

The background of the slide is a screenshot of the SolidWorks CAD software interface. It shows a 3D model of a mechanical assembly, possibly a transmission, with various components highlighted in different colors like blue, red, and grey. The interface includes a top toolbar with icons for various functions like 'Insert Components', 'Mate', 'Linear Component...', 'Smart Fasteners', 'Move Component', 'Show Hidden Components', 'Assembly Features', 'Reference Geometry', 'New Motion Study', 'Bill of Materials', 'Exploded View', 'Explode Line Sketch', 'Instant3D', 'Update Speedpak', 'Take Snapshot', 'New Motion Study', and 'Center of Mass'. On the left, there are panels for 'Section View', 'Drawing Section', 'Section 1', and 'Section 2'. The main title 'COMPUTER MODELING OF GEOMETRY' is centered over the 3D model in a large, bold, black font.

COMPUTER MODELING OF GEOMETRY

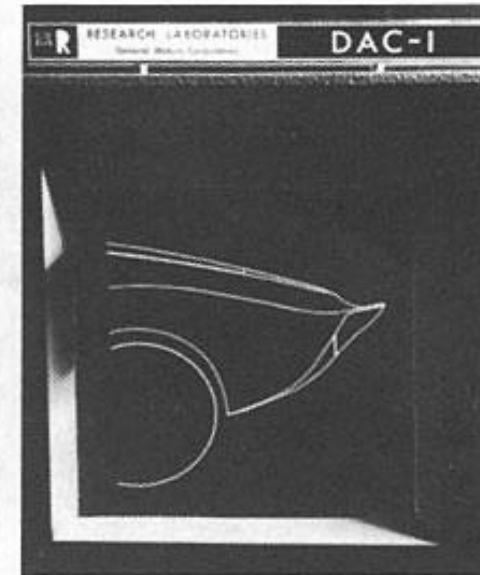
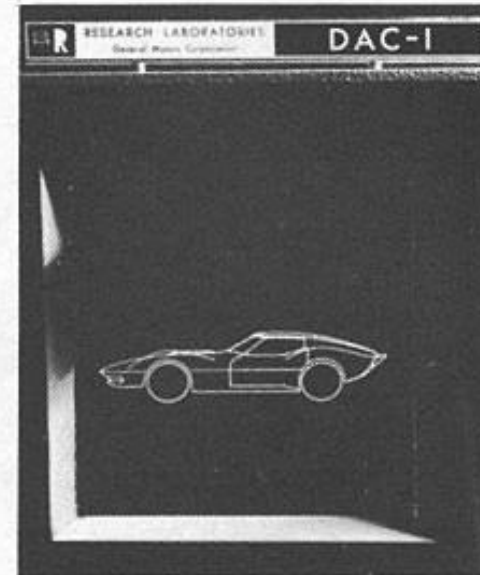
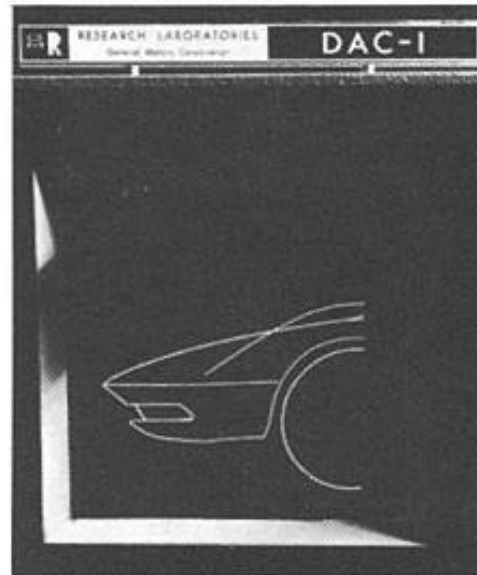
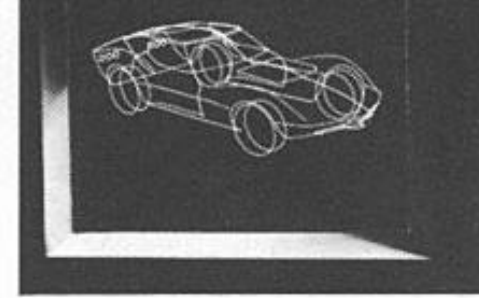
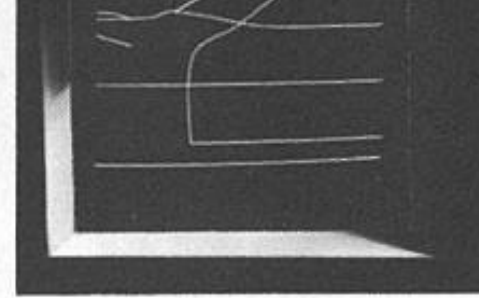
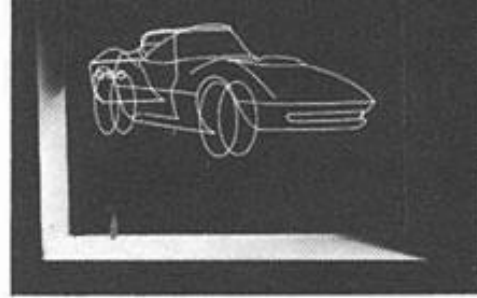
Lecture 3

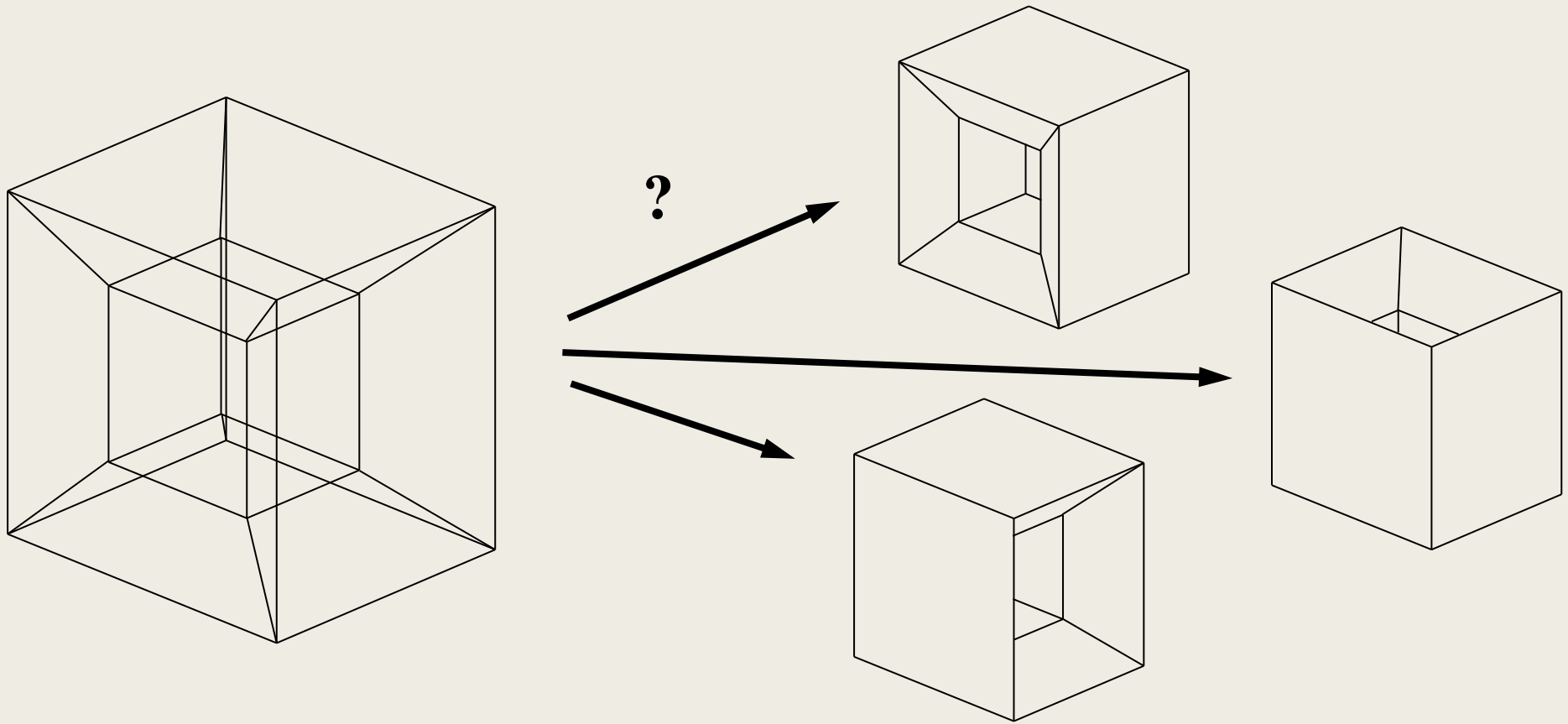
MAE 455 – Computer-Aided Drafting and Design



1963 –
BOSTON,
MA

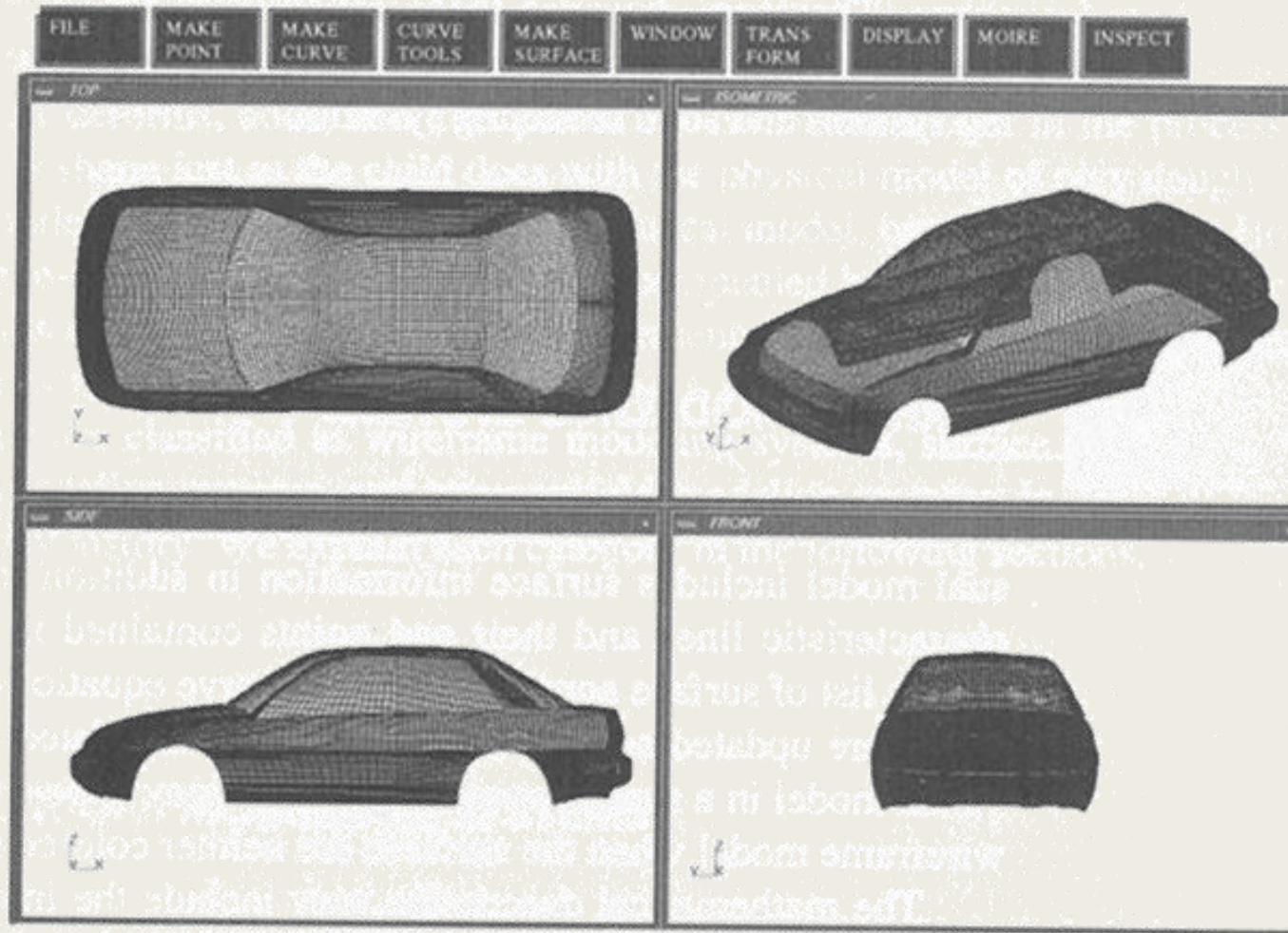
1964
DAC-1,
GENERAL
MOTORS



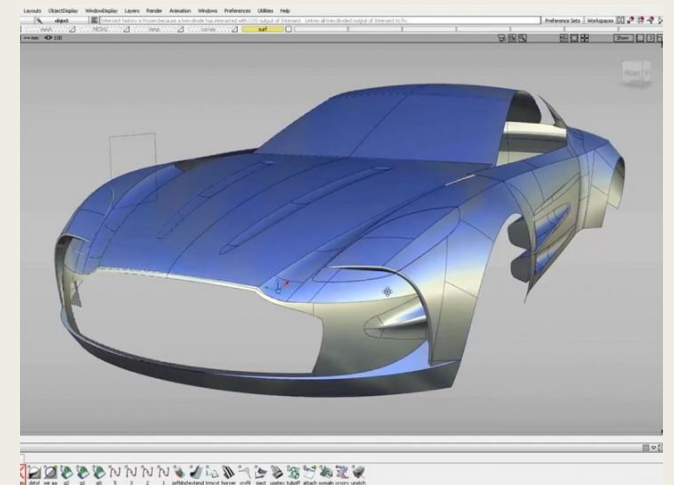


The problem with wireframe

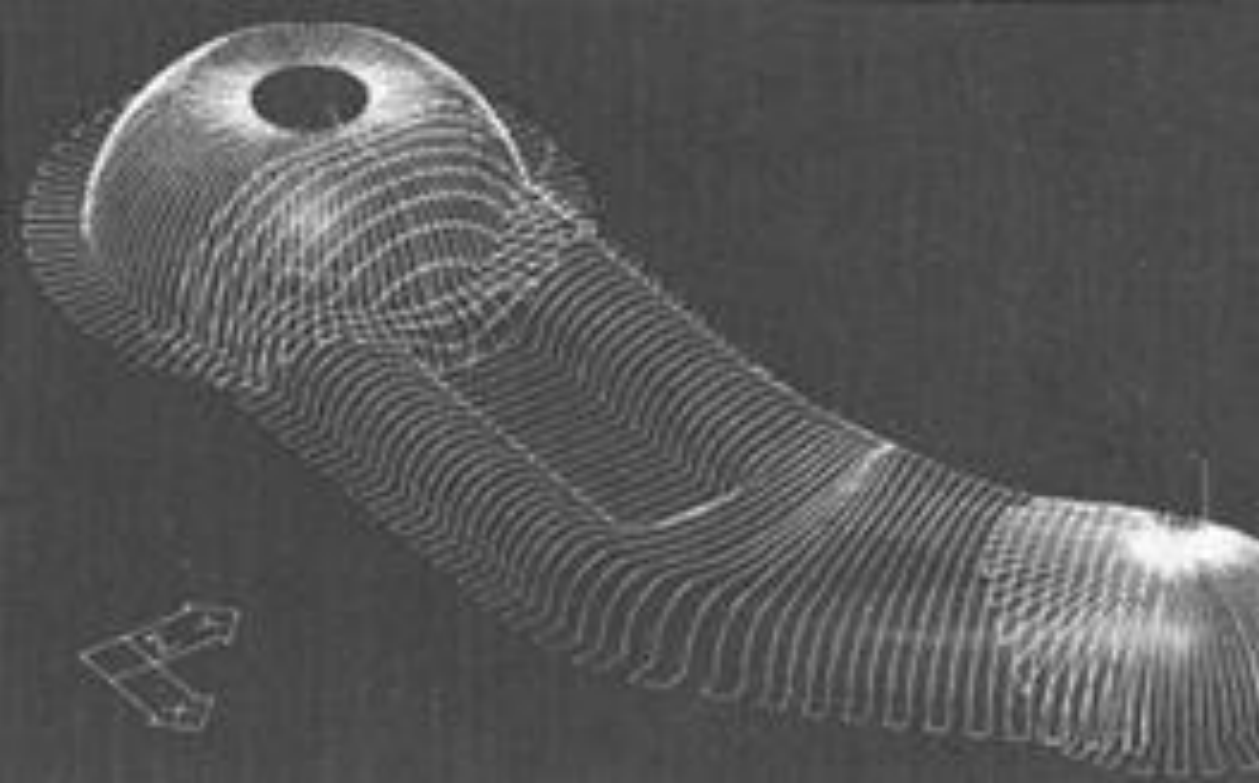
1967 – BOSTON, MA



Images from K. Lee "Principles of CAD/CAM/CAE Systems," Addison-Wesley



Nice picture from web used without permission.



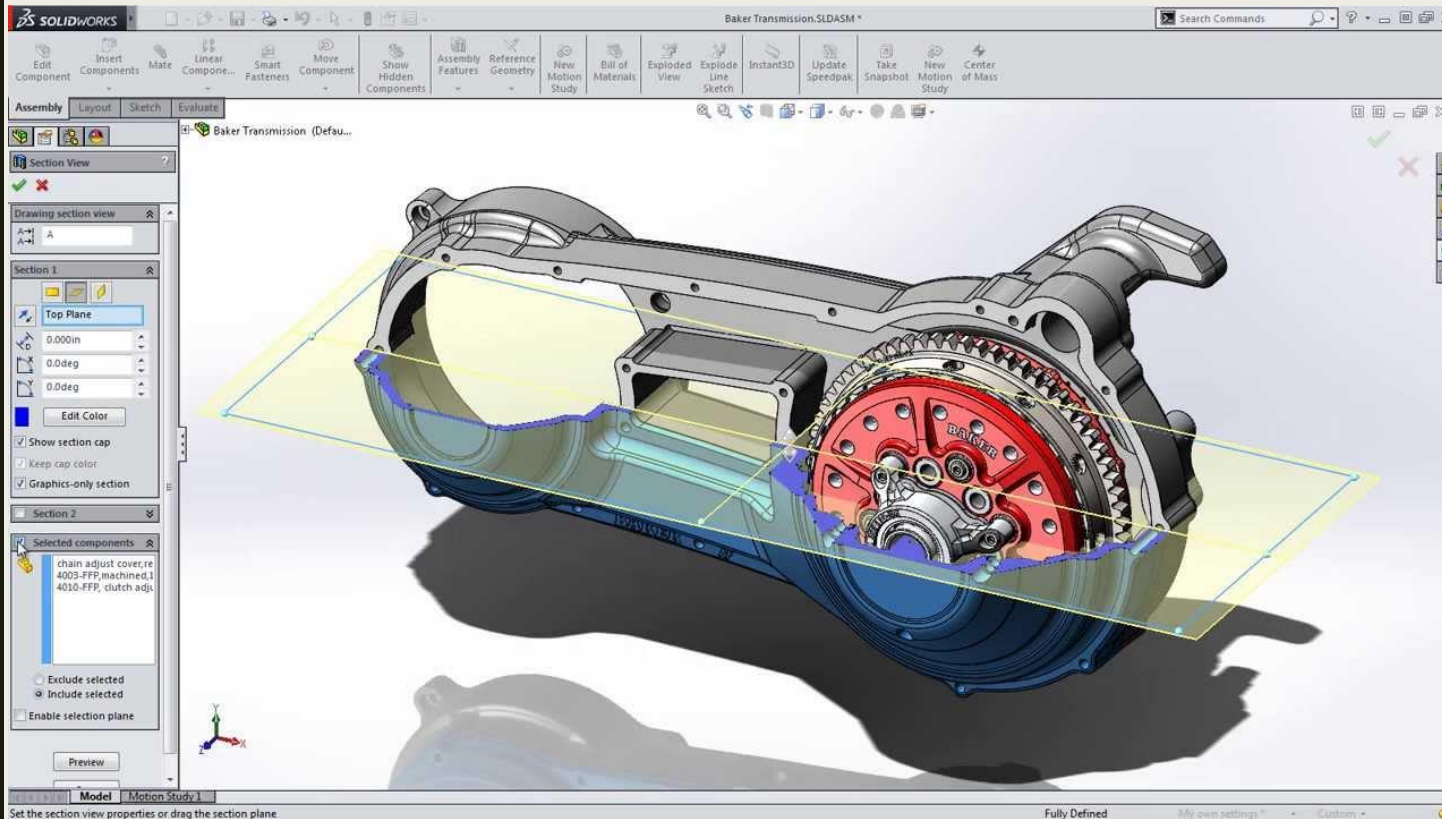
K. Lee "Principles of CAD/CAM/CAE Systems," Addison-Wesley



Image from YouTube – GameNews, Apr 4, 2018

Other uses for surface models

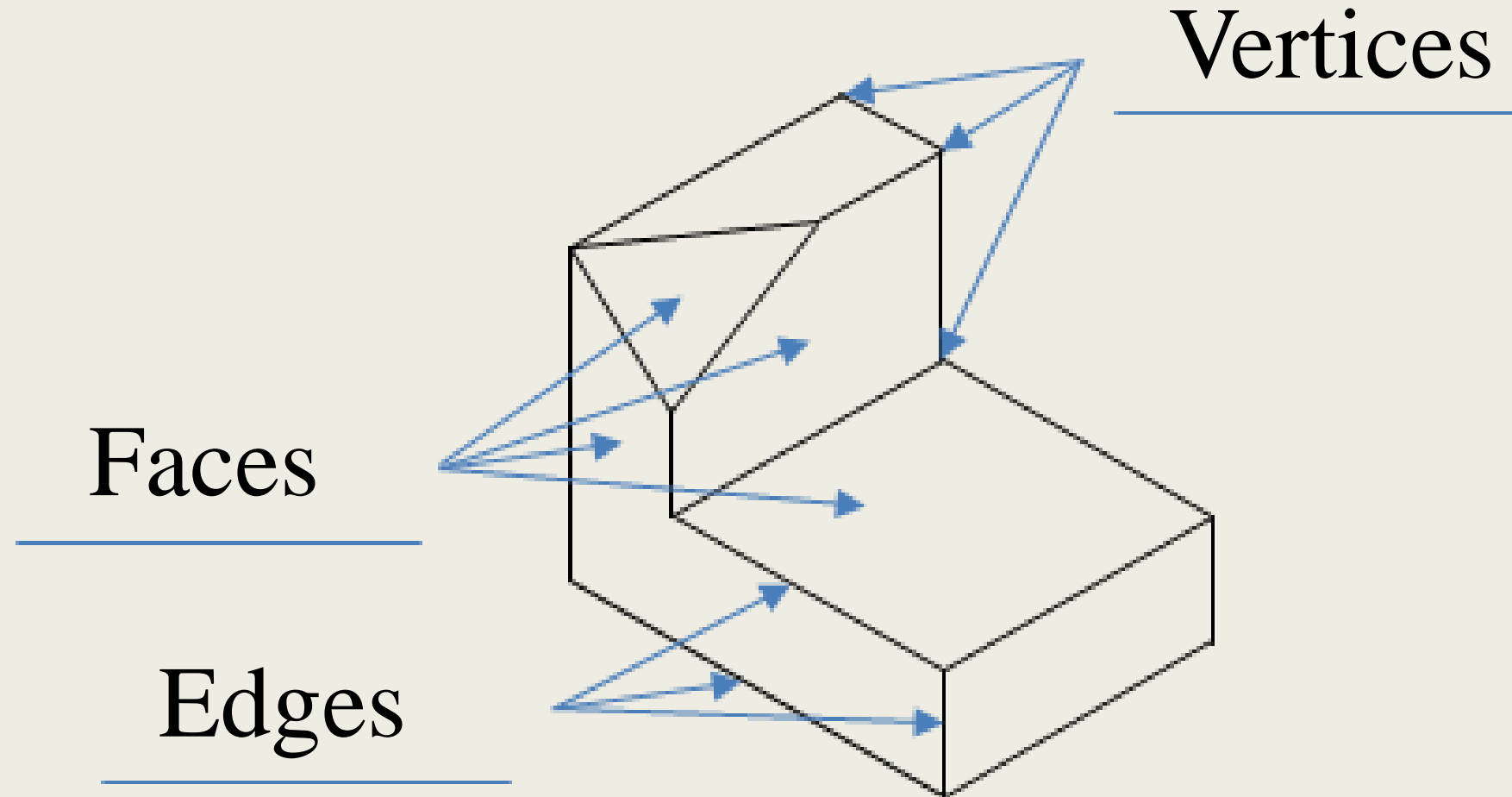
- CNC milling path generation
- Video games



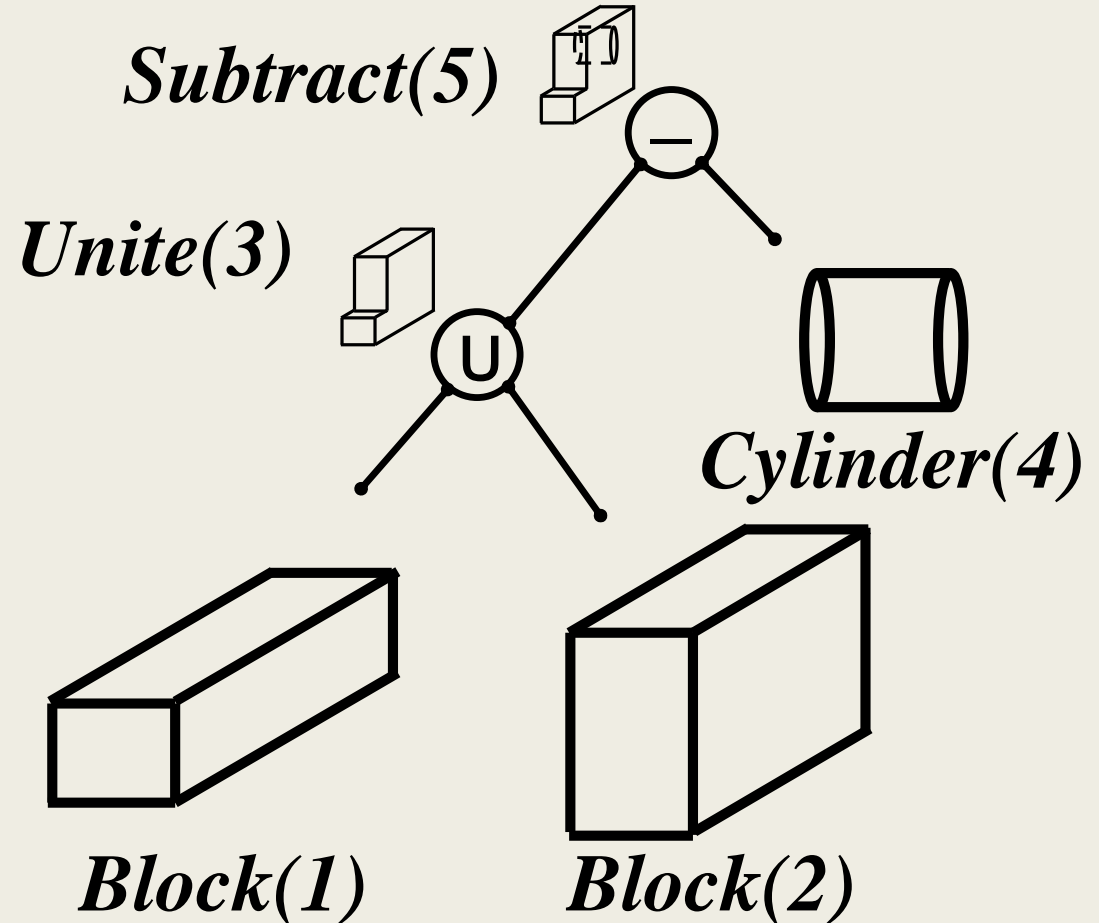
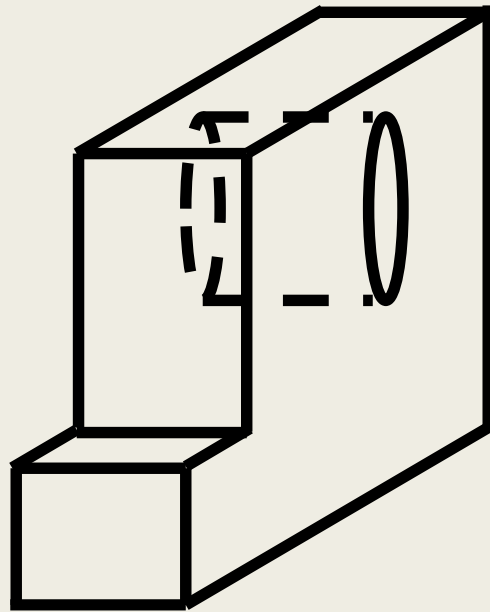
Nice picture from web used without permission.

1973 –
CAMBRIDGE,
MA &
ENGLAND

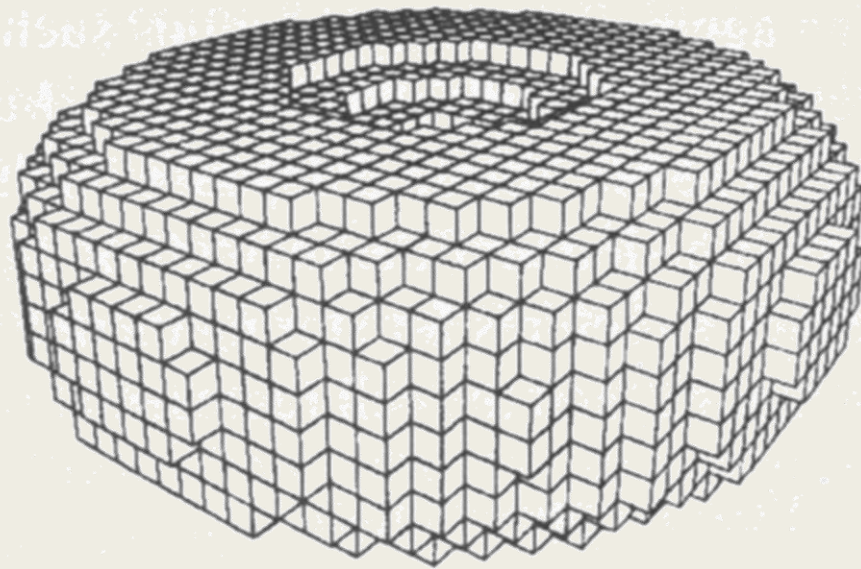
Boundary Representation



Constructive Solid Geometry



Decomposition Representations



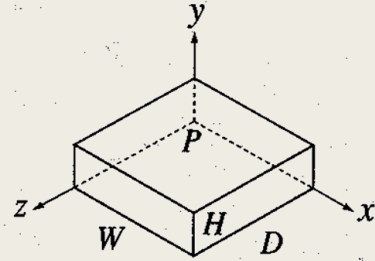
Images from K. Lee "Principles of CAD/CAM/CAE Systems," Addison-Wesley



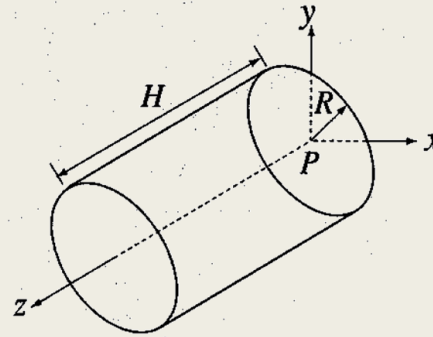
WAYS TO CREATE OR MODIFY SOLID MODELS



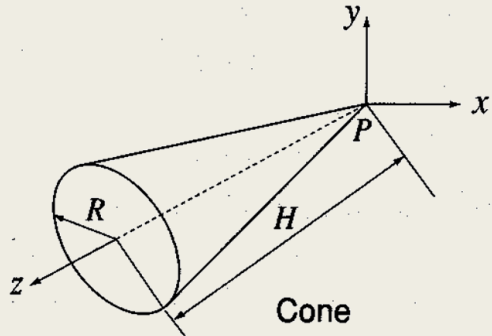
PRIMITIVE SOLID SHAPES



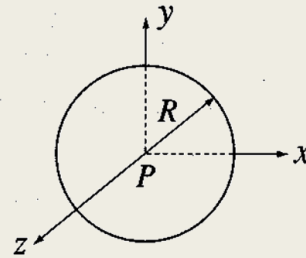
Block



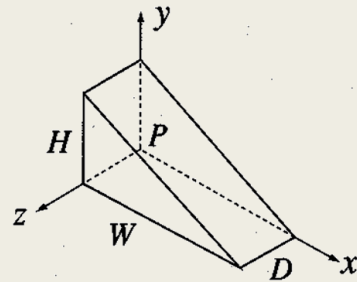
Cylinder



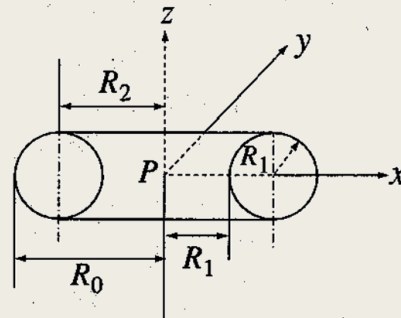
Cone



Sphere



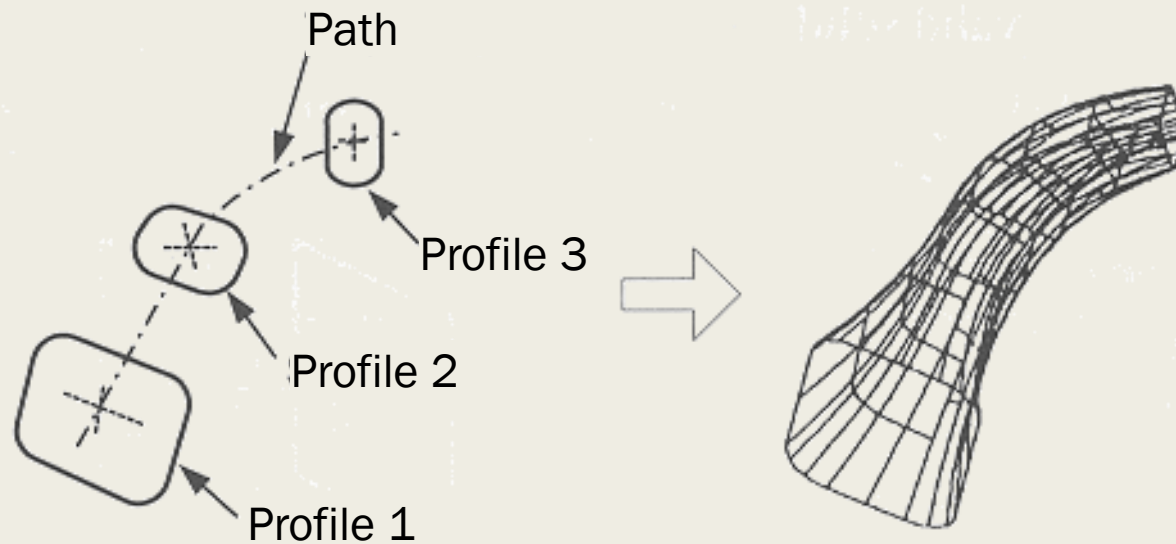
Wedge



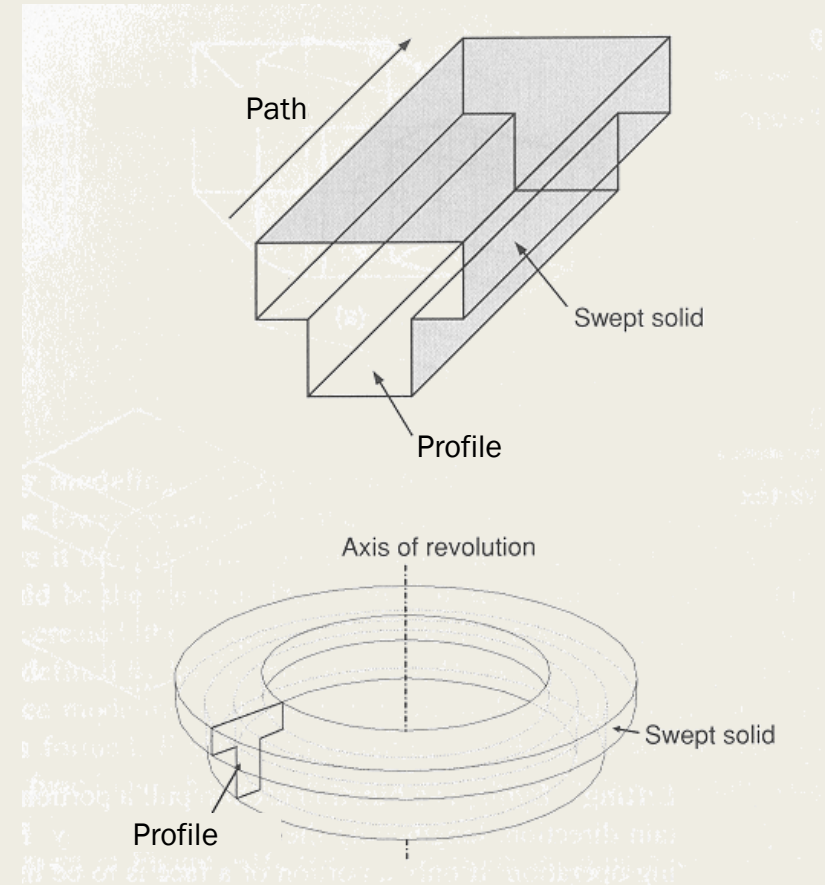
Torus

Sweep Operations

- require a profile and a path



Images from K. Lee "Principles of CAD/CAM/CAE Systems," Addison-Wesley



“Boolean” Operations

Three types of operations are possible:

- union (\cup) or “join” or “add”
- intersection (\cap) or “common”
- difference ($-$) or “subtract”

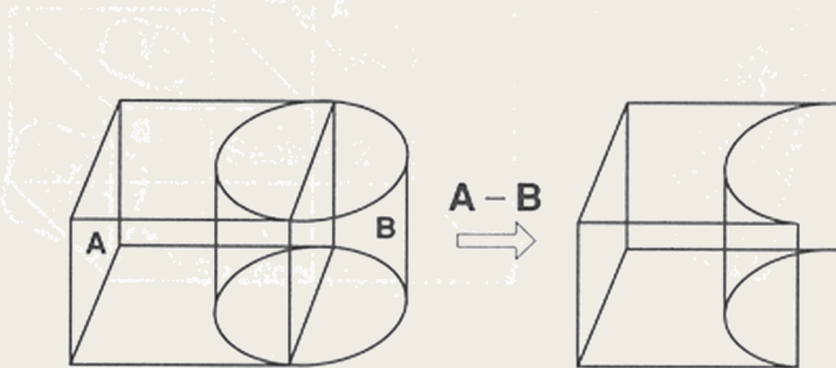
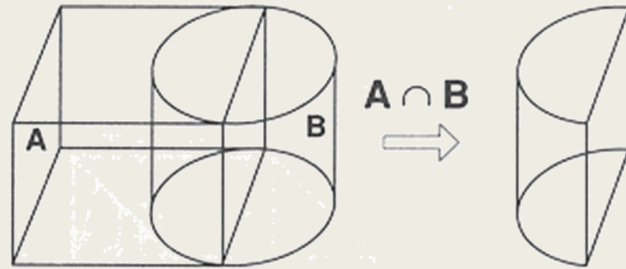
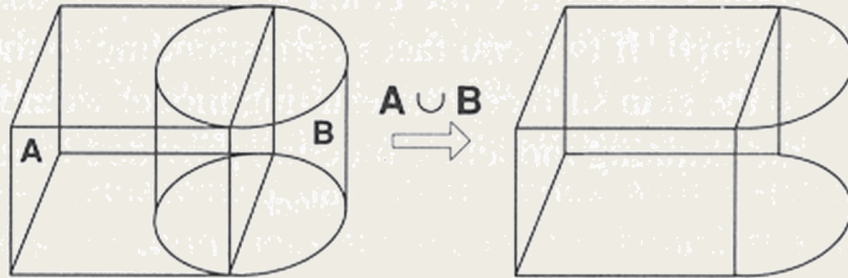
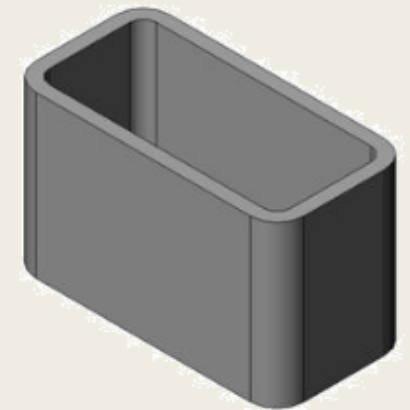
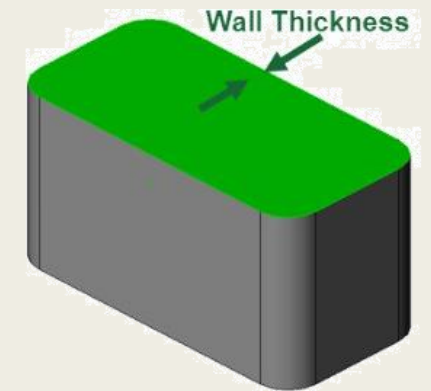
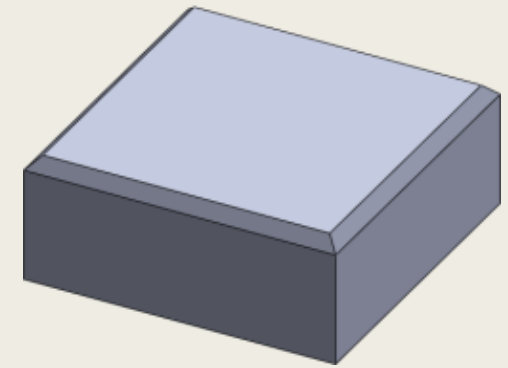
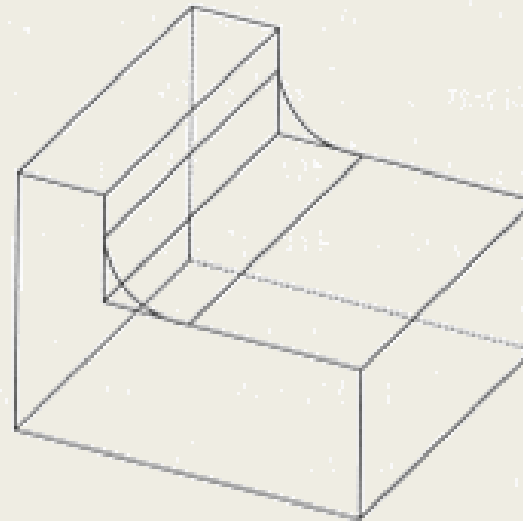
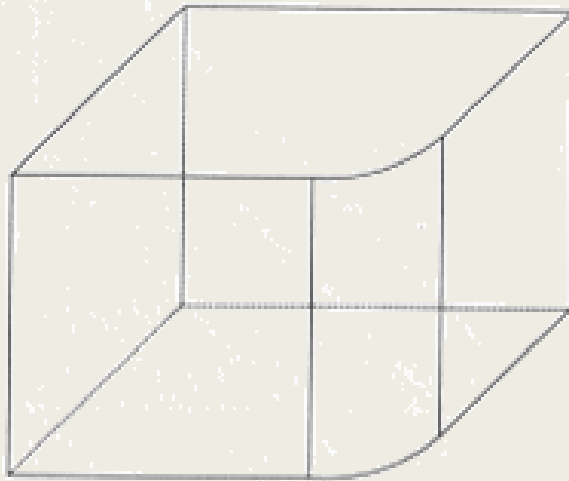


Image from K. Lee “Principles of CAD/CAM/CAE Systems,” Addison-Wesley

Local Modifications

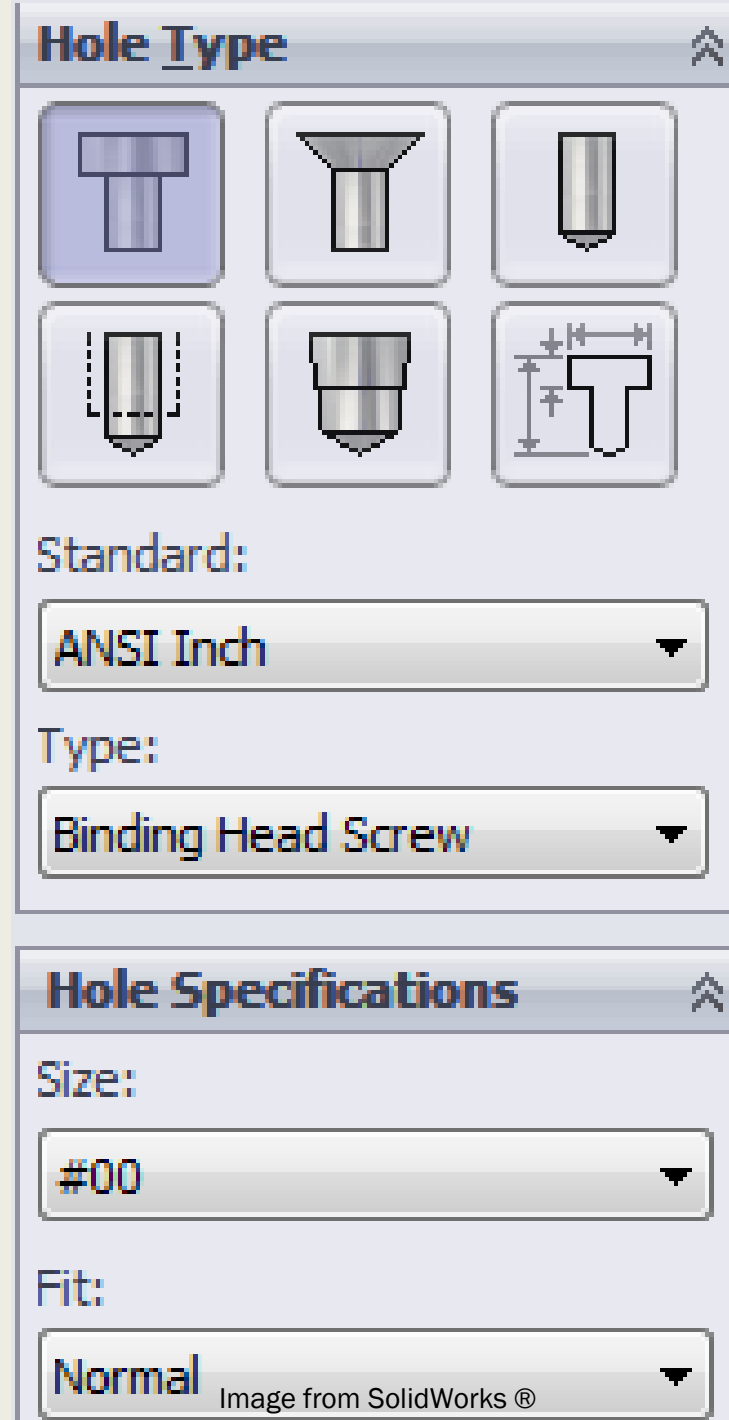
- Directly remove and add faces, edges, and vertices in the B-Rep
- E.g., in:
 - Rounds and fillets
 - Chamfers
 - Shell or hollow



Images from K. Lee "Principles of CAD/CAM/CAE Systems," Addison-Wesley, Autodesk Inc., and Dassault Systèmes

Feature Modeling

- Hole
- Pocket
- Slot
- User-defined



Parametric Modeling

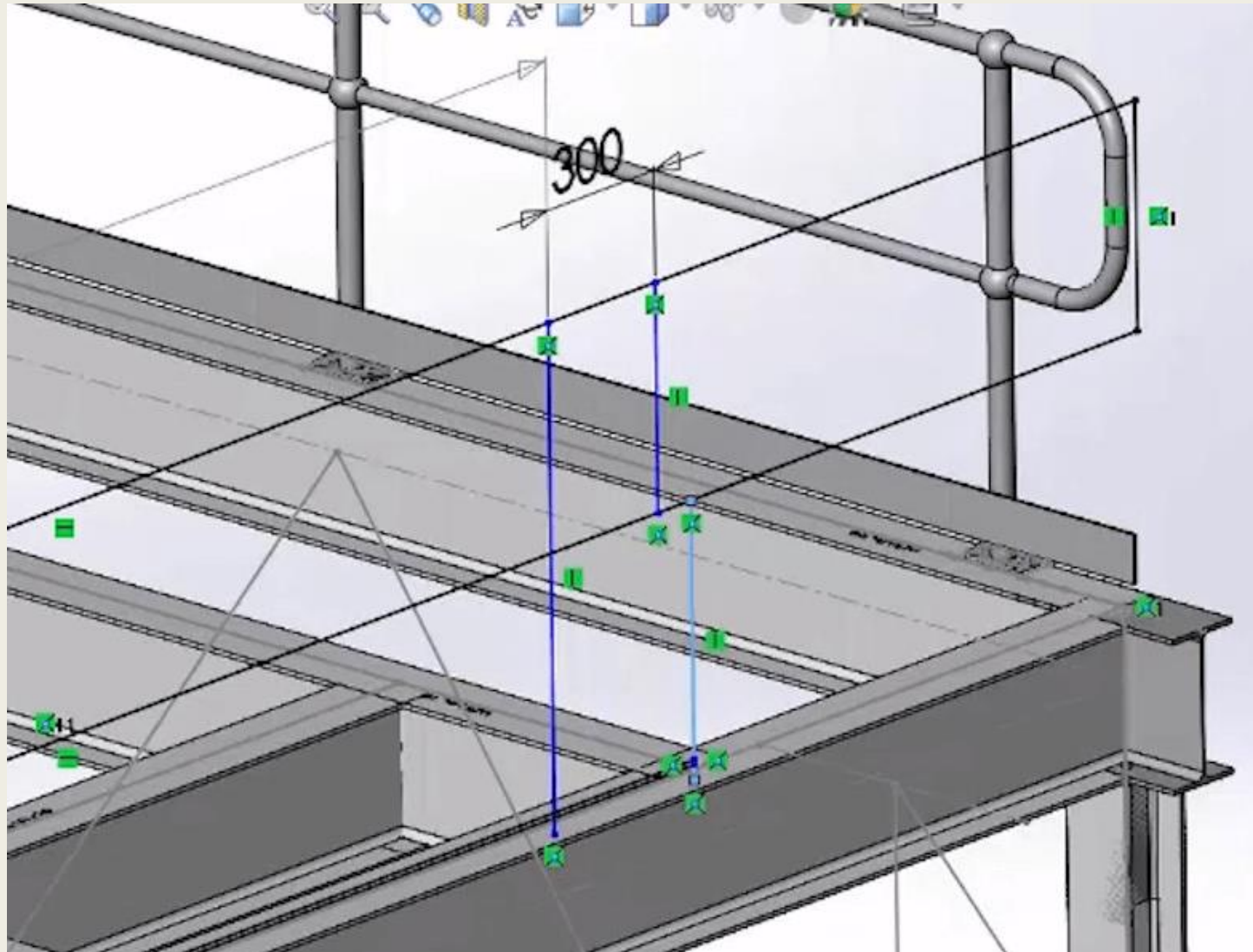


Image from MT Fabrications Ltd.

Direct Modeling

- Translate, Rotate, Scale
- Draft (taper)
- Dome, Move face
- Flex: Bend, twist, stretch

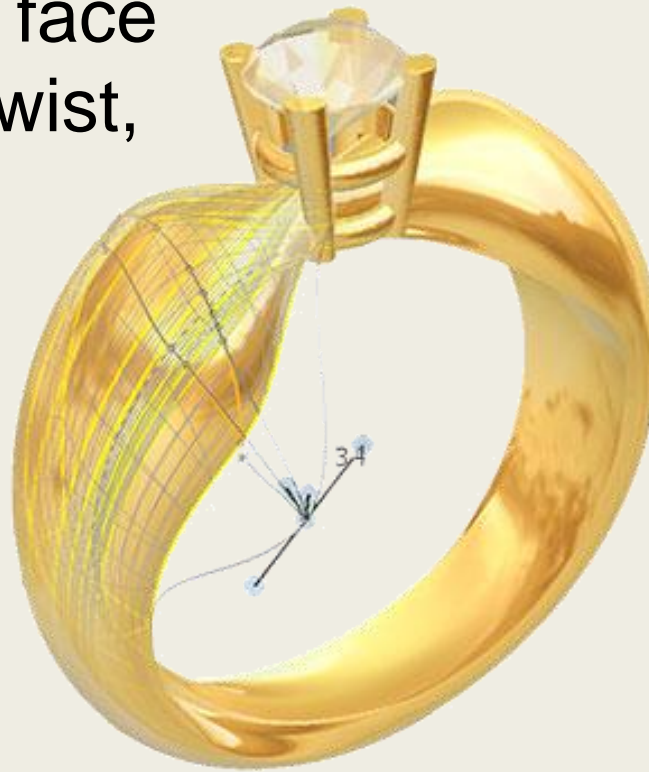


Image from Delcam PLC

Knowledge/Rule-Based Design

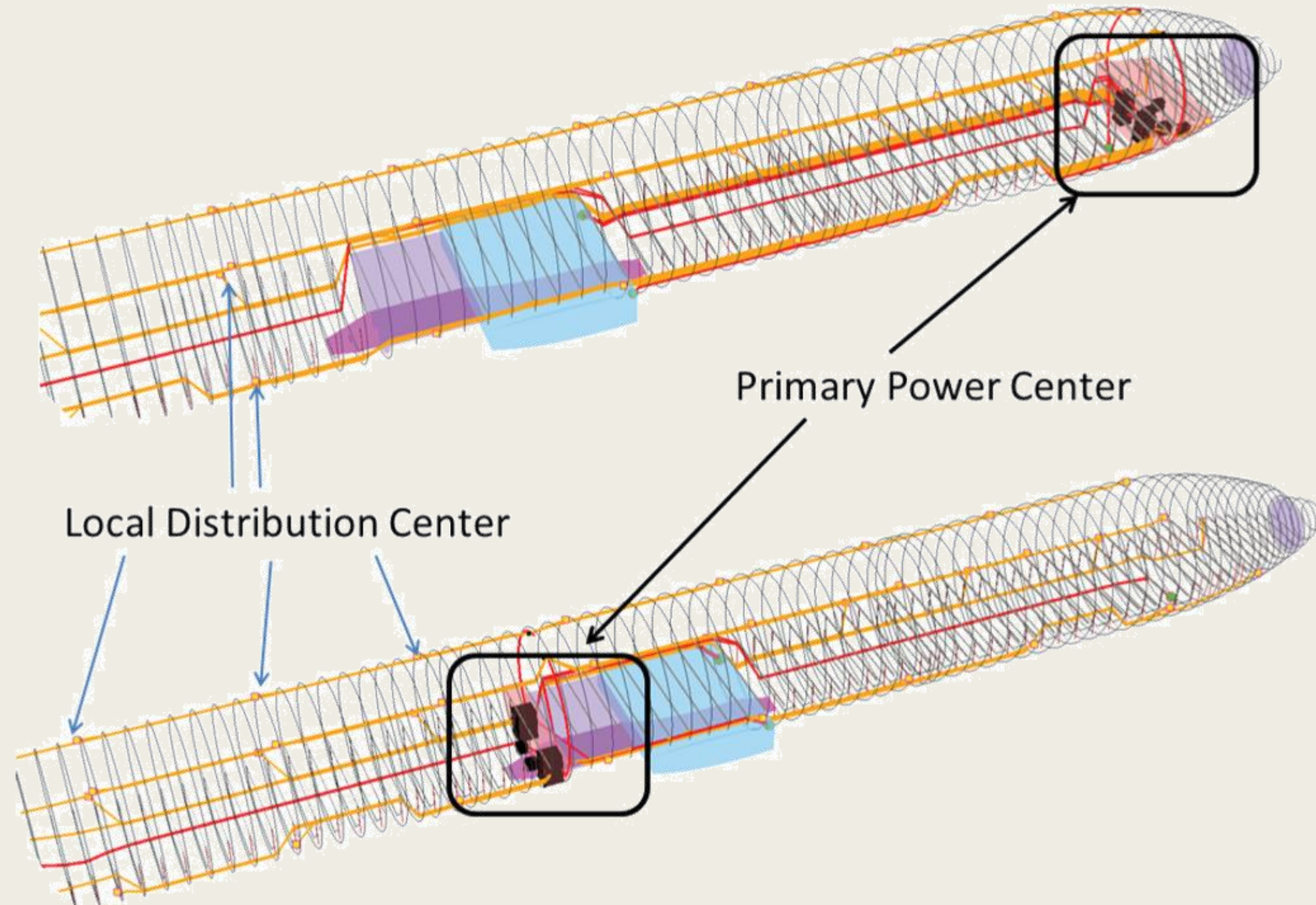


Image from Fuchte, Nagel, Gollnick, "Automatic Fuselage System Layout Using Knowledge Based Design Rules"