MAS 961: Special Topics

"How To Make Something That Makes (almost) Anything"


Spring Semester, 2004
Taxonomy of Devices

Historical & Theoretical Overview

Various Devices

Objects
1952 – MIT Servo Lab
Numerically Controlled Machines

• Began with the US Air Force
• The work Started at the Parsons Lab in the 1940s
• Developed the idea of Positional Data on Punch Cards
• 1949 MIT Servomechanism Laboratory to develop a prototype
• The first NC machines was presented in 1952 – 3 Axis milling machine
• Work led to the development of the APT (Automatically Programmed Tooling)
Basic Components of an NC Machine

Program

Machine Control Unit

Processing Equipment
ELECTRONIC SYSTEMS LABORATORY

M.I.T. INNOVATIONS IN MANUFACTURING TECHNOLOGY

TRADITIONAL MANUFACTURING METHOD
PRIOR TO 1949

NUMERICAL MACHINE CONTROL (NMC) PROJECT
1949-1954

AUTOMATICALLY PROGRAMMED TOOL (APT) PROJECT
1955-1959

COMPUTER-AIDED DESIGN (CAD) PROJECT
(IN COOPERATION WITH THE DEPARTMENT OF MECHANICAL ENGINEERING)
1960-

PROGRAM SYSTEM FOR AUTOMATED ENGINEERING DESIGN (AED)
Origins of Rapid Prototyping

- Refers to a layering process of materials from a CAD file
- The work was developed from solid modeling
Key Terms

- Automation of Design
  - Solid Modeling
  - Pre Processing
  - Post Processing

- Algorithmic Thinking
  - Algorithmic Thinking
Design Descriptions (1)

Device Descriptions (2)

Algorithmic Approach
Taxonomy of Devices

1. Building Devices

2. Cutting Devices

3. Drilling Devices
Building Devices
Stereolithography

Mirror
Power Supply
Mirror
Table & Polymer Vat
<table>
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<tr>
<th>Laser Source</th>
<th>Models</th>
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ZCORP
3D Printer

MIT –Licensed Process

Cornstarch
Plaster
Ceramics
Wax

Plaster

- 3D Printer Advantages
  - Speed
  - Self Supporting
  - Low Cost
Fuse Deposition Modeling

Material
Support
Head
Envelope
ABS Material .010
ABS Support Base .010
Building Devices

Stereo Lithography (STL)
1986 – Charles Hull and 3M Systems

Fuse Deposition Modeling (FDM)
Stratasys

3D Printing
ZCORP
3D Systems
Solid Scape

Laminated Object Manufacturing (LOM)
2001 - Gone

Selective Laser Sintering (SLS)
Carl Deckard 1989

Pro Metal Systems
MIT-Licensed

Solid Ground Curing
[2]

Cutting Devices
Laser Cutter
Assembly Methods
Assembly of Building Components using digital devices

Incorporate the natural features of CAM
Precise cuts
Control of tolerance
Variations in cutting and or build
Methods

Build in 3 dimensions

Fabricate in 2 dimensions
CAMM Paper Cutter
Milling
References

“Rapid Product Development”
Naoya Ikawa, Takeshi Kishinami, and Fumihiko Kimura
Conference Proceeding 1997
Sapporo, Japan

“Rapid Prototyping Technology Selection and Application”
Kenneth Cooper
2001