COMPUTER AIDED ENGINEERING DESIGN (BFF2612)

Introduction

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OVERVIEW

- Aims
  - Introduction of CAD/CAE/CAM
- Expected Outcomes
  - Students should be able to understand to the terms of CAD/CAE/CAM and it applications
- References

1. Ibrahim Zeid, 2005. Mastering CAD/CAM, McGraw Hill
2. Chris Mc Mohan, Jimmie Browne CAD CAM from principle to practice, Addison Wesley Publishing

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- Computer Aided Design
- Computer Aided Engineering
- Computer Aided Manufacturing

- CAD
- CAE
- CAM

} Engineering design + production function

- Computer Integrated Manufacturing

- CIM → Business philosophy

WHAT IS CAD?
COMPUTER AIDED DESIGN

- Process that utilized computers to create, design and edit the models or drawings.
- Create geometric features for architectural structure, mechanical part, building layout or other electronic circuit,
- The information stored in computer database as the basis to produce engineering drawings.
- The CAD referred to 3D work in computer aided design, 2D computer aided drafting.

ADVANTAGES OF 3D CAD

- Reduces the time and labour required to make engineering drawings.
- Eliminates drawing errors and mistakes caused by misreading the drawings.
- Gives an accurate geometric database that can be used to generate Numerical Control (NC), to design patterns, special tools, and fixtures needed to manufacture the part.
- The master model can be used to purchasing agents, cost estimators, inspectors, and production planners all directly viewed the CAD model to do their jobs.

What is CAE?
COMPUTER AIDED ENGINEERING

- To analyze CAD geometry, to *simulate* and to observe how the product will behave and find any errors earlier during the design cycle.
- Therefore, the design able to be refined and optimized and reducing overall product development time and cost.
- To analyze products that are already manufactured, but experiencing problems.

What is CAE?
COMPUTER AIDED ENGINEERING

- Finite element analysis (FEA) or Finite element model (FEM) function to analyze stress, strain, displacement, force, etc. of structure/part design.
- Kinematics: to analyze the movement of mechanism (displacement, force, velocity and acceleration).
- Dynamics: to analyze displacements, forces or vibration in complex mechanical systems such as vehicles.
- Rapid prototyping: to quickly transform CAD models into small physical models.

COMPUTER-AIDED ENGINEERING (CAE)

What if:

I change the *size*?
I change the *material*?
I change the *entire concept*?

ANALYSIS – SIMULATION – VALIDATION – OPTIMIZATION
The process of analysis involves simulating a product within an environment to predict an outcome.

Example:

- In computer games, simulate other worlds and times.
- Print preview in word processors simulates how the printed page will look.

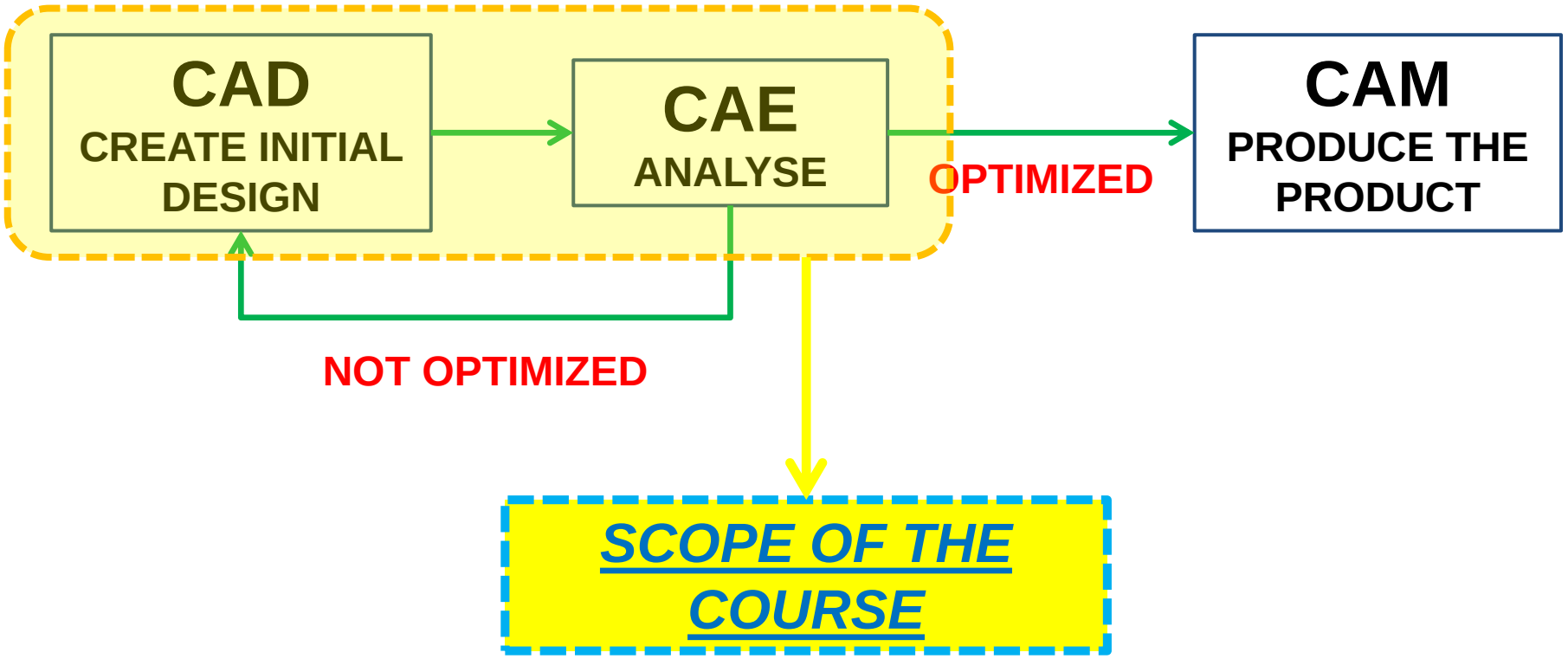
What is CAM?
COMPUTER AIDED MANUFACTURING

- Provide *instructions to automated machines*. Used to manufacture parts, assemblies, and circuits,
- The geometric data from CAD is used as a starting point.
- Generate Computer Numerical Control (CNC): to control a machine tool that grinds, cuts, mills, etc.

What is CIM?
Computer Integrated Manufacturing

- Process of using *computer databases* to run an entire factory more efficiently, such as in accounting, factory management, scheduling, and shipping.
- Overall data sharing, information flow and work.
- CIM applies in the areas as design, drafting, analysis, and testing:
  - Inventory control, engineering department, machine control, process planning, quality assurance;
  - Generate report, forecast, and plant management.

CAD / CAE / CAM



CAD-CAE-CAM SYSTEMS

- A CAD-CAE-CAM system is a complex application that requires both hardware and software.
- CAD-CAE-CAM software can run as a client/server or standalone application.
- CAD-CAE-CAM software utilizes a data structure to save the geometry and topology of geometric models.
- The data structure is a well-defined storage scheme that stores model data.
- A CAD database is the file that stores the model information where each file has a name and an extension.

CAD-CAE-CAM SYSTEMS

- New users are faced with two challenging problems:
  - ✓ Must understand the concepts of 3D modeling and viewing and how to control geometric construction.
  - ✓ Must learn the structure of the software Graphical User Interface (GUI) and where to find commands when needed.
- Learning and using one system should help accelerate learning and using other systems.
- CAD-CAE-CAM software is designed to run on all platforms and operating system.

Why is it important to study these subjects?

- CAD-CAE-CAM have been utilized in engineering practices:
  - Drafting
  - Design
  - Simulation
  - Analysis
  - Manufacturing
- CAD-CAE-CAM users become very inefficient in using the systems unless they understand the fundamental concepts on which these systems are built.

So, what will be learned in this course?

This course will explain and apply the concepts and practices of geometric modeling in CAD/CAE system.

ADDITIONAL INFORMATION AND LECTURE NOTES

- https://grabcad.com/library/category/aviation
- http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Computer%20Aided%20Design%20&%20Manufacturingl/
- http://www.freecadweb.org/

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