

SECTION 2

Generators, Motors, and Mutual Inductance

SECTION OBJECTIVES

- Describe how generators and motors operate.
- Explain the energy conversions that take place in generators and motors.
- Describe how mutual induction occurs in circuits.

generator

a machine that converts mechanical energy into electrical energy

GENERATORS AND ALTERNATING CURRENT

In the previous section, you learned that a current can be induced in a circuit either by changing the magnetic field strength or by moving the circuit loop in or out of the magnetic field. Another way to induce a current is to change the orientation of the loop with respect to the magnetic field.

This second approach to inducing a current represents a practical means of generating electrical energy. In effect, the mechanical energy used to turn the loop is converted to electrical energy. A device that does this conversion is called an electric **generator**.

In most commercial power plants, mechanical energy is provided in the form of rotational motion. For example, in a hydroelectric plant, falling water directed against the blades of a turbine causes the turbine to turn. In a coal or natural-gas-burning plant, energy produced by burning fuel is used to convert water to steam, and this steam is directed against the turbine blades to turn the turbine.

Basically, a generator uses the turbine's rotary motion to turn a wire loop in a magnetic field. A simple generator is shown in **Figure 7**. As the loop rotates, the effective area of the loop changes with time, inducing an emf and a current in an external circuit connected to the ends of the loop.

A generator produces a continuously changing emf

Consider a single loop of wire that is rotated with a constant angular frequency in a uniform magnetic field. The loop can be thought of as four conducting wires. In this example, the loop is rotating counterclockwise within a magnetic field directed to the left.

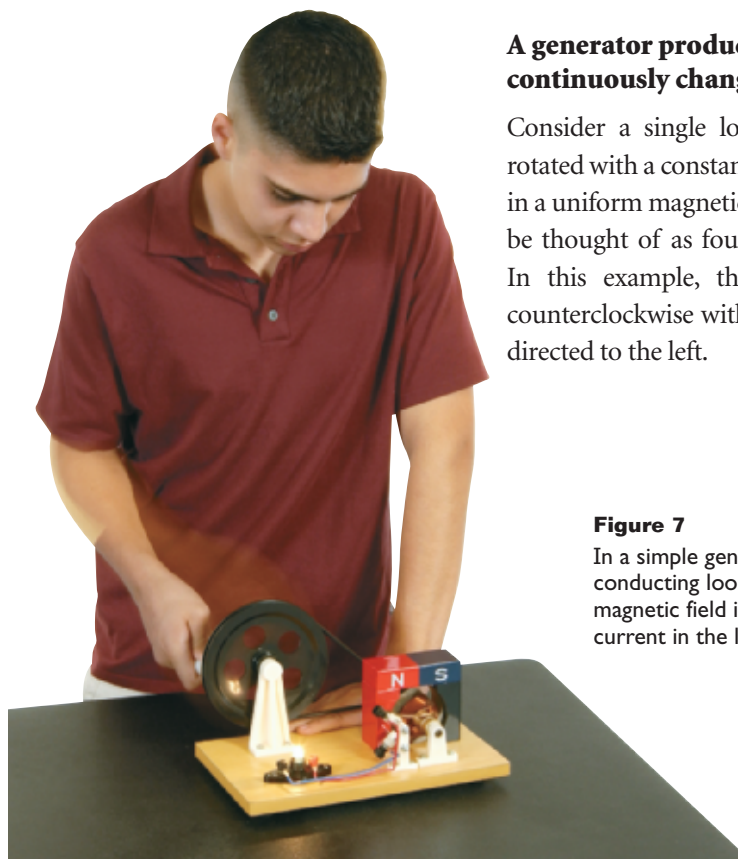


Figure 7

In a simple generator, the rotation of conducting loops through a constant magnetic field induces an alternating current in the loops.