Lecture1: ELECTRICAL CONTROL

Electrical engineering deals with the study and application of physics and mathematics combined with elements of electricity, electronics, and electromagnetism to both large and small scale systems to process information and transmit energy. It covers a wide range of sub-fields including electronics, digital computers, power engineering, telecommunications, *control systems*, RF engineering, and signal processing.

Control engineering or control systems engineering is an engineering discipline that applies control theory to design equipment and systems with desired behaviours in control environments.[1] The discipline of controls overlaps and is usually taught along with electrical engineering and mechanical engineering at many institutions around the world.[1]

The practice uses sensors and detectors to measure the output performance of the process being controlled; these measurements are used to provide corrective feedback helping to achieve the desired performance. Systems designed to perform without requiring human input are called automatic control systems (such as cruise control for regulating the speed of a car). Multi-disciplinary in nature, control systems engineering activities focus on implementation of control systems mainly derived by mathematical modeling of a diverse range of systems.

A control system manages, commands, directs, or regulates the behavior of other devices or systems using control loops. It can range from a single home heating controller using a thermostat controlling a domestic boiler to large Industrial control systems which are used for controlling processes or machines.

An **electrical control system** is a physical interconnection of devices that influences the behaviour of other devices or systems. A simple electronic system is made up of an input, a process, and an output. Both input and output variables to the system are signals. Examples of such systems include circulation pumps, compressors, manufacturing systems, refrigeration plant and motor control panels.

Input devices such as sensors gather and respond to information and control a physical process by using electrical energy in the form of an output action. Electronic systems can be classed as 'causal' in nature. The input signal is the 'cause' of the change in the process or system operation, while the output signal is the 'effect', the consequence of the cause. An example is a microphone (input device) causing sound waves to be converted into electrical signals and being amplified by a speaker (output device) producing sound waves.

Electronic systems are commonly represented as a series of interconnected blocks and signals. Each block is shown with its own set of inputs and outputs. This is known as block-diagram representation.

Electrical systems operate either on continuous-time (CT) signals or discrete-time (DT) signals.

A CT system is where the input signals are continuous over time. These tend to be analogue systems producing a linear operation with input and output signals referenced over a set time period, such as between 13:00 and 14:00.

A DT system is where the input signals are a sequence or series of signal values defined in specific time intervals, such as 13:00 and 14:00 separately.

What is Electrical Engineering?

Electrical engineering deals with the study and application of physics and mathematics combined with elements of electricity, electronics, and electromagnetism to both large and small scale **systems** to process information and transmit energy. It covers a wide range of sub-fields including electronics, digital computers, power engineering, telecommunications, *control systems*, RF engineering, and signal processing.

Three reasons to study Electrical Engineering:

-**Always in demand**: the technology sector grew rapidly in the last decades and so did the demand for those who create, understand and develop electrical control systems, which means good job opportunities for you after graduation.

-**High salaries**: as an electrical engineer, you will begin your career higher on the salary ladder than e.g. teachers or social science graduates.

-**Future technologies**: electrical engineering is at the forefront of developing new technologies for a number of industries including those of transport, healthcare, construction and robotics.

What do Electrical Engineers do?

Electrical engineers basically designing several electrical systems that work in automobiles and aircraft systems.

The roles of Electrical Engineers are:

- They help in the development and improvement of electrical products
- Perform calculations to develop, manufacture, install, and construct different specifications of products
- Supervise the installation, testing, and manufacturing of electrical equipment so that the products meet standards

What You Can Do with an Electrical Engineering Degree?

Graduates in Electrical Engineering can work as:

- Energy System Engineers
- Signal Processing Engineers
- Telecommunications Engineers
- Electronics engineer
- Naval engineer
- Automotive engineer

- Aerospace engineer
- Oil and gas engineer
- Medical engineer