MAM 302 CAD/CAM

LECTURE NO.1 (Fall 2025) [Mechatronics Engineering and Automation Program]

Dr. Yahya Abdelhameed Amer

LECTURE RULES

"Great things come from hard work and perseverance. No excuses."

KOBE BRYANT

COURSE SPECIFICATIONS

- Course code-title: **MAM 302 - CAD/CAM**
- **3rd level** in Mechatronics Engineering and Automation Program
- **3** credit hours, **4** contact hours [2 Lecture + 2 Laboratory]
- Total grades: **100** [10 Student activity, 30 Midterm exam, 20 Practical exam, 40 Final exam]
- Minimum rating for success: **D Rating** [GPA 1.00, 64% > Grades > 60%]
- Course pre-requisite: **MAM 207 - Mechanical Design**
- Lecture scheduled on **Monday** in **Q7 Hall**, third floor

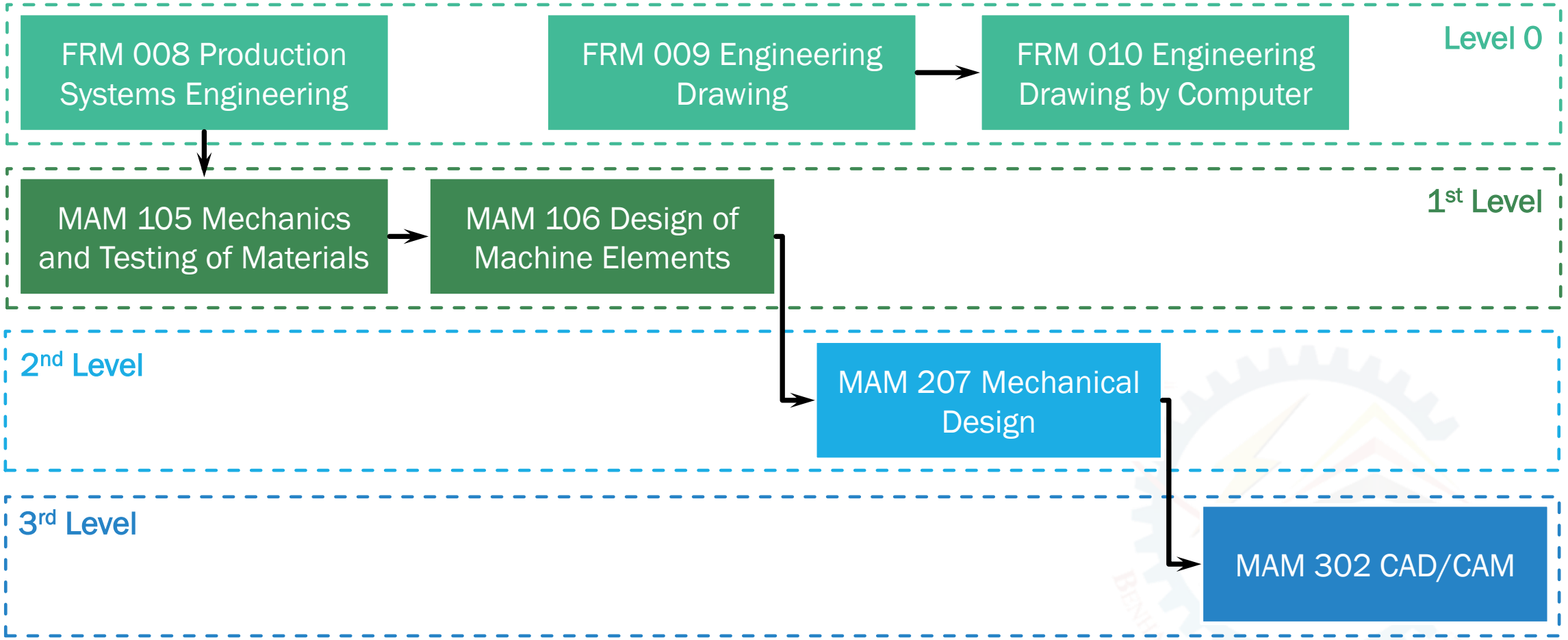
COURSE SPECIFICATIONS

- Course Contents:

- **CAD:** Geometric modeling, data exchange and integration, mechanical assembly and drafting, mechanical tolerance, mechanical stress analysis.
- **CAD/CAM:** Process planning and tool path generation, integration of CAD/CAM with the production machine, programming for lathe, drilling and milling machines, canned cycles, subroutines, Loops, computer assisted part programming, DNC, CNC.
- **Group Technology:** Part families, part classifications and coding systems, group technology.
- **Computer Integrated Manufacturing:** Types of manufacturing systems, types of CIMS, special manufacturing systems, flexible manufacturing systems (FMS), manufacturing cells.

COURSE SPECIFICATIONS

- **Course Map:**



INTRODUCTION

- Computers are essential in manufacturing because they bring **precision**, **efficiency**, **control**, **flexibility,** and **integration** to processes that are otherwise slow, error-prone, or impossible to manage manually.
- <u>The role of computers in manufacturing:</u>

  1. Computer monitoring and control of the manufacturing process.
  2. Manufacturing support applications, which deal essentially with the preparations for actual manufacturing and post-manufacture operations.

INTRODUCTION

- **The complete procedures behind a new product include the following three categories:**

1. Product Engineering: Product functions, Product specifications, Conceptual design, Ergonomics and Aesthetics, Standards, Detailed design, Prototype development, Simulation, Analysis (Strength, Kinematics, Dynamics, Heat, and Flow), Testing.
2. Manufacturing Engineering: Process Planning (Process/Route sheets), Tooling (Cutting tools, Jigs/fixtures, Dies/molds), Manufacturing (CNC part programs, Robot programs, Inspection programs), Production Organization (Bill of materials, Production planning, Shop-floor control, Plant simulation).
3. Marketing and Distribution: Packaging, Distribution, Marketing.

INTRODUCTION

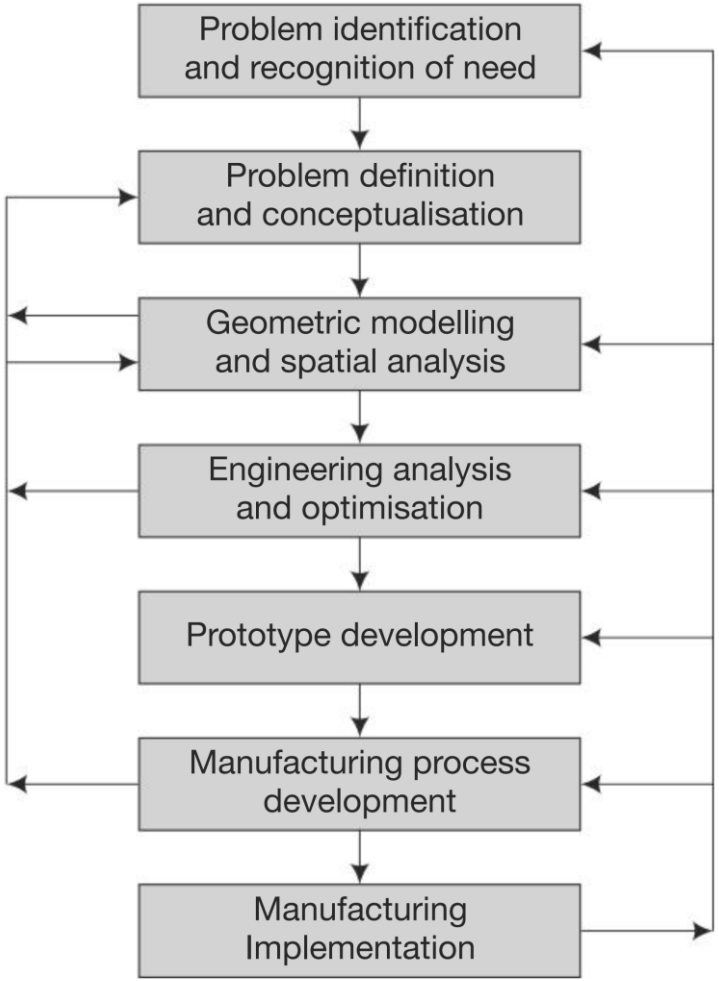


Fig. 1 *Stages in the design process*

INTRODUCTION

- Problem Identification:

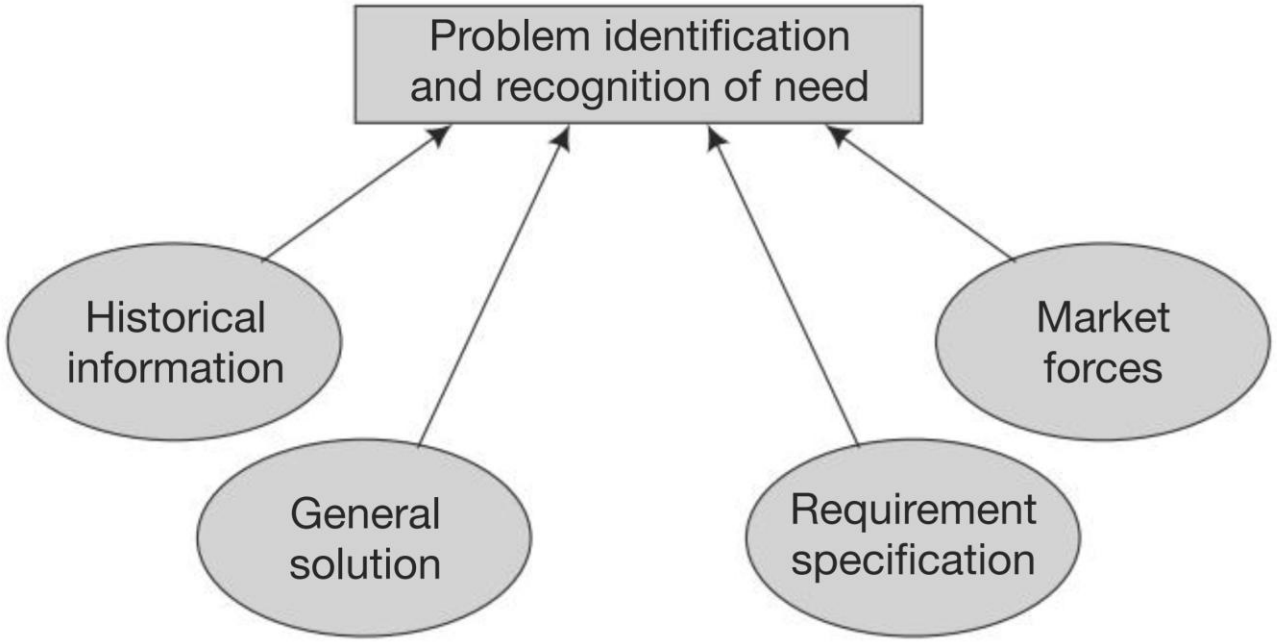


Fig. 2 *Processes involved in the problem-identification stage*

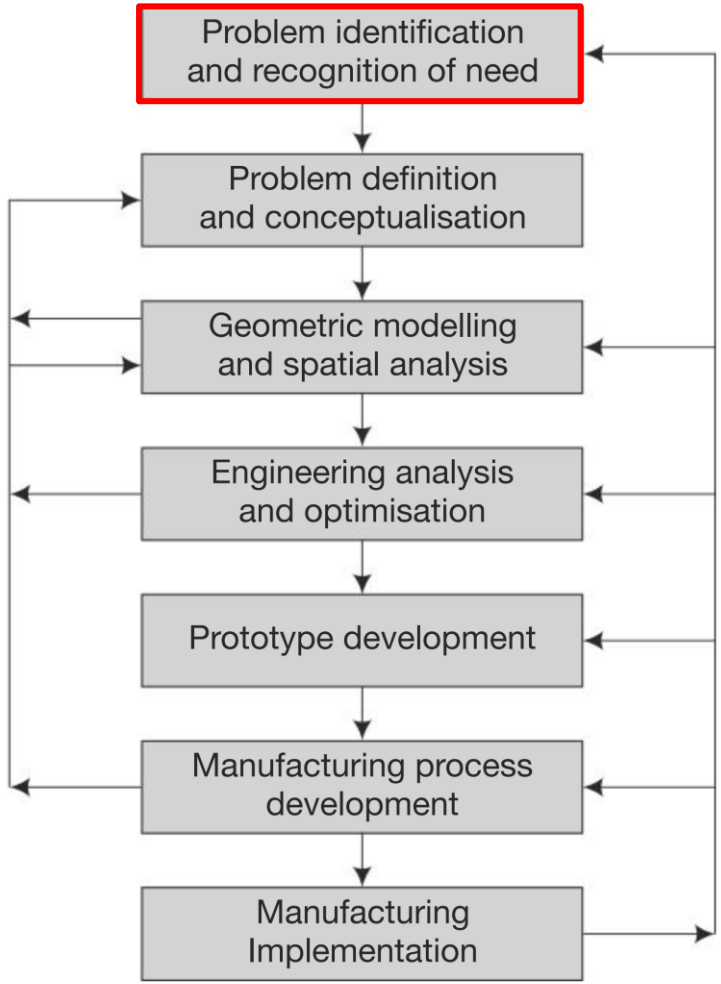


Fig. 1 *Stages in the design process*

INTRODUCTION

- **Problem Definition:**

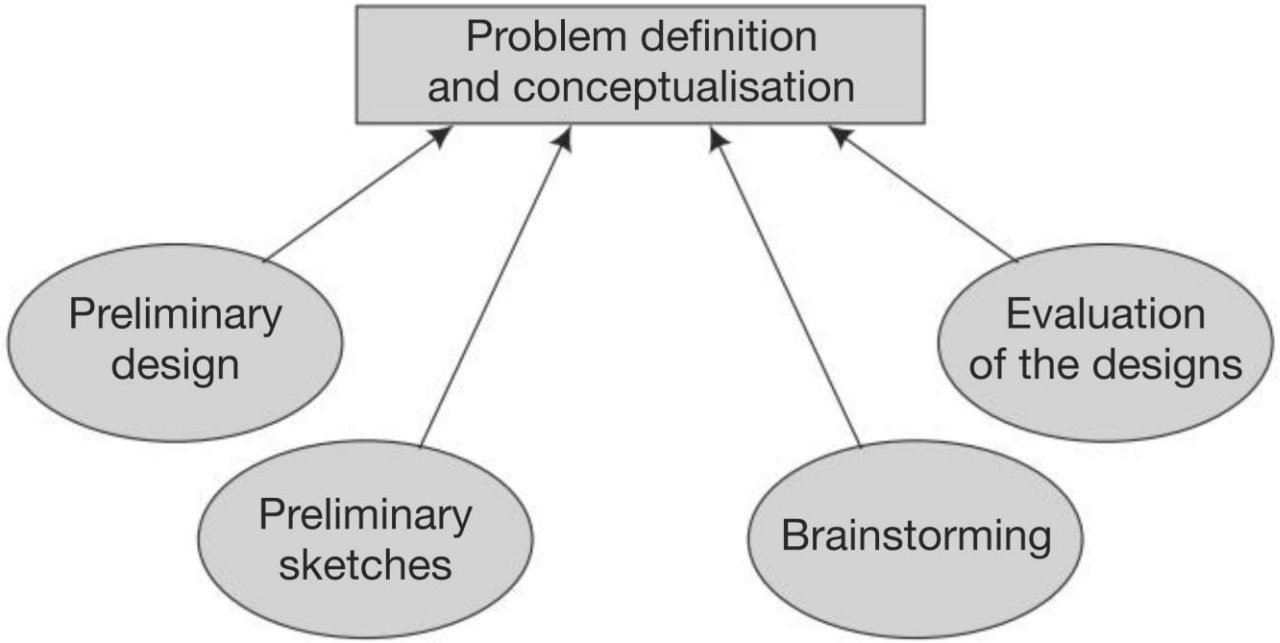


Fig. 3 *Processes involved in the problem-definition stage*

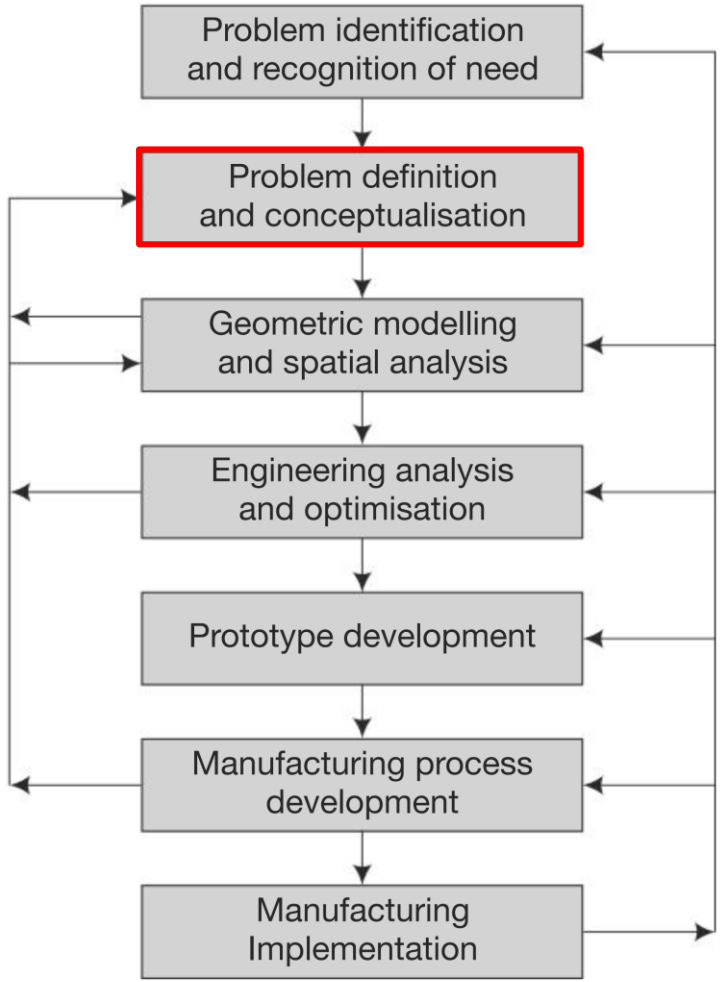


Fig. 1 *Stages in the design process*

INTRODUCTION

- Geometric Modelling:

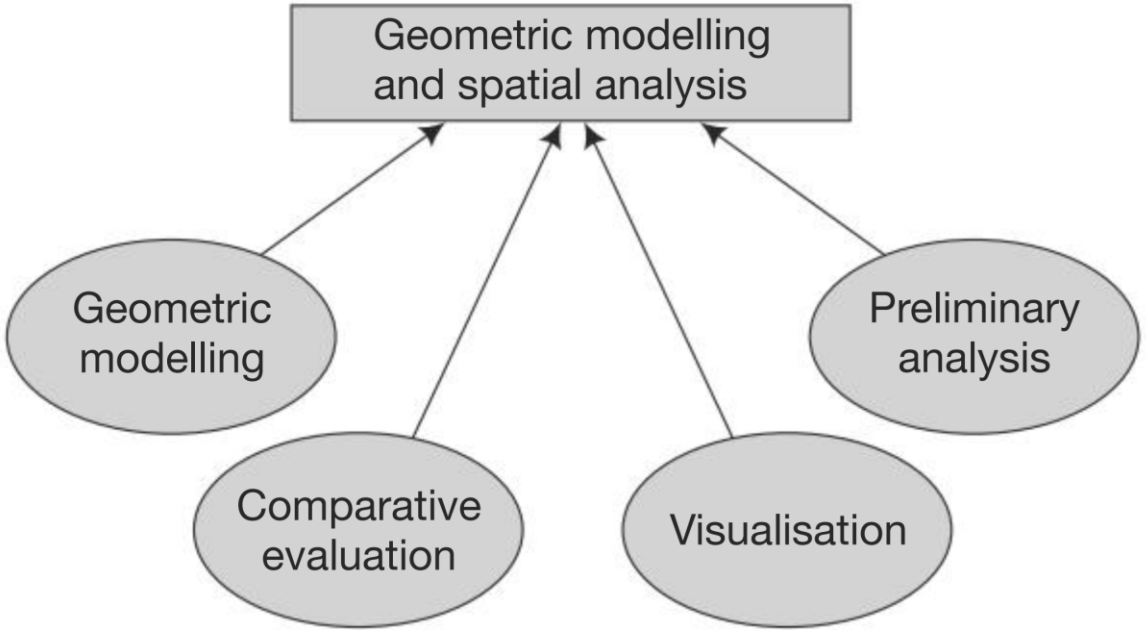


Fig. 4 *Geometric-modelling stage in the design process*

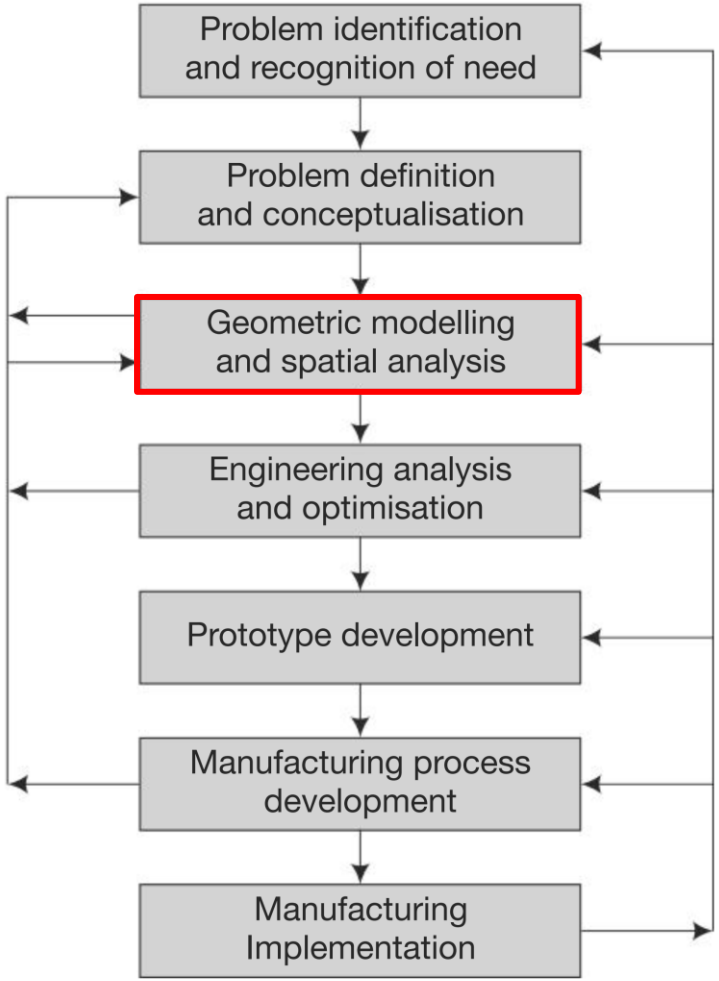


Fig. 1 *Stages in the design process*

INTRODUCTION

- **Engineering Analysis:**

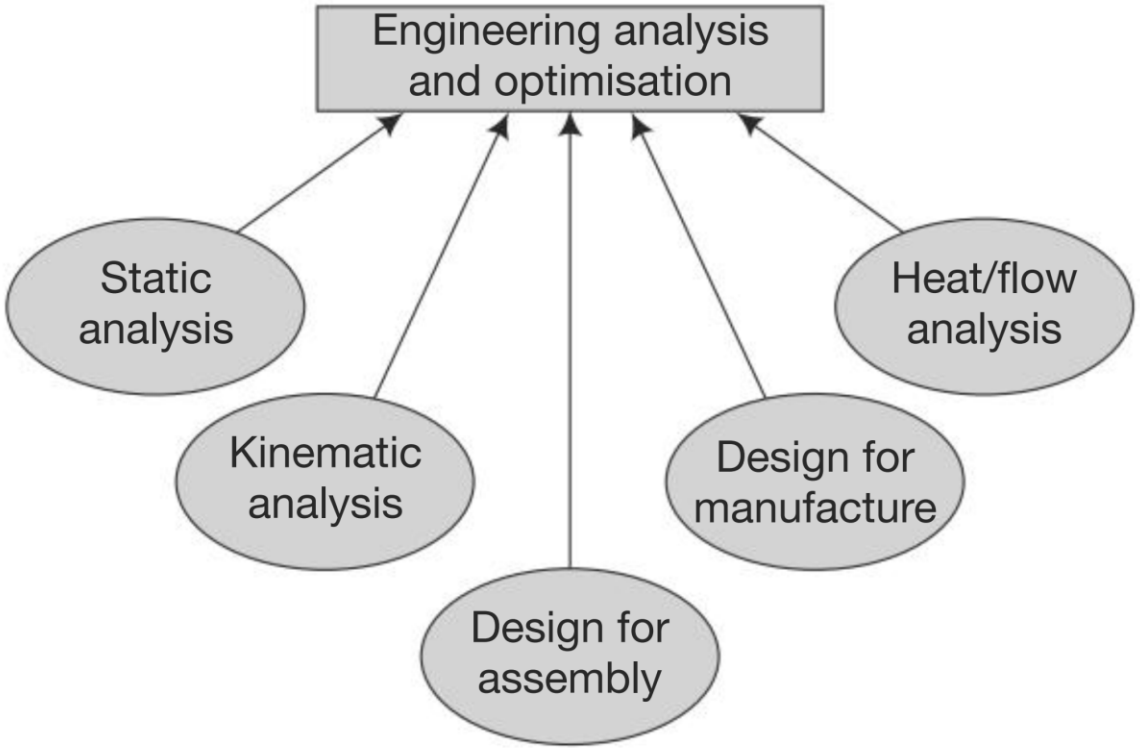


Fig. 5 *Analysis stage in the design process*

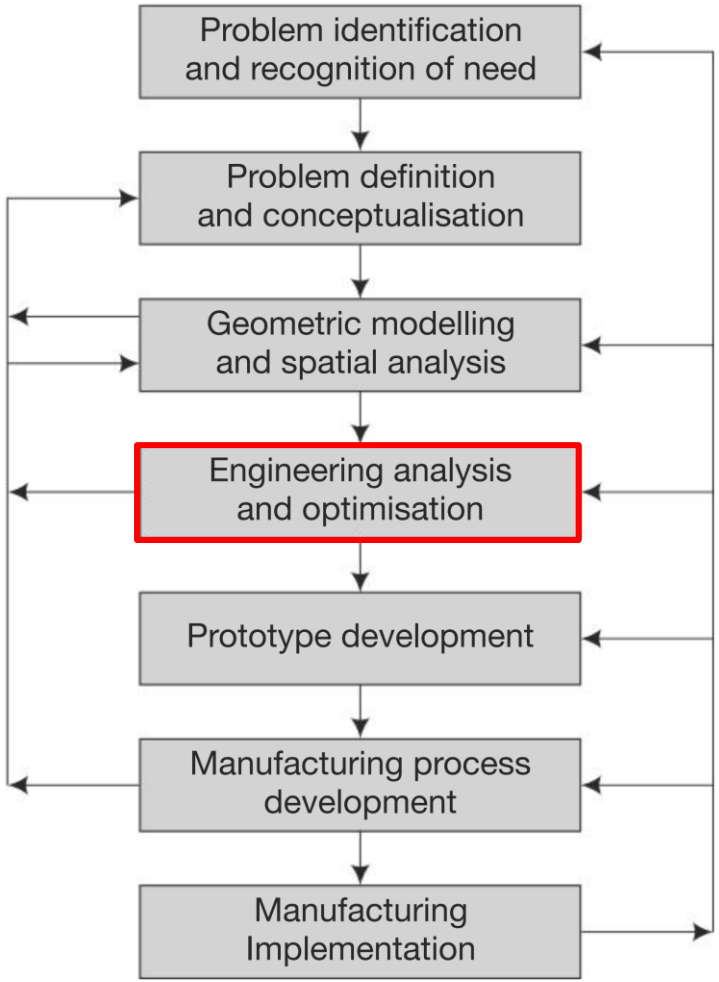


Fig. 1 *Stages in the design process*

INTRODUCTION

- **Prototype Development:**

- Physical Prototypes
- Rapid Prototyping (RP)

  (a) Test and Evaluation In the earlier stage,

  (b) Design Refinement,

  (c) Working Drawings,

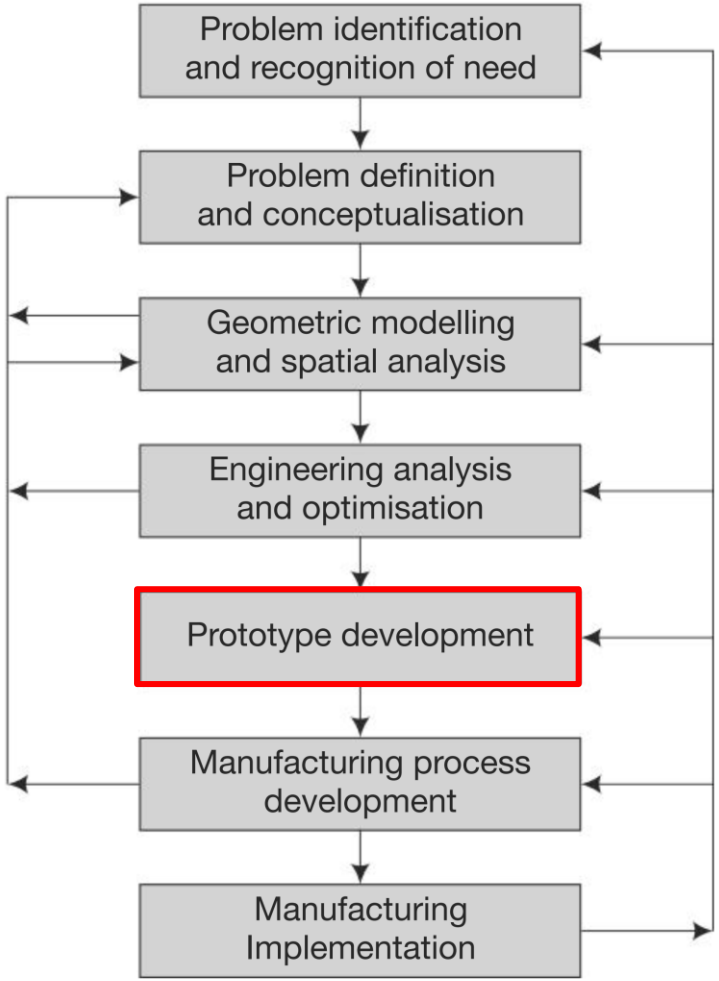


Fig. 1 *Stages in the design process*

INTRODUCTION

- Manufacturing Process Development:

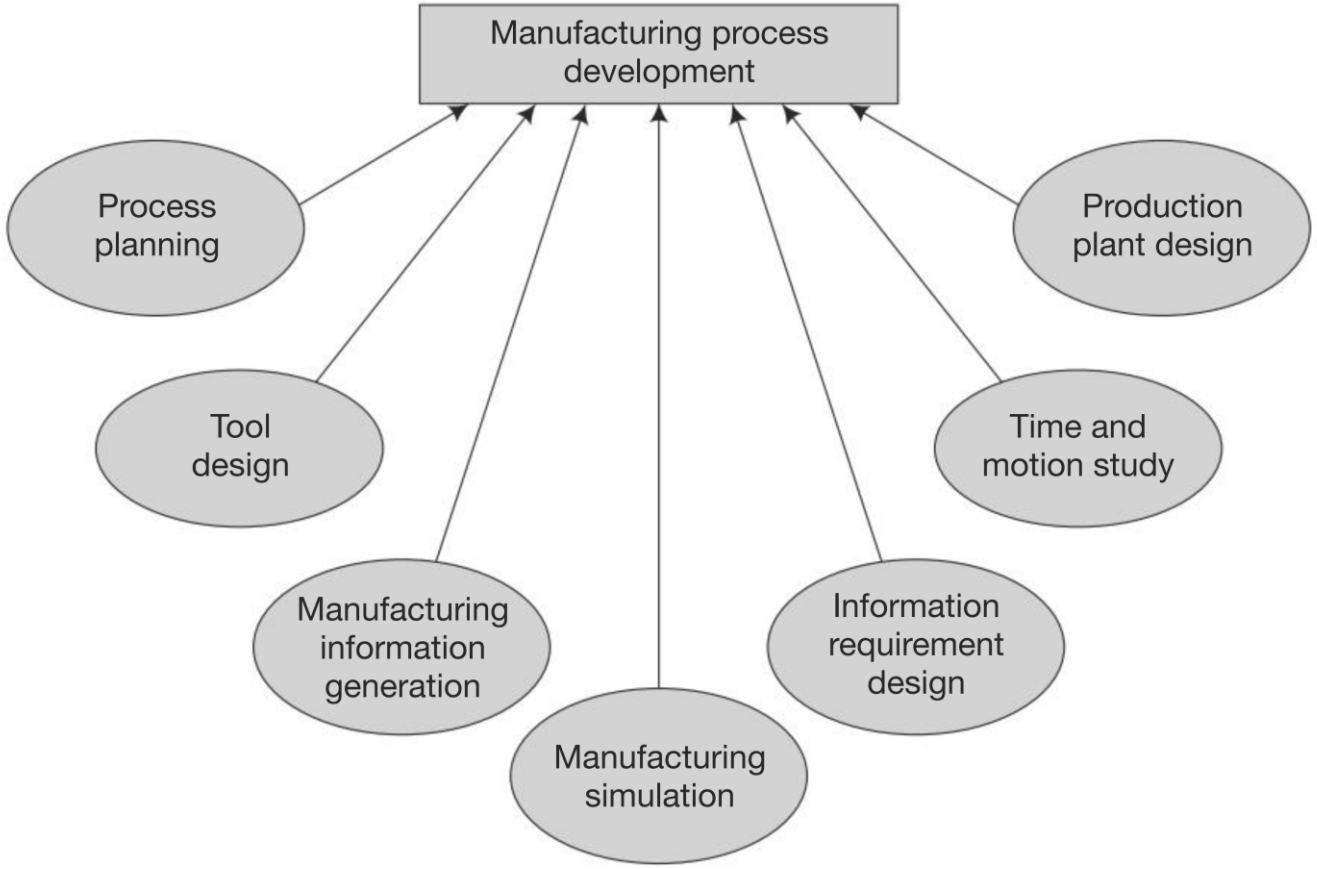


Fig. 6 *Manufacturing-process-development stage in the design process*

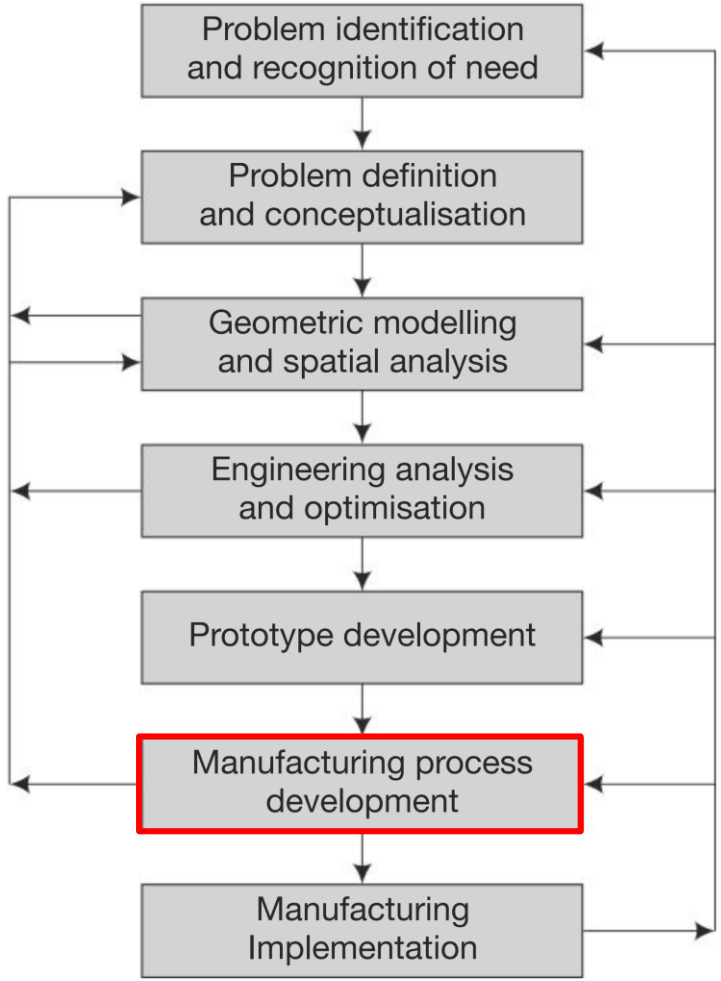


Fig. 1 *Stages in the design process*

INTRODUCTION

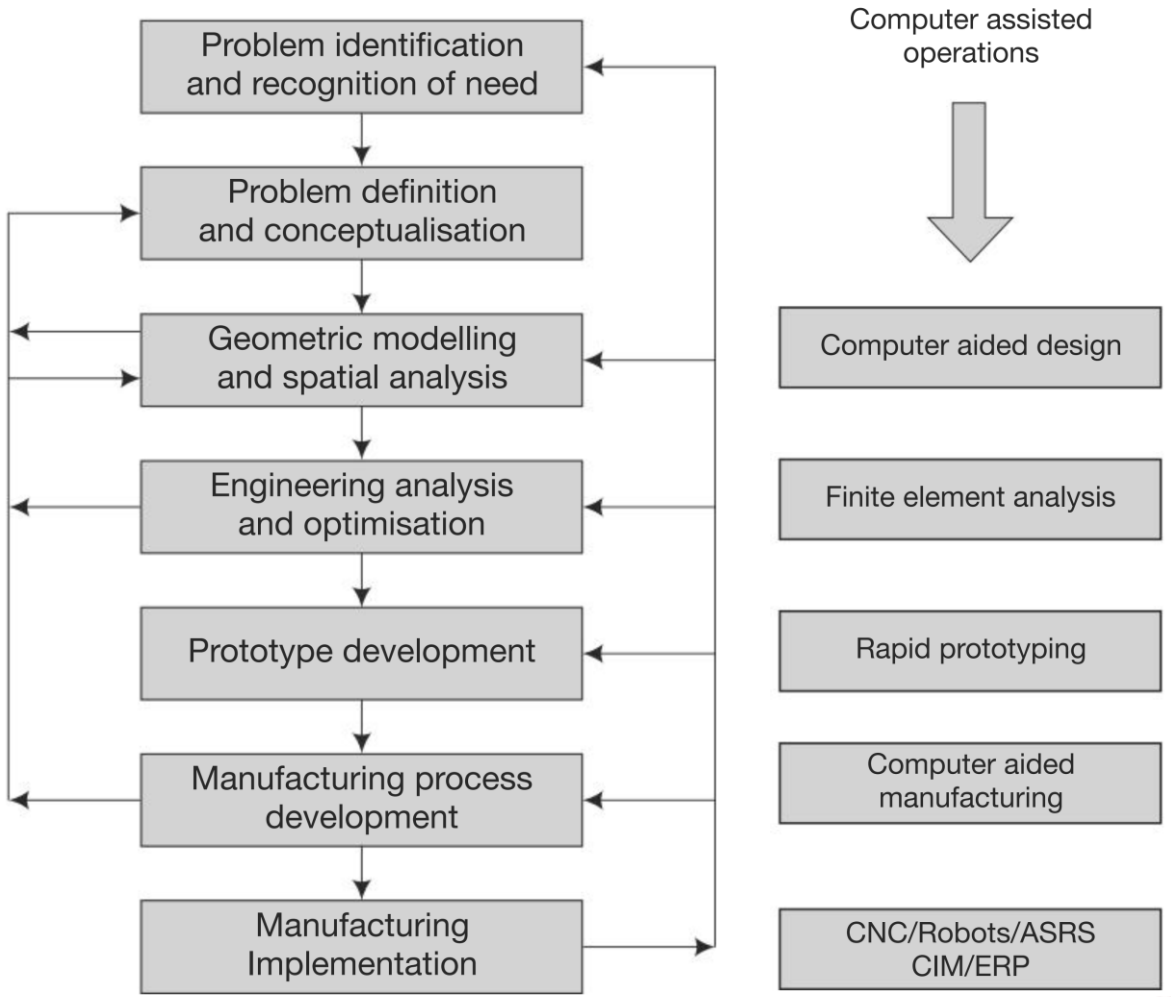
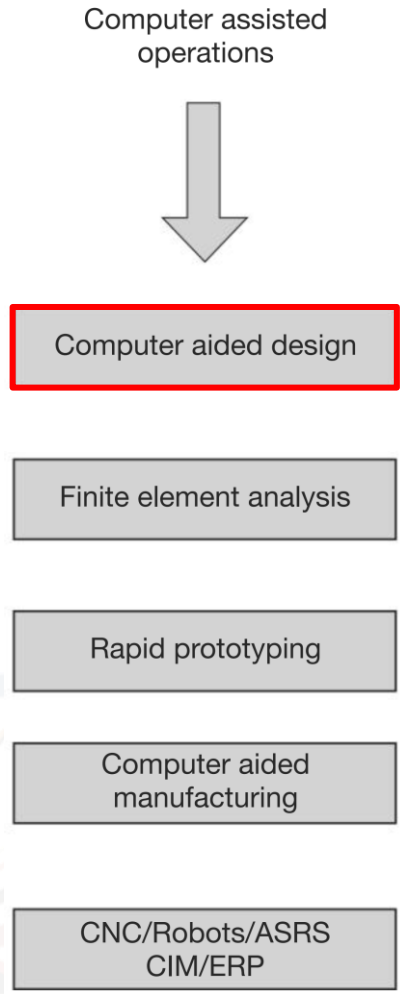


Fig. 1 *Stages in the design process*

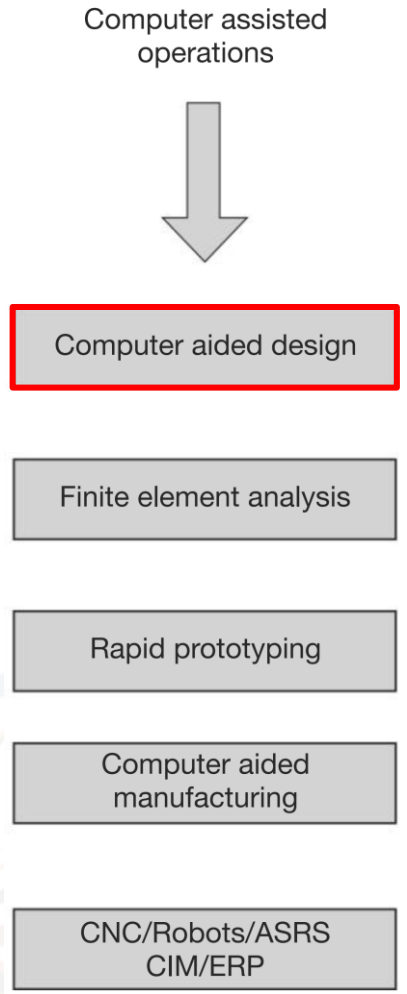
INTRODUCTION

- **Computer Aided Design (CAD):** The use of computer methods to develop the geometric model of the product in three-dimensional form, such that the geometric and manufacturing requirements can be examined.
- **Computer Aided Design and Drafting (CADD):** Combining the CAD function with drafting to generate the production drawings of the part for the purpose of downstream processing.



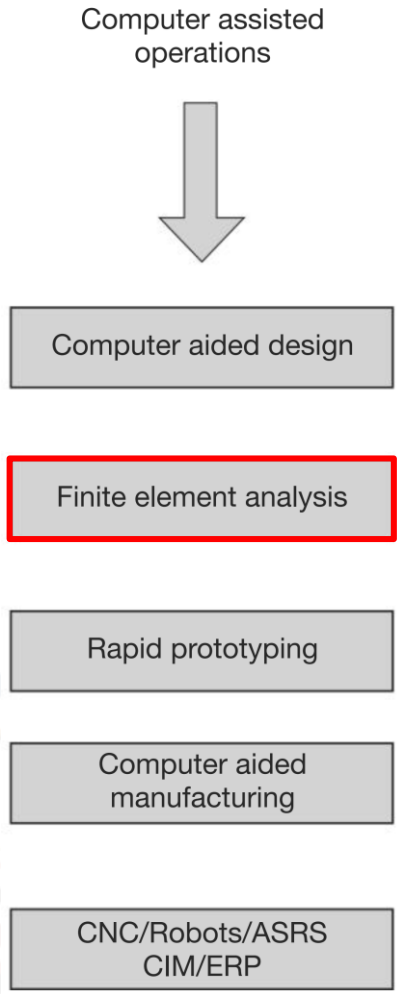
INTRODUCTION

- Advantages of using CAD technology:
- Faster and more accurate than conventional methods.
- Easier in developing the model and associated drafting.
- Possible to manipulate dimensions, attributes and distances.
- No need for design repeating, can be used in further works within seconds.
- Accurate calculation of the various geometric properties.
- Through efficient **design intent**, it is easier to modify/optimize designs.
- Using part libraries makes for a very fast model-development.
- Provide advanced 3D visualization capabilities.



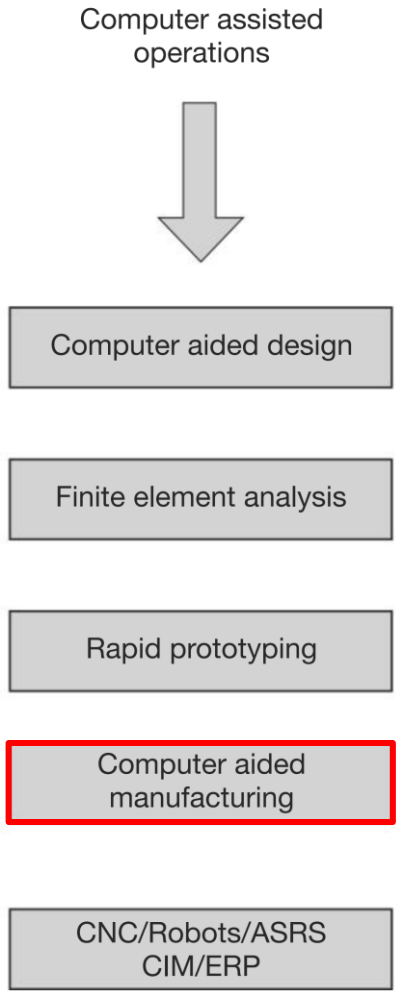
INTRODUCTION

- **Computer Aided Engineering (CAE):** The use of computer methods to support basic error checking, analysis, optimization, manufacturability, etc., of a product design.



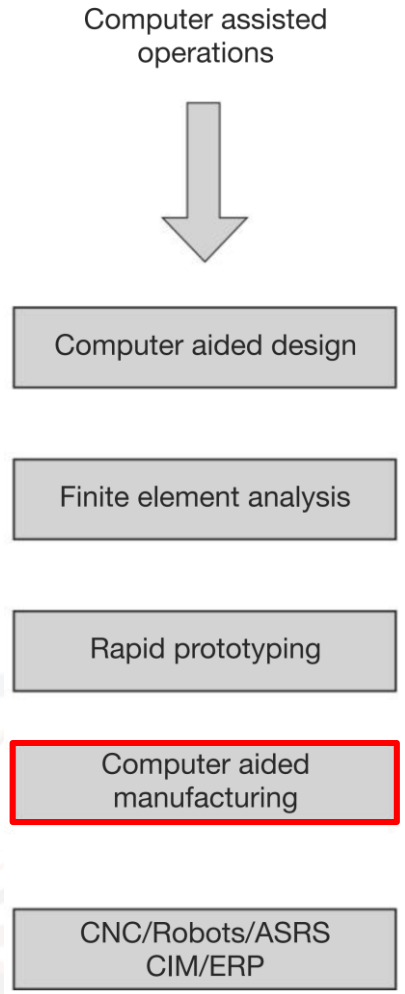
INTRODUCTION

- **Computer Aided Manufacturing (CAM):** Generally, refers to the computer software used to develop the Computer Numerical Control (CNC) part programs for machining and other processing applications.



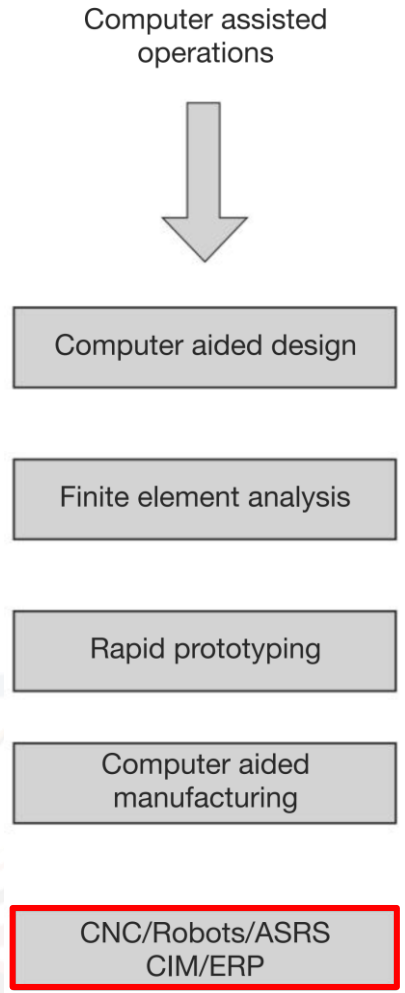
INTRODUCTION

- Advantages of Using CAM:
- **Greater Design Freedom**: Any changes that are required in design can be incorporated at any design stage.
- **Increased Productivity:** The manufacturing activity is completely organized through the computer,
- **Greater Operating Flexibility:** Methods and changing of product lines.
- Shorter Lead Time, Improved Reliability, Reduced Maintenance, Reduced Scrap and Rework, Better Management Control.



INTRODUCTION

- Computer Aided Process Planning (**CAPP**), Computer Aided Tool Design (**CATD**), Computer Aided Planning (**CAP**), Computer Aided Quality Assurance (**CAQ**), Computer Aided Testing (**CAT**).
- **Computer Integrated Manufacturing (CIM):** encompasses all product development and manufacturing activities with all the functions being carried out with the help of dedicated software packages.



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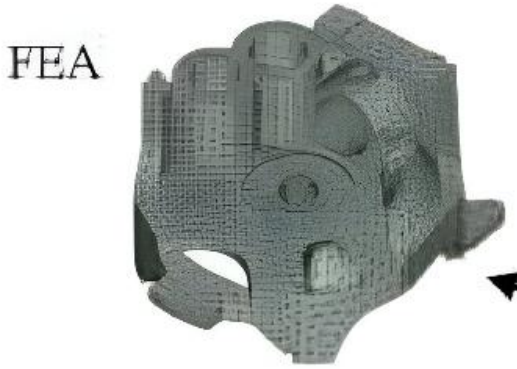
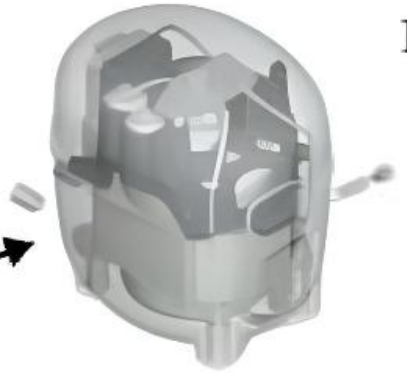
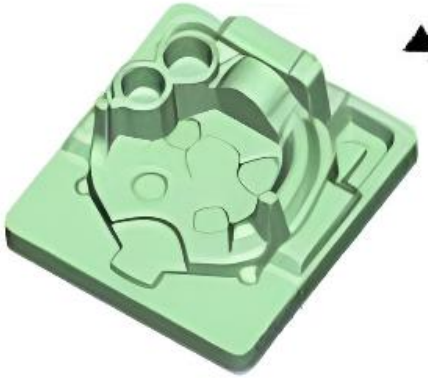
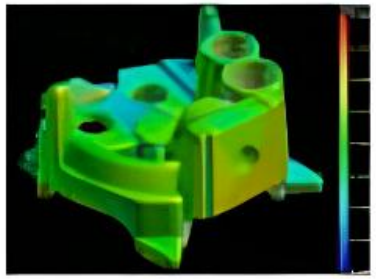
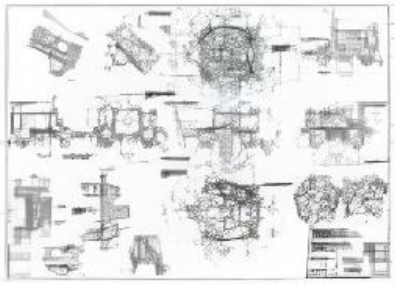






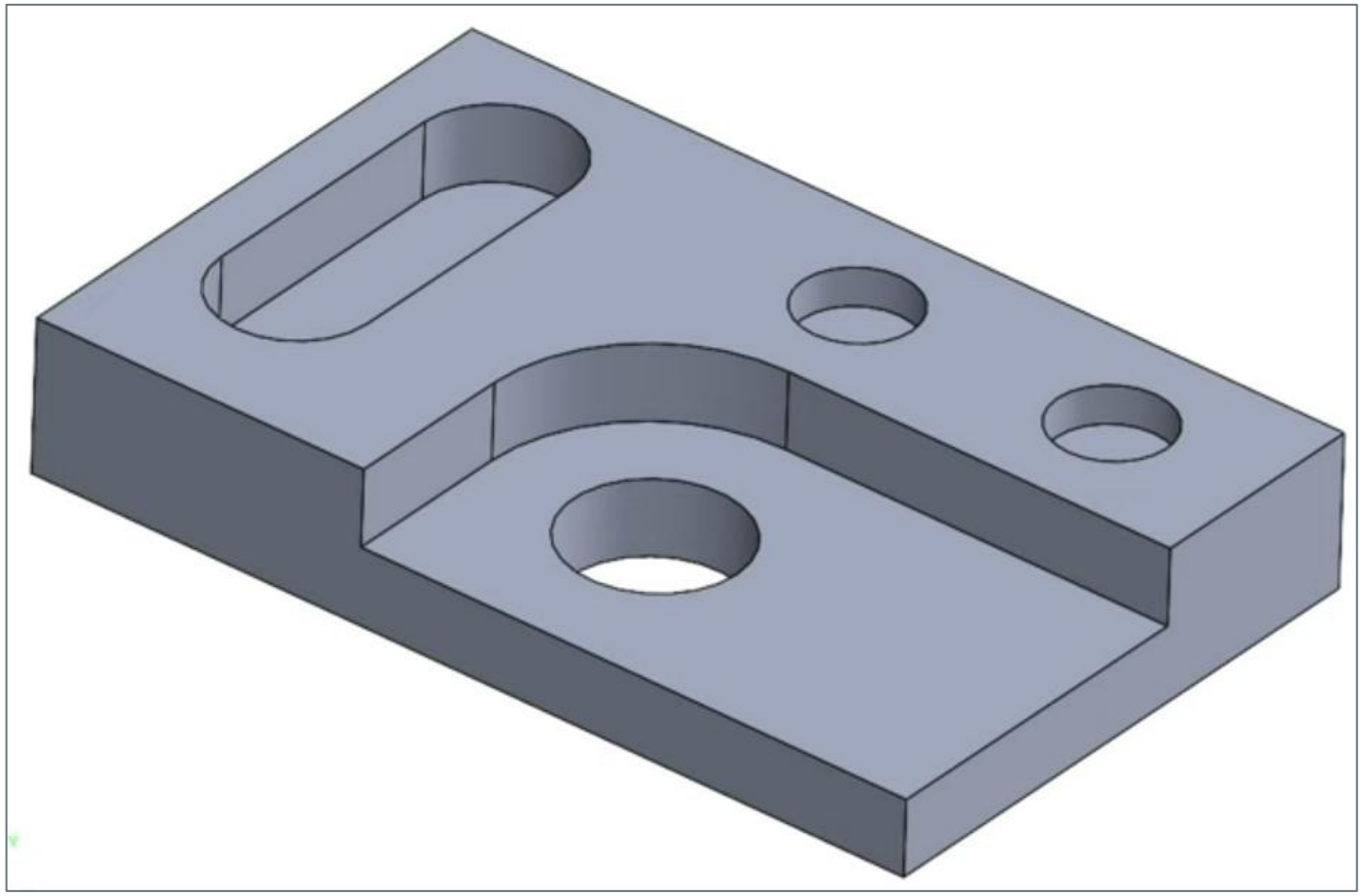




Computer assisted operations

- Computer aided design
- Finite element analysis
- Rapid prototyping
- Computer aided manufacturing
- CNC/Robots/ASRS CIM/ERP

INTRODUCTION



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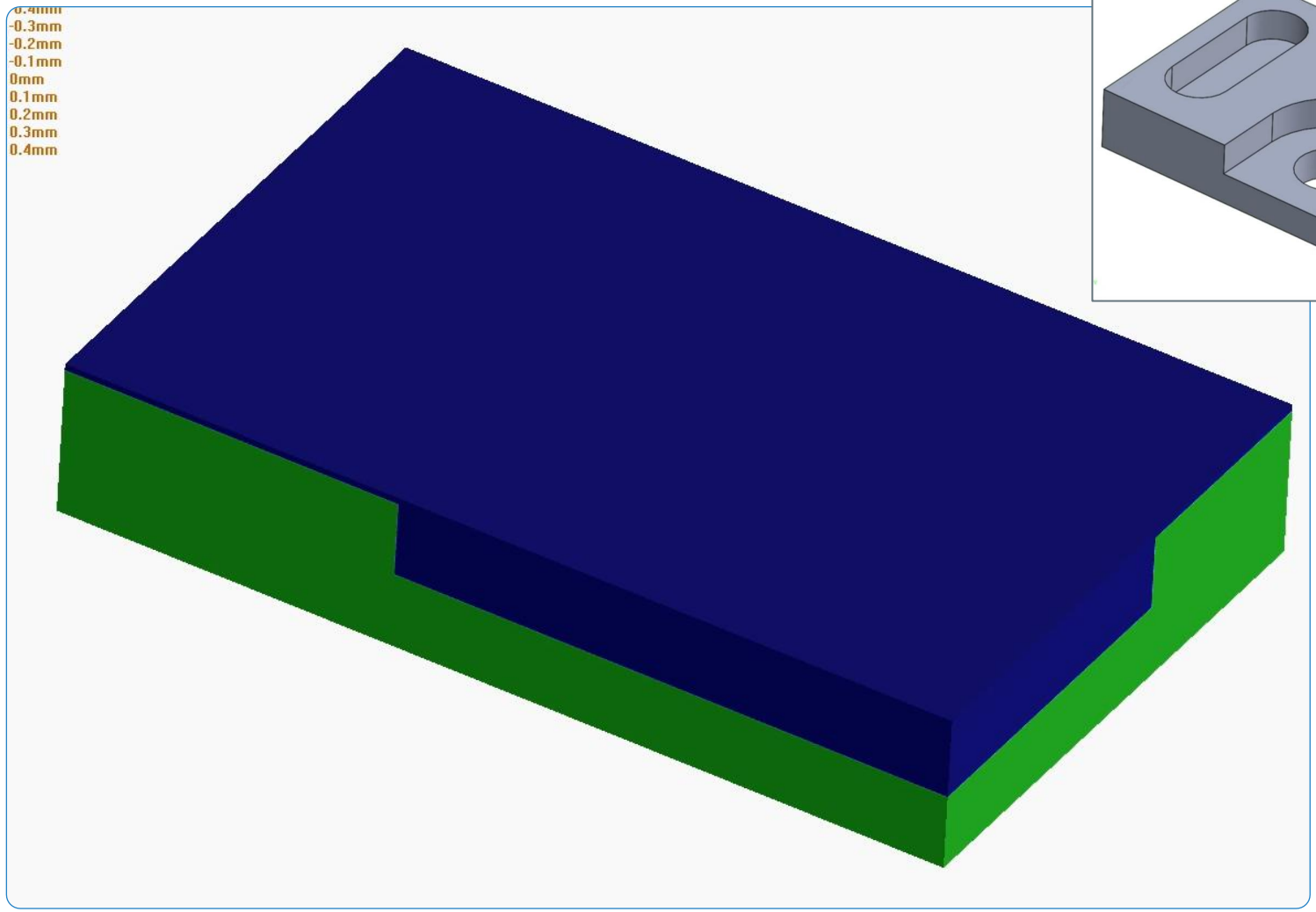
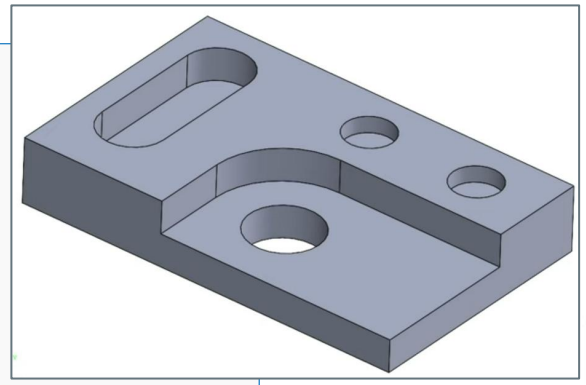
INTRODUCTION





Computer assisted operations

Computer aided design

Finite element analysis

Rapid prototyping

Computer aided manufacturing

CNC/Robots/ASRS CIM/ERP

END OF PRESENTATION