Opinion

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Control Engineering Focuses on the Modeling of a Diverse Range

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Description

Electrical engineering is an engineering discipline concerned with the study, design, and application of equipment, devices, and systems which use electricity, electronics, and electromagnetism. It emerged as an identifiable occupation in the latter half of the 19th century after commercialization of the electric telegraph, the telephone, and electrical power generation, distribution, and use.

Electrical engineering is now divided into a wide range of different fields, including computer engineering, systems engineering, power engineering, telecommunications, radio-frequency engineering, signal processing, instrumentation, photovoltaic cells, electronics, and optics and photonics. Many of these disciplines overlap with other engineering branches, spanning a huge number of specializations including hardware engineering, power electronics, electromagnetics and waves, microwave engineering, nanotechnology, electrochemistry, renewable energies, mechatronics/control, and electrical materials science.

Electrical engineers typically hold a degree in electrical engineering or electronic engineering. Practising engineers may have professional certification and be members of a professional body or an international standards organization. These include the International Electrotechnical Commission (IEC), the Institute of Electrical and Electronics Engineers (IEEE) and the Institution of Engineering and Technology (IET) (formerly the IEE).

Control Engineering

Control engineering focuses on the modeling of a diverse range of dynamic systems and the design of controllers that will cause these systems to behave in the desired manner. To implement such controllers, electronics control engineers may use electronic circuits, digital signal processors, microcontrollers, and Programmable Logic Controllers (PLCs). Control engineering has a wide range of applications from the flight and propulsion systems of commercial airliners to the cruise control present in many modern automobiles. It also plays an important role in industrial automation.

Control engineers often use feedback when designing control systems. For example, in an automobile with cruise control the vehicle's speed is continuously monitored and fed back to the system which adjusts the motor's power output accordingly. Where there is regular feedback, control theory can be used to determine how the system responds to such feedback.

Control engineers also work in robotics to design autonomous systems using control algorithms which interpret sensory feedback to control actuators that move robots such as autonomous vehicles, autonomous drones and others used in a variety of industries.

Electrical engineers work in a very wide range of industries and the skills required are likewise variable. These range from circuit theory to the management skills of a project manager. The tools and equipment that an individual engineer may need are similarly variable, ranging from a simple voltmeter to sophisticated design and manufacturing software.

Electricity has been a subject of scientific interest since at least the early-17th-century. William Gilbert was a prominent early electrical scientist, and was the first to draw a clear distinction between magnetism and static electricity. He is credited with establishing the term "electricity". He also designed the versorium: a device that detects the presence of statically charged objects. In 1762 Swedish professor Johan Wilcke invented a device later named electrophorus that produced a static electric charge. By 1800 Alessandro Volta had developed the voltaic pile, a forerunner of the electric battery.

Power and Energy

Power & Energy engineering deals with the generation, transmission, and distribution of electricity as well as the design of a range of related devices. These include transformers, electric generators, electric motors, high voltage engineering, and power electronics. In many regions of the world, governments maintain an electrical network called a power grid that connects a variety of generators together with users of their energy. Users purchase electrical energy from the grid, avoiding the costly exercise of having to generate their own. Power engineers may work on the design and maintenance of the power grid as well as the power systems that connect to it. Such systems are called on-grid power systems and may supply the grid with additional power, draw power from the grid, or do both. Power engineers may also work on systems that do not connect to the grid, called off-grid power systems, which in

some cases are preferable to on-grid systems. The future includes Satellite controlled power systems, with feedback in real time to prevent power surges and prevent blackouts.

Signal processing deals with the analysis and manipulation of signals. Signals can be either analog, in which case the signal varies continuously according to the information, or digital, in which case the signal varies according to a series of discrete values representing the information. For analog signals, signal processing may involve the amplification and filtering of audio signals for audio equipment or the modulation and demodulation of signals for telecommunications. For digital signals, signal processing may involve the compression, error detection and error correction of digitally sampled signals.

Signal Processing is a very mathematically oriented and intensive area forming the core of digital signal processing and it is rapidly expanding with new applications in every field of electrical engineering such as communications, control, radar, audio engineering, broadcast engineering, power electronics, and biomedical engineering as many already existing analog systems are replaced with their digital counterparts. Analog signal processing is still important in the design of many control systems.

Telecommunications engineering focuses on the transmission of information across a communication channel such as a coax cable, optical fiber or free space. Transmissions across free space require information to be encoded in a carrier signal to shift the information to a carrier frequency suitable for transmission; this is known as modulation. Popular analog modulation techniques include amplitude modulation and frequency modulation. The choice of modulation affects the cost and performance of a system and these two factors must be balanced carefully by the engineer.

Once the transmission characteristics of a system are determined, telecommunication engineers design the transmitters and receivers needed for such systems. These two are sometimes combined to form a two-way communication device known as a transceiver. A key consideration in the design of transmitters is their power consumption as this is closely related to their signal strength. Typically, if the power of the transmitted signal is insufficient once the signal arrives at the receiver's antenna(s), the information contained in the signal will be corrupted by noise, specifically static.