Current, voltage, resistance and ohms law essay

Current is a flow of electrical charge carriers, usually electrons or electron-deficient atoms. The common symbol for current is the uppercase letter I. The standard unit is the ampere, symbolized by A. One ampere of current represents one coulomb of electrical charge (6. 24 x 1018 charge carriers) moving past a specific point in one second. Physicists consider current to flow from relatively positive points to relatively negative points; this is called conventional current or Franklin current. Electrons, the most common charge carriers, are negatively charged. They flow from relatively negative points to relatively positive points. Electric current can be either direct or alternating.

Direct current (DC) flows in the same direction at all points in time, although the instantaneous magnitude of the current might vary. In an alternating current (AC), the flow of charge carriers reverses direction periodically. The number of complete AC cycles per second is the frequency, which is measured in hertz. An example of pure DC is the current produced by an electrochemical cell. The output of a power-supply rectifier, prior to filtering, is an example of pulsating DC. The output of common utility outlets is AC. Current per unit cross-sectional area is known as current density. It is expressed in amperes per square meter, amperes per square centimeter, or amperes per square millimeter. Current density can also be expressed in amperes per circular mil.

In general, the greater the current in a conductor, the higher the current density. However, in some situations, current density varies in different parts of an electrical conductor. A classic example is the so-called skin effect, in which current density is high near the outer surface of a conductor, and low near the center. This effect occurs with alternating currents at high frequencies. Another example is the current inside an active electronic component such as a field-effect transistor (FET). An electric current always produces a magnetic field. The stronger the current, the more intense the magnetic field. A pulsating DC, or an AC, characteristically produces an electromagnetic field. This is the principle by which wireless signal propagation occurs. Voltage, also called electromotive force, is a quantitative expression of the potential difference in charge between two points in an electrical field.

The greater the voltage, the greater the flow of electrical current (that is, the quantity of charge carriers that pass a fixed point per unit of time) through a conducting or semiconducting medium for a given resistance to the flow. Voltage is symbolized by an uppercase italic letter V or E. The standard unit is the volt, symbolized by a non-italic uppercase letter V. One volt will drive one coulomb (6. 24 x 1018) charge carriers, such as electrons, through a resistance of oneohm in one second. Voltage can be direct or alternating. A direct voltage maintains the same polarity at all times. In an alternating voltage, the polarity reverses direction periodically.

The number of complete cycles per second is the frequency, which is measured in hertz (one cycle per second), kilohertz, megahertz, gigahertz, or terahertz. An example of direct voltage is the potential difference between the terminals of an electrochemical cell. Alternating voltage exists between the terminals of a common utility outlet. A voltage produces an electrostatic field, even if no charge carriers move (that is, no currentflows). As the voltage increases between two points separated by a specific distance, the electrostatic field becomes more intense. As the separation increases between two points having a given voltage with respect to each other, the electrostatic flux density diminishes in the region between them.

Resistance is the opposition that a substance offers to the flow of electric current. It is represented by the uppercase letter R. The standard unit of resistance is the ohm, sometimes written out as a word, and sometimes symbolized by the uppercase Greek letter omega. When an electric current of one ampere passes through a component across which a potential difference (voltage) of one volt exists, then the resistance of that component is one ohm. In general, when the applied voltage is held constant, the current in a direct-current (DC) electrical circuit is inversely proportional to the resistance. If the resistance is doubled, the current is cut in half; if the resistance is halved, the current is doubled.

This rule also holds true for most low-frequency alternating-current (AC) systems, such as household utility circuits. In some AC circuits, especially at high frequencies, the situation is more complex, because some components in these systems can store and release energy, as well as dissipating or converting it. The electrical resistance per unit length, area, or volume of a substance is known as resistivity. Resistivity figures are often specified for copper and aluminum wire, in ohms per kilometer. Opposition to AC, but not to DC, is a property known as reactance. In an AC circuit, the resistance and reactance combine vectorially to yield impedance. Ohm’s Law is the mathematical relationship among electric current, resistance, and voltage.

The principle is named after the German scientist Georg Simon Ohm. In direct-current (DC) circuits, Ohm’s Law is simple and linear. Suppose a resistance having a value of R ohms carries a current of I amperes. Then the voltage across the resistor is equal to the product IR. There are two corollaries. If a DC power source providing E volts is placed across a resistance of R ohms, then the current through the resistance is equal toE/R amperes. Also, in a DC circuit, if E volts appear across a component that carries Iamperes, then the resistance of that component is equal to E/I ohms. Mathematically, Ohm’s Law for DC circuits can be stated as three equations:

E = IR

I = E/R

R = E/I

When making calculations, compatible units must be used. If the units are other than ohms (for resistance), amperes (for current), and volts for voltage), then unit conversions should be made before calculations are done. For example, kilohms should be converted to ohms, and microamperes should be converted to amperes.