

Magnetostatics

Static Magnetic Field

Sources of static magnetic fields are DC currents.

What is the source of the magnetic field?

Magnet. This is the first source of the magnetic field that people have discovered in Greece long time ago. Danish scientist Oersted discovered later that the current passing through wire will deflect a compass needle. Later French scientists Biot and Savart quantified this statement:

$$B = \mu_0 \frac{I}{2\pi r} \quad (1)$$

Where B is magnetic flux density, μ_0 is magnetic permeability, I is the electric current, and r is the distance to the point where the magnetic field is measured.

HERE PICTURE WITH A WIRE AND THE magnetic field.

In a magnetic material instead of μ_0 in the above formula we have $\mu = \mu_0 \mu_r$. μ_r is relative magnetic permeability.

Constitutive parameters of a material

We have introduced two constitutive parameters so far, electric permittivity ε and magnetic permeability μ . The third parameter is conductivity σ . Conductivity is zero for perfect insulator and infinite for perfect conductor.

The speed of light in air is equal to

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \quad (2)$$

Learning outcomes: Magnetostatic fields.
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 to be exact

Charged Particle in a Static Magnetic Field

Force on a conductor carrying current

Wire frame carrying current in a static magnetic field

Biot-Savart's Law

How to find the magnetic field due to a current distribution.

Amperes Law

Inductance

Types, internal external. Ways to find inductance through energy and directly. What is inductance, how does it affect circuits.

EXAMPLE Two wire line EXAMPLE Coax EXAMPLE Internal inductance of wire, block etc.

Mutual Inductance

Inductance in circuit theory

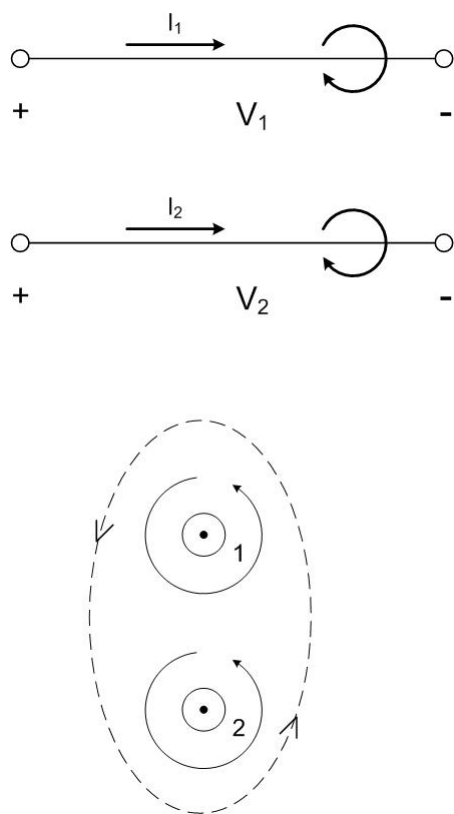


Figure 1: Mutual Inductance: Increasing the magnetic field and therefore current in one wire due to another wire in vicinity.

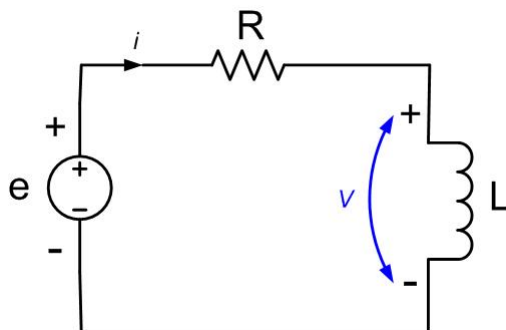


Figure 2: Simple electronic circuit with an inductance and resistance.