SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

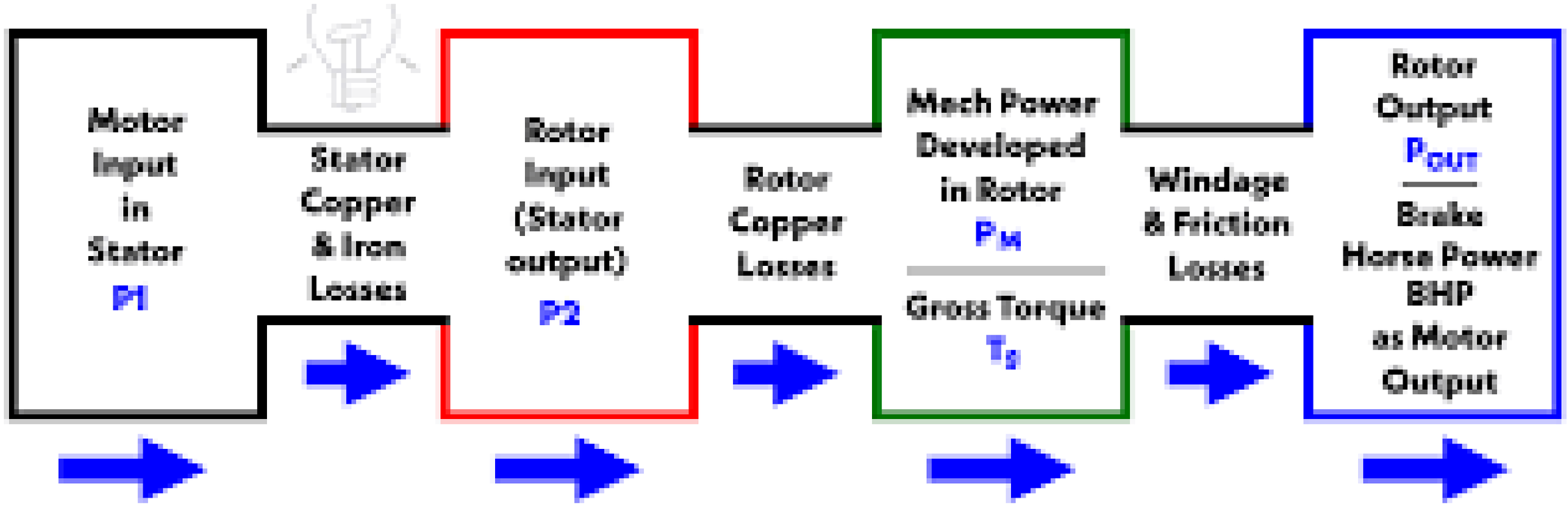
COURSE NAME : 19EE401 SYNCHRONOUS AND INDUCTION MACHINES

II YEAR /IV SEMESTER

Unit 3: INDUCTION MOTOR

Topic 4 : Power Stages of Three Phase Induction Motor

Power Flow Diagram of Three Phase Induction Motor



Power Flow Diagram of Three Phase Induction Motor

Stator Input power of the motor $P_1 = 3V_1 I_1 cos\theta$

Where cosθ is the input power factor

The **losses** in the stator are

I^2R losses in the stator winding resistances. It is also known as **Stator copper losses.** $P_{scu} = 3I_1^2 R_1$

Hysteresis and **Eddy current** losses in the stator core. These are known as **Stator core losses**.

$$P_{iron} = P_{hys} + P_{eddy}$$

The output power of the stator is given as:

$$P_{statoro/p} = P_1 - (P_{scu} + P_{iron})$$

Power Flow Diagram of Three Phase Induction Motor

This output power of the stator is transferred to the rotor of the machine across the air gap between the stator and the rotor. It is called the **air gap P_2** of the machine. $$P_2 = P_{Statoro/p}$$

The losses in the rotor are as follows.

I^2R losses in the rotor resistance. They are also called **Rotor copper losses** and represented as: $$P_{rcu} = 3I_2^2 R_2$$

If the rotor copper losses are subtracted from rotor input power P_2, the remaining power is converted from electrical to mechanical form. This is called **Developed or gross Mechanical Power P_m.**

$$P_m = P_2 - P_{rcu}$$

Power Flow Diagram of Three Phase Induction Motor

Gross Mechanical Power $P_m = \frac{2\pi N_r T_d}{60}$

Rotor Input Power $P_2 = \frac{2\pi N_s T_d}{60}$

Rotor Copper loss $P_{rcu} = \frac{2\pi T_d (N_s - N_r)}{60}$

(Rotor Copper loss/Rotor Input Power) $\frac{P_{rcu}}{P_2} = \frac{N_s - N_r}{N_s}$

Rotor Copper loss $P_{rcu} = sP_2$

Output Power $P_o = P_m - P_{fw}$

References

1.Kothari, D.P., Nagrath, I.J., “Electric Machines”, McGraw Hill Publishing Company Ltd, 5th Edition, 2017.

2. Murugesh Kumar, K., “Induction and Synchronous machines”, Vikas Publishing House Private Ltd, 2016.

Thank You