Electrical Machines 1

Hour 4

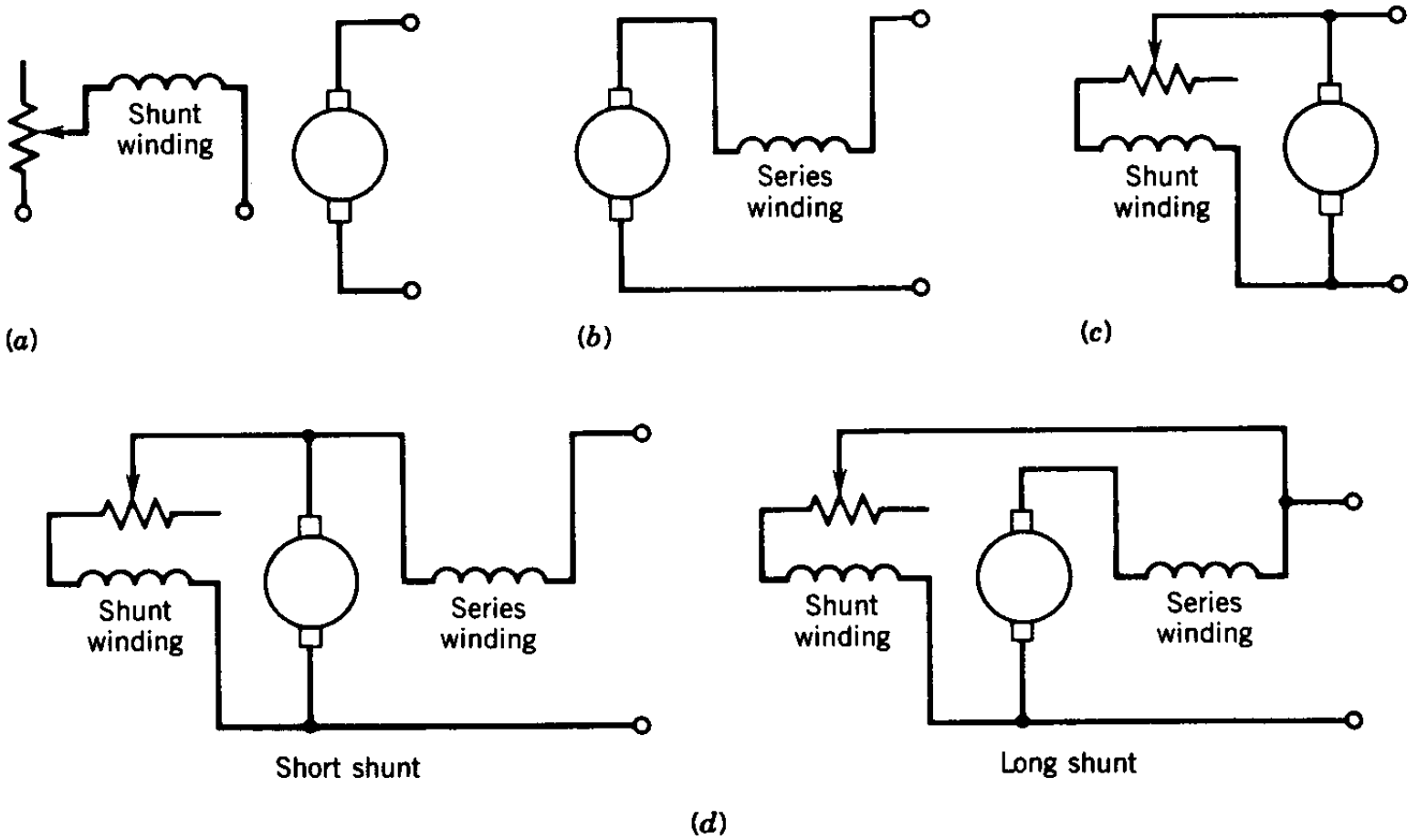
Classification of DC Machines

(Sect 4.2.7 and Fig. 4.27)

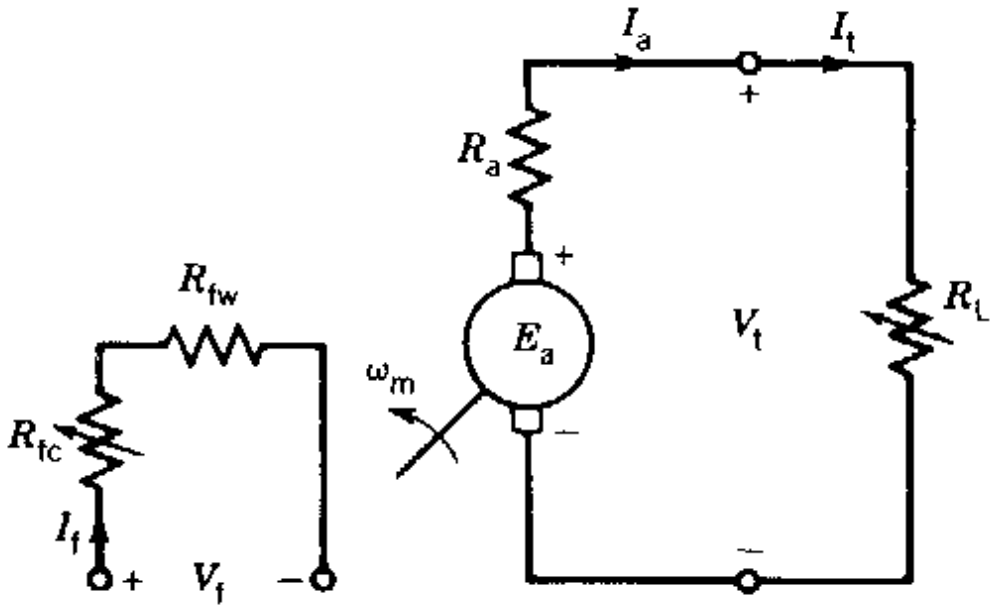
- Separately excited DC machine
- Series DC machine
- Shunt DC machine
- Compound DC machine
  - Long Shunt
  - Short Shunt

Classification of DC Machines

(Sect 4.2.7 and Fig. 4.27)



Voltage Drop Equation (Fig. 4.28)



From Fig. 4.28: $V_t = E_a \pm R_a I_a$

(where (+) for Motor and (–) for Generator)

Armature Circuit Ex 1

A shunt motor is running off a 220V supply taking an armature current of 15A, the resistance of the armature circuit being 0.8Ω. Calculate the value of the generated emf. If the flux were suddenly reduced by 10 per cent, to what value would the armature current increase momentarily?

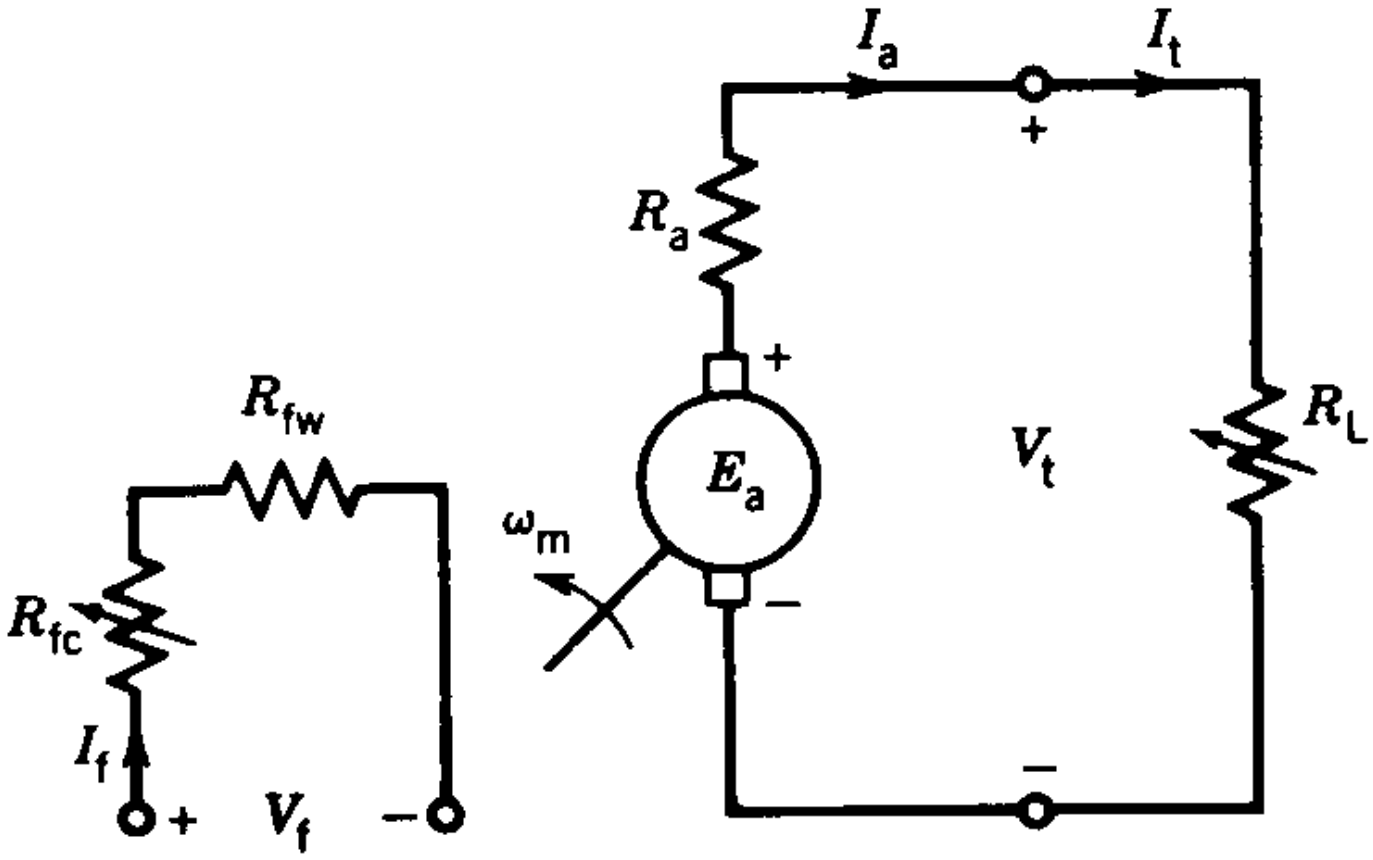
(ans: 187.2V, 41A)

DC Generators

1. Separately Excited Generator
2. Shunt Generator
3. Series Generator
4. Compound Generator
   - Long Shunt
   - Short Shunt

Separately Excited Generator

(sect. 4.3.1 and Fig. 4.28)



Separately Excited Generator

(sect 4.3.1 and Fig. 4.28)

$$V_f = R_f I_f$$

$$E_a = V_t + I_a R_a$$

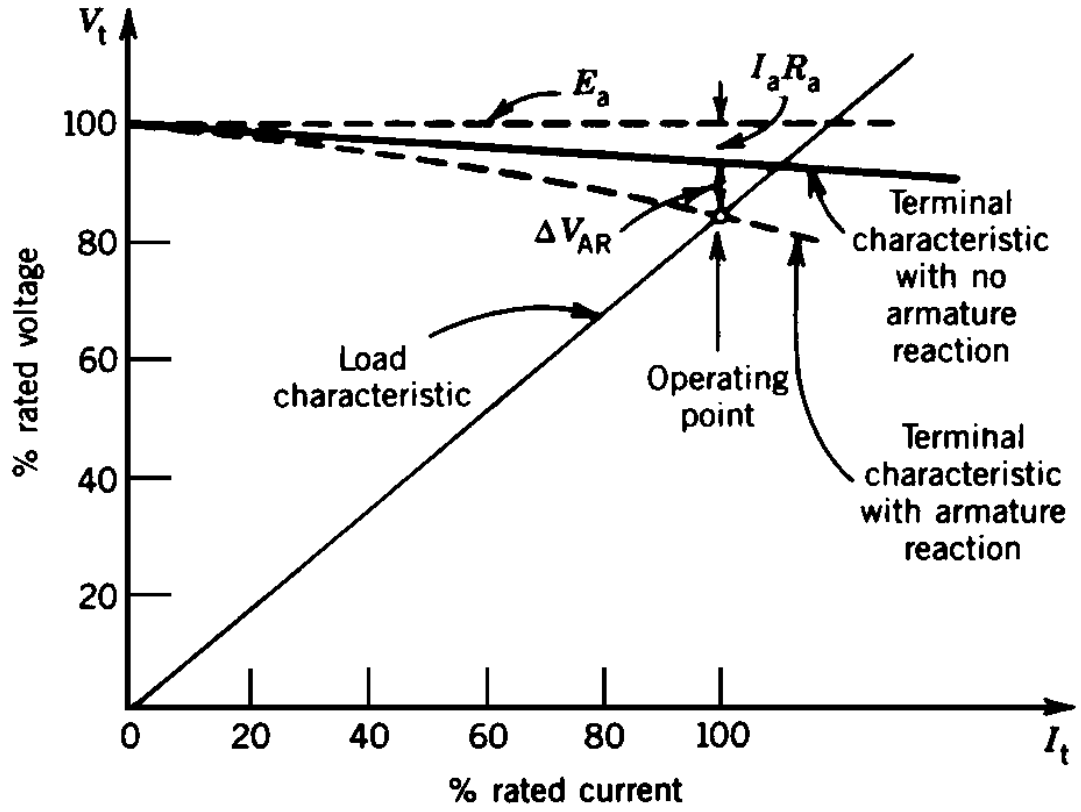
$$E_a = K_a \Phi \omega_m$$

$$V_t = I_t R_L$$

$$I_a = I_t$$

Separately Excited Generator (1/2)

- External Characteristic of a Separately excited DC Generator (see Fig. 4.29)



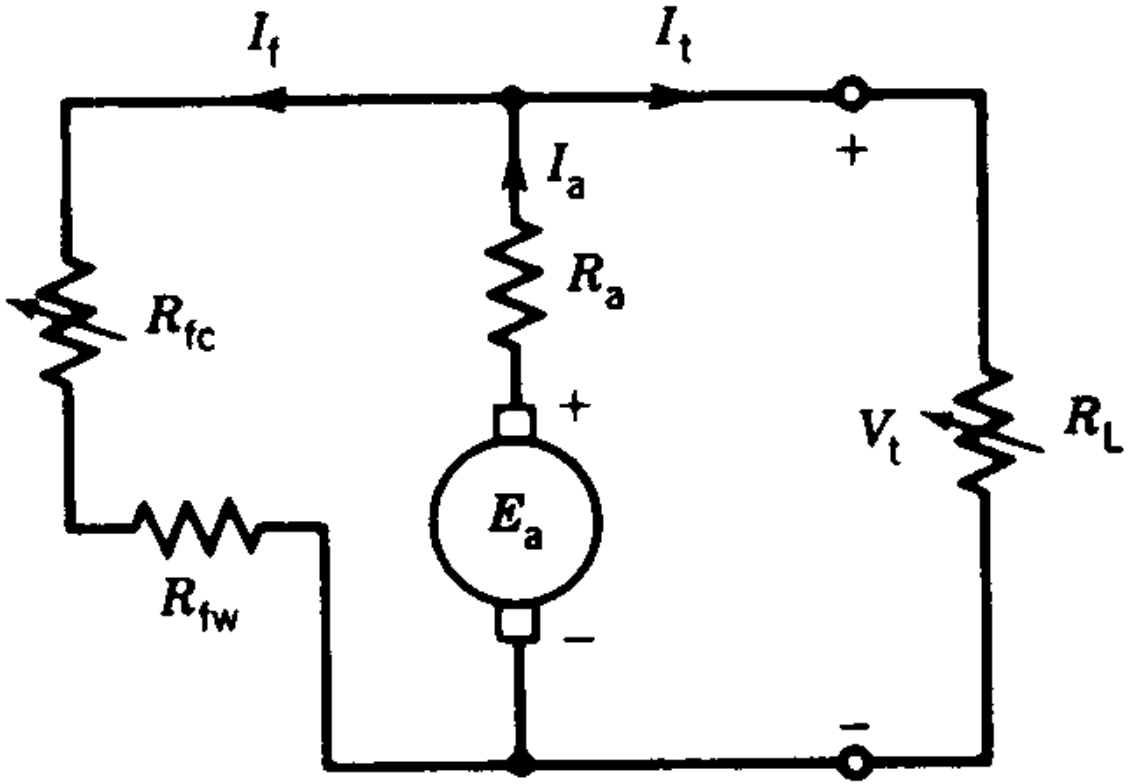
Separately Excited Generator (2/2)

- Terminal Characteristic
- Load Characteristic
- Dropping of terminal voltage:
  - I_aR_a drop
  - reduction of flux due to AR
- Example 4.2 (P.151)

Electrical Machines 1

Hour 5

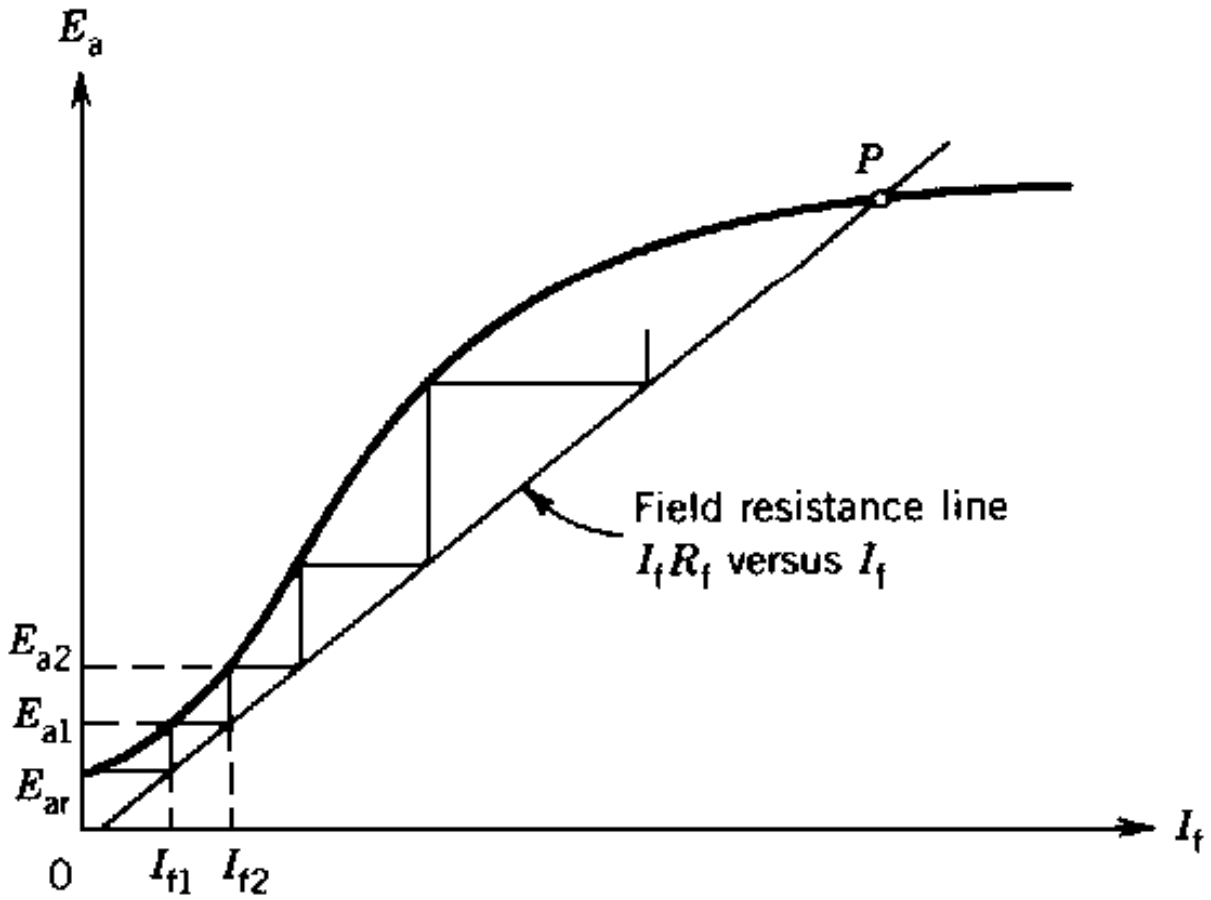
Shunt (Self-excited) Excited Generator (Sect. 4.3.2)



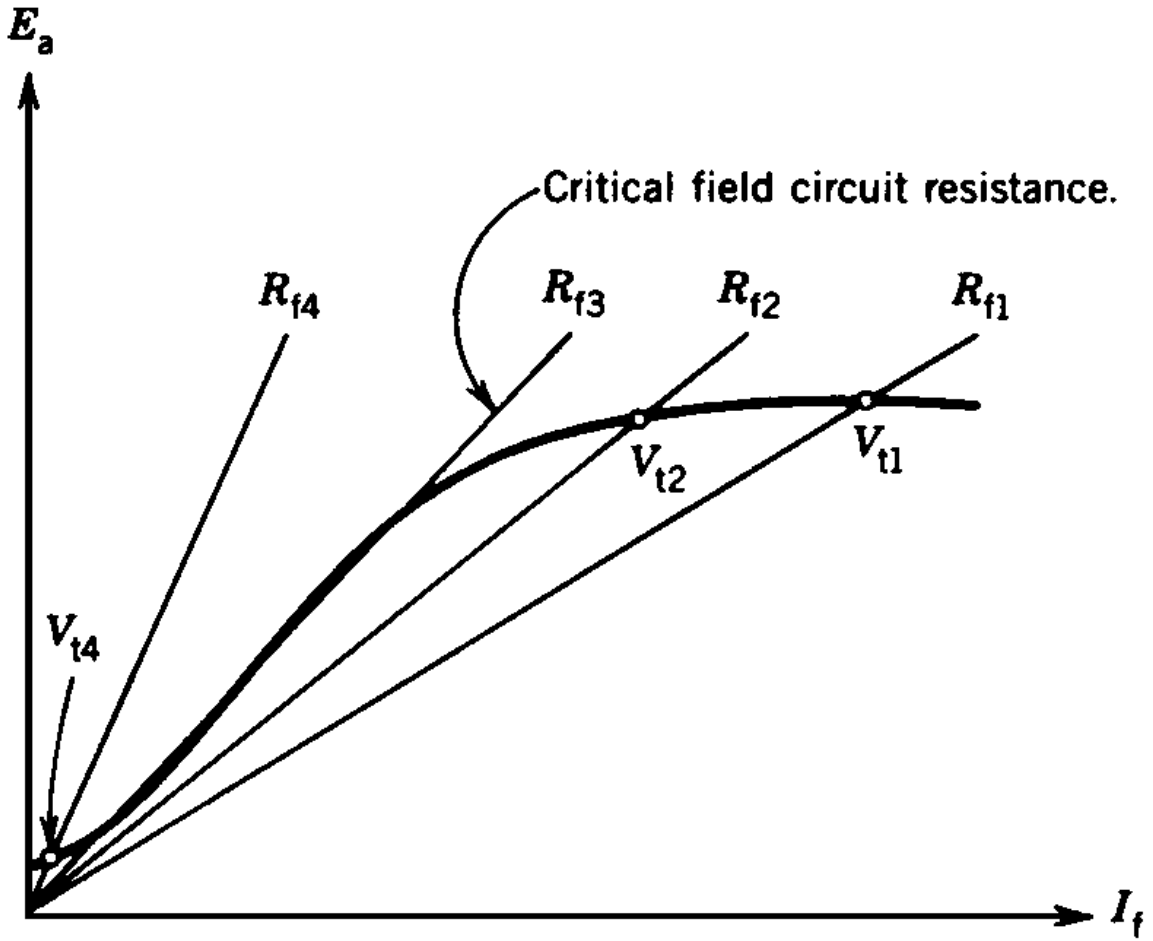
Shunt (Self-excited) Excited Generator (Sect. 4.3.2)

- Problem to Building-up emf (Fig.4.35)
- Effect of field resistance (Fig.4.36)
- Critical Field Circuit Resistance

Building-up of emf (Fig. 4.35)



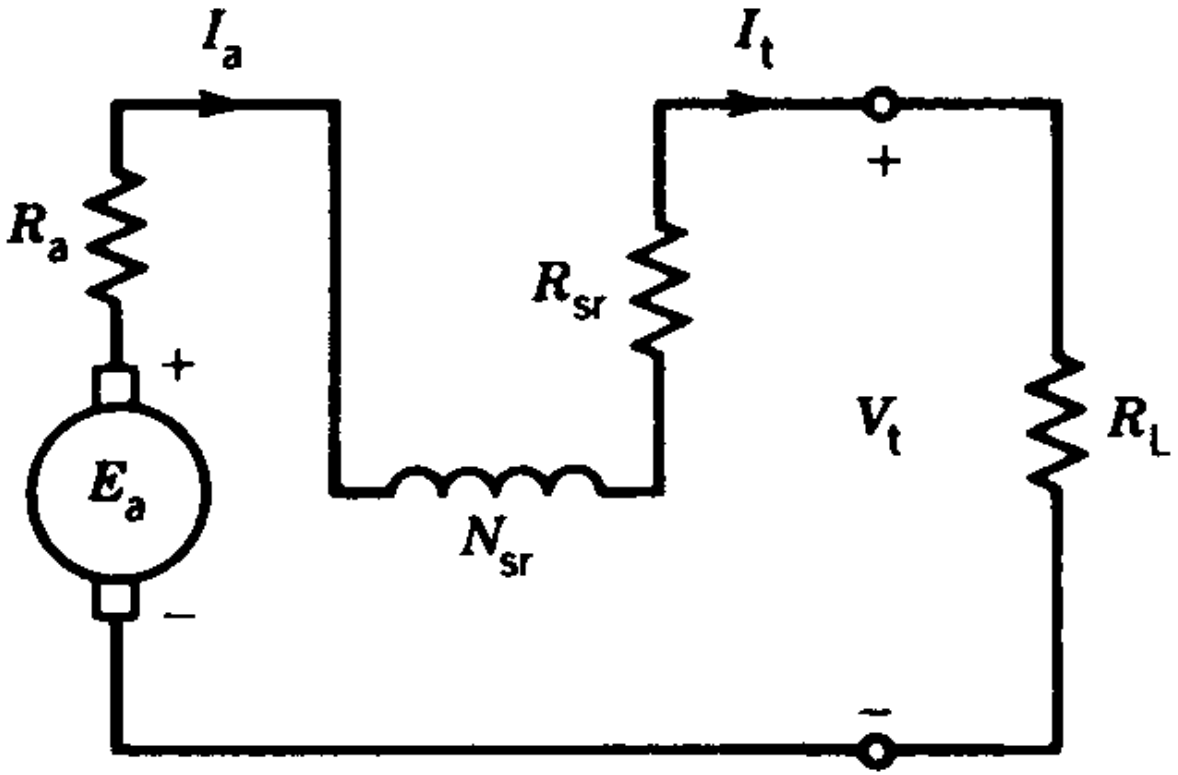
Effect of Field Resistance (Fig. 4.36)



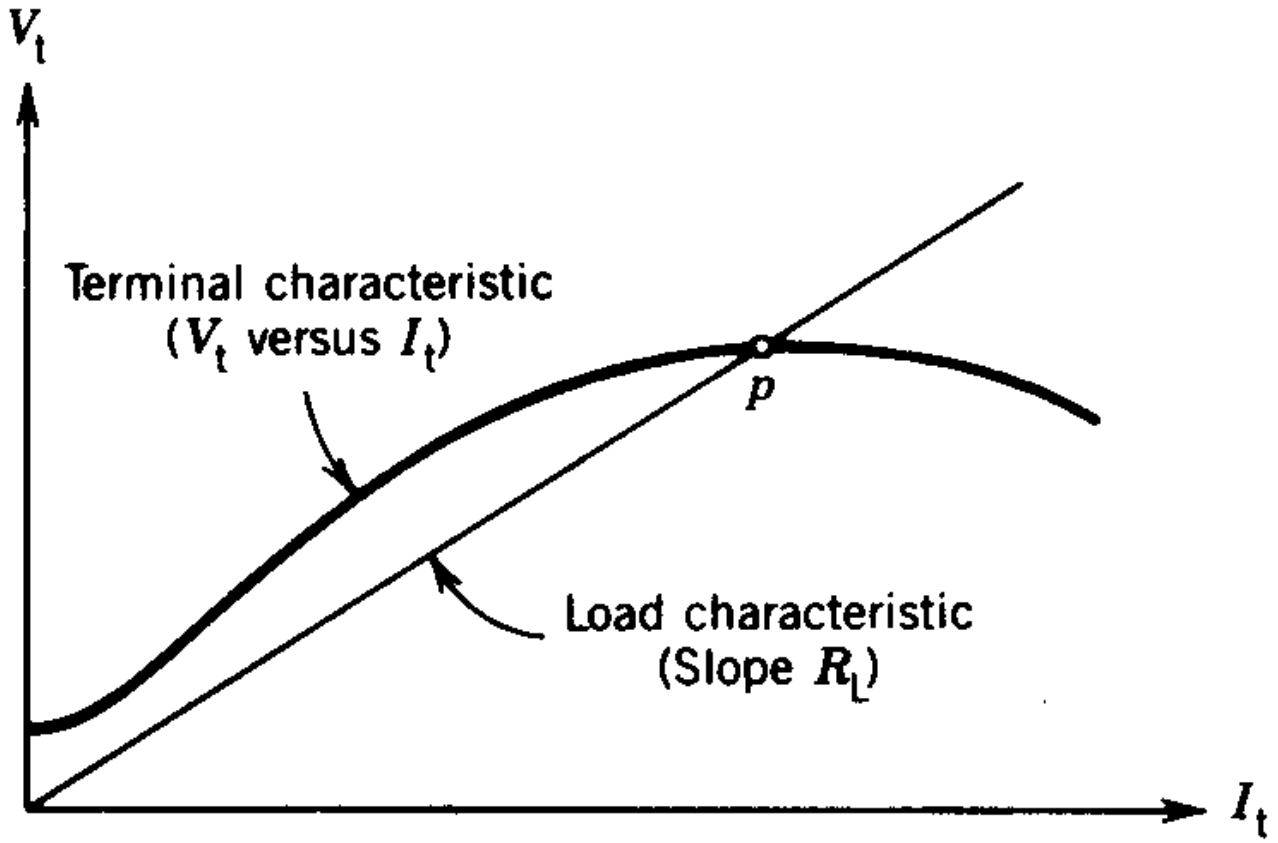
Shunt (Self-excited) Excited Generator (Sect. 4.3.2)

- 3 conditions for building-up of voltage:
  - Residual magnetism must be present in the magnetic system
  - Field winding mmf should aid the residual magnetism
  - Field circuit resistance should be less than the critical field circuit resistance
- Example 4.3 (P.154)

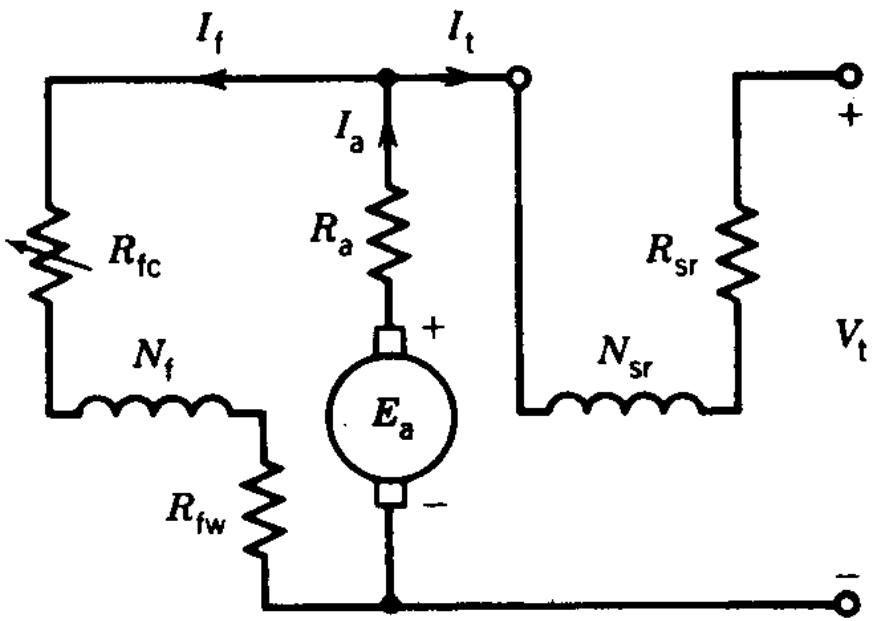
Series Generator (Sect. 4.3.4)

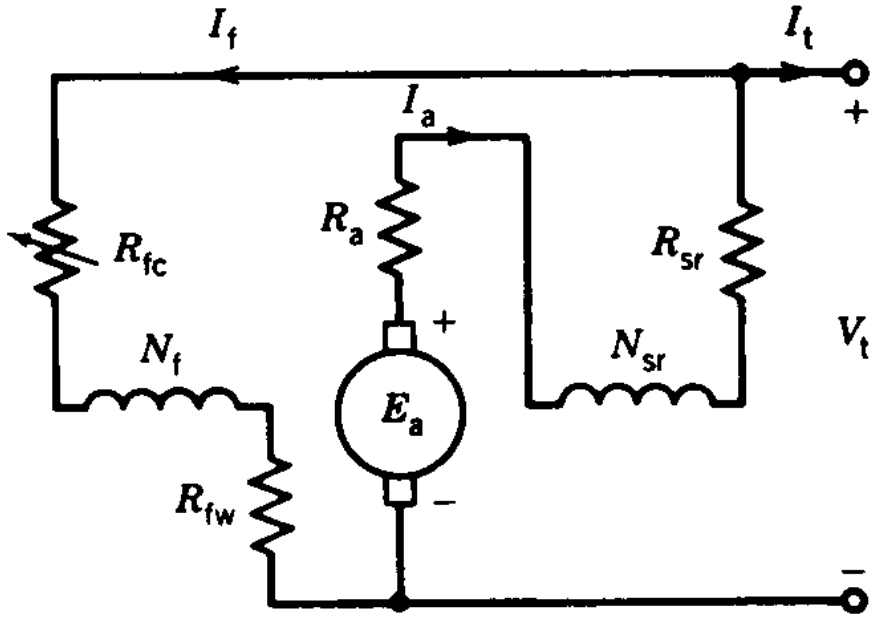


External Characteristic of Series Generator (Fig. 4.45)



Compound Generator (Sect. 4.3.3)





V-I Characteristic of Compound Generator (Fig. 4.42)