4.212
Design Fabrication
Design, Computation and
Computer Controlled Devices

Prof. Larry Sass
Teaching Assistant: Carlos Barrios
Department of Architecture and Planning

MIT
4.212
Reminders

Mike Sure
Fee $100
People group who did not get the email
Group Printing
  4 groups
  One Person in Charge

Photo as you go

Assignment #1
  Technical report
  Deadline - October 6
  After October 6 - 1 Letter grade
  October 13 final date to accept assignment
[1] Physical Representation of Information

[2] Design Exploration as a Paperless Process

[3] New Languages of Design
process

[ design ] + [ fabrication ]
Design through Exploration of Shape and Construction
fabrication process

a - CAD - Design Model

b - Construction Model

c - Cut Sheet

d - Model Assembly
[ Design Practice ]

Product Design

Car Design

Architectural Design
History of Numerically Controlled Machines

Origins of CAD and CAM

Rapid Prototyping & Software
CAD Computer Aided Design

CAM Computer Aided Manufacturing

CAE Computer Aided Engineering
[1] Numerically Controlled Machines:
1952
### Basic Components of an NC Machine

<table>
<thead>
<tr>
<th>Program</th>
<th>Machine Control Unit</th>
<th>Processing Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape</td>
<td>Computer</td>
<td>Laser Cutter</td>
</tr>
<tr>
<td>Diskette</td>
<td></td>
<td>Paper Cutter</td>
</tr>
<tr>
<td>CAD file</td>
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<td>FDM</td>
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<td></td>
<td></td>
<td>ZCORP</td>
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<tr>
<td></td>
<td></td>
<td>Modela Milling Machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Milling Machine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Jet Cutter</td>
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</tbody>
</table>
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)
G-Code

O1234
(FM14-9-2003)
N4G0G40G80G91G28Z0
T4M6
G90G54X2.3435Y2.003M8
G43Z1.0H4S4074M3
Z0.1
G1X2.6273Y1.7579Z0.0682F15.28
X2.3435Y2.003Z0.0364
X2.6273Y1.7579Z0.0045
X2.3435Y2.003Z-0.0273
X2.6273Y1.7579Z-0.0591
X2.3435Y2.003Z-0.0909
X2.6273Y1.7579Z-0.1227
X2.3435Y2.003Z-0.1545
X2.6273Y1.7579Z-0.1864
X2.3435Y2.003Z-0.2182
Overview of CAD CAM

1952 Numerical Control machines are widely used to operate a tool positioning through computer commands. MIT’s Servo Mechanisms Laboratory demonstrated a numerically controlled 3 axis milling machine.

1959 Control digital computer. The first application of a control using a digital computer occurred at a Texaco refinery located in Port Author Texas where a catalytic cracking unit was optimized using a linear programming algorithm.

1960 Robotic Implementation - The precursor to widespread use of robots in manufacturing processes

1970 Computer Numerical Control - The advent of the mini computer where tools could have their own memory.

1980 Flexible Manufacturing System - The idea of sets of machines to make a relatively wide variety of products with automatic movement of products through any sequence of machines this lead to Computer integrated Manufacturing

1990 Mass Customization - Joseph Pine
Craft/Manufacturing

Mass Customization

Craft

Manufacturing
[2] Origins of CAD:

1964
1963 – Sketch Pad –
A Man Made Graphical Communication System

- Parametric Modeler for Engineers
  - Small changes to existing drawings
  - Great for the creation of small scientific operations that can only be understood graphically
  - For highly repetitive drawings
[3] Rapid Prototyping:

1980's
Basic Components of a Rapid Prototyping Machine

Table
[ Stereo Lithography ]
[ Lecture 3]
Monday, Sept 15, 2000

Assemblies

Poser