Global Journal of Engineering, Design & Technology

OPEN ACCESS Freely available online

Commentary

Mechanical Engineering and its Sub Disciplines

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ABOUT THE STUDY

The study of physical machinery that may entail force and movement is known as mechanical engineering. To design, analyze, produce, and maintain mechanical systems, it is a branch of engineering that blends engineering physics, mathematics, and materials science. One of the oldest and most diverse engineering branches is it.

Understanding fundamental concepts in mechanics, dynamics, thermodynamics, materials science, design, structural analysis, and electricity is necessary for mechanical engineers. In addition to these fundamental ideas, mechanical engineers design and analyze manufacturing facilities, industrial machinery, heating and cooling systems, transport systems, aircraft, watercraft, robots, medical devices, weapons, and other things using tools like computer-aided design, computer-aided manufacturing, and product lifecycle management.

Sub disciplines

A variety of mechanical engineering science disciplines can be considered of as making up the field of mechanical engineering. Several of these sub-disciplines, which are generally taught at the undergraduate level, are listed along with a brief description and examples of how they are most frequently used [1].

Some of these subfields are specific to mechanical engineering, whilst others combine mechanical engineering with one or more other fields of study. A mechanical engineer uses knowledge and methods from several of these sub disciplines, as well as more specific sub disciplines, in the majority of their work [2].

Mechanics: In its broadest sense, mechanics is the study of forces and how they affect matter. Engineering mechanics is typically used to study and forecast the acceleration and deformation of objects under well-known forces or stresses [3, 4]. The sub disciplines of mechanics include

- Statics is the study of immovable objects subjected to known loads and how forces act on immovable objects.
- Dynamics is the study of the effects of forces on moving objects. Kinematics and kinetics are parts of dynamics.
- Materials mechanics is the study of how diverse materials deform in response to various types of stress.
- The science of fluid mechanics examines how fluids respond to forces.
- Kinematics is the study of how things move while excluding the forces that propel them. In the creation and evaluation of mechanisms, kinematics is frequently used.
- A technique for applying mechanics that presumes that objects are continuous is called continuum mechanics.

Mechatronics and robotics: Combining mechanics with electronics is known as mechatronics. The integration of electrical and mechanical engineering to produce hybrid automation systems is the focus of this multidisciplinary of mechanical engineering, electrical engineering, and software engineering [5]. Servo mechanisms, electric motors, and other electrical systems can all be used to automate machines in this fashion, together with specialized software. A CD-ROM drive is a typical illustration of a mechatronics system [6].

While an optical system reads the data on the CD and transforms it to bits, mechanical systems open and close the drive, spin the CD, and move the laser. The procedure is managed by integrated software, which also informs the computer of the CD's contents.

Robotics is the use of mechatronics to build machines that are frequently utilized in industry to carry out unpleasant, risky, or repetitive activities. These robots can be of any size and shape, but they all have preprogrammed interactions with the actual environment [7].

Structural analysis: The field of mechanical engineering known as structural analysis is focused on analyzing why and how things break down so that they can be fixed and improved. Static failure and fatigue failure are the two main types of structural failure [8]. According to the criteria for failure, static structural failure happens when an object is loaded and either breaks or deforms plastically.

When an object fails as a result of repeated loading and unloading, it has experienced fatigue failure [9]. Inconsistencies in the object lead to fatigue failure; for example, a minute crack on

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Received: 28-Feb-2022, Manuscript No. GJEDT-22-21487; **Editor assigned:** 03-Mar-2022, PreQC No. GJEDT-22-21487 (PQ); **Reviewed:** 18-Mar-2022, QC No. GJEDT-22-21487; **Revised:** 25-Mar-2022, Manuscript No. GJEDT-22-21487 (R); Published: 04-Apr-2022, DOI: 10.35248/2319-7293.22.11.145

Citation: Earley EJ (2022) Mechanical engineering and its Sub disciplines. Global J Eng Des Technol.11:145

the surface of the object may enlarge somewhat with each cycle until it is large enough to lead to eventual failure.

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