4.510 Digital Design Fabrication
Fall 2008

Error in Fabrication

Continuous Glass Surface
Quarter Scale Construction

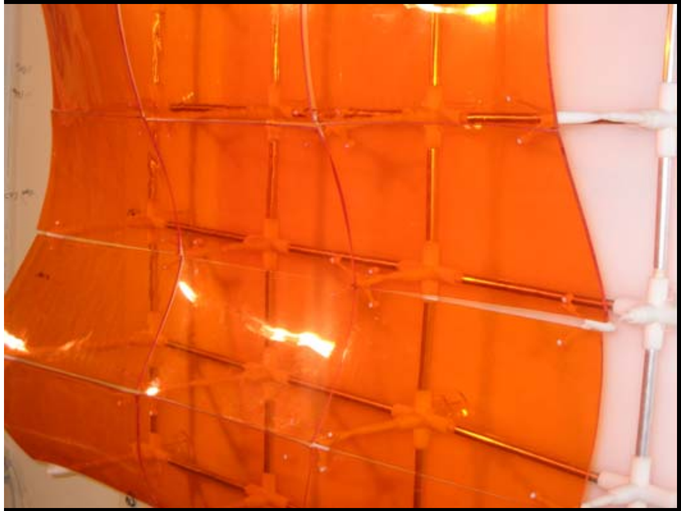
Problems

1. Poor relationship between tools

2. Design is a rain-screen

3. Inconsistent connections at joints from error in measuring, cutting and assembly

Error in Fabrication



Research Questions

Can curved surfaces be modeled in a design office?

Is it possible to construct buildings with smooth continuous transparent structures?

Can the surface be waterproof

Assembly Design

Assembly design accompanies material, machine and cost selections

Sequence of assembly should be a major criteria in assembly design

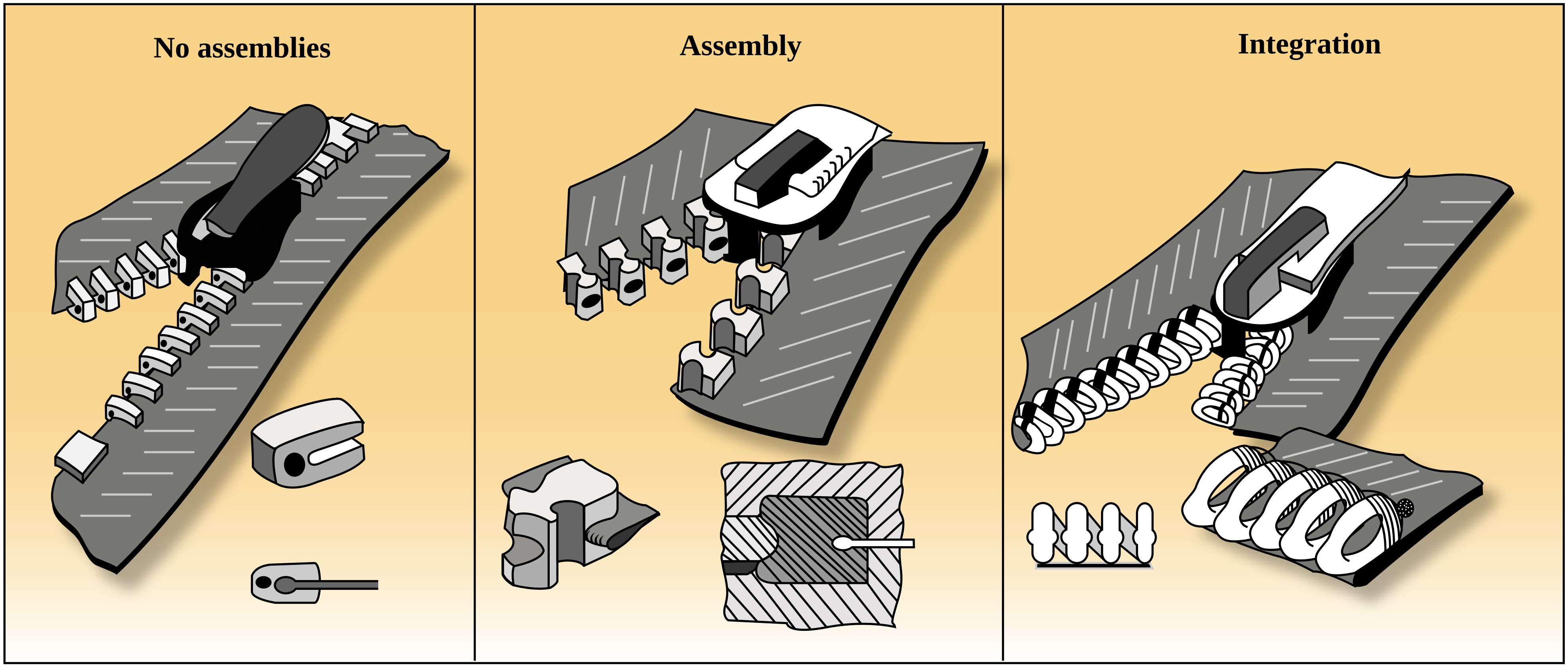
Assembly design is an iterative process as much as it is a destiny - The first model is only the beginning of the process.

Design Factors (Geometry)

1. Part Function - Goal
2. Materials
3. Assembly structure
4. Machining
5. Tolerance between parts

Designing Assemblies

Andreasen, Kahler and Lund

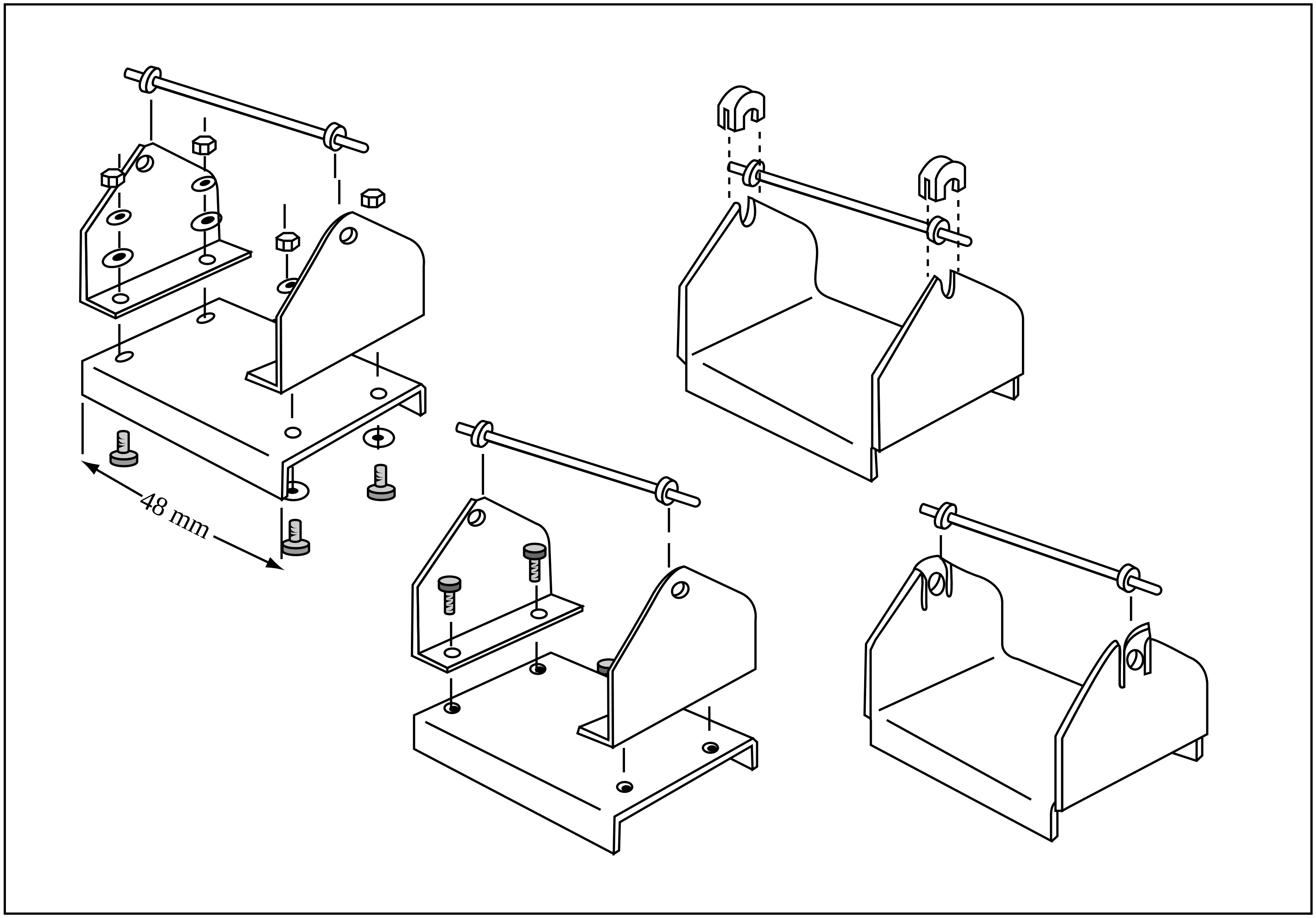


Three different production methods for zip fasteners.

Figure by MIT OpenCourseWare.

Geoffrey Boothroyd

Automated Designing Assemblies



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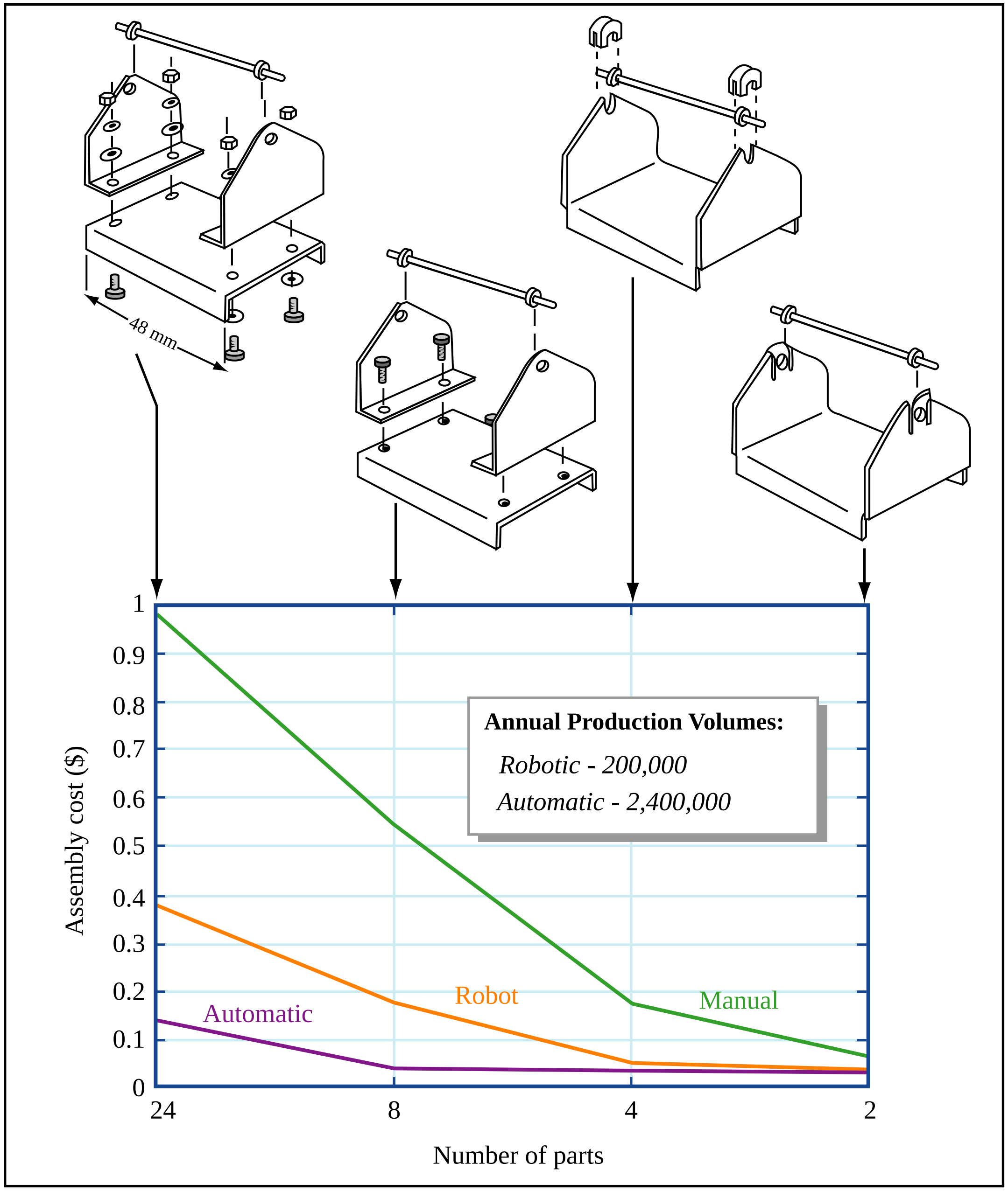


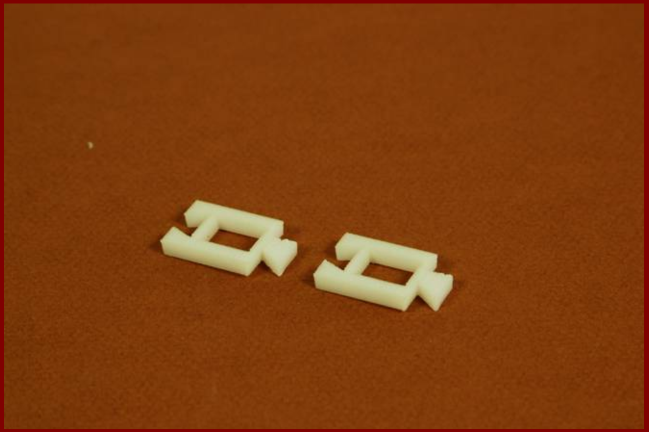
Figure by MIT OpenCourseWare.

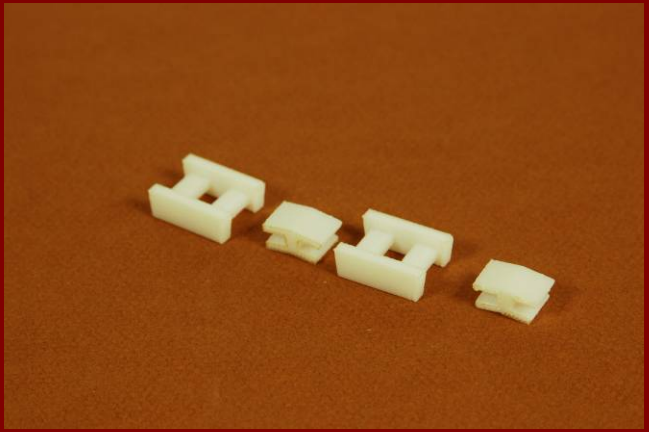
Factors in Automated Assembly

- Automate assembly process using machines that assemble parts on a line
- Increase productivity and reduce cost
- Build a more consistent product with higher reliability

Designing Assemblies
(Redford, A, et al 1984).

- The process should always include methods to improve design of assembly
- The design should be systematic
- The assembly process should be measurable





Functions

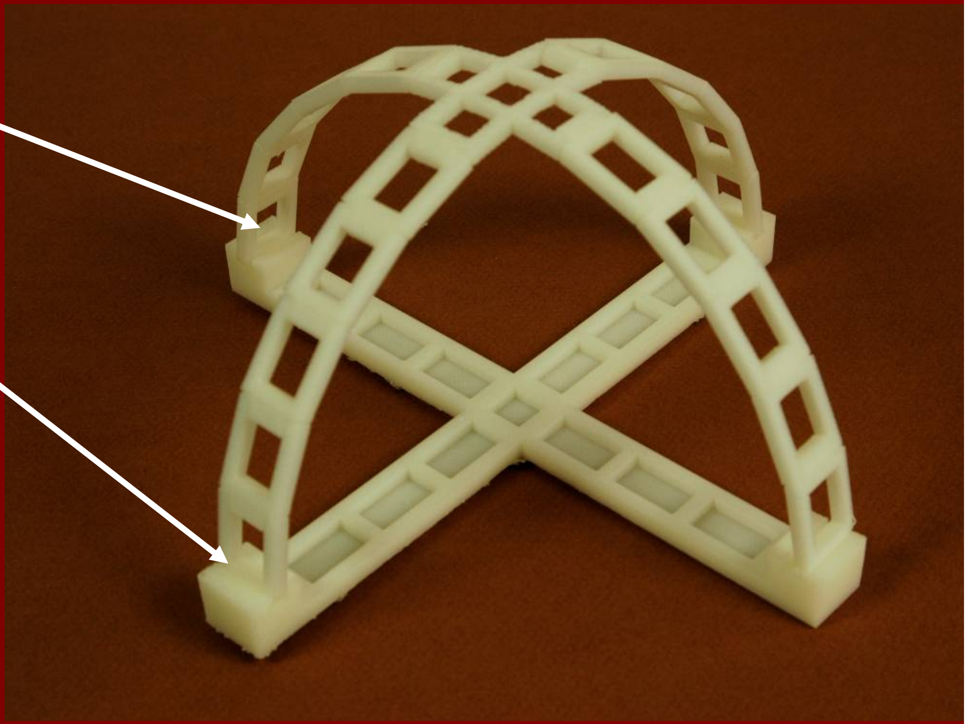
(DFA)

Contains two or more joints

a) An assembly of parts contains a start base

b) The start base or part should contain spring angles

c) The assembly angle should be assured during manufacturing



Assembly Types

Integral Attachments

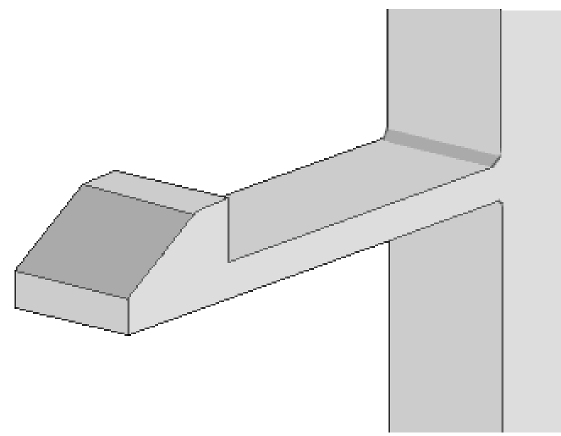
a) Term was developed by the plastics industries in the mid 1990's

b) Flexibility in design

c) Measurable (Computable)

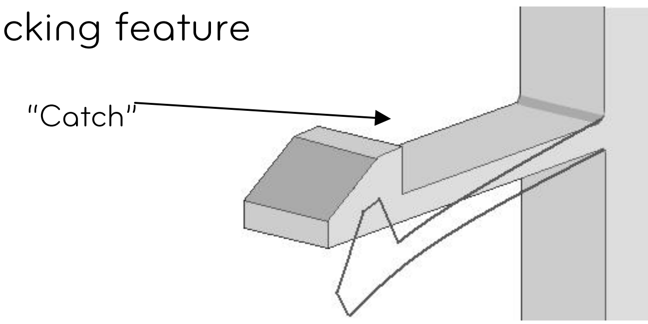
"A snap-fit is a mechanical joint system where part-to-part attachment is accomplished with locating and lockin features (constraint features) that are homogenous with one or the other of the components being joined."

- *The First Snap-Fit Handbook*, Bonenberger, 2000



Snap Fit

- Important Criterion – Flexibility in integral locking feature



- Joining method using springy (elastic) properties of metals and plastics
  - Plastic – Plastic
  - Plastic – Metal
  - Metal – Metal
    - Although most commonly used today with plastic assembled parts, snap-fit has long before existed in metal-metal components in clothing

- Results in reduced man-hour, production cost, and or number of parts in assembly

Snap fit examples

- Toys
- Small Appliances
- Automotive
- Electronic Fields

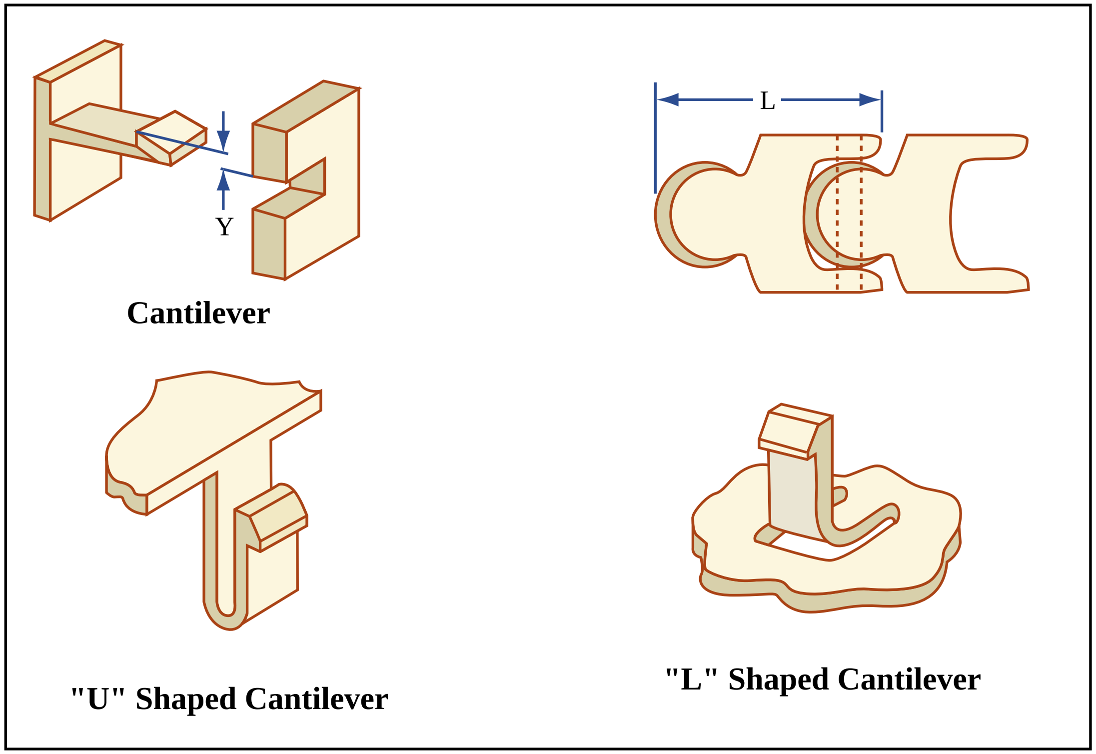
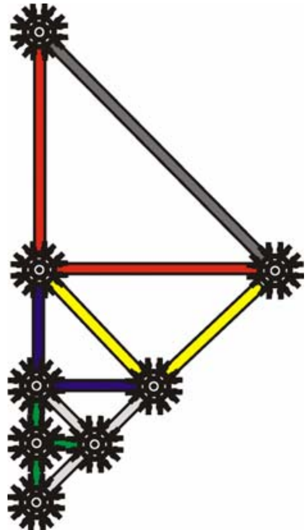
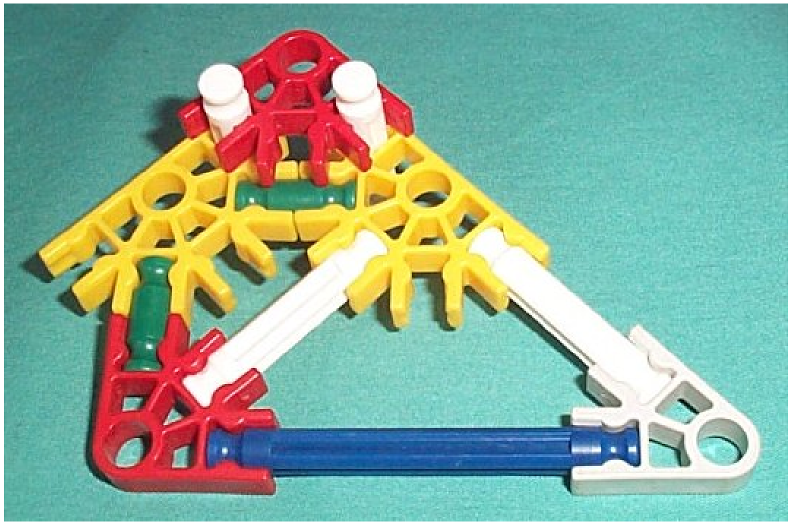
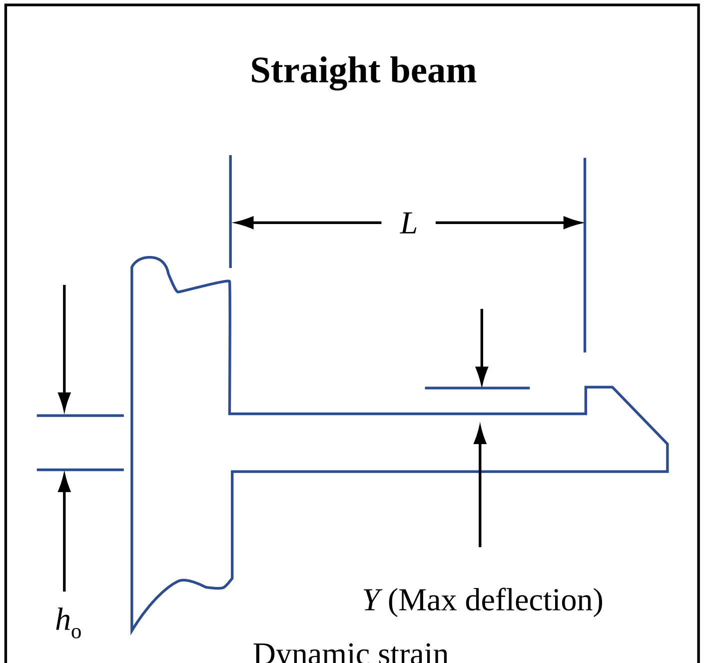


Figure by MIT OpenCourseWare.

K'nex







$$\varepsilon = \frac{3Yh_o}{2L^2}$$

Figure by MIT OpenCourseWare.

Example: Duracon M90-44

Yield strain : 7 - 8%

Thickness: h = 3mm

Height: Y = 2mm

Span: L = 10mm

Strain = 9%

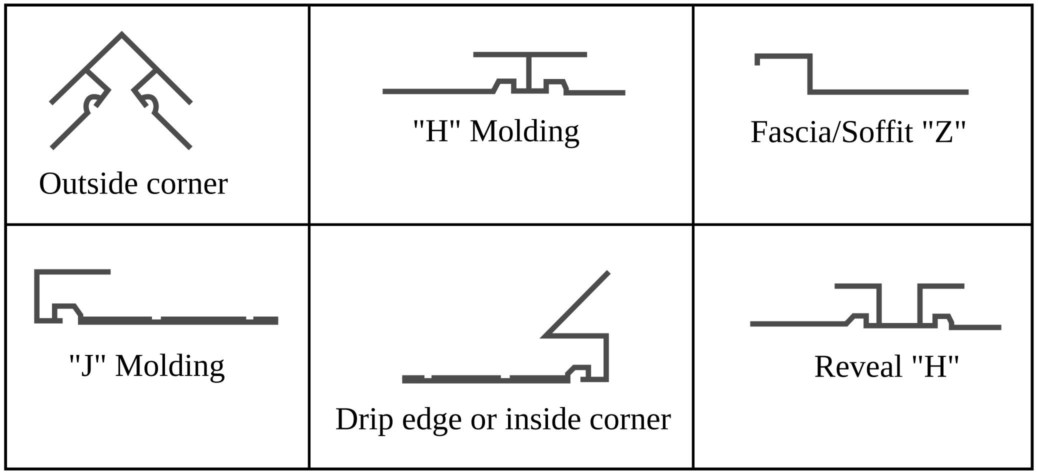
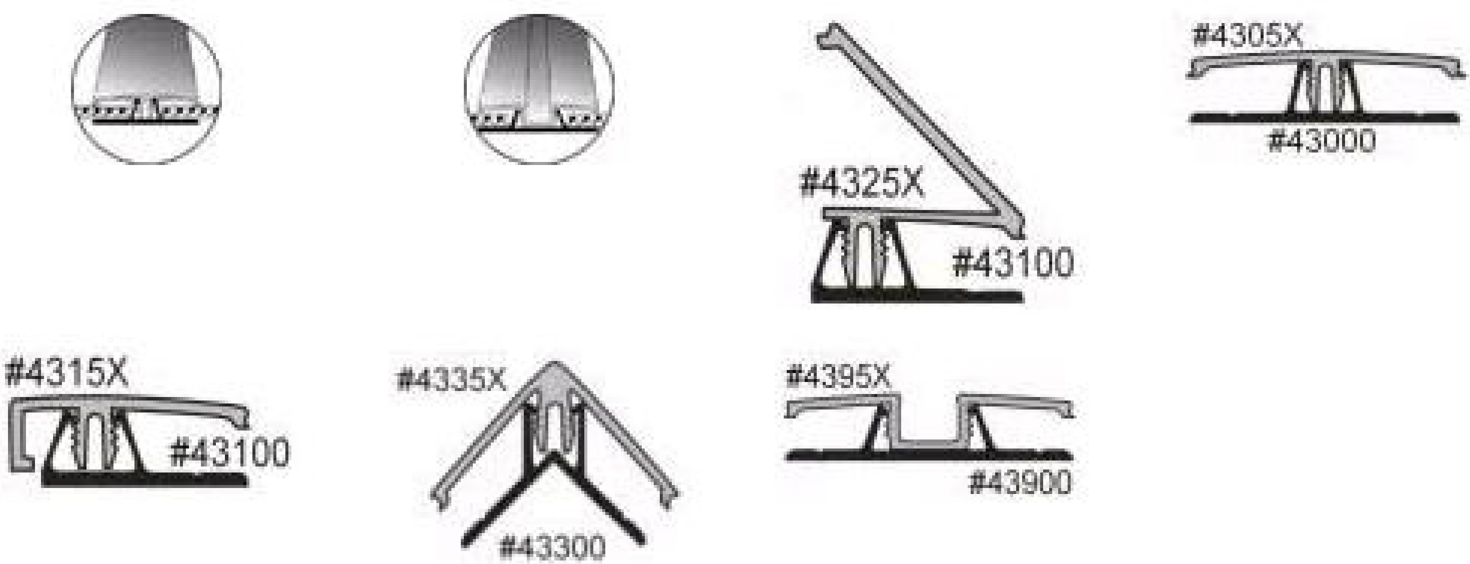
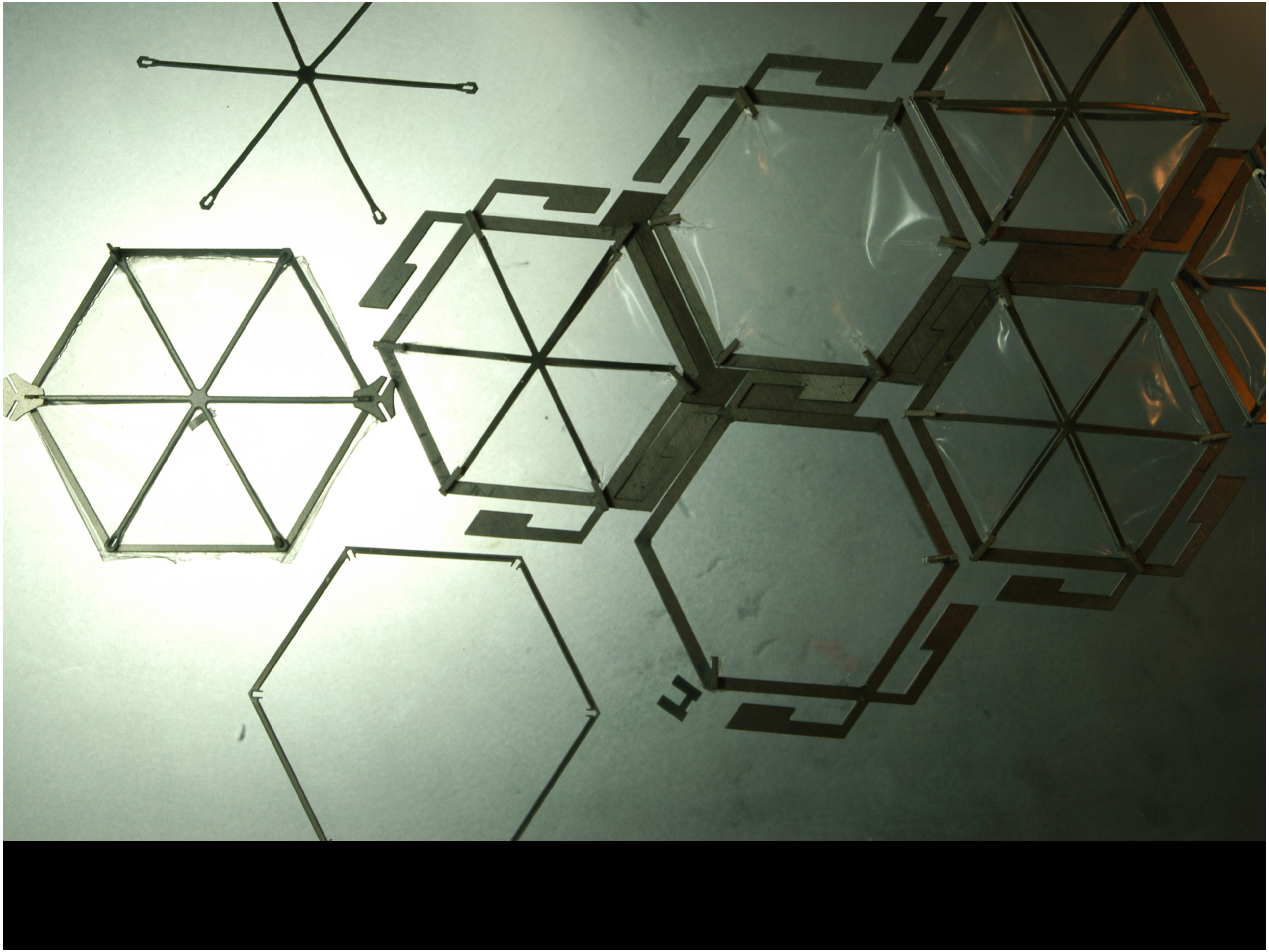
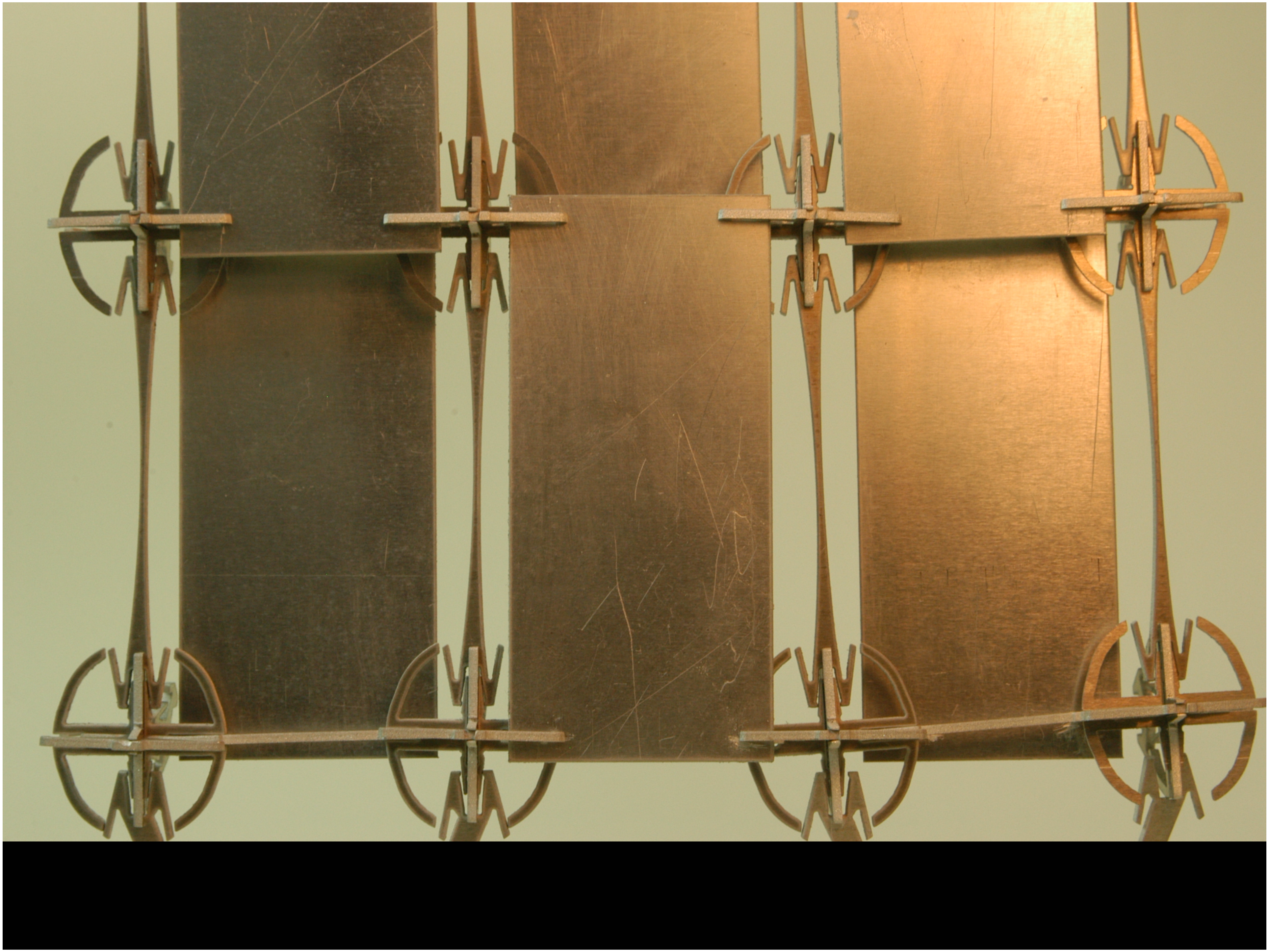


Figure by MIT OpenCourseWare.

2-Piece, "Snap-Fit" Molding








base outer