Electro magnetic Induction

April 03/012

what factors determine the voltage induced in a conductor? How voltage induced in a conductor?

Ans- Michael Faraday discovered that voltage induced in a wire if it cuts magnetic lines of flux. To have a induced voltage in a conductor or wire, we must have a conductor, lines of magnetic flux and motion that produces ~~magnetic flux~~ cutting of the magnetic lines. If there were no magnetic field ~~then~~ no lines would be cut and no voltage would be induced in the conductor.

With an increase in flux density and the conductor moving at the same velocity, the induced voltage will also increased. Thus the induced voltage depends directly upon the flux density.

Again, if the length of the conductor is short, the number of lines of flux cut by the conductor will be small and therefore the induced voltage will be small. If the conductor is made longer, the number of lines of flux cut will be greater and therefore the induced voltage will be greater.

Hence the induced voltage depends directly upon both the flux density and the length of the conductor.

Explain the effect on the magnitude of induced voltage if the direction of motion of the wire is changed from perpendicular to the lines of flux to parallel to the lines of flux.

Ans- when a conductor moves in a magnetic field and cuts magnetic lines of flux a voltage is induced in the conductor. If the direction of motion of the conductor is perpendicular to the lines of flux, then the induced voltage will be maximum.

Again if the ~~conductor~~ direction of motion of the conductor is parallel to the lines of flux, then the induced voltage will be zero because no flux is cut by the conductor.

Describe Fleming's Right-hand rule.

Ans- Fleming. Right-hand rule describes the relation between the direction of the induced voltage and the motion of the conductor in which voltage is induced.

~~According to~~ Fleming's Right-hand rule are noted below:-

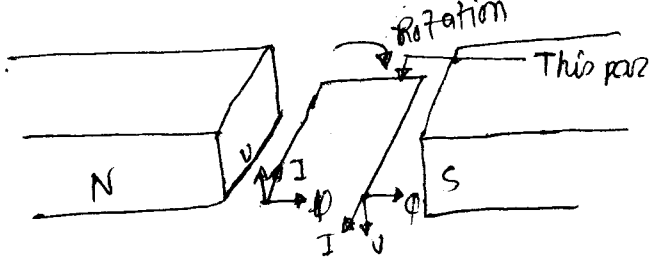
Extend the thumb, index finger and middle finger of the right hand so they are at right angles to each other. With the index finger pointing in the direction of the lines of flux (from north to south) and the thumb pointing in the direction of motion of the conductor, the middle finger will point in the direction that current current will ~~to~~ flow in the conduction. In the following figure current will flow from top to bottom in the conductor. This is known as Fleming's Right-hand rule.

Describe Lenz's Law.

Ans-

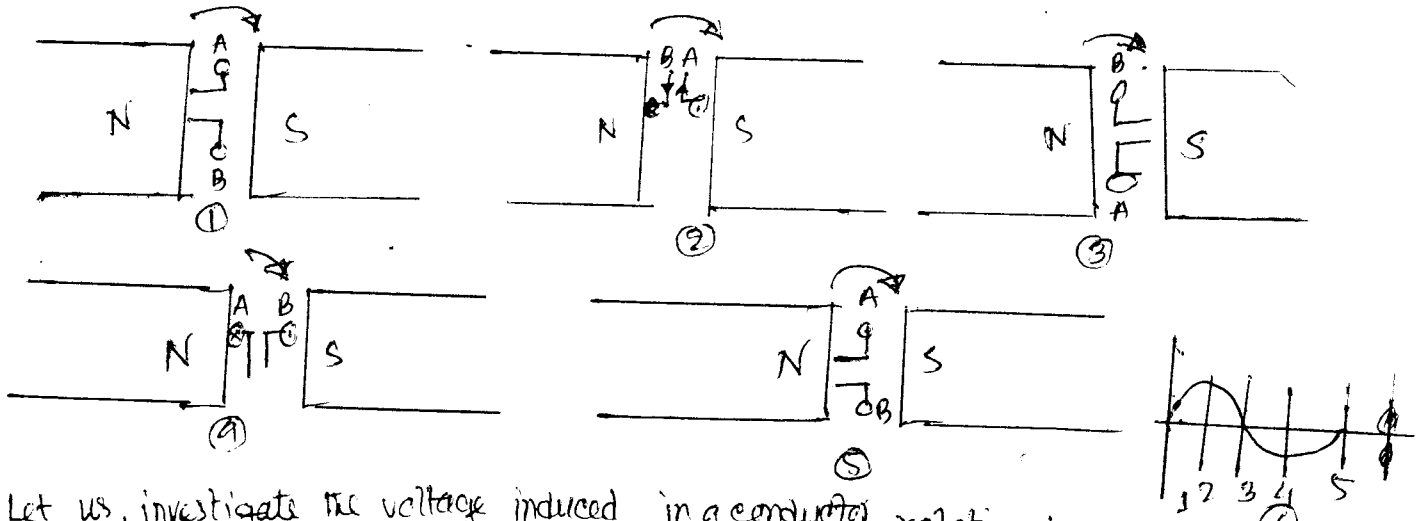
When a conductor is moved through a magnetic field a voltage is induced in the conductor. If the circuit is closed, the induced voltage will cause a current flow. The magnetic field produced by the current will always oppose the motion of the conductor. This is known as Lenz's Law.

Induced voltage in series: In electrical generators conductor moves around an axis, not in a straight line. Since the voltage induced per conductor is small. If we want larger voltage then ~~some~~ two conductors are connected in series are known as a coil of one turn. A coil of one turn still does not produce the required voltage, so it becomes necessary to increase the number of turns. This would make the coil very bulky and ~~and~~ mechanically undesireable. To overcome this problem, a greater number of coils with fewer used and are connected in series. Thus the total voltage becomes the same of the induced voltage in each coil.



E'02 # Show that the voltage induced in a conductor rotating in a magnetic field is alternating in nature.

Ans- Consider the following figure:-



Let us, investigate the voltage induced in a conductor rotating in a magnetic field.

Here, the voltage induced in position ① is zero because the conductors are moving parallel to the lines of flux and does not cut any flux.

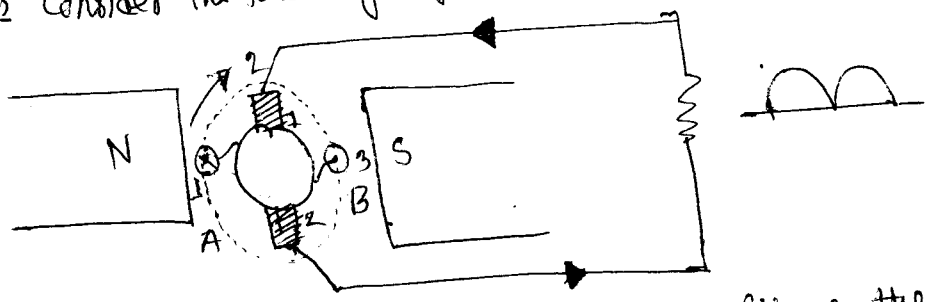
At position ② induced voltage is maximum because the conductors are moving right angles to the lines of flux.

Similarly in position ③ the induced voltage is zero and in position ④ induced voltage is maximum. But the direction of current is opposite in ④ as compared with ②.

At position ⑤ no voltage is induced and finally the current flowing in the coil is alternating in nature. Therefore the voltage is alternating.

E'02 # How the alternating ~~current~~ voltage induced in the conductor can be made unidirectional? Sketch.

Ans- Consider the following figure:-



While the coil moves from position 1 to position 2, the brushes remain in contact with the commutator segments and the current direction remains as indicated although the magnitude decreases. At position 2 the induced voltage in the coil

and the external current in the circuit is zero. At this instant segment A leaves brush 1 and makes contact with brush 2. Similar in the case of segment B. During this time, current returns to the coil through brush 1 and segment B. Again, when the current in the coil becomes zero, the segment in contact with th brush changes, thereby maintaining a unidirectional current in the external circui

#Why single-coil generator is not suited for commercial use? How we can over come this problem?

Ans- The output voltage from a single-generator is a pulsating direct current and is not suited for commercial use because of the varying magnitude.

We can overcome this problem with the use of more coils connected in series will smooth out the pulsation to yield a fairly constant voltage.