

## Starting & Speed Control of D.C Series motor by (i) Field flux control method & (ii) armature voltage control method

Starting and speed control of a DC series motor can be achieved using two different methods: field flux control and armature voltage control. Both methods offer distinct advantages and have their own applications depending on the desired motor performance. In this response, I will explain these two methods in detail.

### (i) Field Flux Control Method:

The field flux control method involves adjusting the field flux of the DC series motor to control its starting and speed. By controlling the field current, the magnetic field strength can be varied, which directly affects the motor's torque-speed characteristics.

To start the motor using this method, the field current is gradually increased. As the field flux builds up, it induces a counter electromotive force (EMF) in the armature, limiting the armature current and preventing excessive starting current. Once the field flux reaches a sufficient level, the motor attains its rated speed.

For speed control, the field flux control method relies on varying the field current. By decreasing the field current, the field flux reduces, leading to a decrease in the motor's back EMF. As a result, the armature current increases, providing more torque and consequently increasing the motor's speed. Similarly, increasing the field current reduces the armature current, leading to a decrease in speed.

The field flux control method offers excellent speed control over a wide range but has limitations when it comes to achieving high starting torques. The motor may struggle to start under heavy load conditions due to limited torque during the starting phase.

### (ii) Armature Voltage Control Method:

The armature voltage control method involves controlling the voltage applied to the armature of the DC series motor. By manipulating the armature voltage, the motor's speed and torque can be regulated effectively.

During motor starting, a reduced voltage is initially applied to the armature. This reduced voltage limits the armature current and prevents excessive starting current, which could damage the motor or associated electrical equipment. As the motor gains speed, the full armature voltage is gradually applied, allowing the motor to reach its rated speed.

For speed control, the armature voltage is varied by using a variable resistance in series with the armature. By increasing the resistance, the armature voltage decreases, reducing the motor's back EMF. As a result, the armature current increases, providing more torque and increasing the speed. Conversely, decreasing the resistance increases the armature voltage, leading to a decrease in speed.

The armature voltage control method offers good speed control and provides high starting torque, making it suitable for applications requiring quick acceleration or heavy load starting. However, this method is less efficient than field flux control due to the energy dissipation across the variable resistance.

In summary, both field flux control and armature voltage control methods offer ways to start and control the speed of a DC series motor. The field flux control method provides excellent speed control but may have limitations in starting under heavy load conditions. On the other hand, the armature voltage control method offers good starting torque but is less efficient due to energy dissipation. The choice between the two methods depends on the specific requirements of the application and the desired motor performance.