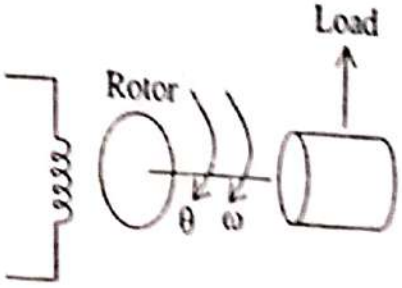
Tachometers

Tacho generator is electromechanial device which produces an output voltage proportional to its shaft speed. It can be employed as an analogouse speed indicator, velocity feedback device or signal integrator. Two of the most commonly used tacho generators are dc and ac tacho generators.

A.C Tachometer A.C Tachometer



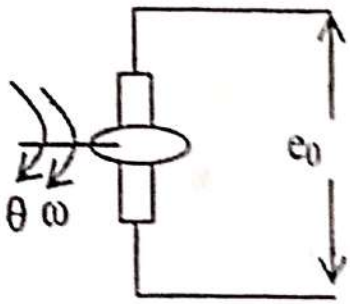
Its construction is similar to 2–ϕ induction motor

Principle of operation

Rotor is stationary the entire flux would be linking the reference winding excited by a constant voltage V_c. As the rotor rotates. This flux gets shifted by 90° to the secondary stator winding placed in quadrature

D.C Tachometer :

D.C Tachometer



Its construction is similar to a D.C generator

Principle of operation:

This is a small D.C generator therefore- an input i.e. shaft speed the out put is in volts proportional to the speed.

Transfer function in terms. of angular displacement

$e_0(t) \propto (d\theta/dt)$ ($e_0 \propto$ speed)

$e_0(t) \propto (d\theta/dt)$, $e_0 = K_t(d\theta/dt)$

where K_t = sensitivity of tachogenerator, volts/(rad/sec)

On taking laplace transform, of equation we get

$E0(s) = K_t s\theta(s)$

$\therefore E_0(s) = K_t s\theta(s)$

Hence this is transfer function of ac tachogenerator

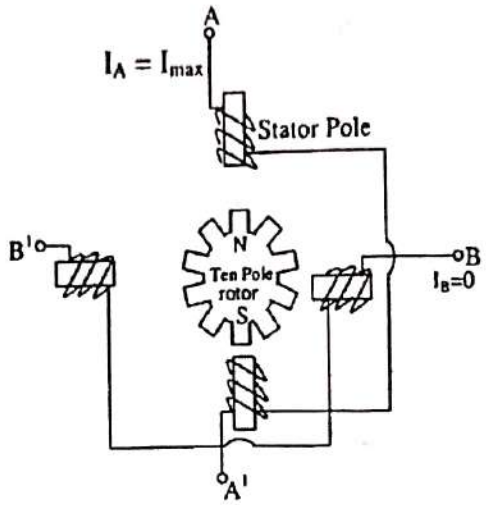
In terms of angular velocity (ω)

$$e_0 \propto \omega$$

$$e_0(s) = K_T\omega(s)$$

$$E_0(s) = K_T\omega(s)$$

Stepper Motor



- The variable reluctance stepper motor has soft iron with number of teeth & a stator which also has teet in addition to number of wound poles.
- When current is applied to the coil in the stator magnetic flux is generated that causes teeth in the roto to line up with teeth in the stator
- When current is switched to the next winding the rotor moves on distance of 1 step angle.

Full step operation:

- Full step operation of stepper motor consists of a movement one full step for each input pulse.

$$\text{Full-step} = \frac{360}{\text{No.of poles} \times \text{No.of stator pole pairs}}$$

- The direction of this current is such that the top stator pole is a south pole and bottom stator pole is north pole. The magnetic attraction between unlike poles will hold the rotor in the position in figure. current of I_m enters the phase B winding and current in phase A is switched OFF. Now the right si stator pole becomes south pole and left side stator pole becomes north [p;e. The top and bottom sta poles are demagnetized. The magnetic attraction and repulsion between unlike poles and like poles h caused the rotor to rotate one step in clockwise direction.

Points to remember

- For half step operation the stator poles currents are reduced to 0.707 I_m i.e. $(I_m/\sqrt{2})$
- For micro step operation to better revolutions $I_A = \cos[(90n)/s]I_m$