RAMA UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Machine-ii

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TYPES OF MOTORS USED IN ELECTRIC DRIVE

Most commonly used electrical machines for speed control applications are the following

DC Machines

Shunt, series, compound, separately excited DC motors and switched reluctance machines.

AC Machines

Induction, wound rotor, synchronous, PM synchronous and synchronous reluctance machines.

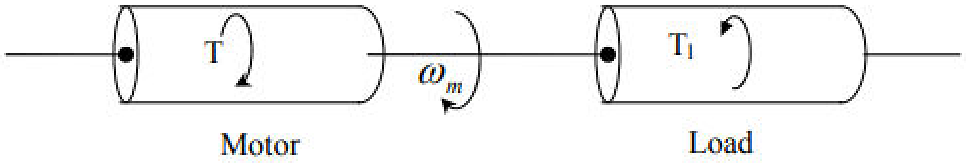
Special Machines

Brush less DC motors, stepper motors, switched reluctance motors are used.

Fundamentals of Torque Equations

A motor generally drives a load (Machines) through some transmission system. While motor always rotates, the load may rotate or undergo a translational motion.

Load speed may be different from that of motor, and if the load has many parts, their speed may be different and while some parts rotate others may go through a translational motion. Equivalent rotational system of motor and load is shown in the figure.



Notations Used:

J = Moment of inertia of motor load system referred to the motor shaft 2kg/m2

ω m = Instantaneous angular velocity of motor shaft, rad/sec.

T = Instantaneous value of developed motor torque, N-m

Tl = Instantaneous value of load torque, referred to the motor shaft N-m

Load torque includes friction and wind age torque of motor. Motor-load system shown in figure can be described by the following fundamental torque equation.

$$T - T_l = \frac{d}{dt}(J\omega_m) = J\frac{d\omega_m}{dt} + \omega_m\frac{dJ}{dt} \text{------------ (1)}$$

Equation (1) is applicable to variable inertia drives such as mine winders, reel drives, Industrial robots. For drives with constant inertia dj /dt =0

$$\therefore T = T_l + J\frac{d\omega_m}{dt} \text{-------------} (2)$$

Equation (2) shows that torque developed by motor is counter balanced by load torque Tl and a dynamic torque $\left(J\frac{d\omega_m}{dt}\right)$ Torque component $\left(J\frac{d\omega_m}{dt}\right)$ is called dynamic torque because it is present only during the transient operations.

Energy associated with dynamic torque $\left(J\frac{d\omega_m}{dt}\right)$ is stored in the form of kinetic energy given by $\frac{J\omega_m^{2}}{2}$