

Vocabulary for Engineering



คำศัพท์
ภาษาอังกฤษ

วิศวกรรมไฟฟ้า



Jack PK

Preface

Vocabularies for Electrical Engineering

English words that are used to name objects or techniques of use. Words spoken both directly and these theoretical practices will be arranged in this book. By the structure of the content those words will be quoted with an explanation appended. Some items may be used at the same time and complement each other as some words. Hope that the book will be suitable for people who want to be an engineer in the future and learn these words to prepare well for the future. This book will focus on Electrical Engineering only and enjoy your read this book at 200 Vocabularies for Electrical Engineering

Sample

Electrical Engineering:

1. Generator
2. Circuit
3. Transformer
4. Voltage
5. Current

6. Resistance
7. Insulator
8. Semiconductor
9. Power supply
10. Amplifier
11. Transistor
12. Capacitor
13. Inductor
14. Electric motor
15. Control system
16. Power distribution
17. Harmonics
18. Renewable energy
19. Electronics
20. Microcontrollers

These words can be used as object names or to describe various techniques and concepts used in the respective fields. The book aims to provide explanations and examples for each word mentioned above, helping aspiring engineers understand and prepare for their future careers.



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Introductions

What is Electrical Engineering?

Electrical engineering is a field of engineering that deals with the study and application of electricity, electronics, and electromagnetism. It involves the design, analysis, and development of electrical systems, components, and devices. Electrical engineers work with a wide range of technologies and applications, including power generation, transmission, and distribution, telecommunications, control systems, electronics, and signal processing.

Electrical engineers are responsible for designing and implementing electrical systems for various purposes, such as powering homes, businesses, and industries. They work on projects involving the generation of electrical power, the distribution of power through transmission lines and substations, and the utilization of power by various electrical devices and machinery.

In addition to power systems, electrical engineers also work on designing and developing electronic devices, such as computers, smartphones, and communication systems. They are involved in

the design and analysis of electronic circuits, microprocessors, and integrated circuits. They also work in areas like digital signal processing, control systems, telecommunications, and wireless communication technologies.

Overall, electrical engineering is a broad and diverse field that plays a crucial role in today's technologically advanced world. Electrical engineers contribute to the development of new technologies, improve existing systems, and ensure the efficient and safe utilization of electrical energy.

200 vocabularies specific to electrical engineering

1. Voltage

Voltage, also referred to as electric potential difference, is a fundamental concept in electrical engineering. It is a measure of the electric potential energy per unit charge between two points in an electrical circuit or system. Voltage is denoted by the symbol V and its unit of measurement is the volt (V).

In electrical engineering, voltage is often considered as the force or pressure that drives the flow of electric current. It represents the difference in electric potential between two points, which determines the direction and magnitude of the current flow.

Voltage can be visualized as the "push" or "pull" given by a power source (such as a battery or generator) to electric charges, enabling them to move within a circuit. The higher the voltage, the greater the potential energy available to drive the flow of electrons.

In practical terms, voltage can be understood by considering a water analogy: voltage is analogous to the difference in water

pressure between two points, which determines the flow rate of water through a pipe. Similarly, in an electrical circuit, voltage determines the flow rate of electric charge (current) through conductive components like wires, resistors, capacitors, and other electronic devices.

Voltage can be either direct current (DC) or alternating current (AC). In DC, the voltage remains constant over time, while in AC, the voltage alternates in polarity and magnitude periodically.

In summary, voltage in electrical engineering refers to the electric potential difference between two points, which drives the flow of electric current in an electrical circuit or system. It is a fundamental parameter used in the design, analysis, and operation of electrical systems and devices.

2. Current

In electrical engineering, current refers to the flow of electric charge through a conductive medium, such as a wire, circuit, or component. It represents the rate at which electric charges move past a point in a circuit. Current is denoted by the symbol I and its unit of measurement is the ampere (A).

Current can be categorized into two types based on the direction of flow:

1. Direct Current (DC): In DC, the flow of electric charges occurs in one direction. The magnitude and direction of current remain constant over time.

2. Alternating Current (AC): In AC, the flow of electric charges alternates in direction and magnitude periodically, typically in the form of a sine wave. This is the type of current commonly supplied by electrical power systems.

Current is driven by voltage, which creates an electric field that pushes or pulls electric charges through a circuit. The relationship between voltage, current, and resistance is governed by Ohm's Law:

$$I = V / R$$

where I is the current in amperes (A), V is the voltage in volts (V), and R is the resistance in ohms (Ω). Ohm's Law states that the current through a conductor is directly proportional to the voltage across it and inversely proportional to the resistance of the conductor.

Current plays a crucial role in electrical engineering as it determines the power consumption, heat generation, and functionality of electrical devices and systems. It is essential to

properly manage and control current to ensure the safe and efficient operation of electrical circuits and components.

3. Resistance

Resistance in electrical engineering refers to the opposition or hindrance offered by a material or component against the flow of electric current. It is denoted by the symbol "R" and measured in units called ohms (Ω). Resistance determines the amount of current that can pass through a circuit for a given voltage. It is influenced by factors such as the material's conductivity, length, cross-sectional area, and temperature. Ohm's Law states that resistance is directly proportional to voltage and inversely proportional to current. It is an essential property in designing and analyzing electrical and electronic circuits, determining power dissipation, and controlling the flow of electricity.

4. Ohm's Law

Ohm's Law in electrical engineering states that the current passing through a conductor is directly proportional to the voltage applied across it, and inversely proportional to the resistance of the conductor. Mathematically, it can be represented as:

$$V = I * R$$

where V is the voltage, I is the current, and R is the resistance. This relationship between voltage, current, and resistance was formulated by German physicist Georg Simon Ohm in the early 19th century.

Ohm's Law is fundamental to understanding and analyzing electrical circuits as it allows engineers to calculate and predict the behavior of different components and circuits. It serves as a foundation for many other electrical laws and principles, facilitating the design, troubleshooting, and analysis of various electrical systems.

5. Circuit

In electrical engineering, a circuit refers to a closed path through which an electric current can flow. It is composed of interconnected components such as resistors, capacitors, inductors, and power sources (such as batteries or generators). Circuits can be categorized into two main types: series circuits and parallel circuits.

A series circuit is one in which the components are connected in a single loop, meaning the current has only one path to follow. In a series circuit, the same current flows through all the components, and the total voltage is divided among the components based on their respective resistances.

A parallel circuit, on the other hand, is one in which the components are connected in multiple branches, allowing the current to divide and flow through different paths. In a parallel circuit, each component has the same voltage across it, while the total current is divided among the branches.

Circuits play a crucial role in electrical engineering as they enable the control and distribution of electrical energy. Engineers use circuit analysis techniques and principles to design, model, and troubleshoot electrical systems, ensuring a safe and efficient flow of current.

6. Power

In electrical engineering, power refers to the rate at which electrical energy is transferred or consumed in an electrical circuit. It is a measure of how quickly work is done or how quickly energy is transformed.

Power is defined mathematically as the product of voltage (V) and current (I):

$$\text{Power (P)} = \text{Voltage (V)} * \text{Current (I)}$$

It is typically measured in units called watts (W) and can also be expressed in kilowatts (kW) for larger values.

Power can be further classified into two forms:

1. Active Power (P): It represents the actual power consumed in a circuit, commonly referred to as real power. It is responsible for doing useful work such as lighting bulb, operating motors, or powering electronics. Active power is sometimes denoted as "P" or "P" and is expressed in watts (W).
2. Reactive Power (Q): It represents the power that oscillates back and forth in certain electrical components due to the presence of inductance or capacitance. Reactive power does not perform useful work but is required for maintaining the magnetic and electric fields in inductive and capacitive loads. Reactive power is denoted as "Q" and is expressed in volt-ampere reactive (VAR).

Power is a fundamental concept in electrical engineering and is critical for determining the energy consumption, efficiency, and performance of electrical systems. It is utilized in analyzing and designing circuits, calculating power losses, and ensuring the safe operation of electrical devices.

7. AC (Alternating Current)

In electrical engineering, AC (Alternating Current) refers to the type of electrical current in which the flow of electric charge periodically reverses direction. It is characterized by its variation

over time, oscillating between positive and negative values. AC differs from DC (Direct Current), which maintains a constant flow of charge in one direction.

AC is commonly used in power distribution systems, as it allows for efficient long-distance transmission and conversion of voltage levels. The primary source of AC power is electrical generators, such as those driven by turbines in power plants. These generators produce a voltage that varies sinusoidally with time.

The main advantage of AC is that it can be easily transformed to different voltage levels using transformers, enabling effective distribution and transmission. AC also allows for efficient energy conversion through devices such as motors and transformers, which rely on the alternating nature of the power supply.

The frequency of AC is expressed in Hertz (Hz) and indicates the number of complete cycles (reversals in direction) in one second. In standard power systems, the frequency is typically 50 or 60 Hz.

In summary, AC is an important concept in electrical engineering that refers to the flow of electrical current that periodically changes direction. It is extensively used in power distribution systems and facilitates efficient energy conversion and transmission.

8. DC (Direct Current)

DC (Direct Current) in electrical engineering refers to the flow of electric charge in a single direction, typically from a power source, such as a battery or a rectifier. Unlike alternating current (AC), which periodically reverses direction, DC maintains a constant polarity. This unidirectional flow of electrons in a circuit allows for a steady and continuous supply of electric power. DC power is often used for applications that require stable voltage levels, such as in electronic devices, computers, and most electronic components.

9. Electric Field

In electrical engineering, an electric field refers to the force exerted by electrically charged particles on other charged particles in their vicinity. It can also be described as the region of space around a charged object where the effect of its electric force can be felt.

Electric fields are generated by electric charges and are characterized by their strength and direction. The strength is determined by the magnitude of the charges involved and the distance between them, following Coulomb's law. The direction of the electric field is defined as the direction a positive test charge would move if placed in the field. The electric field lines,

represented by arrows, indicate the direction and strength of the field.

Electric fields are essential in understanding and designing electrical systems. For example, they play a crucial role in the operation of capacitors, wherein stored energy is associated with the electric field between the plates. Electric fields are also responsible for the movement of charges through conductors in electrical circuits, as well as the interaction between charges in various electronic components.

10. Magnetic Field

In electrical engineering, a magnetic field refers to the region in space where the magnetic forces act on moving electric charges. It is generated by the movement of electric charges, such as the flow of current in a wire or the motion of electrons in an atom.

Magnetic fields are characterized by their strength and direction. The strength of a magnetic field is measured in units of Tesla (T) or Gauss (G), and it depends on factors such as the amount of current, the distance from the source, and the properties of the material. The direction of the magnetic field is indicated by imaginary lines called magnetic field lines. These lines form closed loops around the current-carrying conductor and point in the direction that a compass needle would align in that region.

Magnetic fields are crucial in various electrical applications. They are used in devices such as transformers, motors, and generators, where the interaction between magnetic fields and electric currents enables energy conversion or the generation of mechanical motion. Understanding and controlling magnetic fields is essential for optimizing the performance and efficiency of these devices in electrical engineering.

11. Inductance

In electrical engineering, inductance refers to the property of an electrical circuit or component that opposes changes in current flow. It is a measure of how the magnetic field generated by a current-carrying circuit component (such as a coil or an inductor) responds to changes in the current.

Inductance is denoted by the symbol L and is measured in Henries (H). It depends on the number of turns in a coil, the dimensions of the coil, and the magnetic properties of the core material. When current flows through a conductor, a magnetic field is created around it. This magnetic field induces a voltage in nearby conductors or in the same conductor when the current changes. This phenomenon is known as electromagnetic induction.

Inductance plays a crucial role in many electrical applications. In AC circuits, inductors are used to control the flow of current and store energy in the magnetic field. Inductors can also filter out or block certain frequencies, making them useful in signal processing and communication systems. Additionally, inductance is a fundamental property of transformers and generators, where it enables the efficient transfer and transformation of electrical energy.

12. Capacitance

In electrical engineering, capacitance refers to the ability of a component or circuit to store electric charge. It is a measure of how much electrical energy can be stored per unit of voltage across the component.

Capacitance is denoted by the symbol C and is measured in farads (F). A capacitor is the most common component used to store electric charge and has a specific capacitance value.

Capacitors consist of two conductive plates separated by a dielectric material. When a voltage is applied across the plates, an electric field is established, and electric charge is stored on the plates. The amount of charge stored per unit voltage is the capacitance.

Capacitance is a fundamental property of capacitors and is utilized across various electrical applications. It is used to store energy in power supply circuits and acts as a temporary energy reservoir. Capacitors are used for energy storage, coupling, filtering, and timing applications. They can also smooth out voltage fluctuations and provide reactive power in AC circuits. Understanding capacitance is essential for designing and analyzing electronic circuits and systems.

13. Impedance

In electrical engineering, impedance refers to the measure of total opposition to the flow of alternating current in a circuit. It encompasses both resistive and reactive components and is represented by the complex quantity Z .

Impedance is analogous to resistance in direct current (DC) circuits but takes into account the effects of both resistance and reactance. Resistance (R) represents the straightforward opposition to the current flow, while reactance (X) represents the opposition resulting from the presence of capacitors or inductors in the circuit.

Impedance is a complex quantity because it has both magnitude and phase. The magnitude of impedance depicts the total opposition to the current flow, while the phase angle represents

the phase relationship between the voltage and current in an AC circuit.

Impedance is an essential concept in electrical engineering as it helps analyze and design AC circuits. It influences the flow of current and voltage distribution in alternating current systems. Moreover, impedance matching, which involves optimizing the impedance of different components and systems, is crucial for efficient power transfer and minimizing reflections in communication systems and transmission lines.

14. Resistor

In electrical engineering, a resistor is a passive two-terminal electronic component that limits or controls the flow of electric current in a circuit. It is designed to have a specific resistance value measured in ohms (Ω).

Resistors are typically made of materials with high resistance, such as carbon composition, metal film, or wire wound resistors. They are used to regulate current, divide voltage, provide voltage drop, and dissipate power in various electrical and electronic circuits.

When a voltage is applied across a resistor, according to Ohm's law, the current flow through the resistor is directly proportional

to the voltage and inversely proportional to the resistance. Resistors convert electrical energy into heat due to the resistance they provide, which is often dissipated into the surrounding environment.

Resistors are used in a wide range of applications. They are commonly employed in voltage dividers, current limiters, signal conditioning circuits, temperature sensors, and voltage regulators. They also play a crucial role in setting the operating points of electronic components such as transistors and integrated circuits.

15. Capacitor

In electrical engineering, a capacitor is a two-terminal electronic component that stores and releases electrical energy. It consists of two conductive plates separated by a dielectric material.

When a voltage is applied across the plates, positive and negative charges accumulate on the respective plates. This creates an electric field between the plates and results in the storage of electric energy in the capacitor. The ability of a capacitor to store electric charge is measured in farads (F).

Capacitors are widely used in electrical and electronic circuits for various purposes. They can store energy temporarily and release

it quickly when needed, making them useful in filtering out noise, stabilizing voltage levels, and smoothing out signals. Capacitors are also used for energy storage in power supply circuits and are crucial components in timing circuits, oscillators, and filters.

Different types of capacitors, including ceramic, electrolytic, tantalum, and film capacitors, are employed in electrical engineering, each having distinct characteristics and performance parameters. Capacitors are selected based on factors such as capacitance value, voltage rating, frequency response, tolerance, and other circuit requirements.

16. Inductor

In electrical engineering, an inductor is a passive electronic device designed to store and release energy in the form of a magnetic field. It is typically made of a coil of wire wound around a core material. When an electrical current passes through the coil, it creates a magnetic field around it, which stores the electrical energy. When the current through the coil is changed or interrupted, the magnetic field collapses, releasing the stored energy. Inductors are used in various applications such as energy storage, filtration, inductance tuning, and electromagnetic compatibility. They are also commonly used in power supplies, motors, transformers, oscillators, and various electronic circuits.

17. Transformer

In electrical engineering, a transformer is a static device used to transfer electrical energy between two or more circuits through electromagnetic induction. It consists of two or more coils of wire, known as windings, that are wound around a common core material. The input winding, known as the primary winding, is connected to a voltage source and carries the input current. The output winding, known as the secondary winding, is connected to a load and delivers the output current.

When an alternating current (AC) flows through the primary winding, it creates a changing magnetic field that induces a voltage in the secondary winding. The ratio of the number of turns in the primary winding to the number of turns in the secondary winding determines the voltage transformation ratio. Transformers can step up the voltage (increase the voltage level) or step down the voltage (decrease the voltage level) depending on the turn's ratio.

Transformers are crucial in electrical power distribution systems as they facilitate the efficient transmission of electrical energy at high voltages while reducing losses. They are also used in various electronic devices, such as power supplies, voltage regulators, and audio amplifiers.

18. Diode

In electrical engineering, a diode is a two-terminal electronic device that allows current to flow in only one direction while blocking the flow in the opposite direction. It is composed of a semiconductor material, typically silicon or germanium, with a p-n junction.

The p-n junction consists of two different layers of material: the p-type and the n-type. The p-type has an excess of positively charged carriers (holes), while the n-type has an excess of negatively charged carriers (electrons). When the positive terminal of a voltage source is connected to the p-type region (anode) and the negative terminal to the n-type region (cathode), the diode is said to be forward-biased, and current can flow across the diode. However, when the polarity of the voltage source is reversed, creating a reverse bias, the diode becomes non-conducting and blocks the current flow.

Diodes have a wide range of applications in electrical circuits. They are commonly used as voltage rectifiers, converting alternating current (AC) to direct current (DC). They can also be used for voltage regulation, signal modulation, switching, and protection against voltage spikes or reverse polarity. Different types of diodes, such as Zener diodes, Schottky diodes, and light-

emitting diodes (LEDs), are used for specific applications based on their unique properties.

19. Rectifier

In electrical engineering, a rectifier is a device that converts alternating current (AC) into direct current (DC). It typically consists of diodes that allow the current to flow in one direction only, blocking it in the opposite direction. As a result, it "rectifies" the AC waveform, converting it into a DC waveform that flows in a single direction. Rectifiers are commonly used in power supplies and electronic devices that require a constant DC voltage for their operation.

20. Transistor

A transistor is an electronic device that is widely used in electrical engineering. It is a three-terminal semiconductor device that can amplify or switch electronic signals and electrical power.

Transistors are fundamental building blocks of modern electronic devices such as computers, televisions, radios, and many other electronic systems. They can control the flow of electric current by acting as a switch or an amplifier, allowing them to perform complex operations and carry out various functions in circuits.

21. Integrated Circuit

An integrated circuit (IC) in electrical engineering refers to a miniaturized electronic circuit that is composed of various electronic components, such as transistors, resistors, capacitors, and diodes, etched onto a small semiconductor chip. The components are interconnected through metallic paths created on the chip, allowing the integrated circuit to perform complex functions in a compact and efficient manner.

Integrated circuits play a critical role in modern electronics as they allow for the integration of numerous electronic components onto a single chip, resulting in smaller size, improved performance, and reduced power consumption compared to traditional circuit designs. They are used in a wide range of electronic devices, including computers, smartphones, televisions, medical devices, automotive systems, and more. Integrated circuits have revolutionized the field of electrical engineering and have greatly contributed to the advancement of technology.

22. Amplifier

In electrical engineering, an amplifier is a device that increases the amplitude or power of a signal. It is typically used to boost weak signals or to strengthen a signal so that it can be transmitted over long distances without significant loss of quality. Amplifiers can be found in various forms, ranging from simple

circuit components to dedicated chips or modules. They are widely used in audio systems, radio communications, power electronics, and many other applications where signal amplification is necessary.

23. Oscillator

In electrical engineering, an oscillator is a device or circuit that generates an electrical signal with a specific frequency or waveform. It produces a repetitive output signal without the need for an external input signal. The main purpose of an oscillator is to generate a stable and precise frequency signal for various applications.

Oscillators can be classified into different types based on their working principles and output waveforms. Some common types include:

1. Quartz Crystal Oscillators: These oscillators utilize the piezoelectric properties of quartz crystals to generate a precise frequency signal. They are widely used in electronic devices like clocks, computers, and communication systems.
2. RC Oscillators: These oscillators use resistors (R) and capacitors (C) in combination to generate a time-varying output waveform.