RAMA UNIVERSITY

www.ramauniversity.ac.in

FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-ii

Amit Kumar Singh

SLIP

- The force exerted by the rotor bars causes the rotor to turn in the direction of the rotating magnetic field.
- The difference between the rotor speed, n_r, and the synchronous speed, ns, is called the **Slip Speed**.

$$\text{Slip Speed} = n_s - n_r \quad (\text{rpm or rev/s})$$

- The ratio $(n_s - n_r)/ n_s$ is called the **Fractional Slip** or just the **Slip**, s, and is usually expressed as a percentage. Thus

$$Slip\ ,\ S = (n_s - n_r)/ n_s$$

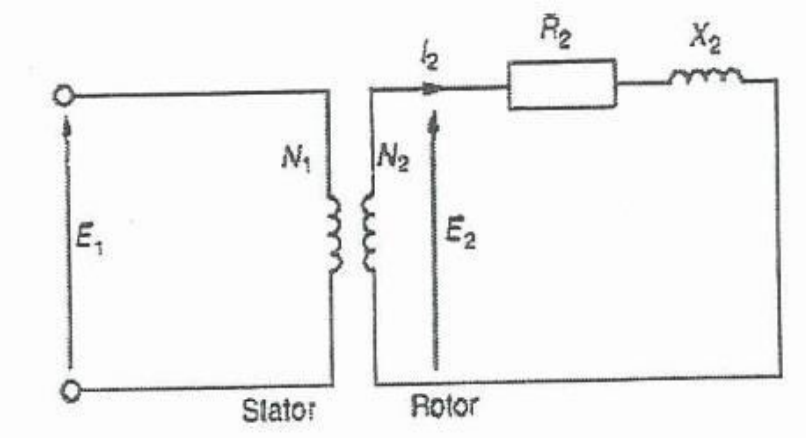
- Typical values of slip between no load and full load are about 4 to 5 per cent for small motors and 1.5 to2 per cent for large motors.

Rotor E.M.F. and Other Parameters

• Rotor e.m.f

When an induction motor is stationary, the stator and rot

- when running, rotor e.m.f. per phase = $E_r = SE_2$
- $$E_2 = S \frac{N_2}{N_1} E_1$$



• Rotor Frequency

The rotor e.m.f. is induced by an alternating flux and the rate at which the flux passes the conductors is the slip speed. Thus the frequency of the rotor e.m.f. is given by:

$$F_r = (n_s - n_r)\, p = (n_s - n_r)\, p \times (n_s / n_s)$$

However $(n_s - n_r)/n_s$ is the slip S and $(n_s p)$ is the supply frequency f,

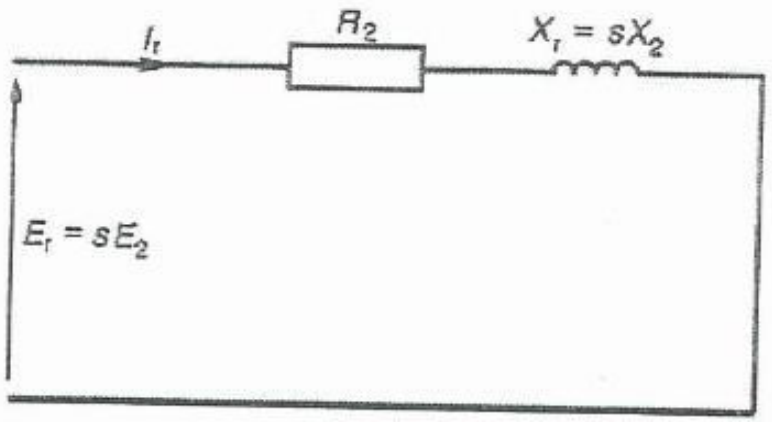
Hence, $f_r = S f$

• Rotor Resistance

The rotor resistance R_2 is unaffected by frequency or slip, and hence remains constant.

$X_r = 2\pi f_r L$
$= 2\pi (S f) L$
$= S (2\pi f L)$

$\boldsymbol{X_r = S X_2}$



- ## Rotor Impedance

Rotor impedance per phase,

when running: $Z_r = \sqrt{R_2^2 + s\,X_2^2}$

At standstill, slip $S = 1$, then: $Z_r = \sqrt{R_2^2 + X_2^2}$

- ## Rotor Current

At standstill ($S=1$), starting current: $I_2 = E_2 / Z_2$

Rotor current, when running: $I_r = E_r / Z_r$