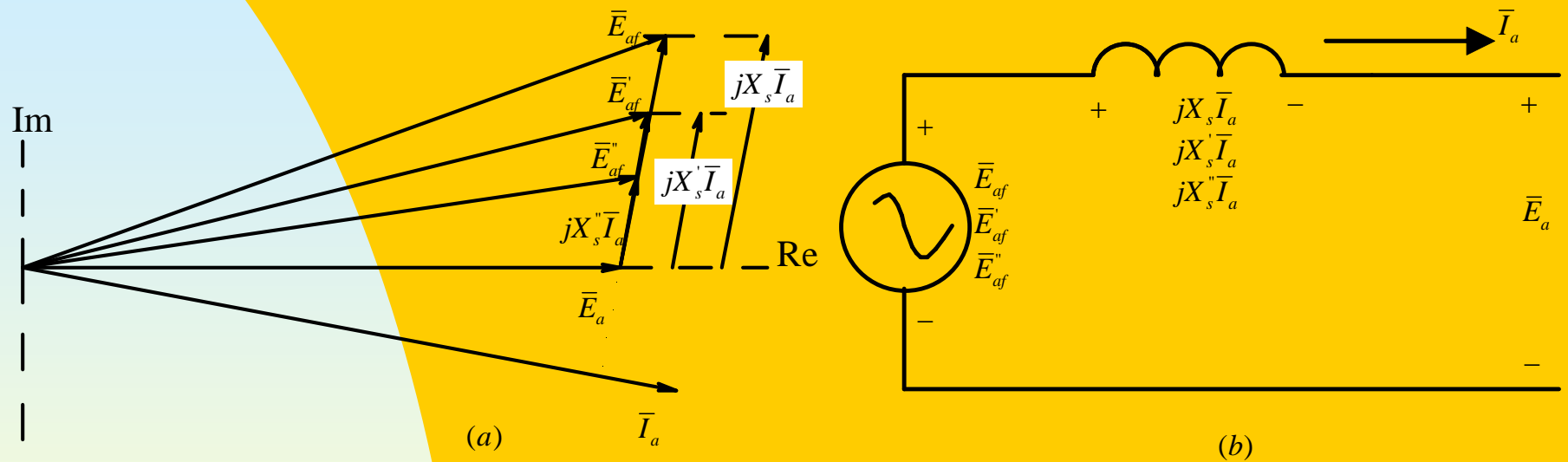


Fig. 9-18 Synchronous generator modeling for transient and sub-transient conditions.

$$\bar{E}_{af} = \bar{E}_a + jX_s \bar{I}_a$$

$$\bar{E}'_{af} = \bar{E}_a + jX'_s \bar{I}_a$$

$$\bar{E}''_{af} = \bar{E}_a + jX''_s \bar{I}_a$$

Summary

- Importance
- Structure
- Principle of Operation and Equivalent Circuit
- Steady State Stability
- Field-Excitation Control to Adjust Reactive Power
- Synchronous Condensers
- AVR
- Modeling for Various Conditions