

PART II

ELECTRICAL ENGINEERING APPLICATIONS

1. Digital Logic Circuits
2. Principles and applications of transformers
3. Diode, rectifiers and Power supplies
4. Principles and applications of DC motors

Text Books :

1. Electrical Engineering Principles and Applications, Allan R. Hambley
2. Principles and Applications of Electrical Engineering, Giorgio Rizzoni

ELECTRICAL ENGINEERING

Electrical engineering is an important field of study for all engineers.

It can be broadly defined as the study and application of electrical systems or circuits that are formed from an interconnection of electrical devices and components.

- Component – usually refers to a resistor, capacitor, inductor or transformer (passive elements)
- Device – usually refers to active devices, such as, transistors, motors, generators.

Electrical engineering has a pervasive presence in almost all engineering applications and our everyday lives.

Electrical circuits were covered in the first part of this course because they are the basis of all branches of electrical engineering. The second part of the course will cover some of the applications of electrical engineering.

Electrical engineering disciplines

Power Systems:

This is the oldest specialty within the field and continues to be of great importance to society. This is the only field that deals with generation and transmission of electricity from one location to another.

Electric Machinery:

This field deals with conversion of energy to and from electrical form, and studies the design and operation of devices such as motors and generators.

Electronics:

This covers study and application of materials, devices and circuits used in amplifying and switching electrical signals. The most important electronic devices are transistors of various kinds, which are found in nearly all places where electrical information or energy is employed.

Computer Systems:

These process and store information in digital form and are becoming more and more omnipresent. It includes design and development of computer hardware systems and the computer programs (software) that control them.

Control Systems:

These are a very important class of systems that gather information with sensors and use electrical energy to control a physical process.

Communication Systems:

These systems transport information in electrical form by encoding information on an electrical signal. Some examples of such systems include cellular phone, radio, satellite television, and the Internet.

Instrumentation Systems:

These include sensors and instruments commonly used in engineering systems. Modern instrumentation systems typically use electronic amplifiers and converters.

We can find the pervasive presence of these systems in almost everything around us.

Example: Electrical Engineering Systems in a passenger automobile

Many of these seemingly different electrical engineering systems can be found in a very common application – the automobile.

A modern car typically has an electric power system, several electric machines (generator and motors), sophisticated computer systems, many control systems, thousands of electronic components, and several measurement and instrumentation systems.

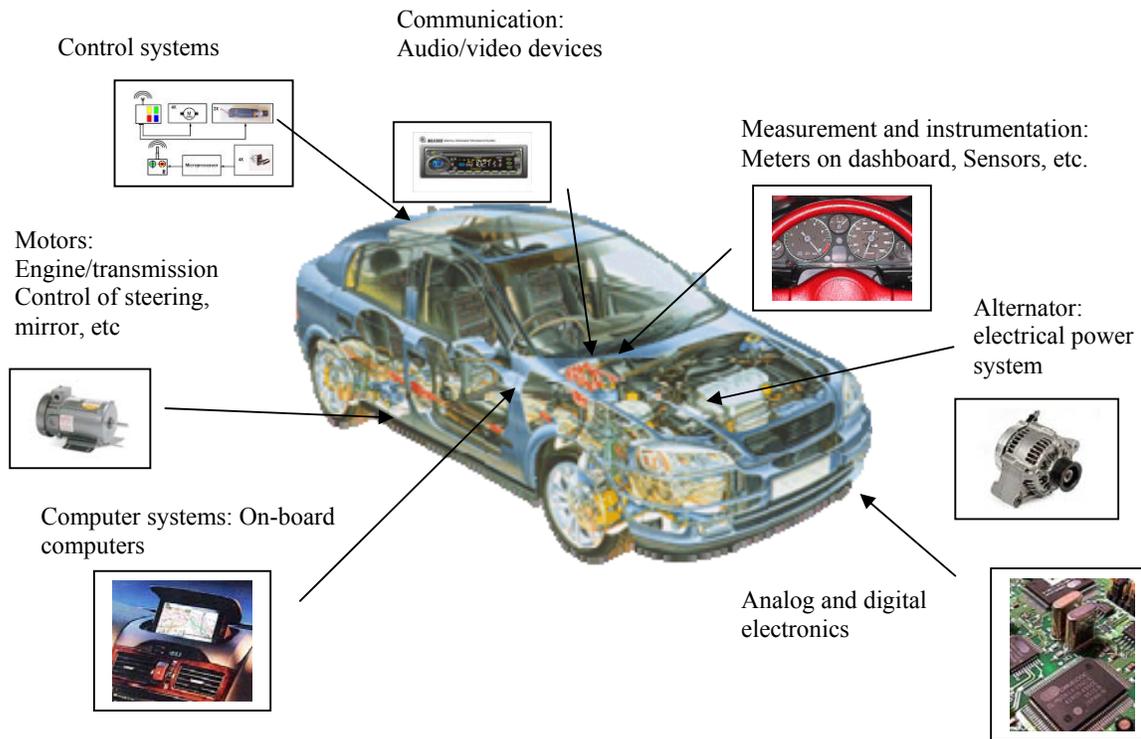


Figure 1: Electrical Engineering systems in a modern automobile

The following figure gives an overall picture of electrical engineering by listing the major areas and their relationship to other subjects.

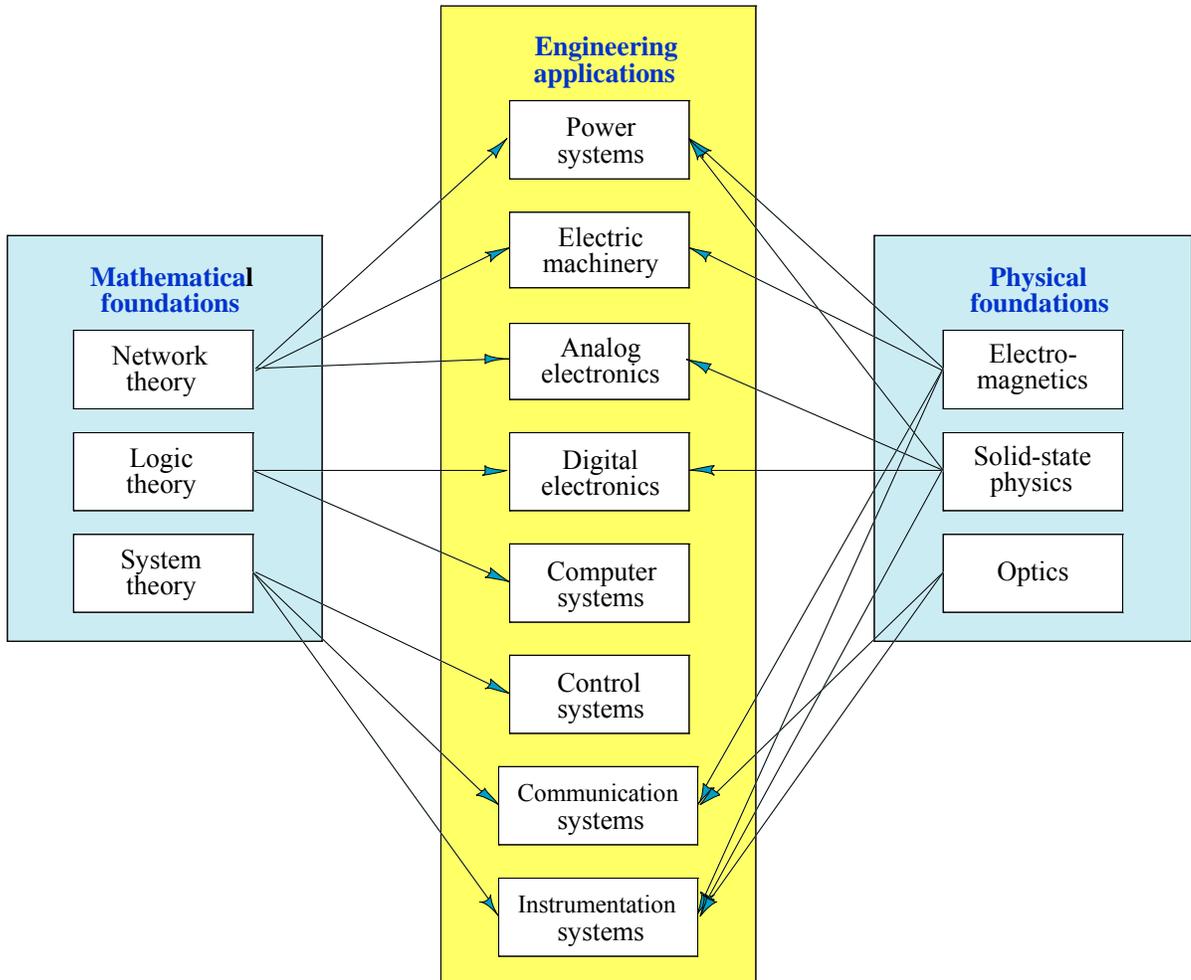


Figure 2: Electrical engineering disciplines

As we can see, electrical engineering fields are interwoven with nearly all design projects in other fields of engineering. In this second part of EG1108, we will study some of the important fields in electrical engineering that are considered relevant and useful for all engineers. In particular, in the field of power systems, we will focus on transformers, which are extensively used in large-scale power systems, as well as, in small power supplies for domestic applications; in electric machinery, we will study DC motors, which find widespread application in the industry; in the field of electronics, we will focus on Diode and rectifier circuits, and operational amplifiers; and then we will study some basic types of instrumentation systems which are extensively used in all fields of engineering.

Role of Electrical Circuits

Electrical circuits form the basis of all branches of electrical engineering. The concepts covered in *circuits* are used in the various branches of electrical engineering.

Example: Circuit representation of headlight circuit of an automobile

For example, there are numerous electrical circuits in a car. Figure 3 shows an example of the electric circuit used for controlling the headlight.

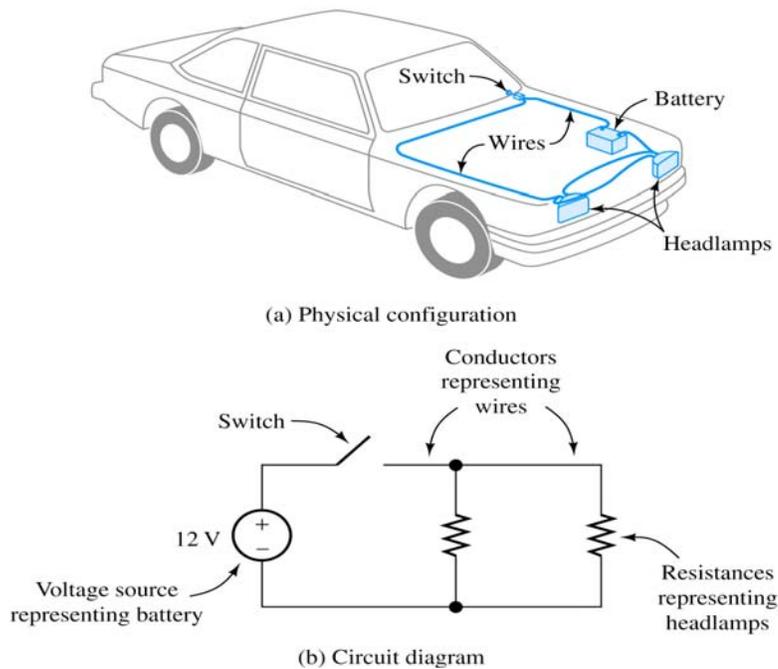


Figure 3: Example of an electric circuit in an automobile

A solid foundation in electric circuits is essential in the study of almost all the fields of electrical engineering, and forms the core body of knowledge. It will make possible the understanding of the various electrical and electronic devices, and their applications that we will study in this second part of the module.