# RELATIONSHIP BETWEEN AIR GAP POWER, LOSSES, GROSS AND NET TORQUE



STATOR COPPER LOSS

$I^2R$ LOSS

IRON LOSS

$I^2R$ LOSS

WINDAGE & FRICTION LOSS

ACTIVE POWER TO STATOR

$P_s$

MECHANICAL POWER

SHAFT POWER

$P_{sf}$

$P_0$ ACTIVE POWER SUPPLY TO ROTOR
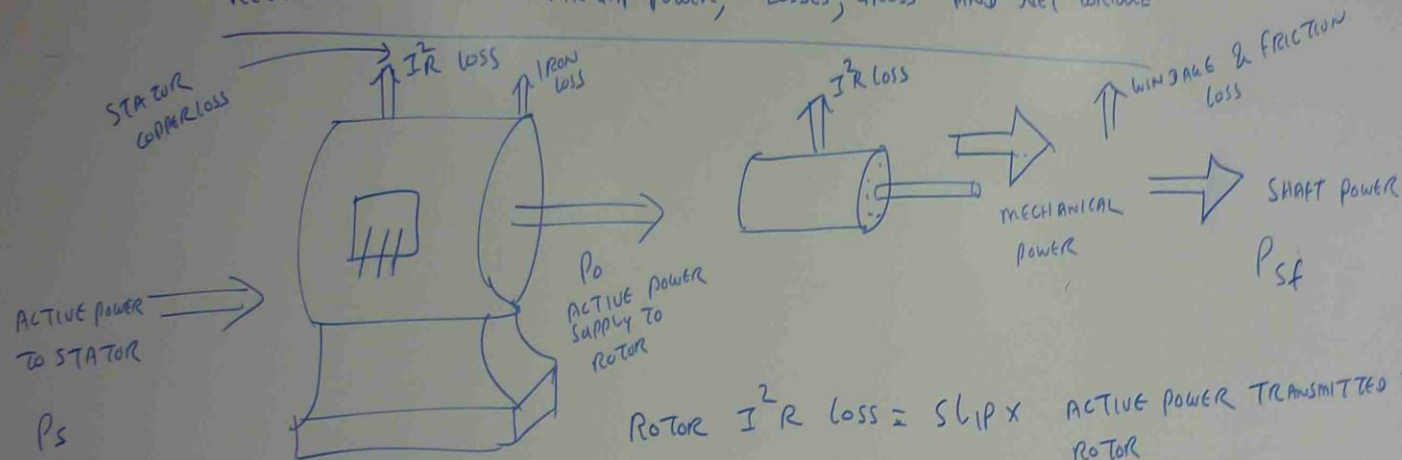
ROTOR $I^2R$ LOSS = SLIP × ACTIVE POWER TRANSMITTED TO ROTOR

$$= SLIP \times P_0$$

$$n_s = \frac{f}{P/2}$$

MECHANICAL POWER DEVELOPED BY ROTOR $(P_m)$ = ACTIVE POWER TRANSMITTED TO ROTOR − ROTOR $I^2R$ LOSS

$$= P_0 - \textcircled{S} \, P_0$$

$$P_m = (1 - \textcircled{S}) \, P_0$$

$$P_m = \frac{ROTOR \; SPEED \times MECHANICAL \; TORQUE}{9.55} \quad WATT$$

MECHANICAL POWER DELIVERED TO LOAD = $P_m$ − FRICTION AND WINDAGE LOSSES

MECHANICAL TORQUE = $\dfrac{P_m \times 9.55}{ROTOR \; SPEED}$

$$T_m = \frac{P_m \times 9.55}{(1 - \textcircled{S}) \; SYNCHRONOUS \; SPEED}$$