

## **CAD & SIMULATION LAB**

### **Description of the Laboratory:**

Fortunately, advances in Computer-Aided Design (CAD) software and computer hardware performance have enabled the use of virtual models. Objects are designed on a computer and displayed visually using three-dimensional graphics rendering. They are also tested in simulated physical conditions using the same CAD software in which they were designed.

The traditional use of CAD software in systems development was concerned only with the size and shape of an object, whether it is tiny part of a machine or a giant ship or an aircraft or a building. But CAD software users recognizing the value of simulation began to demand the ability to test their virtual objects in virtual environments, and CAD software developers were happy to oblige.

In order to test a virtual object under the conditions that approximate the real world as closely as possible, simply knowing the size and shape of the object is not enough. It is also essential to know its physical properties, to know how to represent these properties in the computer model. To know the influence of these properties on the performance of the object under test. This is usually done with equations—that is, a mathematical model of the system's behavior, to go along with the system's shape, size, and material properties.

For example, when testing a virtual aircraft, it's important to know how the air flowing around the wing generates lift. We have a well-established body of mathematical equations to handle the physics of airfoils, and they can be incorporated into the CAD representation of the system. Further, the materials used in the wing are important, because they determine how heavy the wing is and how it bends and flexes under load and in various situations, such as takeoff, landing, and turbulence. Thus, physical properties such as coefficient of friction and various parameters that determine the strength of the wing structure must also be incorporated into the model.

An important approach to simulation modeling in CAD is the use of Finite Element Modeling (FEM). Physical phenomena are often described by complex equations that are impractical or impossible to solve for every point in an object. FEM addresses this problem by subdividing the object into small three-dimensional chunks; CAD software enables meshing, the process of creating a 3D grid within the object to define the subdivisions.

### List of Experiments:

1. Exercises (2-D & 3-D) using design packages:
  - a) Drafting: Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting.
  - b) Part Modeling: Generation of various 3D models through protrusion, revolve, shell sweep, Creation of various features, Study of parent child relation, Feature based and Boolean based modeling surface and assembly modeling, Study of various standard translators, Design simple components.
2. Exercises using Analysis software:
  - a) Structural Analysis:
    - Determination of deflection and stresses in 2D trusses and beams.
    - Determination of deflections component and principal and Von-Mises stresses in simple 3D plane and axisymmetric components.
  - b) Thermal Analysis:
    - Steady state heat transfer Analysis of plane and axisymmetric components.
    - 2D problem with conduction and convection boundary conditions.
  - c) Computational Fluid Dynamics(CFD) Analysis:
    - Simple fluid flow and heat transfer problems.
    - Modeling Periodic flow and heat transfer.
    - Modeling external compressible flows.
    - Modeling transient compressible flows.
    - Modeling radiation and natural convection.

### List of Software:

- Solidworks-2016
- CREO Version 2.0
- HyperMesh
- ANSYS
- OpenFoam
- Scilab 6.1.0

**Computer system configuration:**

S. No	Equipment/ Software	Description	Total No.
1.	Lenovo Think Centre Desktop	Intel core i3-2120 CPU 3.30GHz 8 GB RAM, 500GB HDD ZOTAC GT 440 Graphic Card, Lenovo Keyboard & Mouse 18.5" LG LED Monitor	36

**Photographs of the Lab/Equipment:**

