EXPERIMENT 8

SPEED CONTROL OF DC SERIES MOTOR

**EQUIPMENT**

* DC Excited Motor
* Variable DC Supply
* Variable Resistor
* DC Voltmeter and Ammeter

**INTRODUCTION**

* **Using Flux Control**

In flux control method, a variable resistance also called flux diverter is connected in parallel with the field winding. Its purpose is to divide some portion of line current from series field winding, there by weakening the flux and increasing the speed since speed is inversely proportional to flux (𝑁𝑁 ∝ 1/∅). The lowest speed obtainable is that corresponding to zero current in the diverter and it is also the normal speed of the motor. Consequently, this method can only provide speed above the normal speed of motor. The circuit diagram for speed control of series motor using Flux Control Method is shown in Figure 8.1

**CIRCUIT DIAGRAM**



**(B) Using Armature Resistance Control**

In Armature resistance control method, a variable resistance is directly connected in series with the supply to the motor. This reduces the voltage available across the armature and hence the speed falls. By changing the value of variable resistance, any speed below the normal speed can be obtained. This is the most common method to control the speed of DC series motor. Although this method has poor speed regulation, but this has no significance in case of series motors, because they are used in varying speed regulations. The loss of power in series resistance for many applications of series motors is not too serious, since in these applications the control is utilized for large portion of time for reducing speed under light load conditions and is only used intermittently when the motor is carrying full load. The circuit diagram for speed control of series motor using Armature Control Method is shown in Figure 8.2

**CIRCUIT DIAGRAM**



**OBJECTIVE**

* Speed control of a DC series motor by using flux control method.
* Speed control of a DC series motor by using armature resistance control method.

**APPLICATION**

* DC series motors are much suitable for applications which require high starting torque and variable speed applications.
* Following are some several applications of DC series motors.
* Electrical Cranes
* Trolley Cars
* Conveyors Belt Drives
* Electric locomotives
* **Applications** range from cheap toys to automotive **applications**.
* They are inexpensive to manufacture and are used in variable speed household appliances such as sewing machines and power tools.

**PROCEDURE**

**(A) Using Flux Control**

1. Make connections as shown in the Figure 8.1 by placing a variable resistance in parallel with the field winding.

2. Keep the motor starting rheostat at its maximum position and field rheostat at its minimum position while starting motor.

3. Start the motor by pressing switch "ON" without load and provide 40 volts approx.

4. Adjust the motor start rheostat to its minimum value.

5. Increase the value of field flux diverter step by step and take readings of field current and speed from digital tachometer at every step and note them in Table - I. Adjust the flux diverter to note the maximum speed at which motor can be operated safely.

**(B) Using Armature Resistance Control**

1. Make connections as shown in Figure 8.2 by placing a variable resistance in series with the armature and field winding.

2. Keep the motor starting rheostat at its maximum position and field rheostat at its minimum position while starting motor.

3. Start the motor by pressing switch "ON" without load and provide 40 volts approx.

4. Adjust the motor start rheostat to its minimum value. 5. Increase the value of rheostat step by step and take readings of armature voltage and speed from digital tachometer at every step and note them in Table - II. Adjust the rheostat to note the minimum speed at which motor can be operated safely.

**OBSERVATION**





**ISSUE**

Faced no issue .

**CONCLUSION**

The **DC Series Motor** can easily drive the car with its loads. When rotating speed of **DC Series Motor** is reduced till zero during the car running, **DC Series Motor** can operate as generator to regenerate energy, but this needs special additional electric circuits.

**POST LAB QUESTIONS**

* **Why it is not suitable to start the DC series without load?**

The motor armature current is decided by the **load**. On light **load** or **no load**, the armature current drawn by the motor is very small. On **no load** as Ia is small hence flux produced is also very small. Thus, a **DC series** motor should never be started on **no** - **load**.

**2. Plot the speed and armature current characteristics of DC series motor?**



**3. By using armature diverter, what range of speed of DC motor can be obtained?**

Diverter is connected across the armature.  
For a given constant load torque, if armature current is reduced then the flux must increase, as Ta ∝ ØIa  
This will result in an increase in current taken from the supply and hence flux Ø will increase and subsequently **speed of the motor** will decrease. The speed of the DC motor may go decrease as resistance increase **it ranges from 141.3 to 5.677**

**4. If the rated speed of DC series motor is 15000 rpm and you want to run the motor on a speed of 1000 rpm, which method would you choose to achieve the desired speed and why?**

**We use armature resistance method to decrease the speed of DC motor to achieve the desired speed because as we increase the resistance the speed may do decrease this is the reason we choose this method.**

**5. Plot the armature voltage vs speed at different readings?**



**6. What are the factors on which the speed of DC series motor depends?**

* **Voltage** of **Power Supply**.
* Type of **Power Supply**.
* Winding Specifications.
* Environmental Temperature.
* Type of Magnet.
* Flux Yoke.
* Phase.