Breaking Modes

The term braking comes from the term brake. We know that brake is an equipment to reduce the speed of any moving or rotating equipment, like vehicles, locomotives. The process of applying brakes can be termed as braking. Now coming to the term or question **what is braking**. First of all we can classify the term braking in two parts i) mechanical braking and the ii) electrical braking.

Types of Braking

Brakes are used to reduce or cease the speed of motors. We know that there are various types of motors available(DC motors, induction motors, synchronous motors, single phase motors etc.) and the specialty and properties of these motors are different from each other, hence this braking methods also differs from each other.

But we can divide braking in to three parts mainly, which are applicable for almost every type of motors.

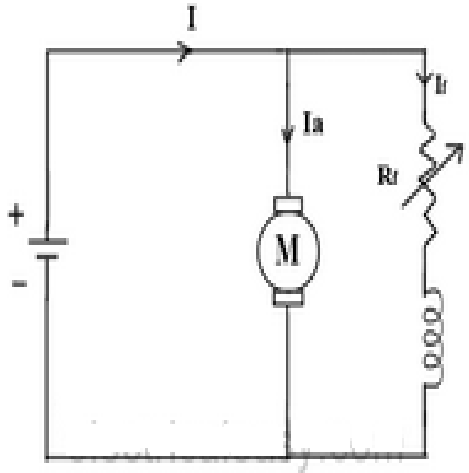
i) Regenerative Braking

ii) Plugging type braking

iii) Dynamic braking.

Schemes for D.C. Motor Speed Control

1. Flux Control Method



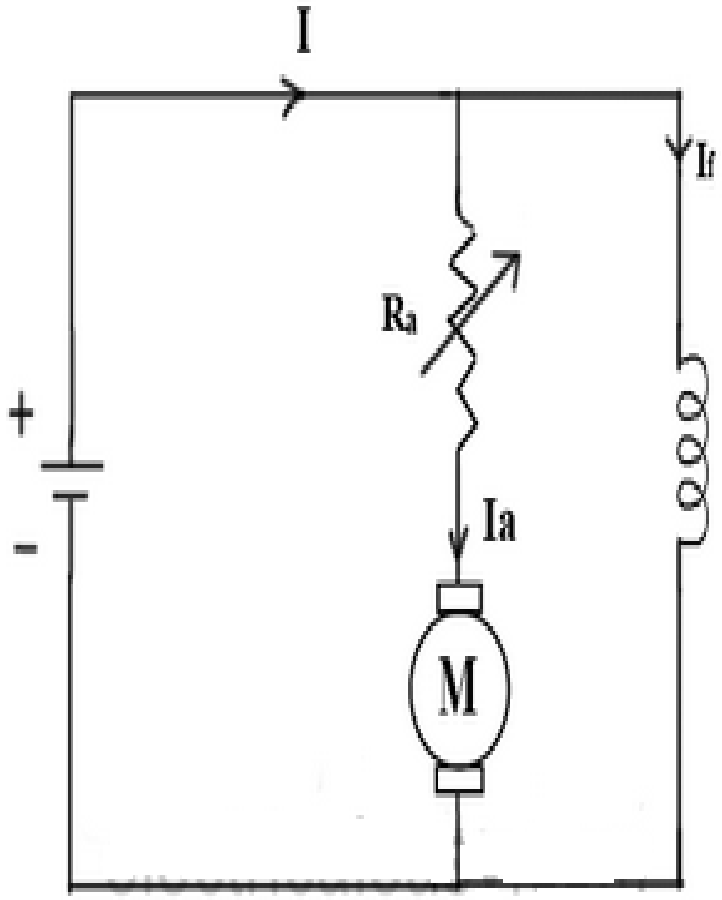
It is seen that **speed of the motor** is inversely proportional to flux. Thus by decreasing flux speed can be increased and vice versa.

To control the flux, a rheostat is added in series with the field winding, as shown in the circuit diagram. Adding more resistance in series with field winding will increase the speed, as it will decrease the flux. Field current is relatively small and hence I^2R loss is small, hence this method is quiet efficient. Though speed can be increased by reducing flux with this method, it puts a limit to maximum speed as weakening of flux beyond the limit will adversely affect the commutation.

2. Armature Control Method

Speed of the motor is directly proportional to the back emf E_b and $E_b = V - I_a R_a$. That is when supply voltage V and armature resistance R_a are kept constant, speed is directly proportional to armature current I_a. Thus if we add resistance in series with armature, I_a decreases and hence speed decreases.

Greater the resistance in series with armature, greater the decrease in speed.



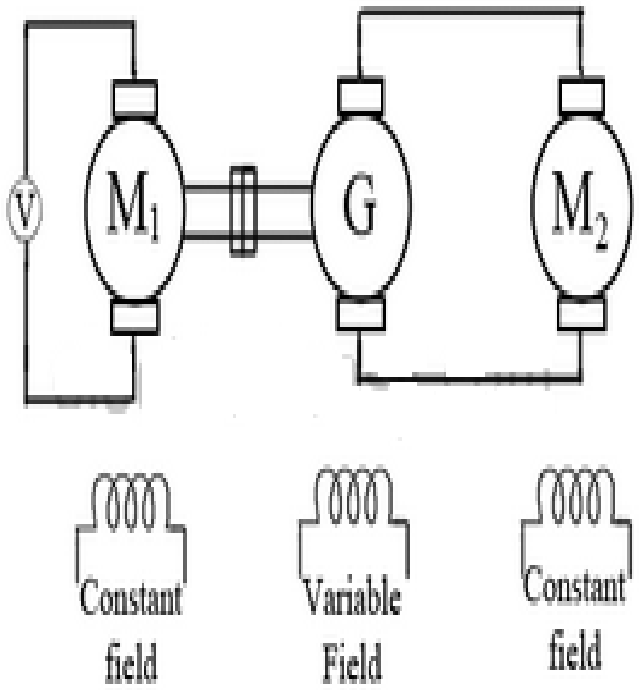
3. Voltage Control Method

A) Multiple voltage control: In this method the, shunt filed is connected to a fixed exciting voltage, and armature is supplied with different voltages. Voltage across armature is changed with the help of a suitable switchgear. The speed is approximately proportional to the voltage across the armature.

B) Ward-Leonard System:

This system is used where very sensitive **speed control of motor** is required (e.g electric excavators, elevators etc.)

The arrangement of this system is as required in the figure beside.



M_2 is the motor whose speed control is required.

M_1 may be any AC motor or DC motor with constant speed.

G is the generator directly coupled to M_1.