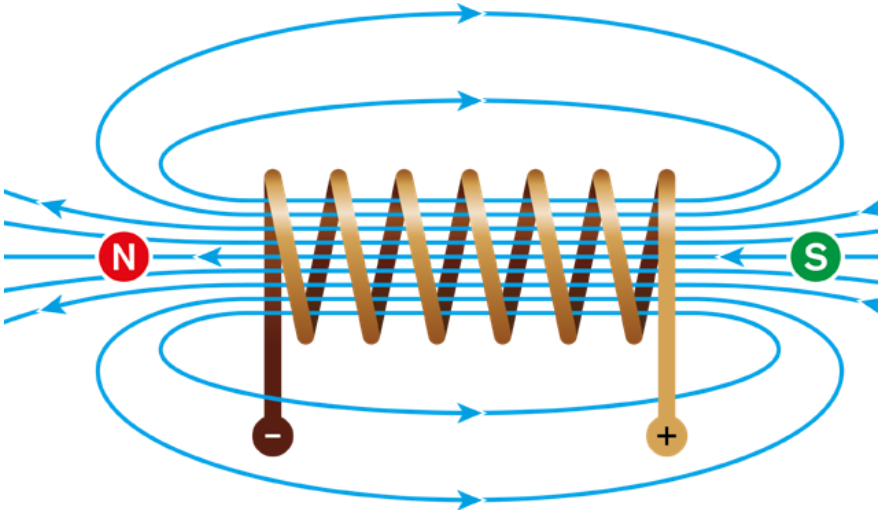
Electromagnets

Introduction

Description and Purpose

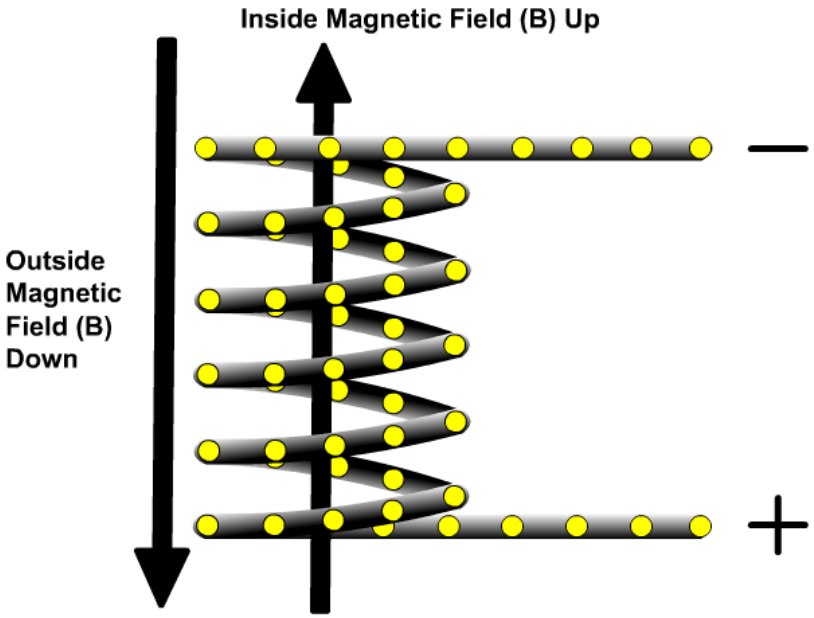
- Electromagnets are comprised of three main components to produce a magnetic field:
  1. Core
  2. Coil
  3. Current source



Their general purpose is to provide a **magnetic force** for a mechanical application.

Operation

How do they work?

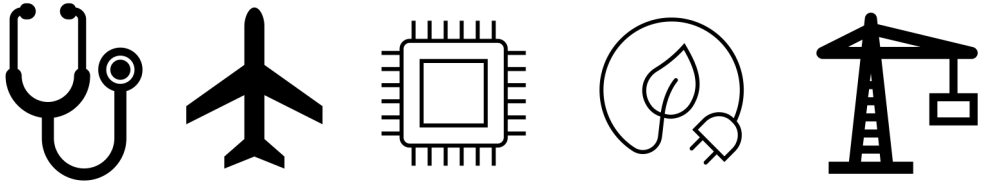


A wound coil known as a solenoid produces a magnetic field using right hand rule

- The field can be manipulated by a change in
  - Supplied voltage
  - Current
  - Core material
  - Number of wire loops
- Turn on and off
- Their designs do not require rare earth magnet materials

Types & Applications

- **The three main types of electromagnets:**
  1. Low Frequency AC
  2. DC
  3. Pulse
- **The applications of electromagnets are diverse and used across industries**



Advantages

Permanent Magnets

Constantly maintain magnetic field without a drop in strength
Doesn't require a power supply
Can be designed to be lightweight and have a smaller footprint
Overall, can be a cheaper solution (especially since no power is needed to run/operate)
No maintenance or cooling required

Electromagnets

Easy to change field strength - based on current supplied to the system
Can be turned off (safety, reduce power consumption)
Can feasibly achieve higher strengths
Safer assembly of devices
Electromagnets don't risk demagnetization the way permanent magnets do

Specifications Outline

Based on Dexter's previous experience, but can operate beyond these specs

Specifications	DC Electromagnets	Low Frequency AC Electromagnets	Pulse Electromagnets
Magnetic Field (T)	>1.8	> 2.0	>0.6
Field homogeneity (%)	±2%	±2%	±2%
Skew Angle (°)	<0.2°	<0.2°	<0.2°
Air gap (mm)	Fixed / Adjustable	Fixed / Adjustable	Fixed / Adjustable
Max. Energy (J)	-	-	1600
Max. Power (W)	5000	35,000	300
Max. Voltage (V)	80	13	2000
Max. Current (A)	65	2625	550 (pulse)
Frequency (Hz)	N/A	10	N/A
Power Supply	DC	AC	Pulse
Temperature Rise (°C)	30	35	30
Max Dimensions (mm)	520 X 390 X 540	1120 X 1040 X 1460	510 X 485 X 120
Max. Weight (kg)	1400	3000	10
Cooling Scheme	Water cooled Ambient air cooled	Water cooled Ambient air cooled	Ambient air cooled
Thermal Switch	Optional	Optional	Optional
Yoke Alloy	Carbon Steel; Iron-Cobalt-Vanadium alloys; etc.	Carbon Steel; Iron-Cobalt-Vanadium alloys; etc.	Air Core; Carbon Steel; Iron-Cobalt-Vanadium alloys; etc.

For Unique and Custom Electromagnet Applications

DEXTER magnetic technologies

Value Add

- Magnetic expertise to design complex and/or extremely uniform fields
- Understand how material selection impacts magnetic field performance (cores)
- Mapping capabilities
  - 1D, 2D, and 3D field mapping
  - Point, Linear, Platform, Rotational
- Full system solutions
  - coil, fixtures, housing, power supply, cooling, feedback loop, etc.
- History of high quality, complex magnetic assembly manufacturing