# SWITCHED RELUCTANCE MOTOR

Basic Voltage equation of SRM is given by

$$V = Ri + \frac{d\lambda}{dt} \quad [\lambda = Li]$$

where,

$V \rightarrow$ input Voltage

$i \rightarrow$ Current through phase winding

$R \rightarrow$ resistance of phase winding

$\lambda \rightarrow$ flux linkage $= Li$

$$\frac{d\lambda}{dt} = \frac{d(Li)}{dt}$$

$$\frac{\partial \lambda}{\partial t} = \frac{\partial i}{\partial t}(L) + \frac{\partial L}{\partial t}(i)$$

$$= L\frac{\partial i}{\partial t} + i\frac{\partial L}{\partial \theta}\cdot\frac{d\theta}{\partial t}$$

$$= L\frac{\partial i}{\partial t} + i\omega\frac{\partial L}{\partial \theta} \quad \text{where } \omega = \frac{\partial \theta}{\partial t}$$

$$V = iR + L\frac{\partial i}{\partial t} + i\omega\frac{\partial L}{\partial \theta} \quad \text{---(1)}$$

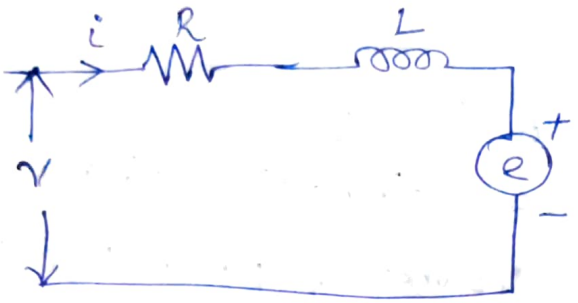
$$V = iR + L\frac{\partial i}{\partial t} + e \quad \text{---(2)}$$

It is the voltage eq of SEM.

where R → resistive drop

$L \frac{\partial i}{\partial t}$ → emf due to inductance

$i\omega \frac{\partial L}{\partial \theta} = e$ → self emf.




eq. circuit

Xply i on both sides in eq (1)

$$Vi = \left( Ri + L\frac{\partial i}{\partial t} + i\omega \frac{\partial L}{\partial \theta} \right) i$$

$$= i^2R + Li\frac{\partial i}{\partial t} + i^2\omega \frac{\partial L}{\partial \theta} \quad \text{—(3)}$$

where.

$Vi$ = electrical power supplied (W)

$i^2R$ = resistive losses.

$Li\frac{\partial i}{\partial t}$ = power associated with incremental inductance

$i^2\omega \frac{\partial L}{\partial \theta} = ei$ → power due to self emf

Stored energy in magnetic field $= \frac{1}{2} L i^2$

Power associated with change in stored energy $= \frac{dW_{st}}{dt}$

$$\frac{dW_{st}}{dt} = \frac{1}{2} L (2i) \frac{\partial i}{\partial t} + \frac{1}{2} i^2 \frac{\partial L}{\partial t}$$

$$= Li \frac{\partial i}{\partial t} + \frac{1}{2} i^2 \frac{\partial L}{\partial \theta} \cdot \frac{\partial \theta}{\partial t}$$

$$= Li \frac{\partial i}{\partial t} + \frac{1}{2} i^2 \omega \frac{\partial L}{\partial \theta} \quad \text{—— (4)}$$

$P_m = Vi - i^2R$ – power associated with change in stored energy

$$= Vi - i^2R - \frac{dW_{st}}{dt} \quad \text{—— (5)}$$

Sub eq (3), (4) & (5)

$$P_m = \frac{1}{2} i^2 \omega \frac{\partial L}{\partial \theta} \quad \text{—— (6)}$$

Torque developed by motor

$$T = P_m / \omega$$

$$T = \frac{1}{2} i^2 \frac{\partial L}{\partial \theta} \ N\text{-}m$$