



D . C motor characteristics

The characteristic curves of a motor are those curves which show relation between the following quantities .

1. Torque and armature current T_a / I_a
2. Speed and armature current
3. Speed and torque

It is useful to remember that

$$T_a \propto \Phi I_a \quad \text{and} \quad N \propto \frac{E}{\Phi}$$

• Characteristics of series motor

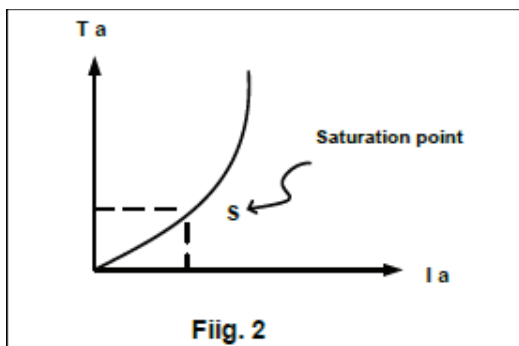
1. T_a / I_a characteristic

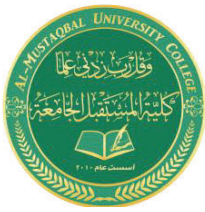
$T_a \propto \Phi I_a$, in this case as field winding also carry the armature current

$\Phi \propto I_a$ up to the magnetic saturation point .

$$T_a \propto I_a^2$$

T_a / I_a curve is parabola up to saturation point as shown in fig . 2 . After this point the curve will be a straight line . It is clear that before point (s) the torque is directly proportional to the I_a^2 , therefore this type is used for loads which need high starting torque .





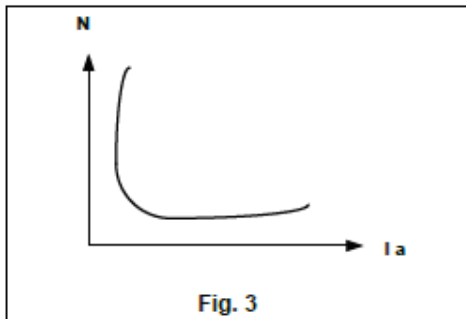
2. N / I a characteristic

Variation of speed can be deduced from the formula

$$N \propto \frac{E}{\Phi}$$

Change in E for various loads current is small . With increased I a , the flux Φ also increased . Hence , speed varies inversely with armature current as shown in fig . 3 .
When load is heavy,

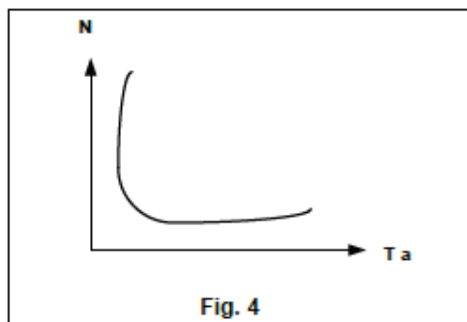
I a is large , hence speed is low . When I a falls to small value , speed become dangerously high . Series motor should never be started without some mechanical load on it .



3. N/T a

The relation between speed and torque can be obtained from T a/I a and N/I a characteristics .

It is found that when speed is high , torque is low and vice versa as shown in fig . 4 .

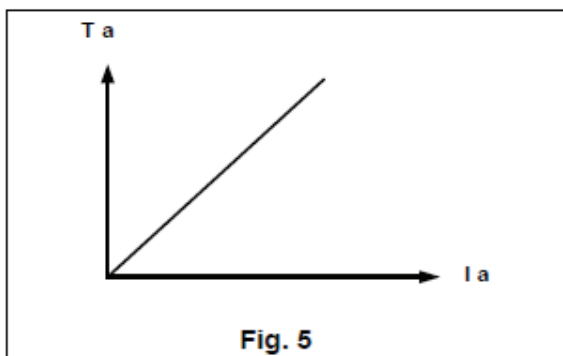


Characteristic of shunt motor :

1. T_a / I_a characteristic

Assuming the flux Φ to be constant (though at heavy loads , flux decrease due to increased in armature reaction. ($T_a \propto I_a$)

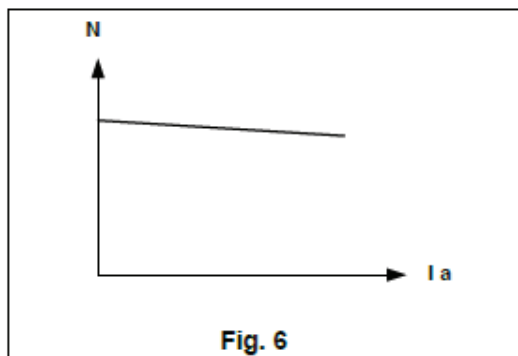
The relationship between T_a and I_a is a straight line through the origin as shown in fig . 5 . Since a heavy starting load need a heavy starting current , shunt motor should never be started on heavy load .



2. N/I_a characteristic

If the flux Φ assumed to be constant then $N \propto E$. As E is also practically constant , speed is for most purpose constant.

In fact both Φ and E decrease with increasing load , therefore there is some decrease in speed as shown in fig .6. Shunt motor is taken as a constant speed motor .





3. $N / T a$

It can be deduced from 1 and 2 above . The relationship between N and $T a$ is shown in fig .7 .

