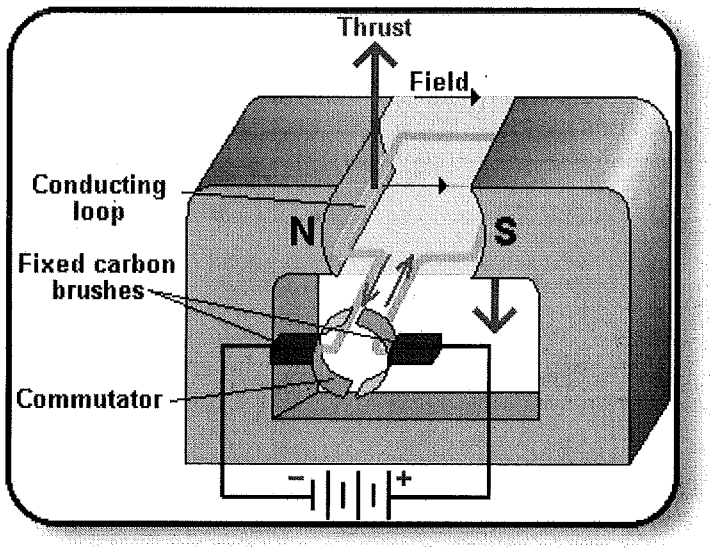
Physics 12 Section 21-6
Counter EMF

1. When a motor turns you would expect it to accelerate indefinitely. Fortunately this is not the case. The load and the back (counter) EMF help slow the acceleration.

2. The load is what the motor is trying to move and the back EMF is the result of Lenz's law –induced EMF acts to oppose the motion.



3. In the above example the current is going in the counter clockwise direction. The back EMF is going in the clockwise direction. The two currents stabilize.

4. When a motor first starts to move, it draws a large current since there is a very small back EMF due to the slow motion of the rotation.

5. When the motor is up to speed, the back EMF is maximum since the rotation speed is maximum.

Example p632: the armature windings of a DC motor have a resistance of 5.0Ω. The motor is connected to a 120V line, and when the motor reaches full speed against its normal load, the counter EMF is 108V. Calculate the current into the motor when it is just starting up and the current when it reaches full speed.

Initially there is no movement of the coil and therefore not back EMF

$$I = \frac{V}{R}$$

$$I = \frac{120V}{5.0\Omega}$$

$$I = 24A$$

At full speed the back EMF is 108V, this is working against the 120V

$$120V - 108V = I \times (5.0\Omega)$$

$$I = \frac{12V}{5.0\Omega}$$

$$I = 2.4V$$