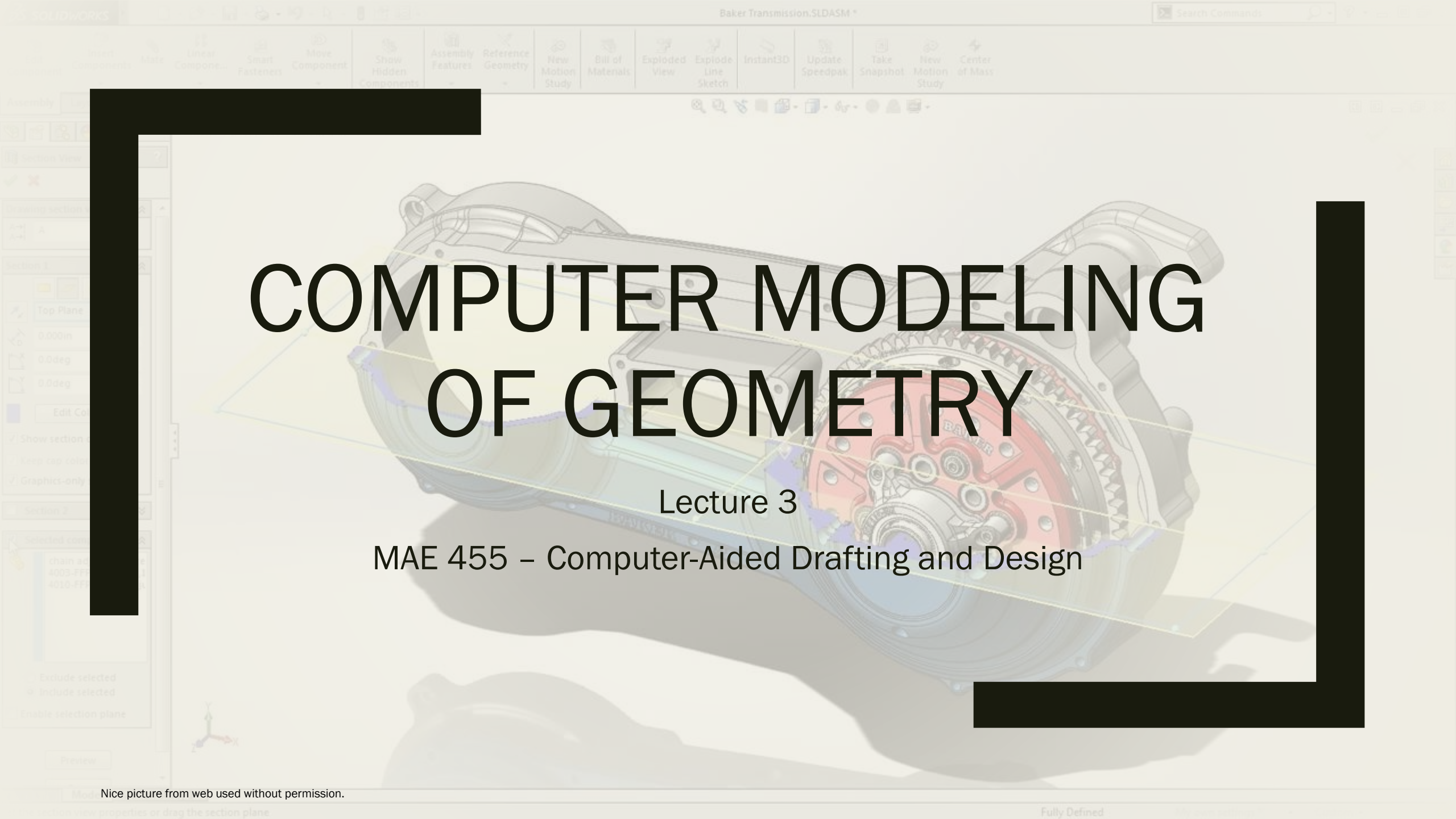
COMPUTER MODELING OF GEOMETRY

Lecture 3

MAE 455 – Computer-Aided Drafting and Design



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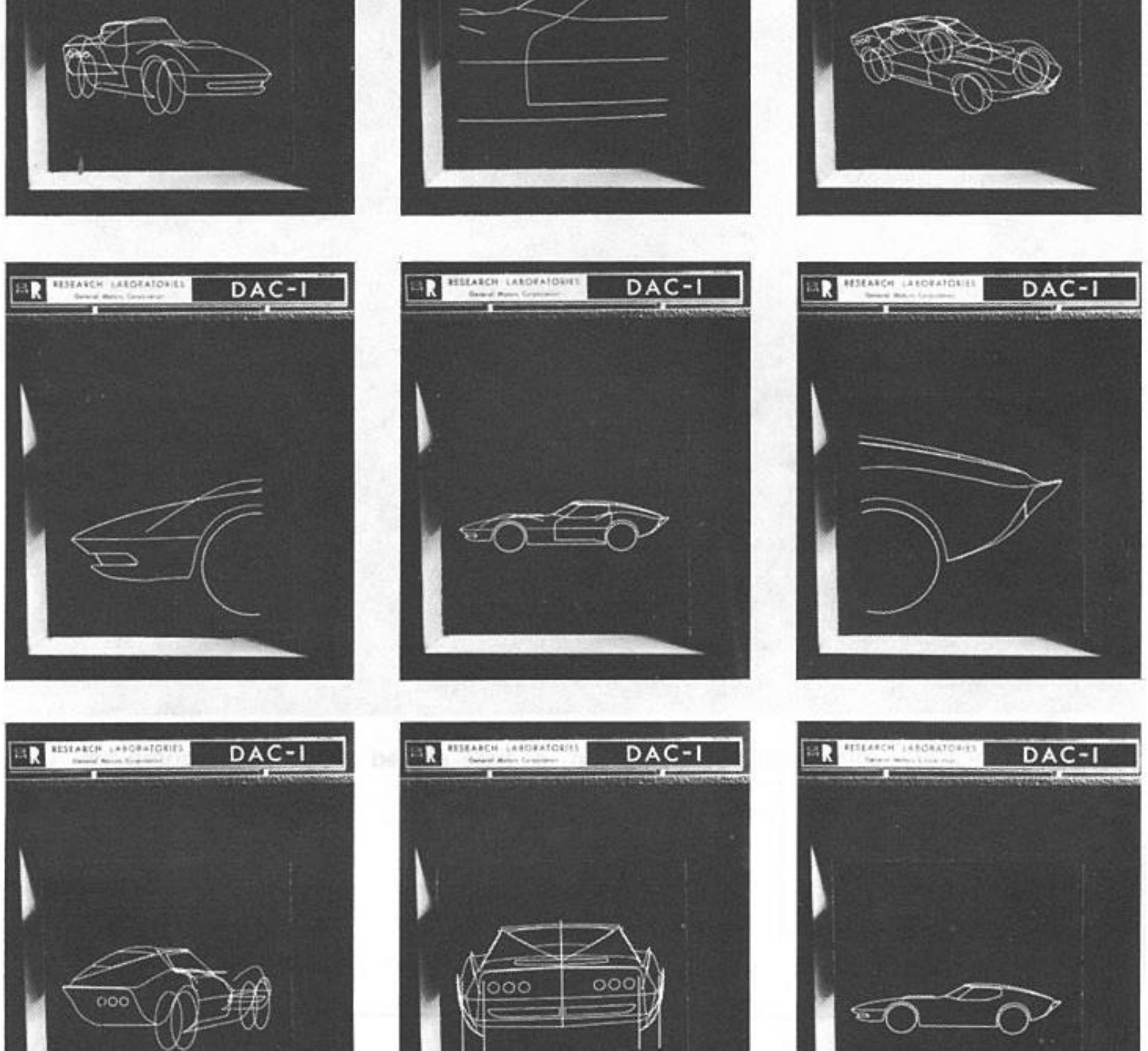
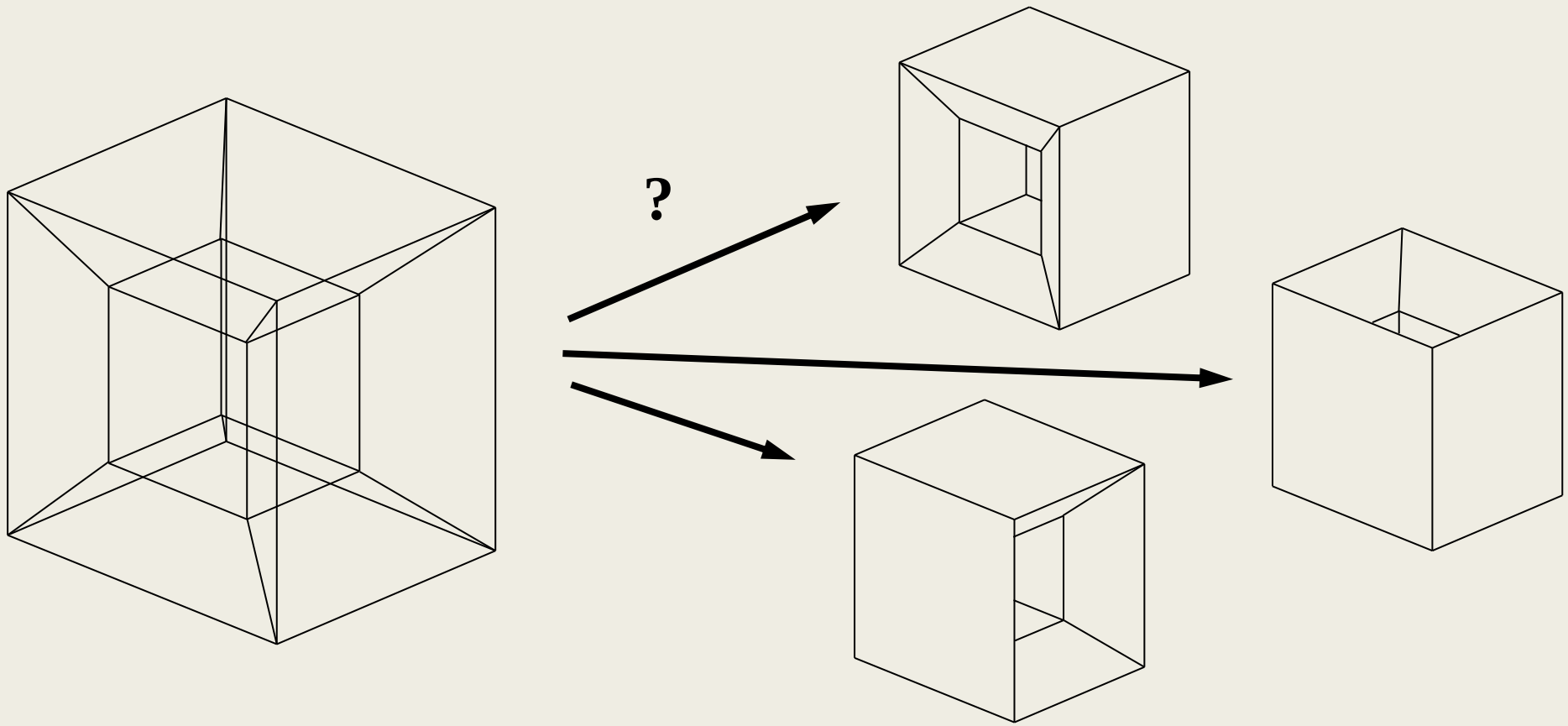
1963 – BOSTON, MA

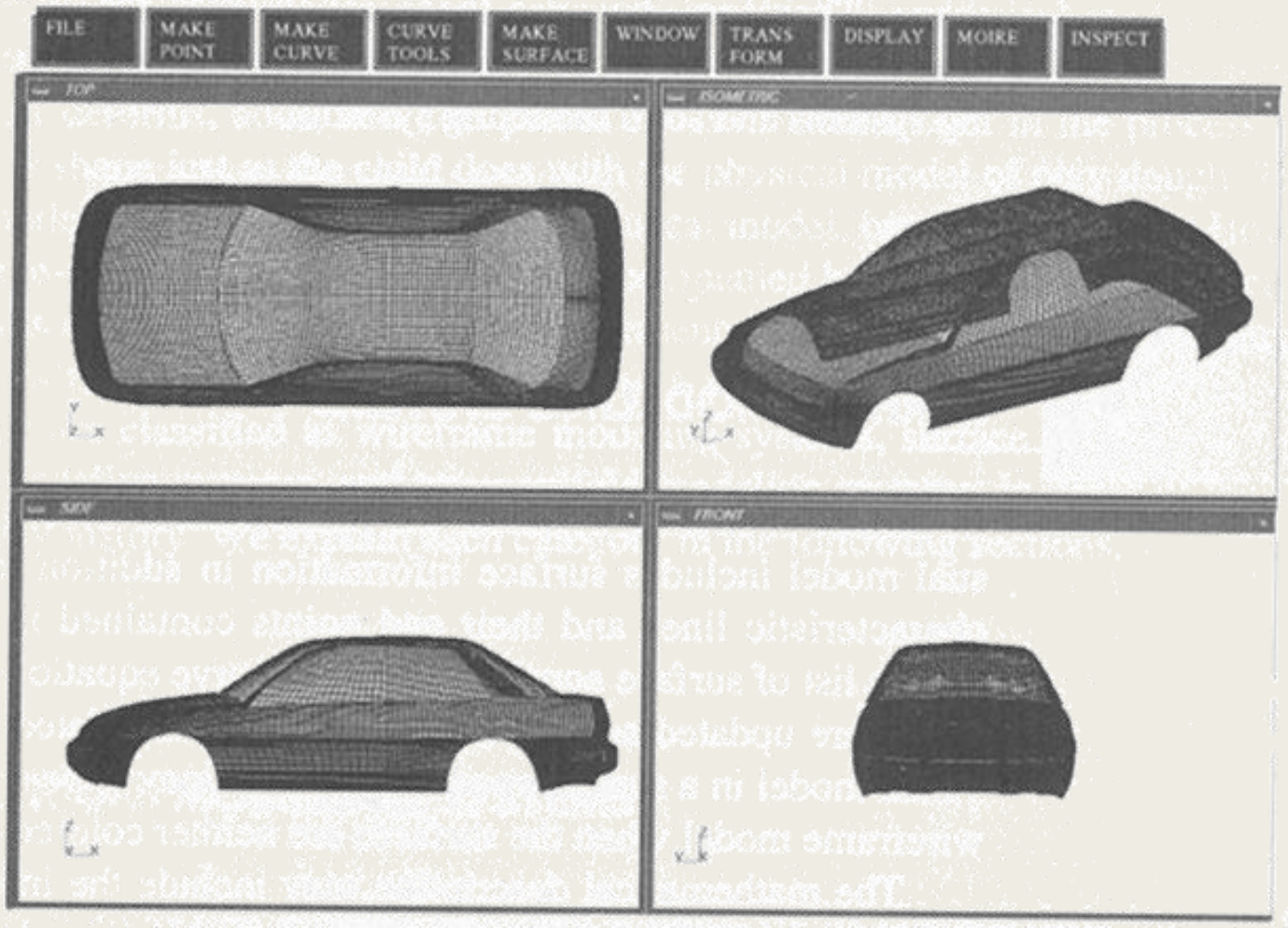
1964

DAC-1, GENERAL MOTORS



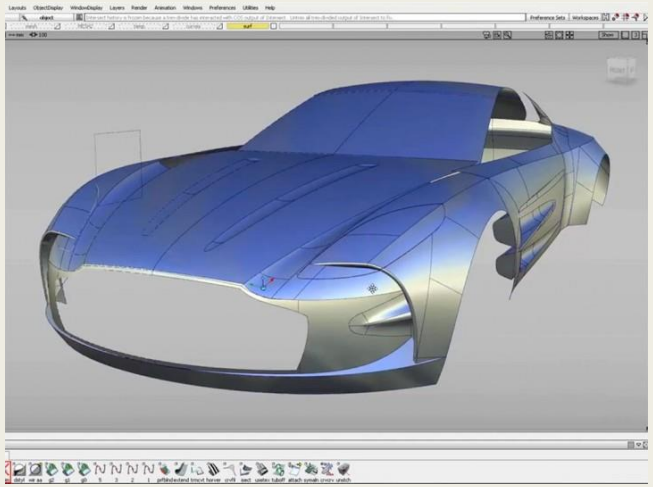


The problem with wireframe



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

1967 – BOSTON, MA



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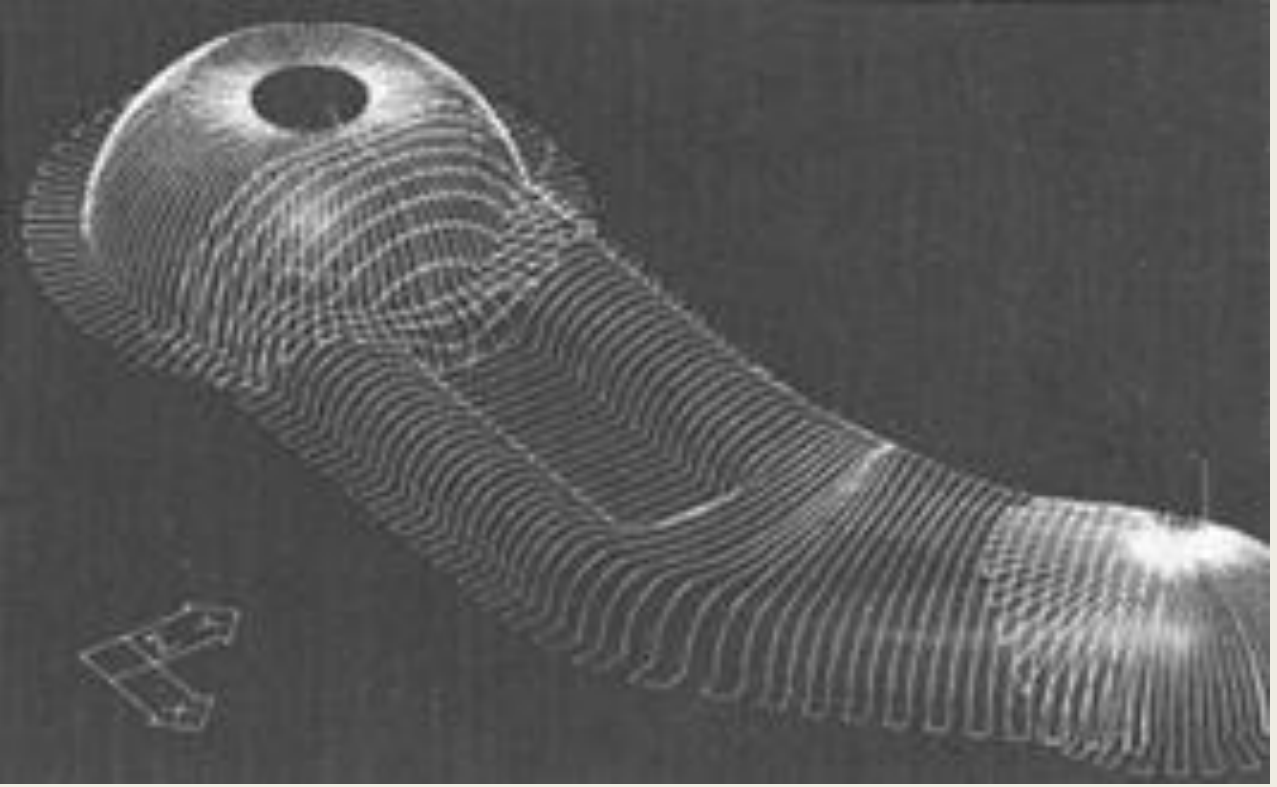
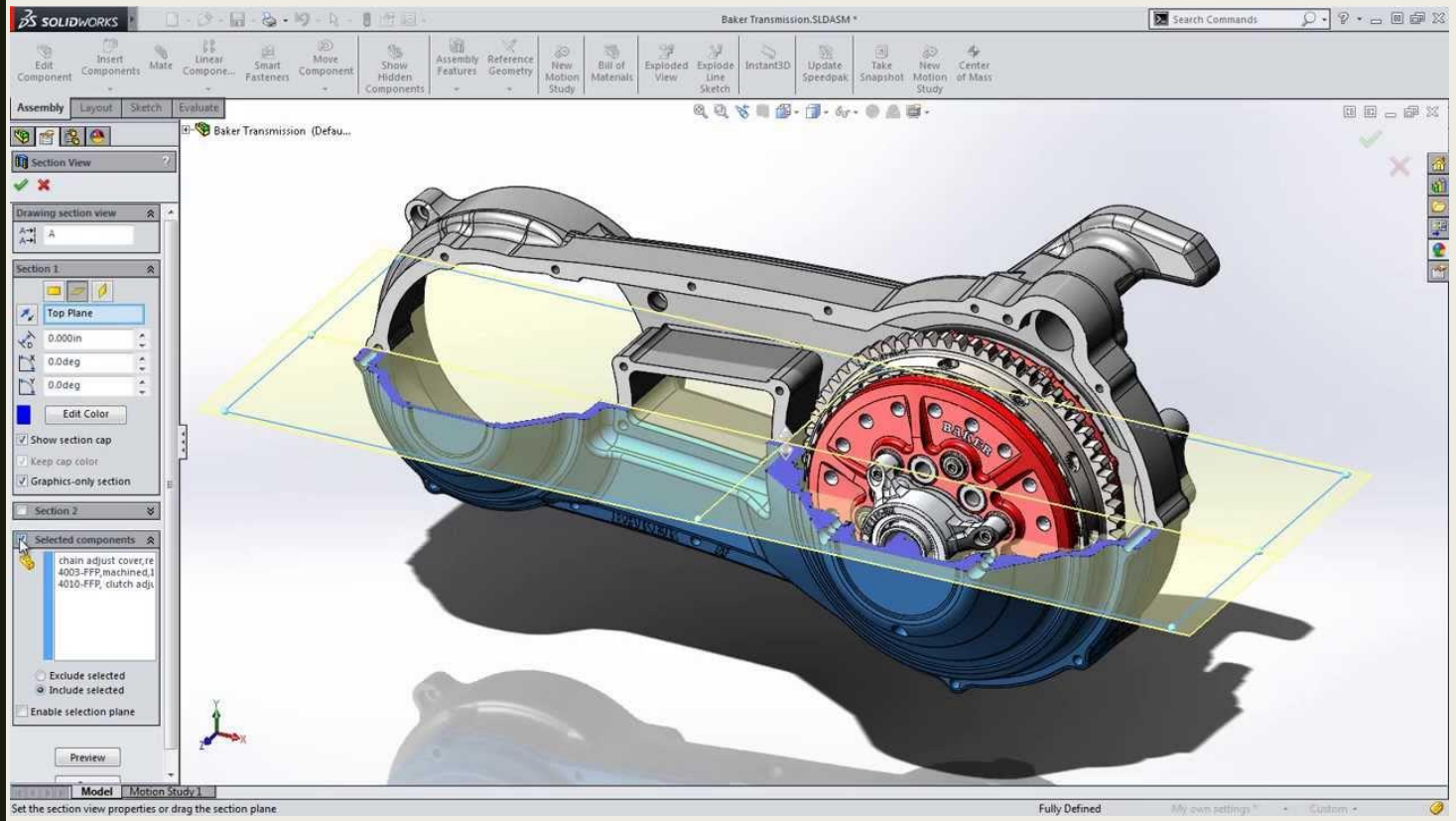


K. Lee “Principles of CAD/CAM/CAE Systems,” Addison-Wesley

Image from YouTube – GameNews, Apr 4, 2018

Other uses for surface models

- CNC milling path generation
- Video games



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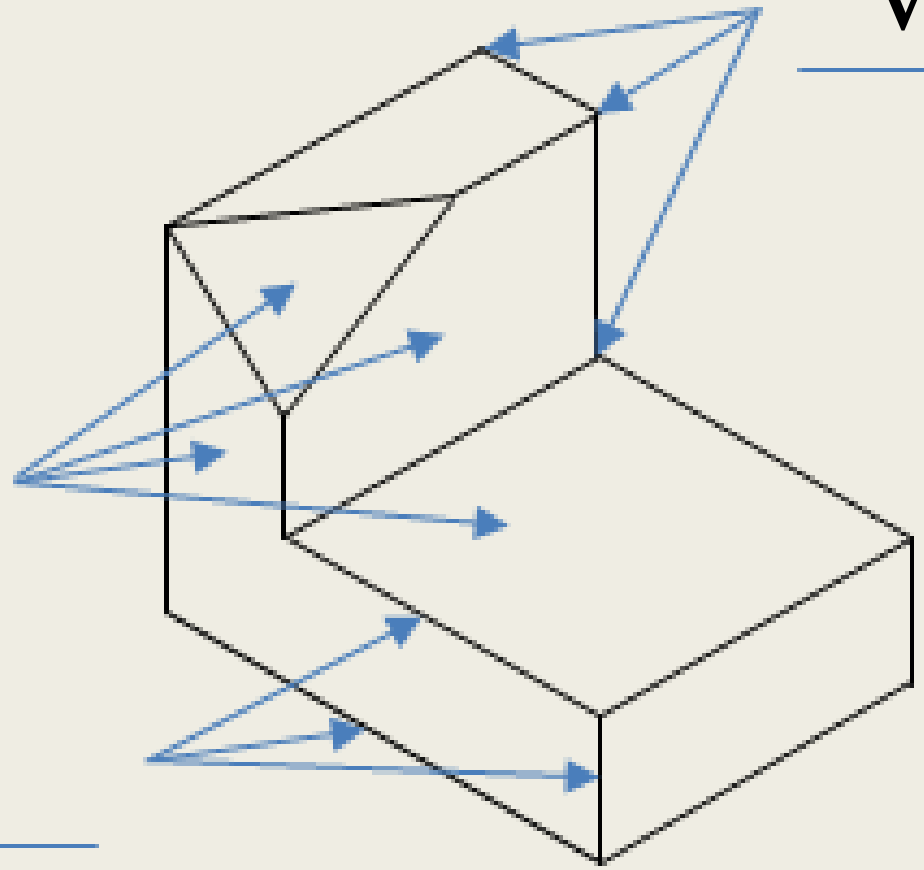
1973 – CAMBRIDGE, MA & ENGLAND

Boundary Representation

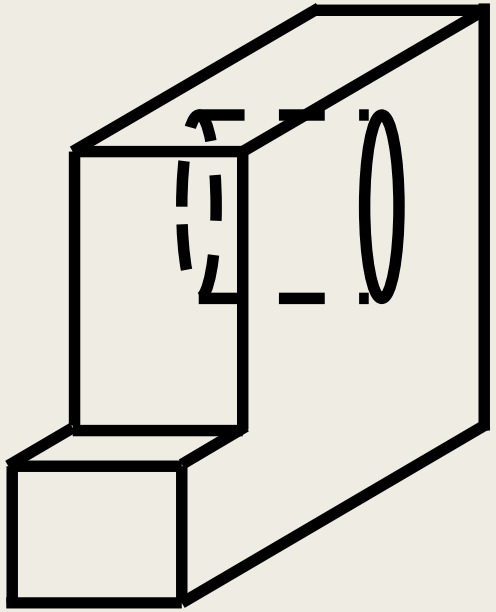
Vertices

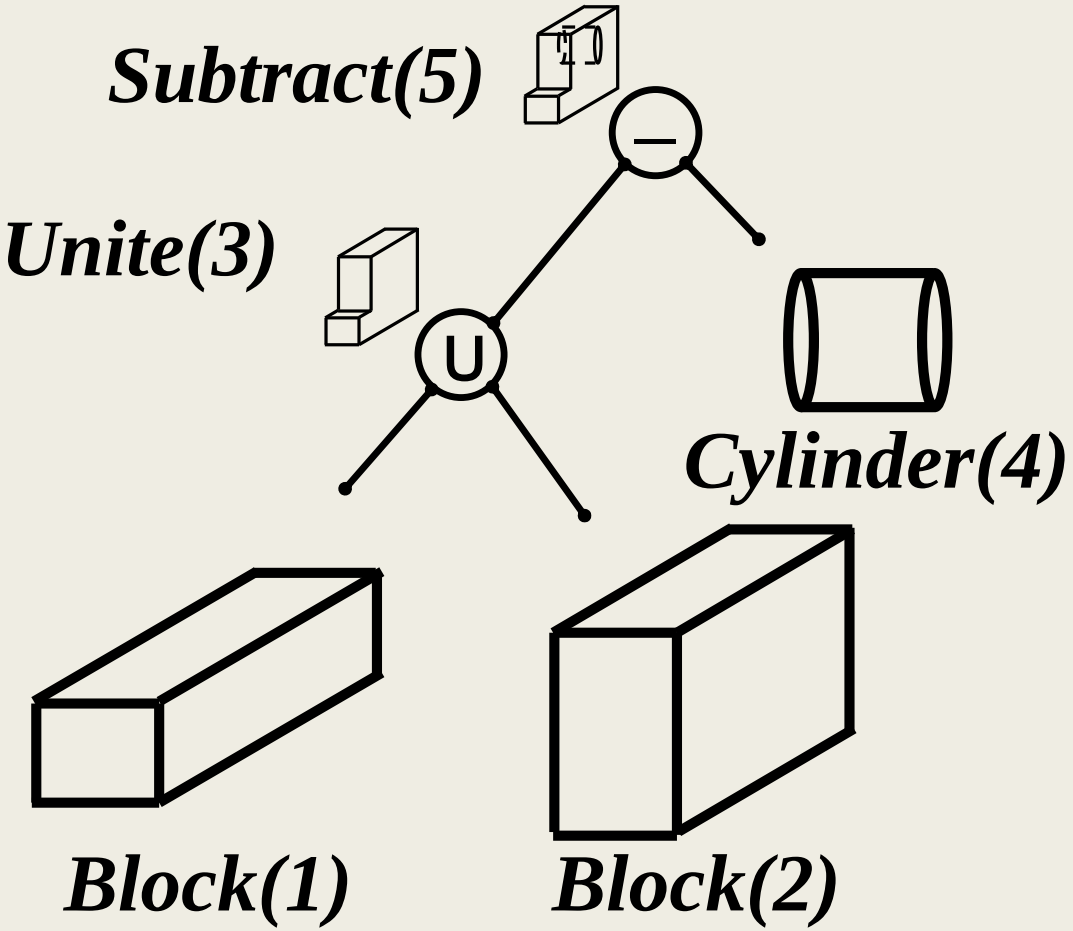


Faces

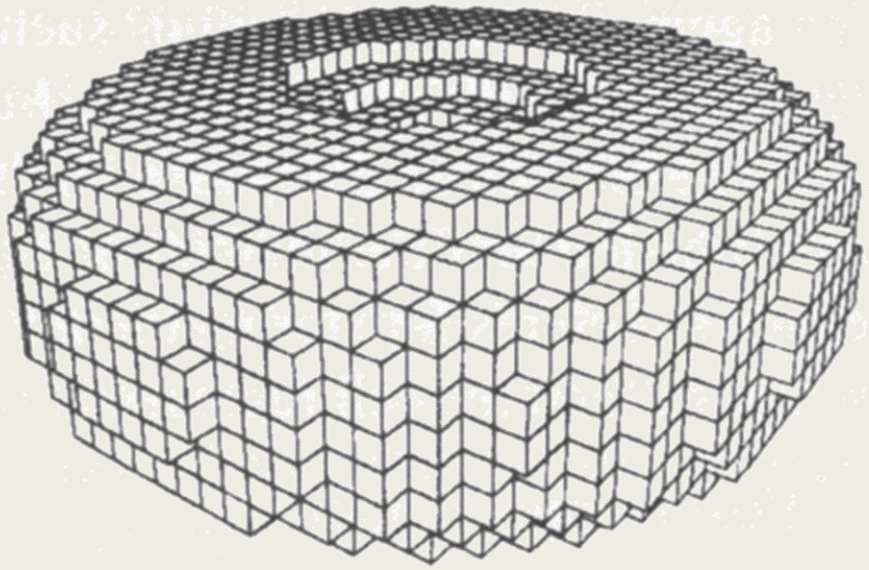
Edges

Constructive Solid Geometry





Decomposition Representations

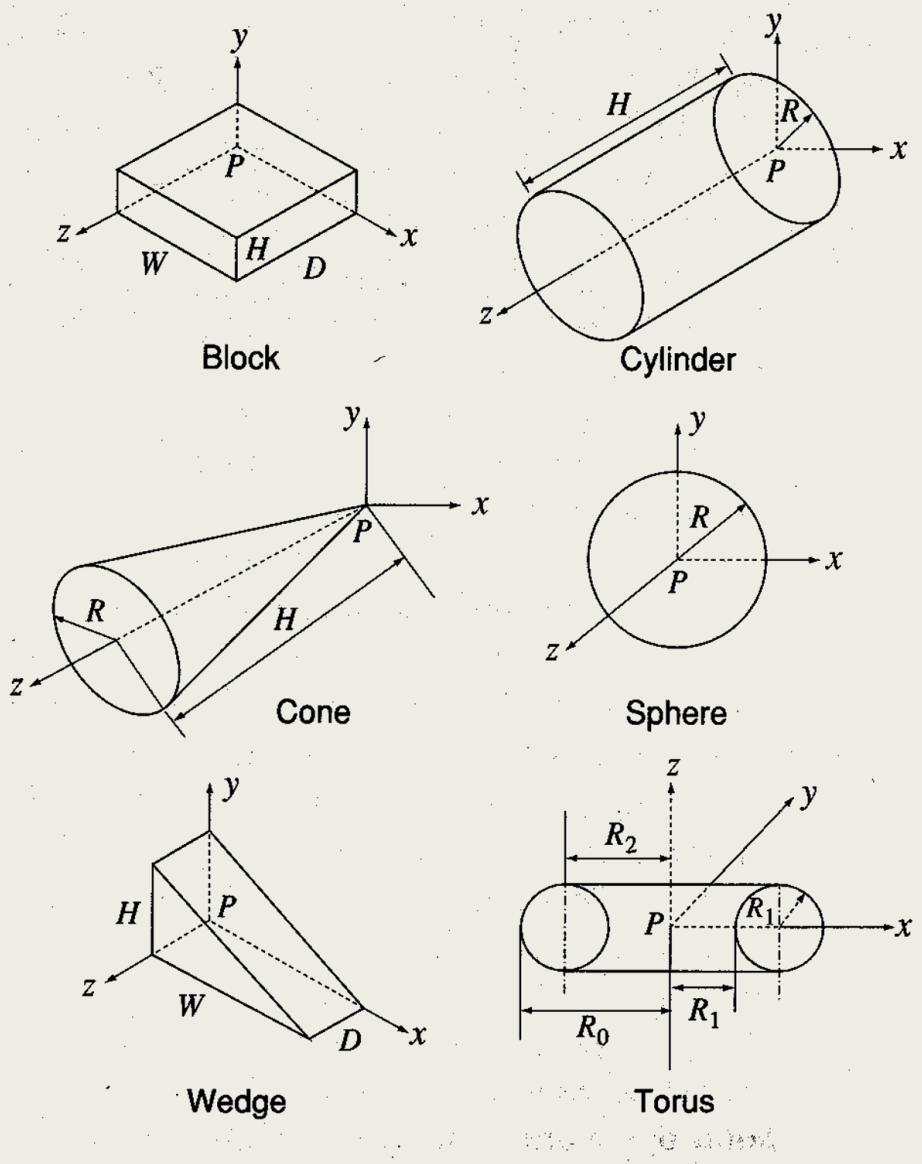


Images from K. Lee “Principles of CAD/CAM/CAE Systems,” Addison-Wesley

WAYS TO

CREATE OR MODIFY SOLID MODELS

PRIMITIVE SOLID SHAPES



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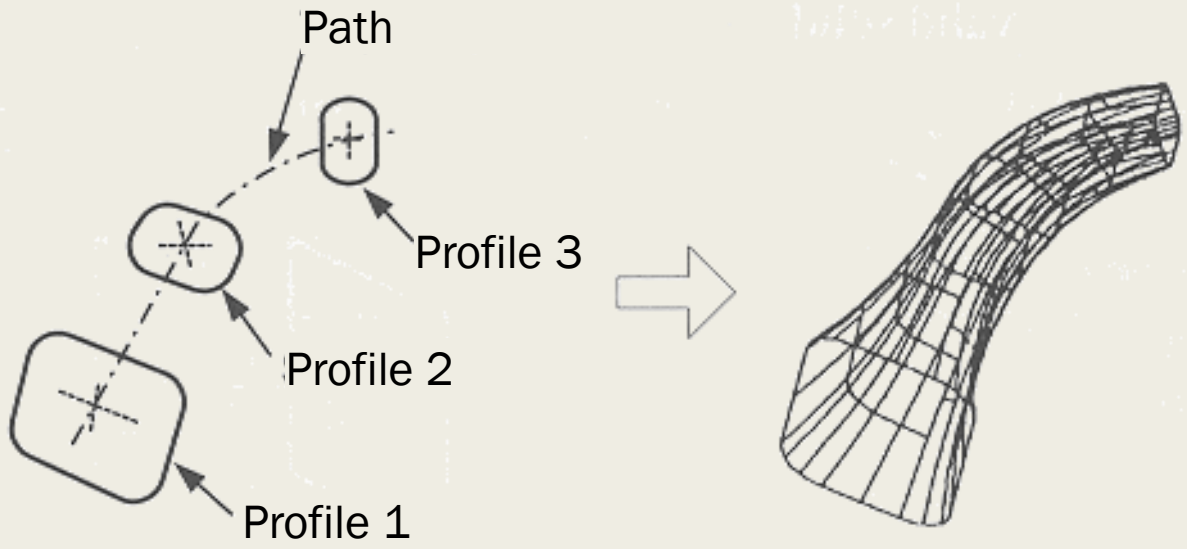
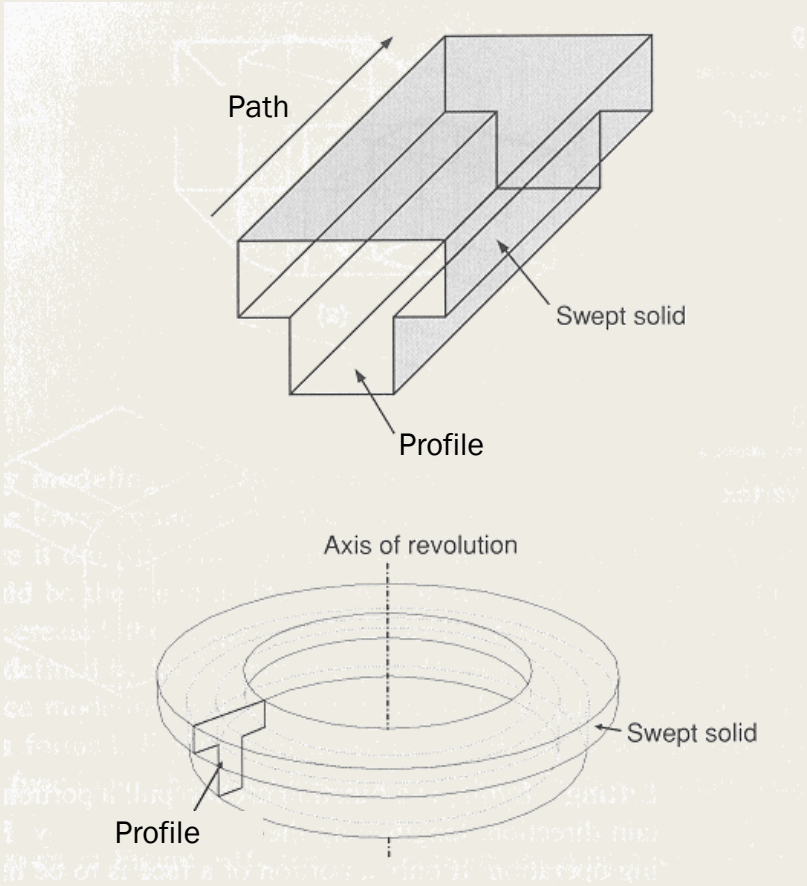
Sweep Operations

- require a profile and a path





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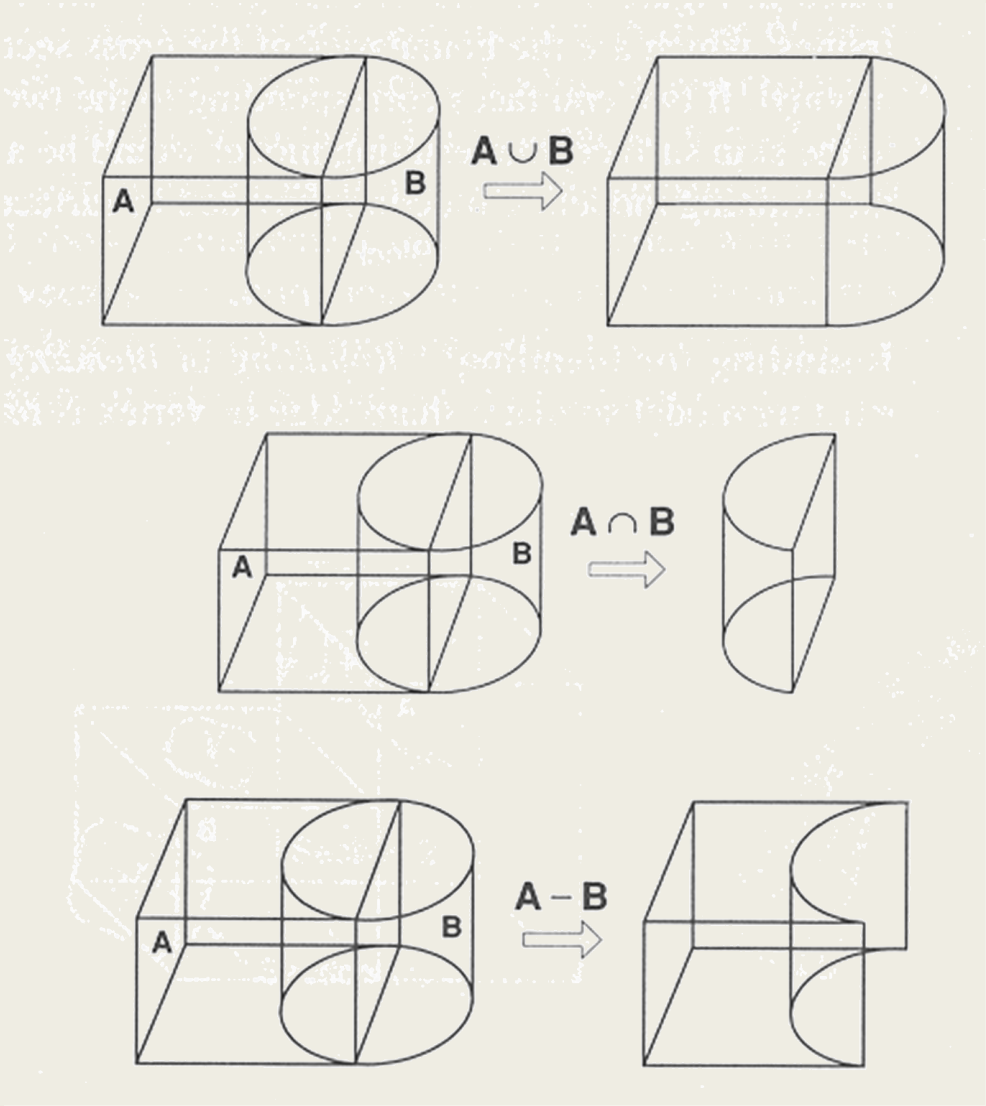


Image from K. Lee “Principles of CAD/CAM/CAE Systems,” Addison-Wesley

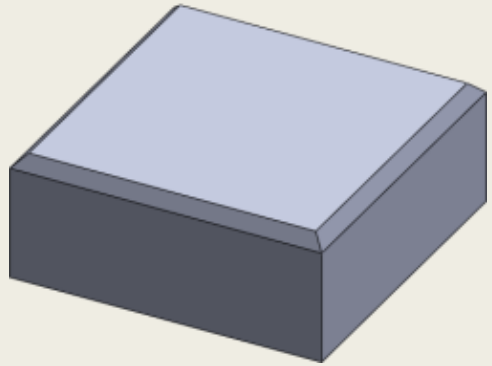
“Boolean” Operations

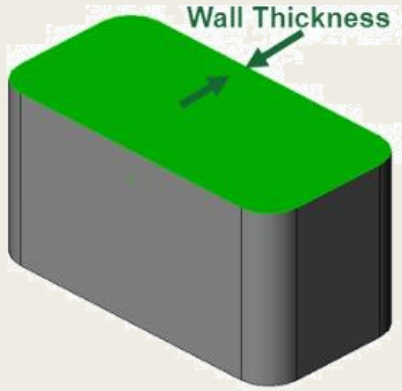
Three types of operations are possible:

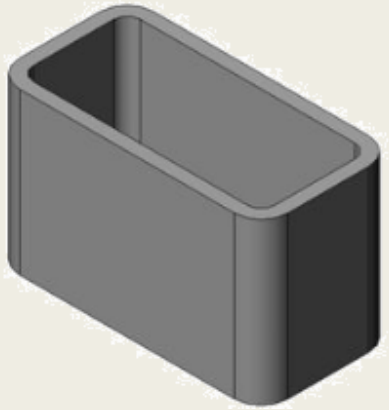
- union (‘∪’) or “join” or “add”
- intersection (‘∩’) or “common”
- difference (‘-’) or “subtract”

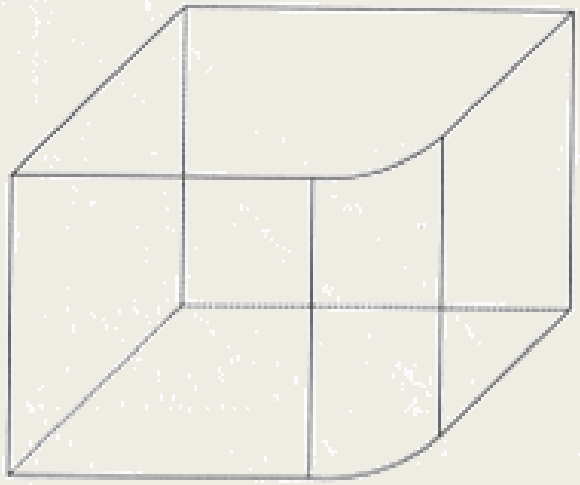
Local Modifications

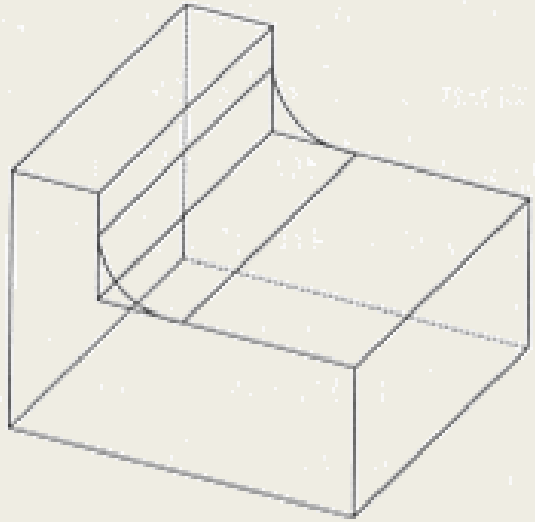
- Directly remove and add faces, edges, and vertices in the B-Rep
- E.g., in:
  - Rounds and fillets
  - Chamfers
  - Shell or hollow











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

Feature Modeling

- Hole
- Pocket
- Slot
- User-defined

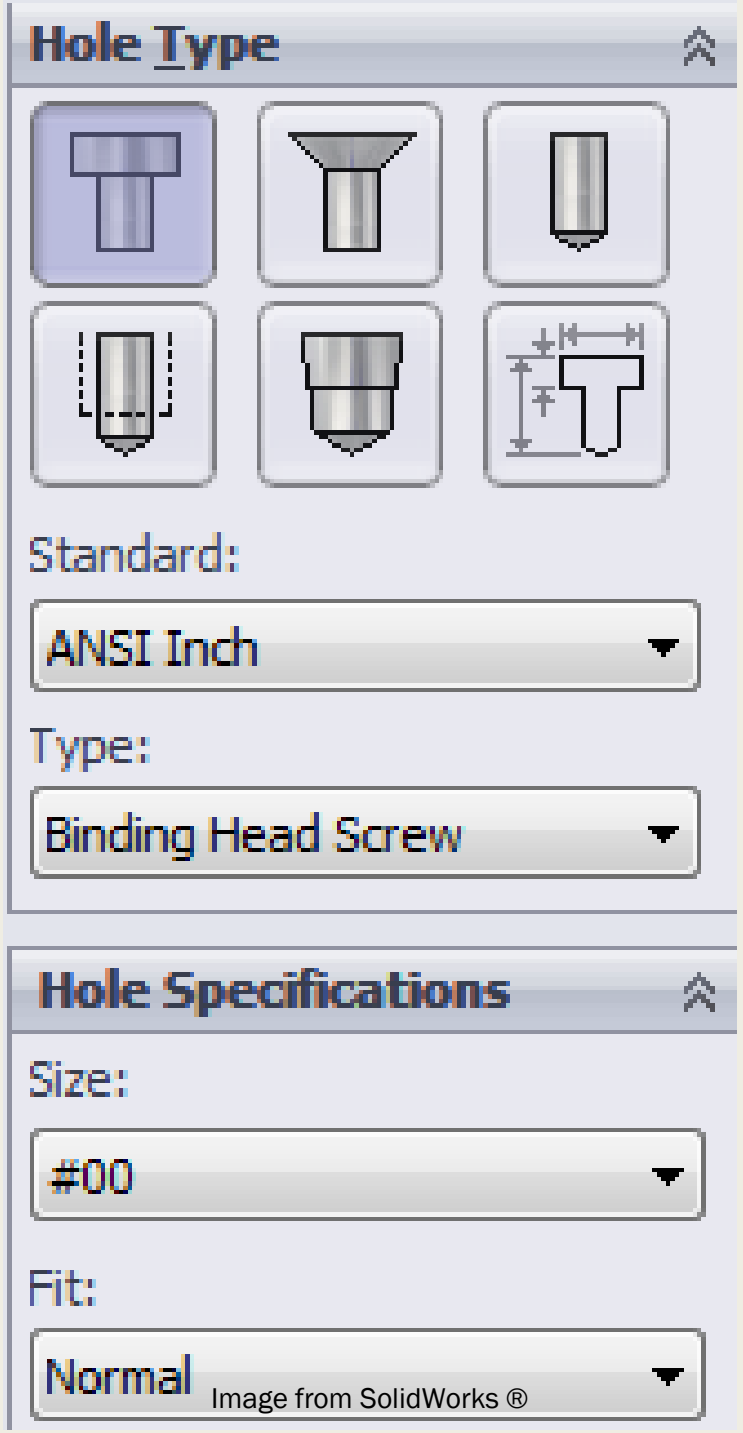


Image from SolidWorks ®

Parametric Modeling

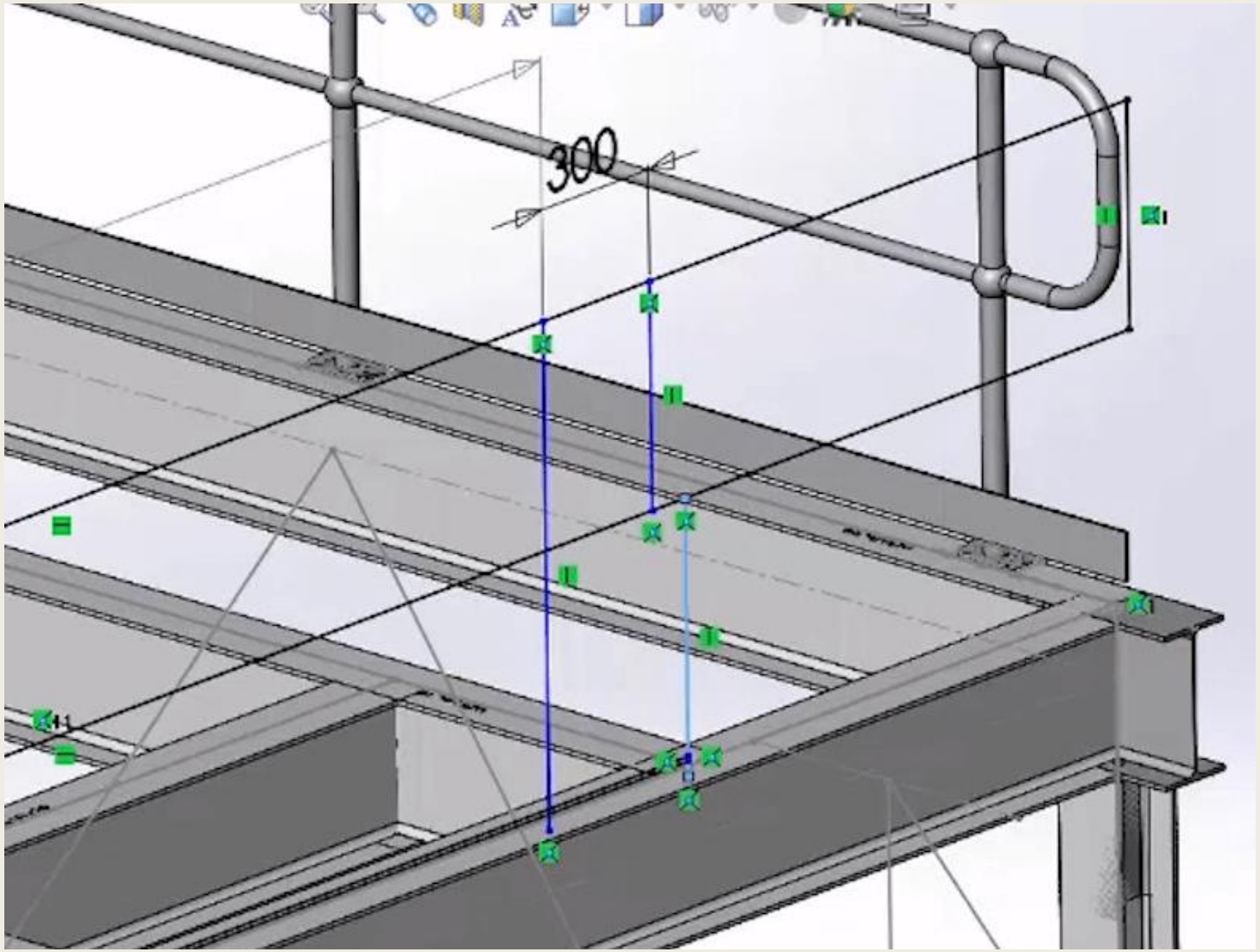


Image from MT Fabrications Ltd.

Direct Modeling

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

Image from Delcam PLC

Knowledge/Rule-Based Design

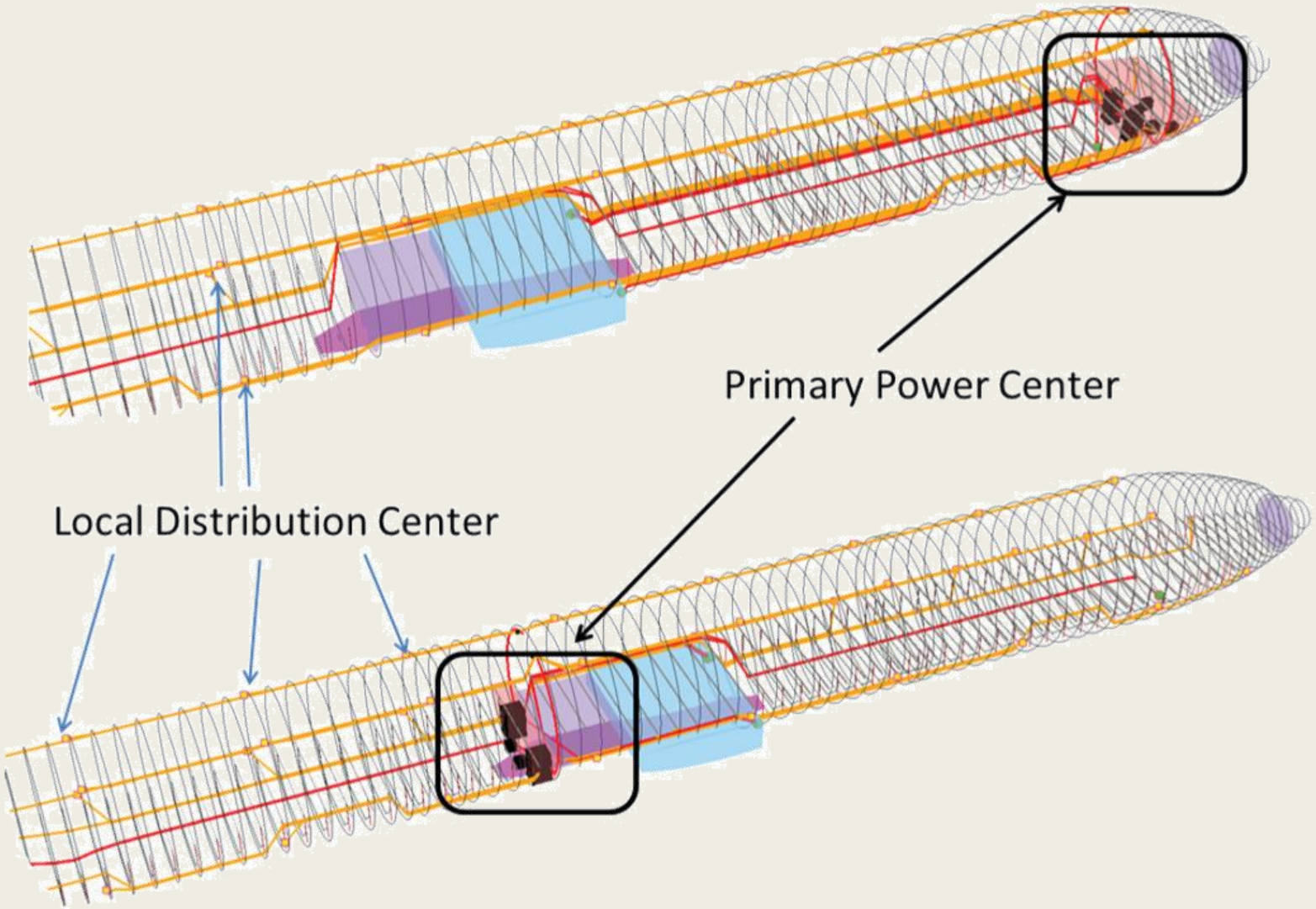


Image from Fuchte, Nagel, Gollnick, “Automatic Fuselage System Layout Using Knowledge Based Design Rules”