IE360: CAD/CAM

Computer Aided Design and Computer Aided Manufacturing

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Course Specifications

➢ Learning Objectives

- Understanding the science behind the CAD/CAM.
- Gaining practical knowledge and skills of using the CAD/CAM software such as CATIA.

➢ Learning Resources

- Required Text: Principles of CAD/CAM/CAE Systems by Kunwoo Lee, Addison Wesley, 1997.
- Essential References:
  - CAD/CAM by Ibrahim Zeid, McGraw-Hill, 2005,
  - Introduction to CNC by Valentino and Goldenberg, Prentice Hall, 2003.

➢ Assessment Methods

- Final exam 40%, Mid-term exams 30%, Lab work 20%, home works and term projects 10%.

Course Outline

- CAD Part (8 lectures)
  - Introduction to CAD/CAM Systems
  - Components of CAD/CAM Systems
  - Geometric Modeling Systems
  - Geometric Transformations
  - Representation and Manipulation of Curves
  - Geometric Projections
  - Data Exchange between CAD/CAM Systems
  - Finite Element Modeling and Analysis

- CAM Part (5 lectures)
  - Introduction to Numerical Control (NC)
  - Manual Part Programming (2 lectures)
  - Computer-Assisted Part Programming
  - Group Technology

Lecture (1)

Introduction to CAD/CAM Systems

Outline

- Overview of CAD/CAM Systems
- Definition of CAD/CAM Tools
- Advantages of CAD/CAM Systems

Overview of the CAD/CAM Systems:

- CAD/CAM is the technology concerned with the use of computers to perform design and manufacturing functions.

- CAD can be defined as the use of computer systems to perform certain functions in the design process.

- CAM is the use of computer systems to plan, manage and control the operations of manufacturing plant through either direct or indirect computer interface with the plant's production resources.

- In order to establish the scope and definition of CAD/CAM in an engineering environment and identify existing and future related tools, a study of a typical product cycle is necessary. Figure 1 shows a flowchart of such a cycle.

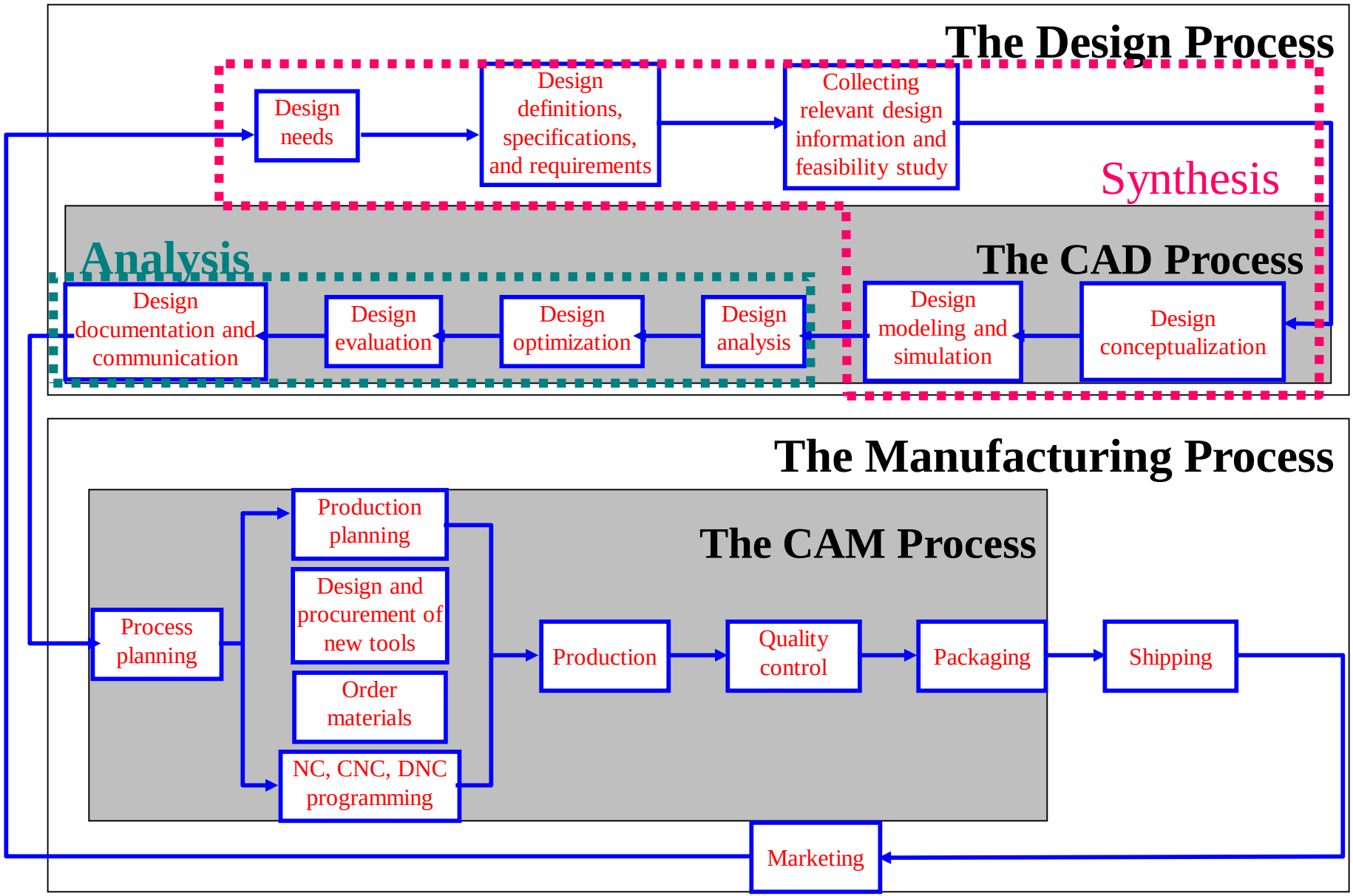

Figure 1: Typical product life cycle.

- The product begins with a need which is identified based on customers' and markets' demands.

- The product goes through two main processes from the idea conceptualization to the finished product:
  - The design process.
  - The manufacturing process.

- The main sub-processes that constitute the design process are:
  - Synthesis.
  - Analysis.

➢ The implementation of the CAD process on current systems takes the generic flow presented in Figure 2.

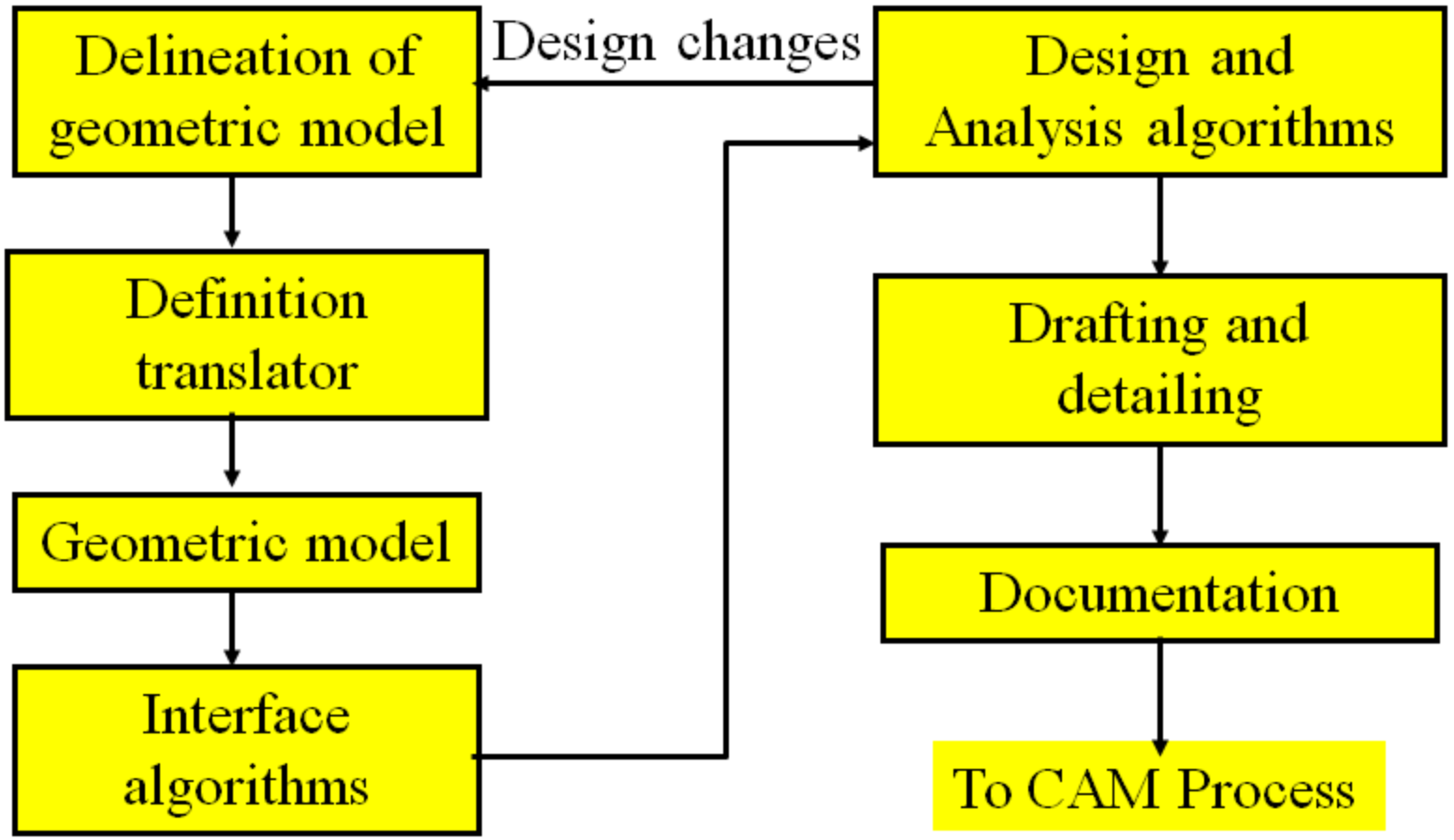

Figure 2: Implementation of a typical CAD process on a CAD/CAM system.

➢ Table 1 relates the CAD tools to the various phases of the design process.

Table 1: CAD tools required to support the design process.

Design phase	Required CAD tools
Design conceptualization	Geometric modeling techniques; Graphics aids; manipulations; and visualization
Design modeling and simulation	Same as above; animation; assemblies; special modeling packages.
Design analysis	Analysis packages; customized programs and packages.
Design optimization	Customized applications; structural optimization.
Design evaluation	Dimensioning; tolerances; BOM; NC.
Design communication and documentation	Drafting and detailing…

➢ The implementation of the CAM process on CAD/CAM systems is shown in Figure 3.

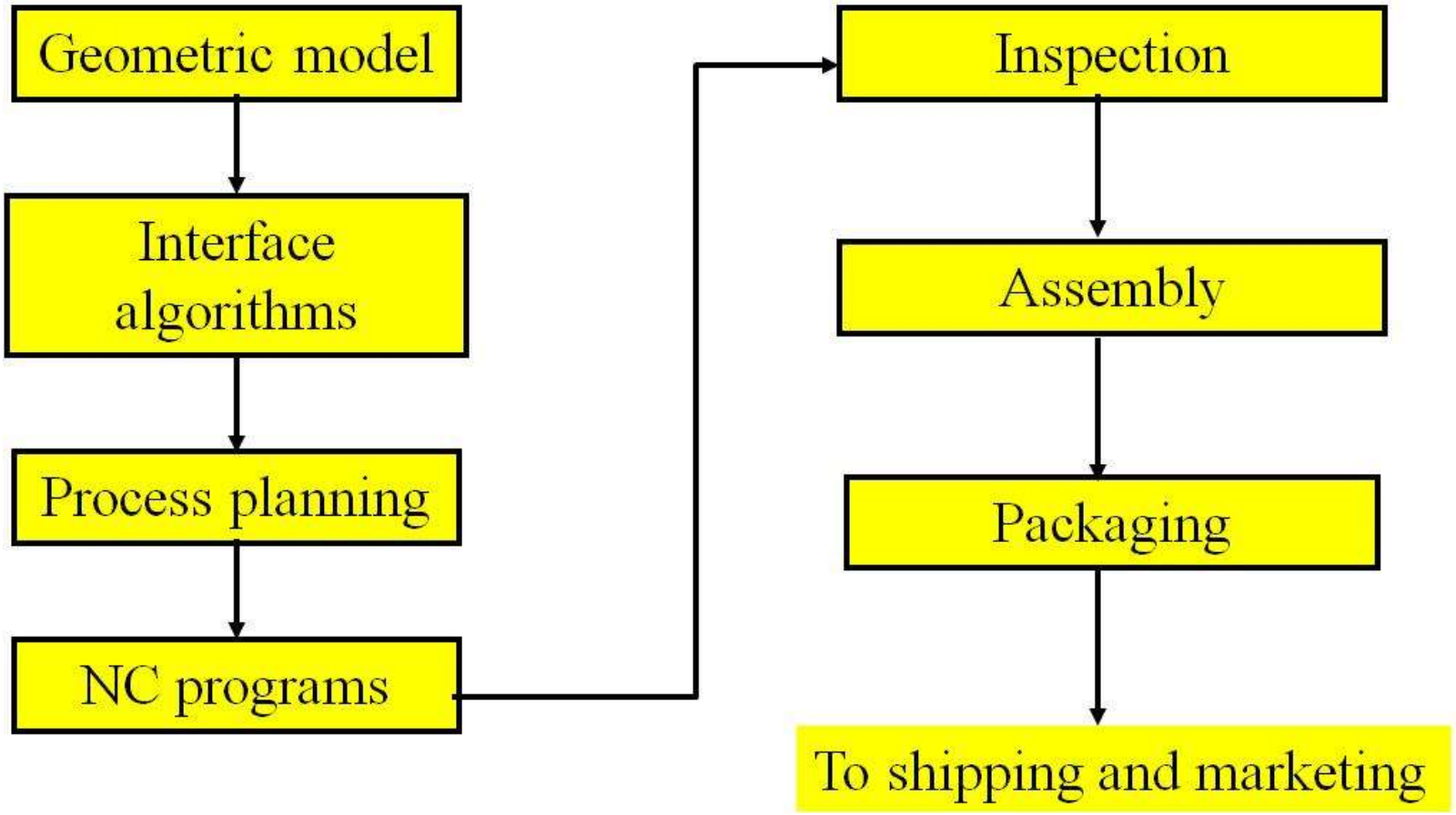

Figure 3: Implementation of a typical CAM process on a CAD/CAM system.

➢ Table 2 relates the CAM tools to the various phases of the manufacturing process.

Table 1: CAM tools required to support the manufacturing process.

Manufacturing phase	Required CAM tools
Process planning	CAPP techniques; cost analysis; material and tooling specification.
Part programming	NC programming
Inspection	CAQ; and Inspection software
Assembly	Robotics simulation and programming

➢ Figure 10 shows how a CAD/CAM system is utilized in a typical industrial environment.

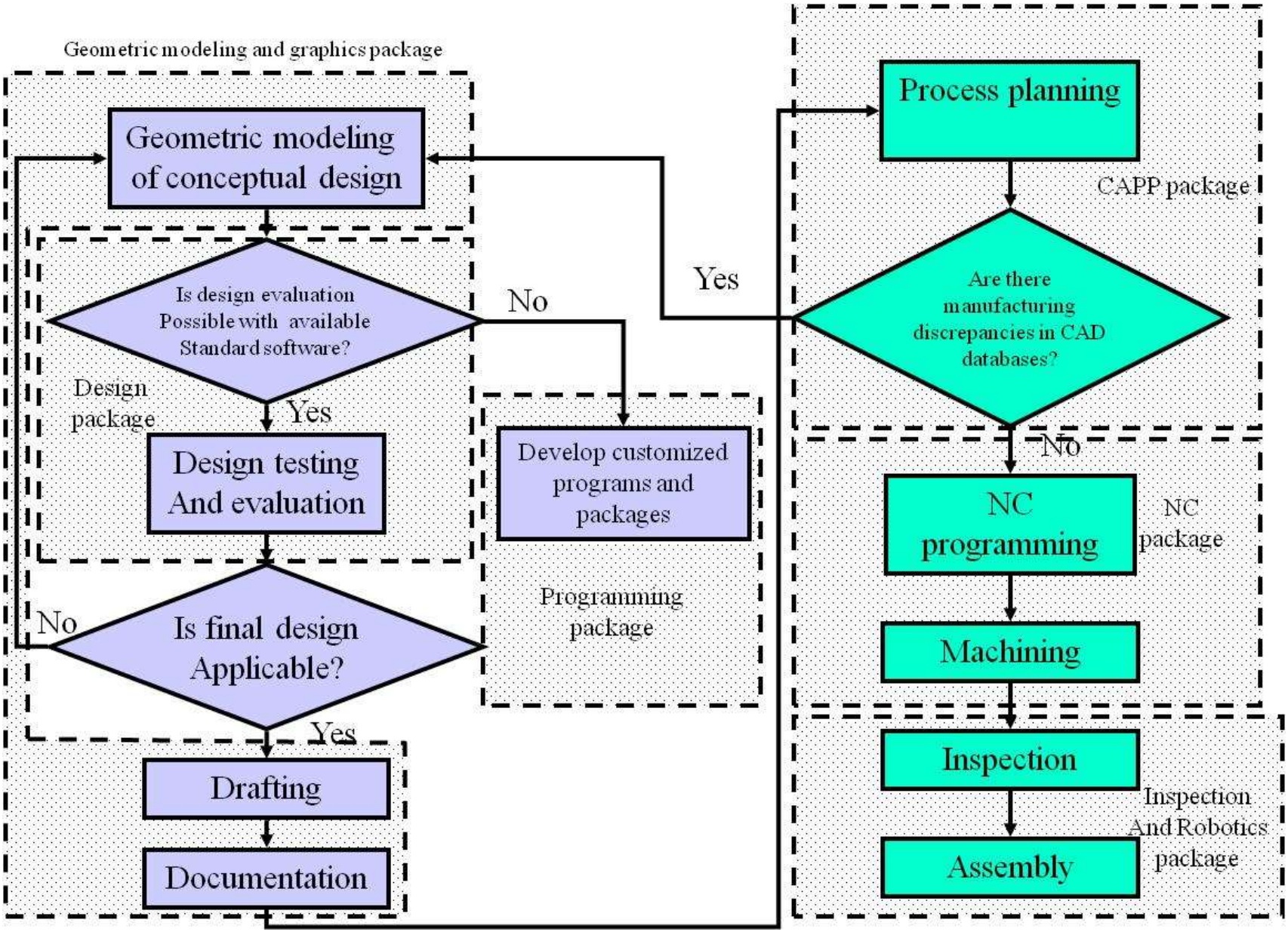

Figure 10: Typical utilization of CAD/CAM systems in an industrial environment.

Advantages of CAD/CAM Systems:

- Greater flexibility.
- Reduced lead times.
- Reduced inventories.
- Increased Productivity.
- Improved customer service.
- Improved quality.
- Improved communications with suppliers.
- Better product design.
- Greater manufacturing control.
- Supported integration.
- Reduced costs.
- Increased utilization.
- Reduction of machine tools.
- Less floor space.