N_s = speed of rotating magnetic field.

N = speed of rotor.

N_s-N = relative speed.

- If rotor catches the speed of rotating magnetic field the relative motion between rotor speed & speed of rotating field vanishes.
- Relative speed is main cause of induced emf in rotor. i.e. N_s –N =0, induced emf will vanish & hence there will not be rotor current & flux which is required to produce torque on rotor. Eventually the motor stops.
- Immediately there will exist a relative motion N_s – N & motor will start.
- But due to inertia of rotor this does not happen in practice & rotor continues to rotate with a speed slightly less than synchronous speed of rotating magnetic field.
- So induction motor never rotates at synchronous speed.

$N < N_s$

So it can be said that rotor slip behind the rotating magnetic field produced by stator.

- The difference between rotor speed & synchronous speed is called **slip speed** of motor.

Slip speed = $N_s – N$

- The slip speed is generally expressed as the % of synchronous speed of the rotating magnetic field.
- Slip is defined as difference between synchronous speed (N_s) & actual speed (N) expressed as a fraction of synchronous speed (N_s).

$$S = \frac{Ns - N}{Ns} \text{ ---------- (absolute slip)}$$

$$\% S = \frac{Ns - N}{Ns} * 100 \text{---------- (\% slip)}$$

At start, M=0 ∴ S = 1

This is maximum slip and minimum slip is zero for which $N=N_s$.

- Actually motor rotates in slip range of 1% to 5%.

$$N_s = \frac{120f}{p} \quad \& \quad N_s - N = \frac{120f'}{p}$$

$$\frac{f'}{f} = \frac{Ns - N}{Ns} = S$$