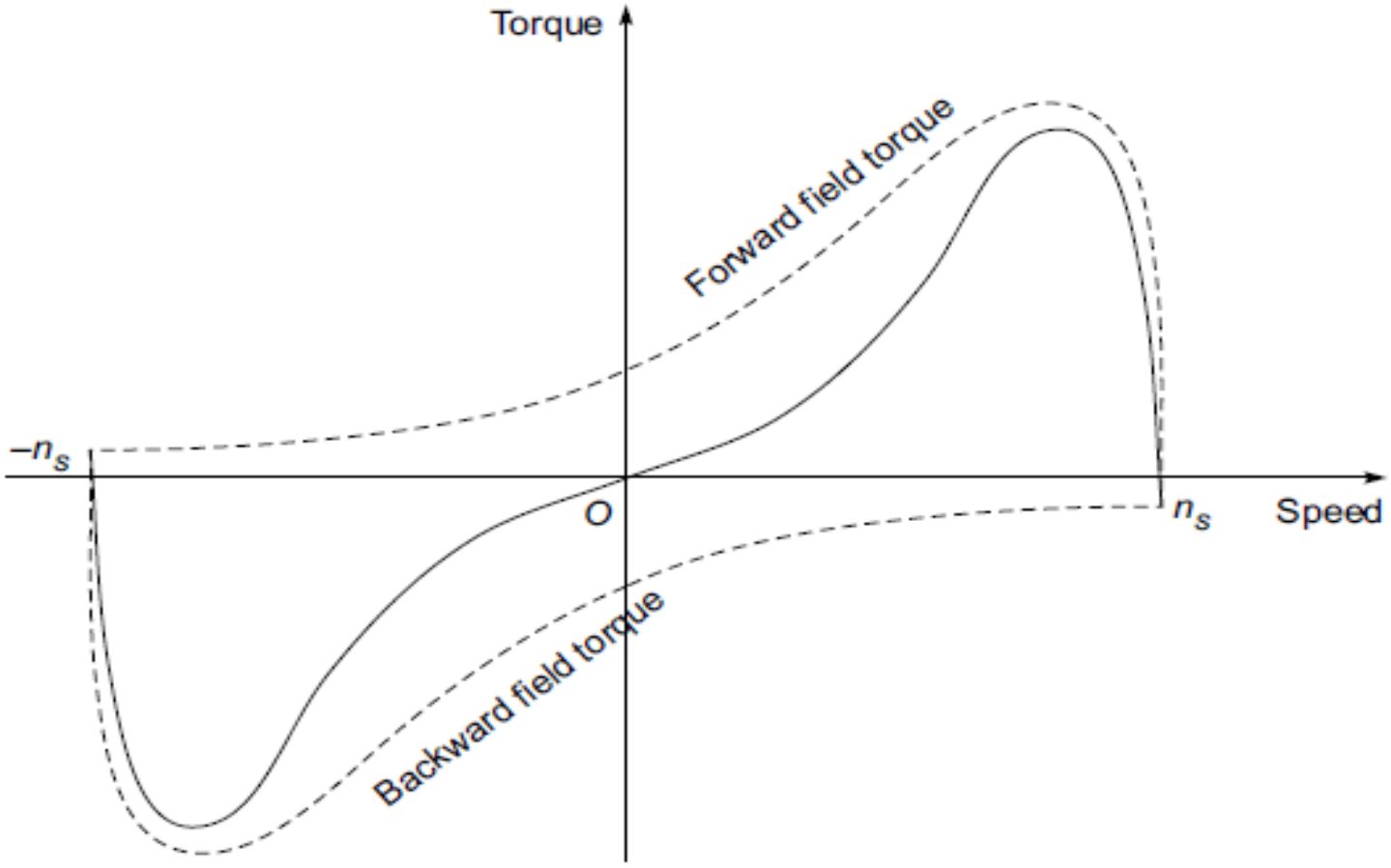
Single ph. I.M.

Module-4
Lecture -31

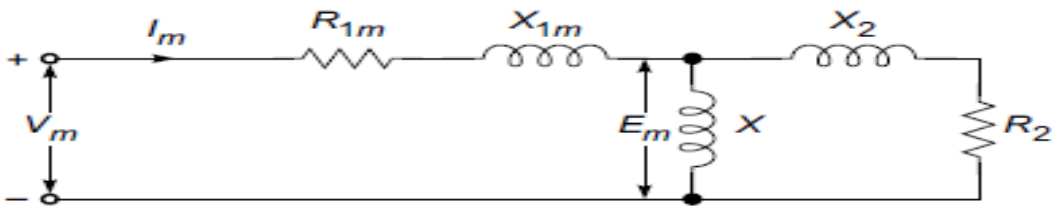
- Topic covered as:

  ✓Torque slip characteristic of Single ph I.M
  ✓Equivalent circuit

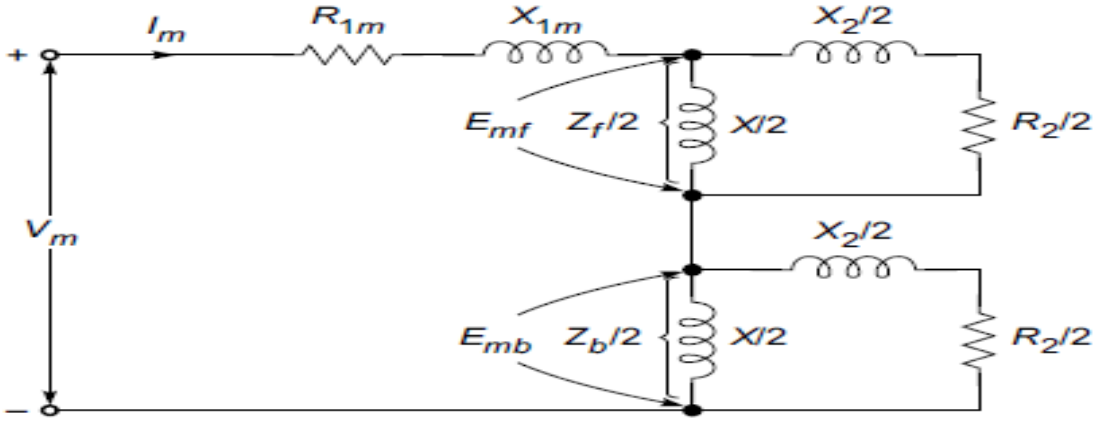
Torque slip characteristic of single winding 1 ph I.M



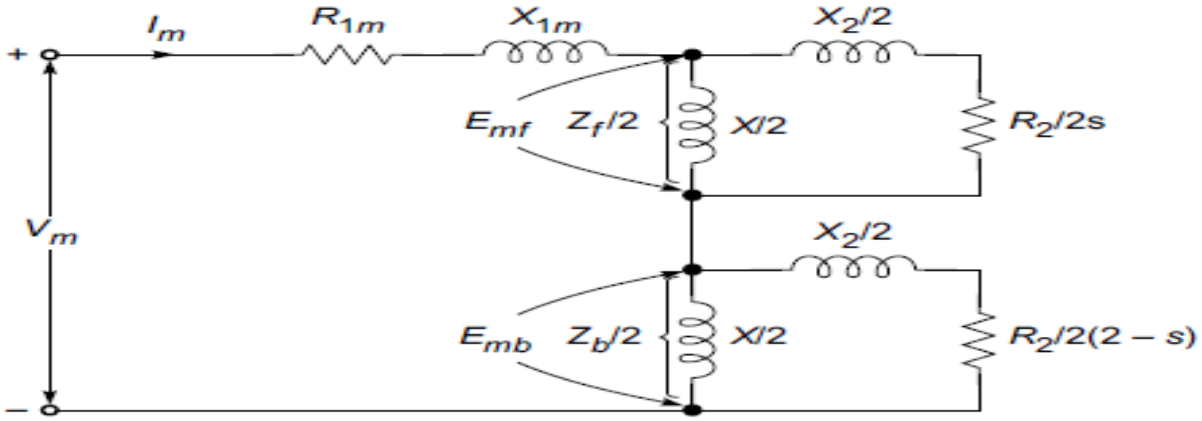
Equivalent circuit of single ph I.M



(a) Transformer equivalent of single-phase motor with rotor stationary



(b) Rotating field equivalent of single-phase motor with rotor stationary



(c) Rotating field equivalent of single-phase motor under running condition

- The performance of a single-phase induction motor can be obtained by analysis of the circuit model of the motor.

The air-gap powers for the forward and backward fields are given by

- $\text{Air} - \text{gap power for forward field} = \quad P_{gf} = \frac{1}{2} {I_m}^2 R_f$
- Air-gap power for backward field $P_{gb} = \frac{1}{2} {I_m}^2 R_b$

Here, I_m =main winding current

R_f *and* R_b are the real parts of the complex number impedances Z_f and Z_b

- The torques produced by the two fields can be expressed as

$$T_f = \frac{1}{\omega_s} P_{gf}$$

$$T_b = \frac{1}{\omega_s} P_{gb}$$

- Resultant torque developed is

$$T = T_f - T_b$$

$$T = \frac{1}{\omega_s}(P_{gf} - P_{gb}) = \frac{I_m^2}{2\omega_s}(R_f - R_b)$$

- Rotor copper-loss corresponding to forward field= sP_{gf}
- Rotor copper $-$ loss corresponding to backward field $= (2 - s)P_{gb}$
- Total rotor copper-loss= $sP_{gf} + (2 - s)P_{gb}$
- gross mechanical Power $P_m = (1 - s)\omega_s T$

$$P_m = (1 - s)\,(P_{gf} - P_{gb})$$

$$P_m = (1 - s)\,P_{gf} + [1 - (2 - s)]\,P_{gb}$$