

Lecture 9

Electromagnetic Induction

Chapter 20.1 - 20.4

Outline

- Induced Emf
- Magnetic Flux
- Faraday's Law of Induction

Electromagnetic Induction

If an electric current produces a magnetic field, then a magnet should be able to generate an electric current.

A **current** is produced in a wire when there is relative motion between the wire and a magnetic field.

Such a current is called an **induced current (emf)**.

The effect is called **electromagnetic induction** (discovered by Michael Faraday in the XIX century).

The strength of the current depends on the magnetic field strength and the wire's speed.

Magnetic Flux

The emf is induced by the magnetic flux, rather than the magnetic field.

Magnetic flux is a measure of the total number of magnetic lines passing through an area.

Consider a loop of wire in the presence of a uniform magnetic field \mathbf{B} . If the loop area is A , then the magnetic flux Φ_B through it is defined as:

$$\Phi_B = B_{\perp} A = BA \cos \theta$$

B_{\perp} is the component of B , perpendicular to the plane of the loop