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Subject:- Electrical Machine

Final term

A

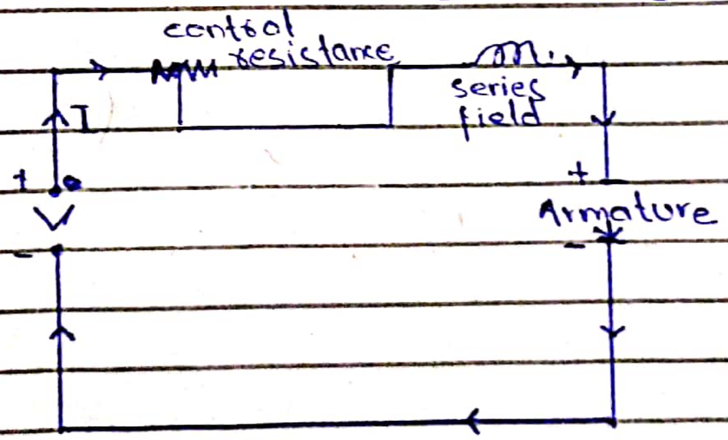
Q1 Discuss any two methods of speed control each for series & shunt wound Dc motors?

Ans:

Speed control of Dc series motors:-

(1) Armature resistance control method:

Here the controlling resistance is connected directly in series with supply of the motor as shown

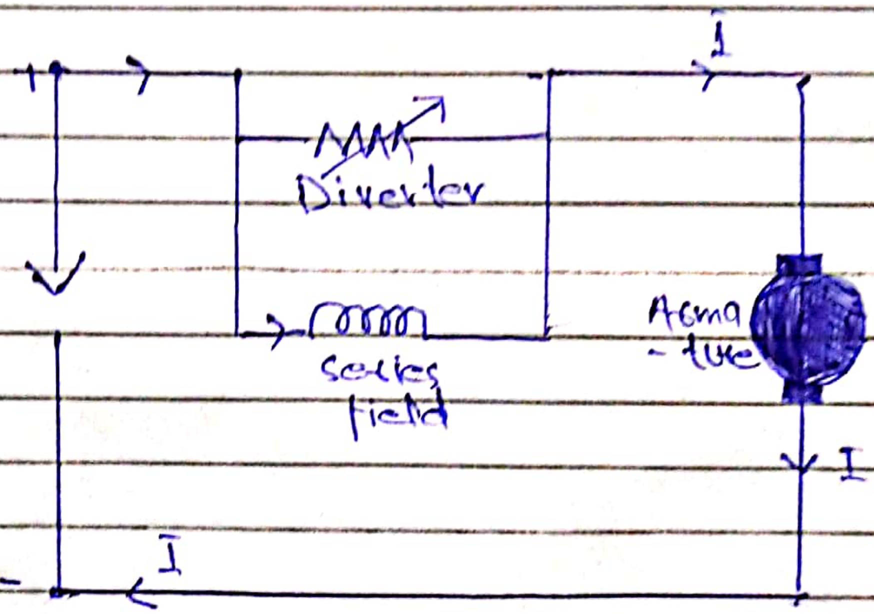


This reduce the voltage available across the armature & hence the speed falls. By changing the value of variable resistance.

This method of speed control is most economical for constant torque.

(2) Field Diverter Method.

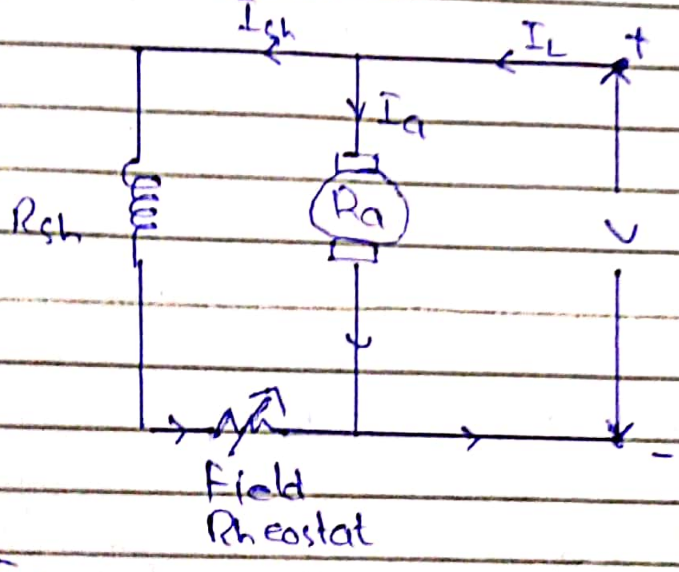
This method uses a diverter. Here the field flux can be reduce by shunting a portion of motors current around the series field. lesser the diverter resistance less is the field current less flux therefore more speed.



Speed control of DC shunt Motor:- (1) Flux control method:-

→ In this method a variable resistance is placed in series with shunt field winding.

→ An increase is controlling resistance reduces the field current with a reduction in flux & in a increase speed.

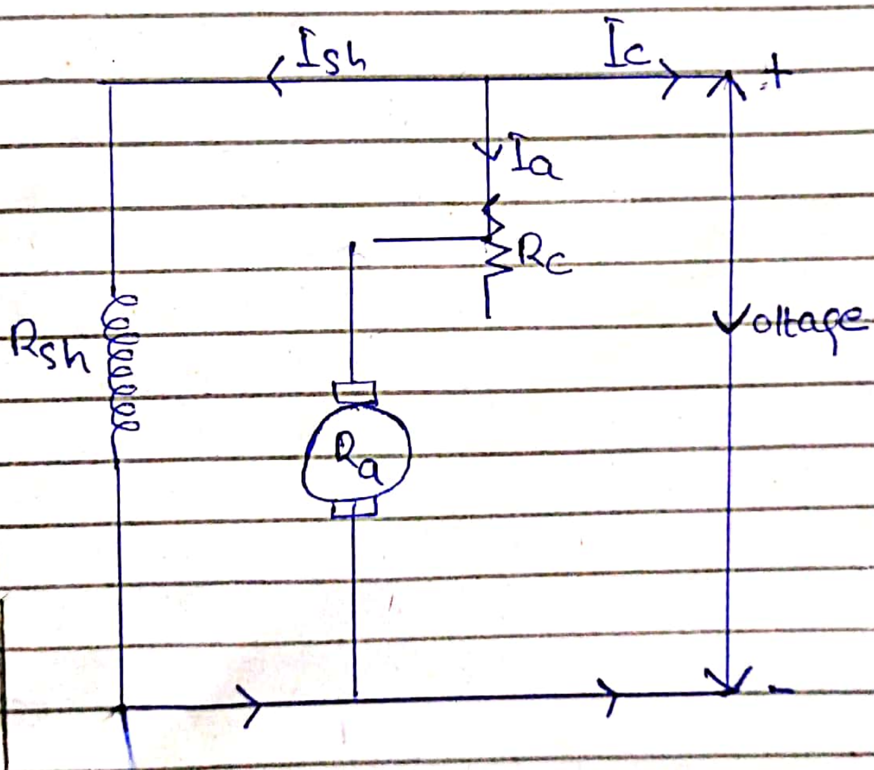


- This is an easy of convenient method.
- It is an expensive method since very little power is wasted in the short field rheostat due to relatively small value of I_{sh}.

(2) Armature Control Method :-

→ This is done by inserting a variable resistance R_C in series with armature.

→ The flux remain constant while armature current is change produces change in speed.



large amount of power wasted in the controller resistance since it carries for all amature current I_a.

B
Q1

Solution:-

No. of conductor per path
480/8 = 60

Terminal voltage
= emf per conductor × no of conductor

= 0.22 × 60
= 13.2V

Output current

= current per conductor × no. of parallel paths

= 100 × 8 = 800 A

Power generated for loop winding

= O/P I × generated EMF
= 800 × 13.2

= 10560 W

For wave winding
No. of parallel paths = 2

No. of conductor per path

$480/2 = 240$

terminal voltage $= 0.22 \times 240$

$= 52.8 V$

output current

$100 \times 2 = 200 A$

Power generated for wave winding

$= 200 \times 52.8$

$= 10,560 W$

2

Q2 (A) Determine Relation between torque & armature current?

Ans:- **Torque & Armature Current Relationship :-**

$P_e = P_m$

P_e = Electrical power

P_m = Mechanical power

$P_e = E_a I_a$ as ($E_a = E_b + I_a R_a$) KVL

$P_e = (E_b + I_a R_a) I_a$

$P_e = E_b I_a + \cancel{I_a R_a}$ (as dissipate in form of heat)

$P_e = E_b I_a$

$P_m = T_g W$: T_g (Torque in Nm) W (angular speed in rad/sec)

1 rad = 1/2π : In RPM = N * 2π/60 = rad/sec

$P_m = T_g N\, 2\pi / 60$

$P_m = P_e$

$T_g\, N\, 2\pi/60 = E_b I_a$

$$T = \frac{P \cdot Z \phi \cdot I_a}{2\pi \cdot A}$$

$$E_b = \frac{P\phi \cdot Z N}{60 \cdot A}$$

Scanned with CamScanner

Q2B Differentiate between lap winding & wave winding?

Ans:-

Basis for Differentiate	Lap Winding	Wave Winding
(1) Defination	The coil is lap back to the succeding coil.	The coil of the winding form the wave shape.
(2) Connection	The end of the armature coil is connected to an adjacent segment of the comutators	The end of the armature coil is connected to comutator segments some distance a part.
(3) Parallel path	The number of parallel path are equal to the total of number poles.	The number of parallel paths is equal to two.
(4) EMF induce	Less.	More.
(5) No. of Brushes	Equal to the no. of parallel paths	Two.

(6)	Types	Simplex & duplex lap winding.	Progressive & retrogressive wave winding.
(7)	Efficiency	less.	High.
(8)	Additional coils	Equalizer Ring.	Dummy coil.
(9)	cost	High (because more condutor is required)	Low.
(10)	Voltage & current.	In low voltage, high current machine.	In high voltage, low currents.