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Computational Modeling Sciences Department

Removing Small Features with Real CAD Operations

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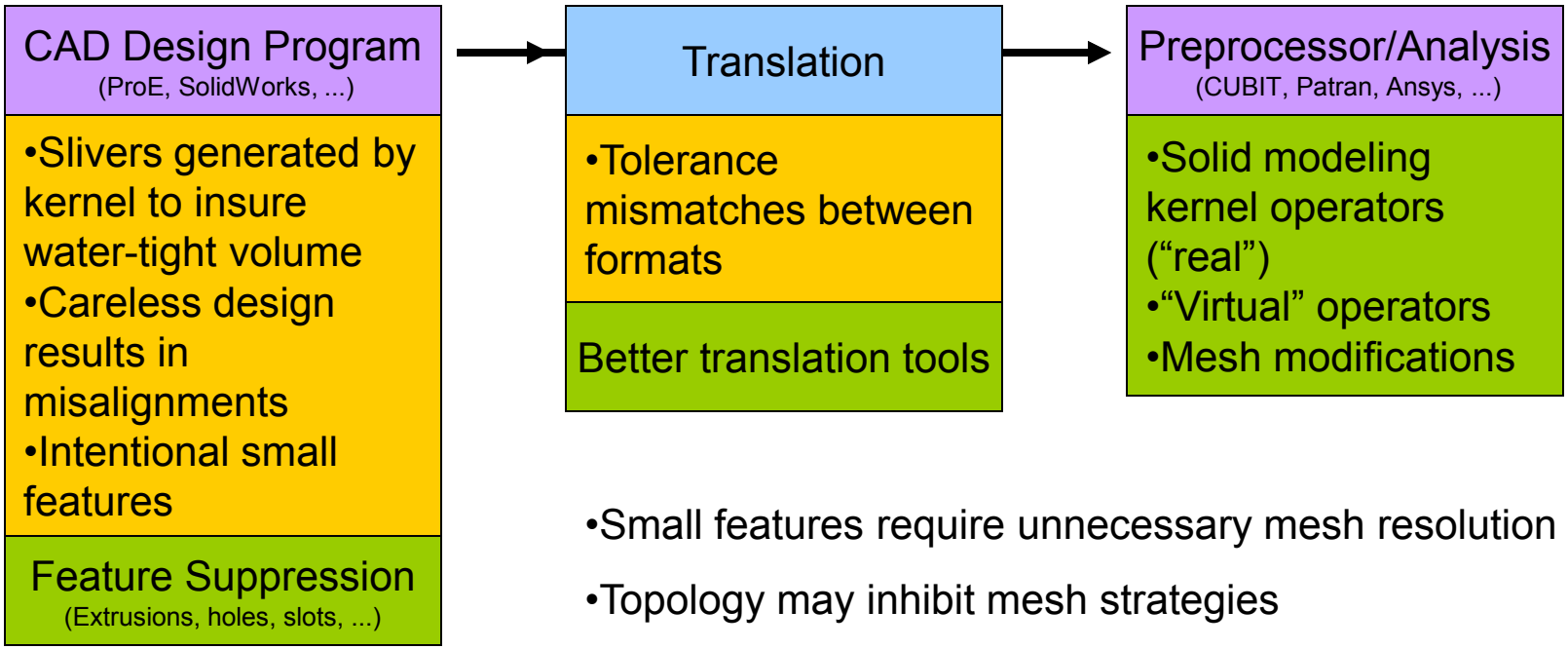
Geometry Preparation



- Small features require unnecessary mesh resolution
- Topology may inhibit mesh strategies

Current Approaches

- Suppress features in CAD design system
  - Effective, but does not address non-feature topology
  - Tools in the CAD design system for modifying arbitrary are topology are very limited

- "Real" solid modeling operations in the Preprocessor/Analysis package
  - Can be very effective if available
  - Dependent on what the package exposes to the user
  - Persistent—can be saved and used in other processes

- "Virtual" operations (composite/merge, partition/split)
  - Very powerful
  - Not very persistent
  - Not usually interoperable with real operations

- Mesh modification
  - Very powerful
  - Specific to mesh instance and mesh algorithm

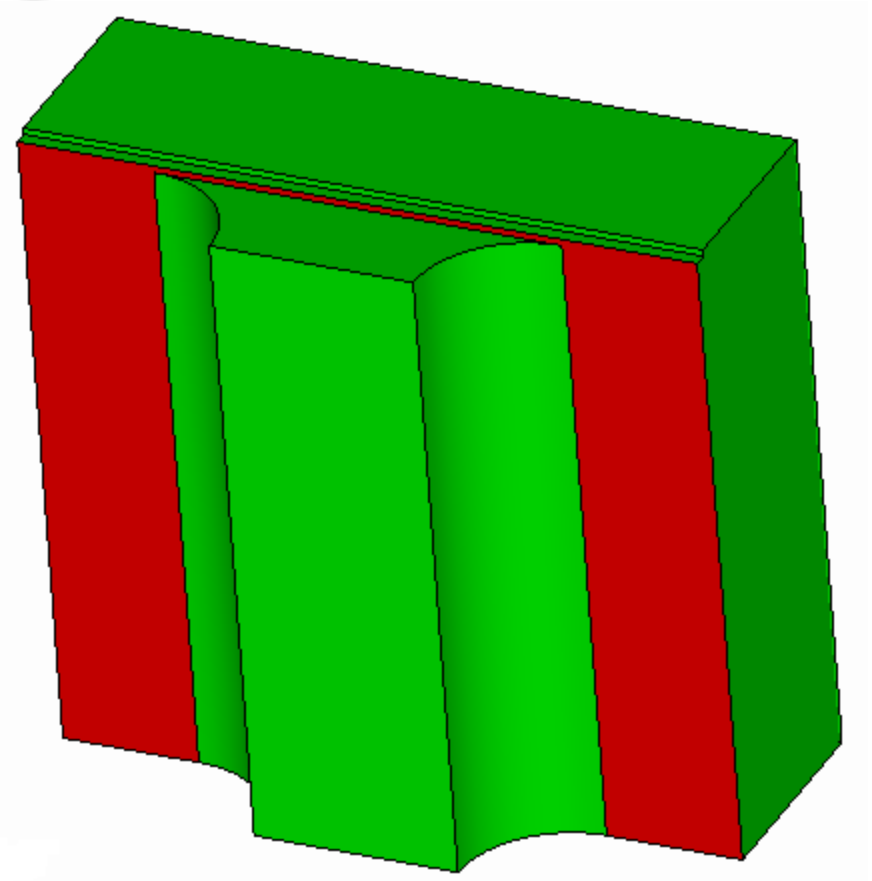
Topology Removal Process Overview

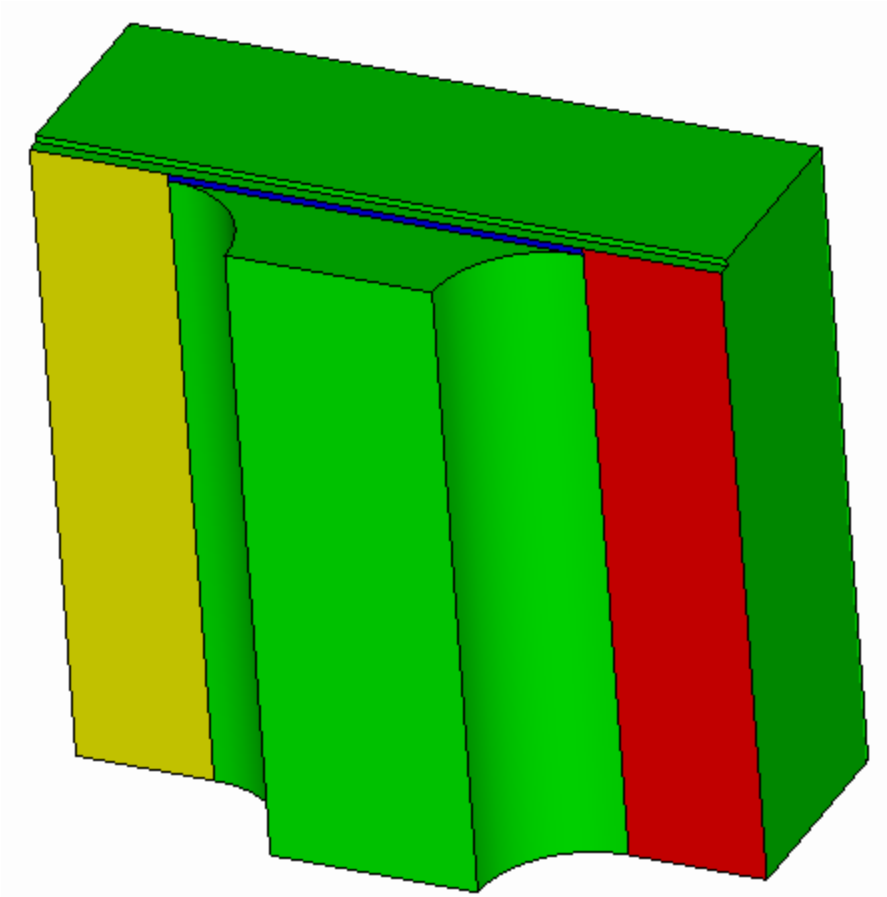
- Preprocess narrow regions and surfaces
- Recognize topology to be removed ("old topology")
- Define "new topology"
- Back away from old topology and cut it out
- Stitch in new topology (generate interface)
- Regularize or composite out extraneous curves

= Real operations

= Virtual operations

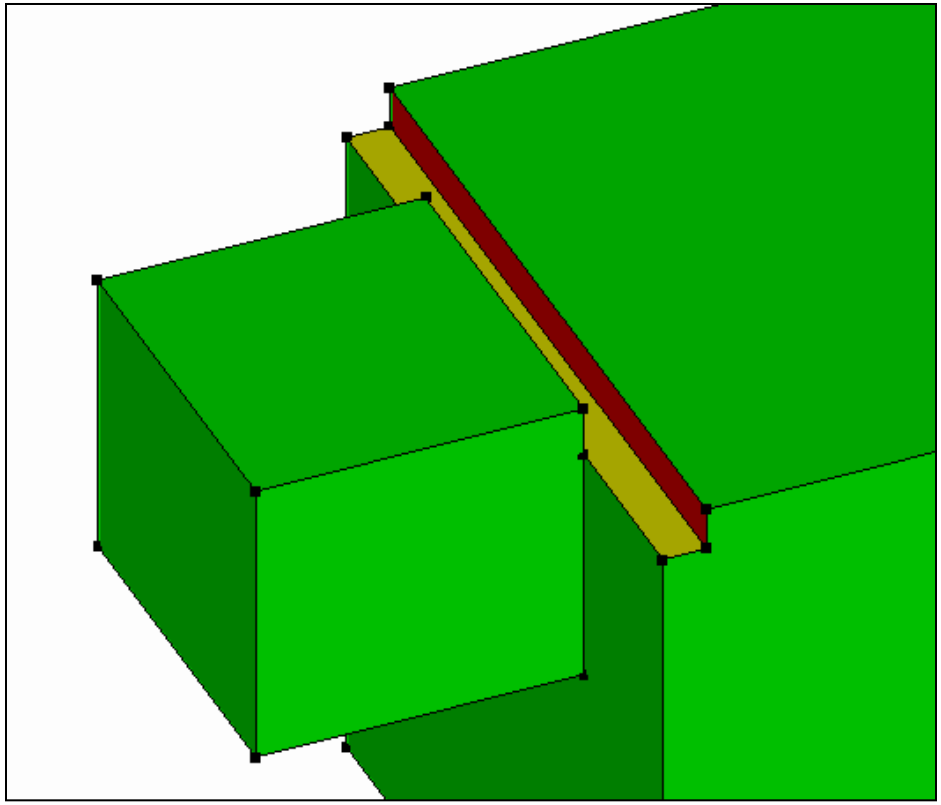
Preprocess: Narrow Region Separation

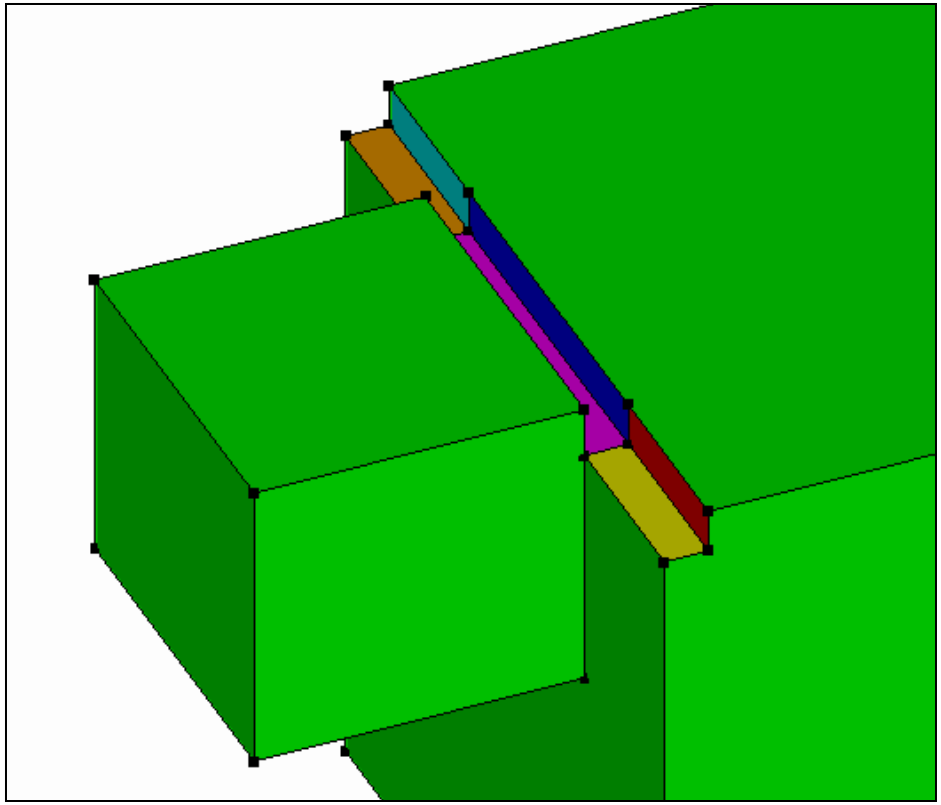




Utilizes solid modeling kernel “split surface” functionality.

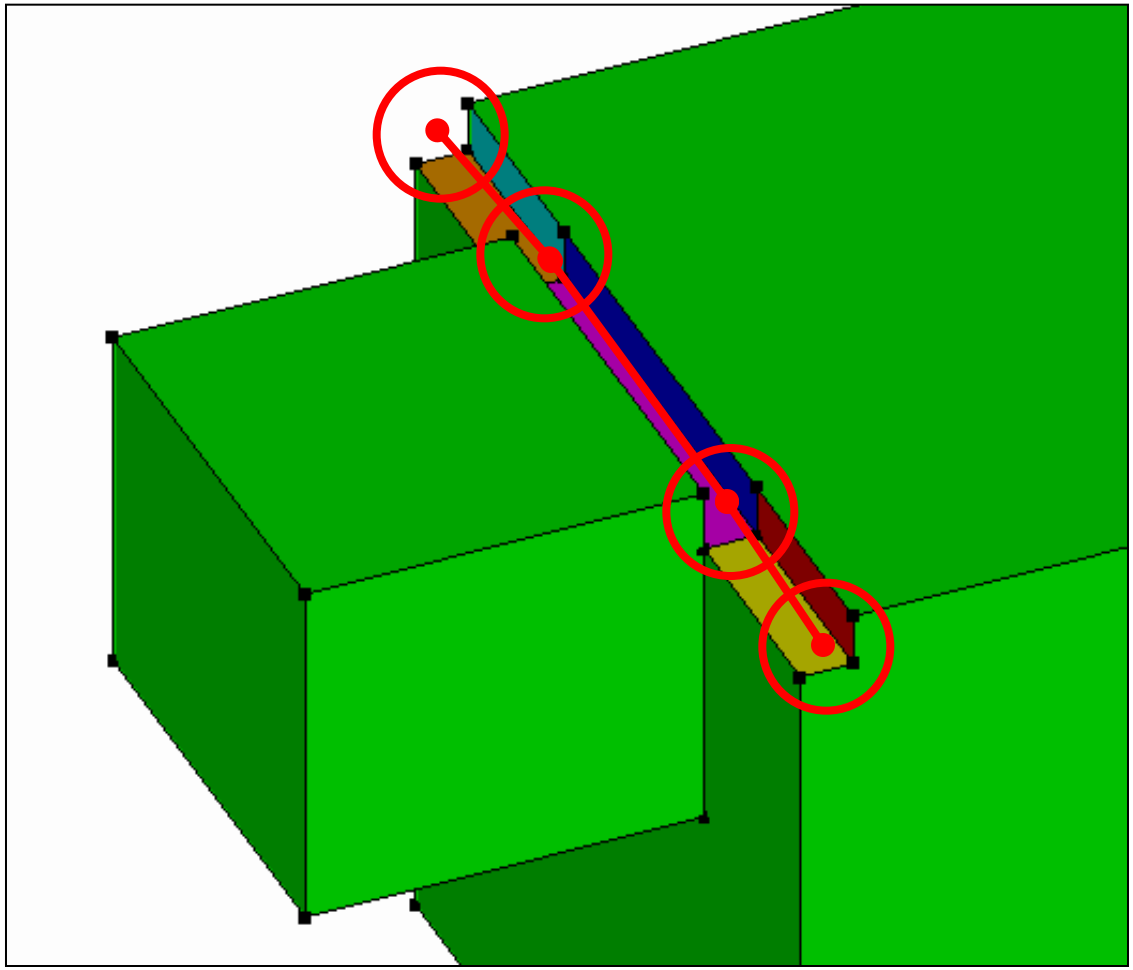
Preprocess: Narrow Surface Splitting





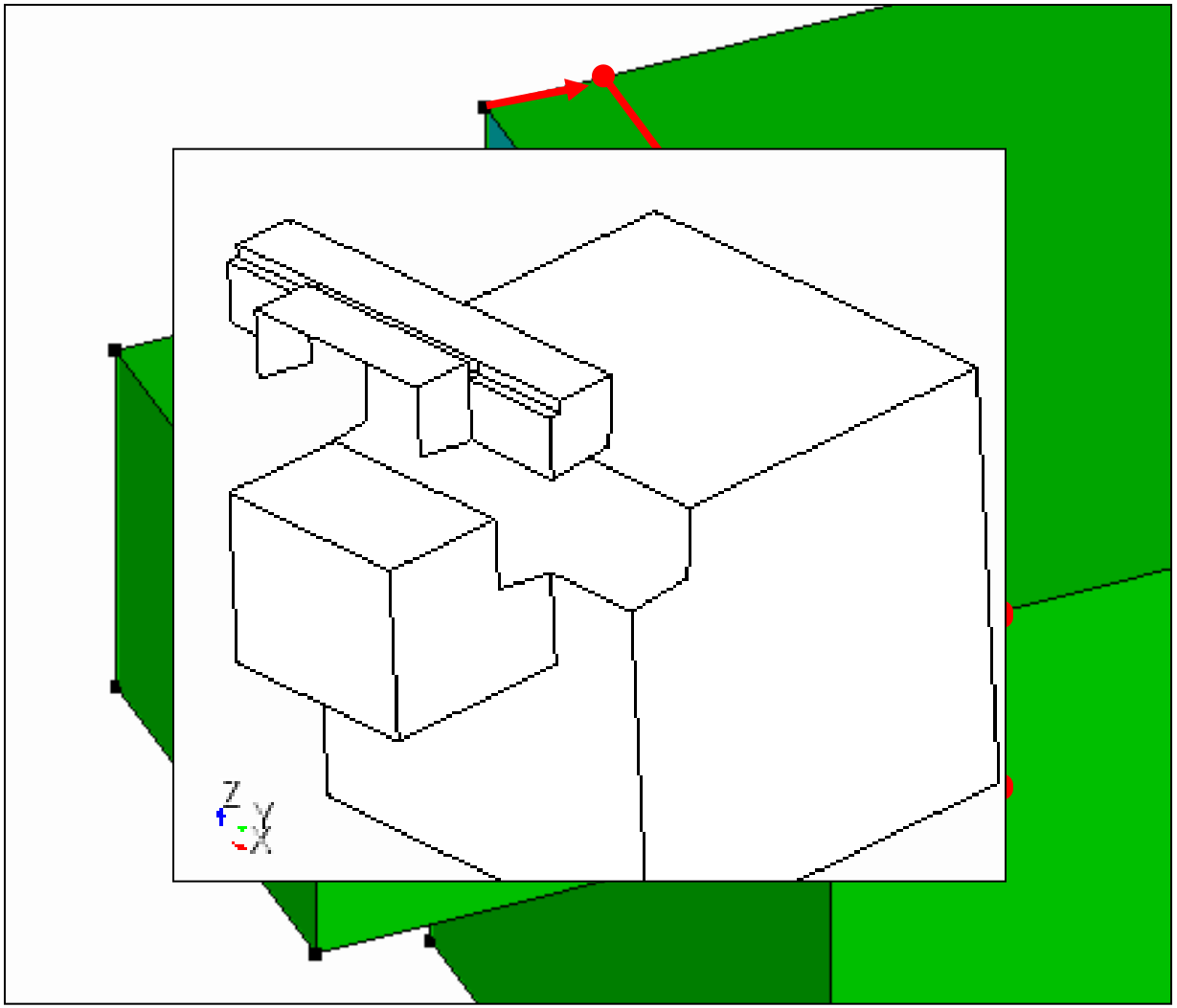
Utilizes solid modeling kernel “split surface” functionality.

Locate Vertex Clumps and Create New Topology



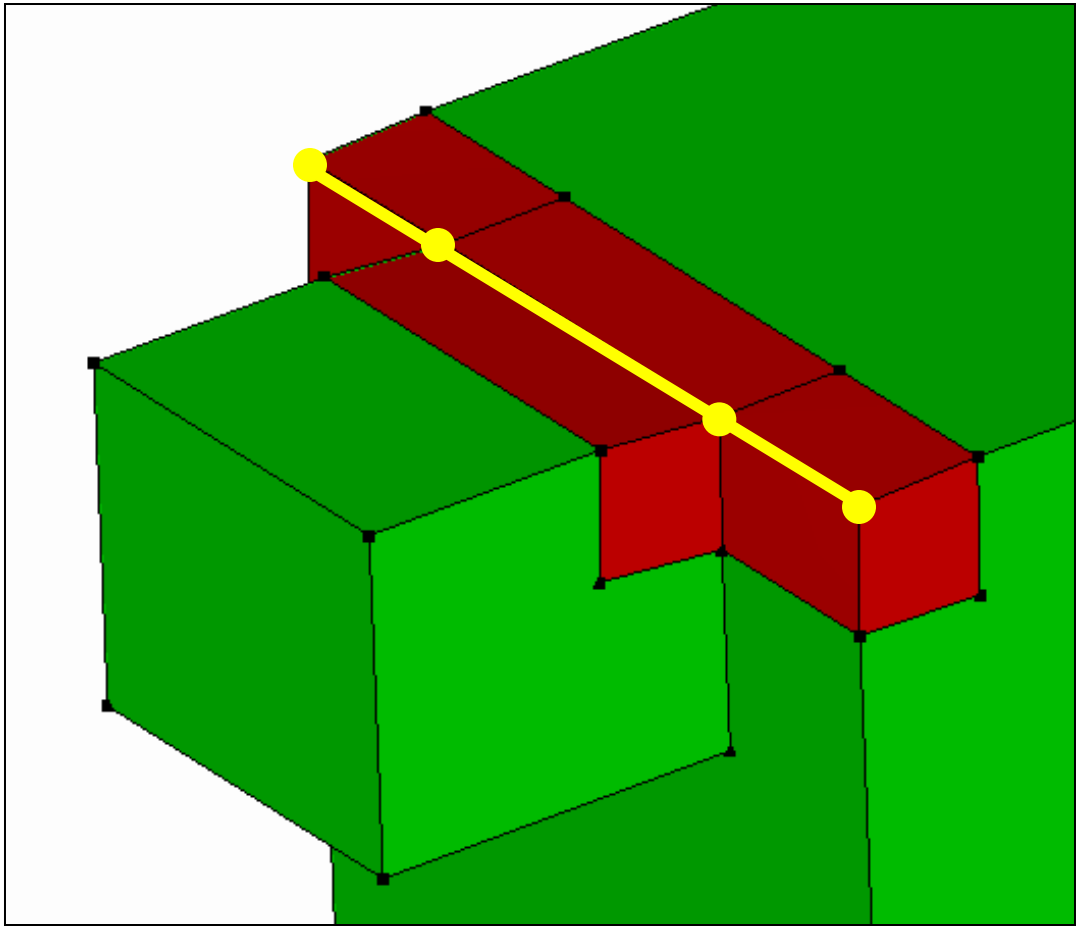
Create vertices and curves bottom up in the solid modeling kernel.

Cut out Old Topology



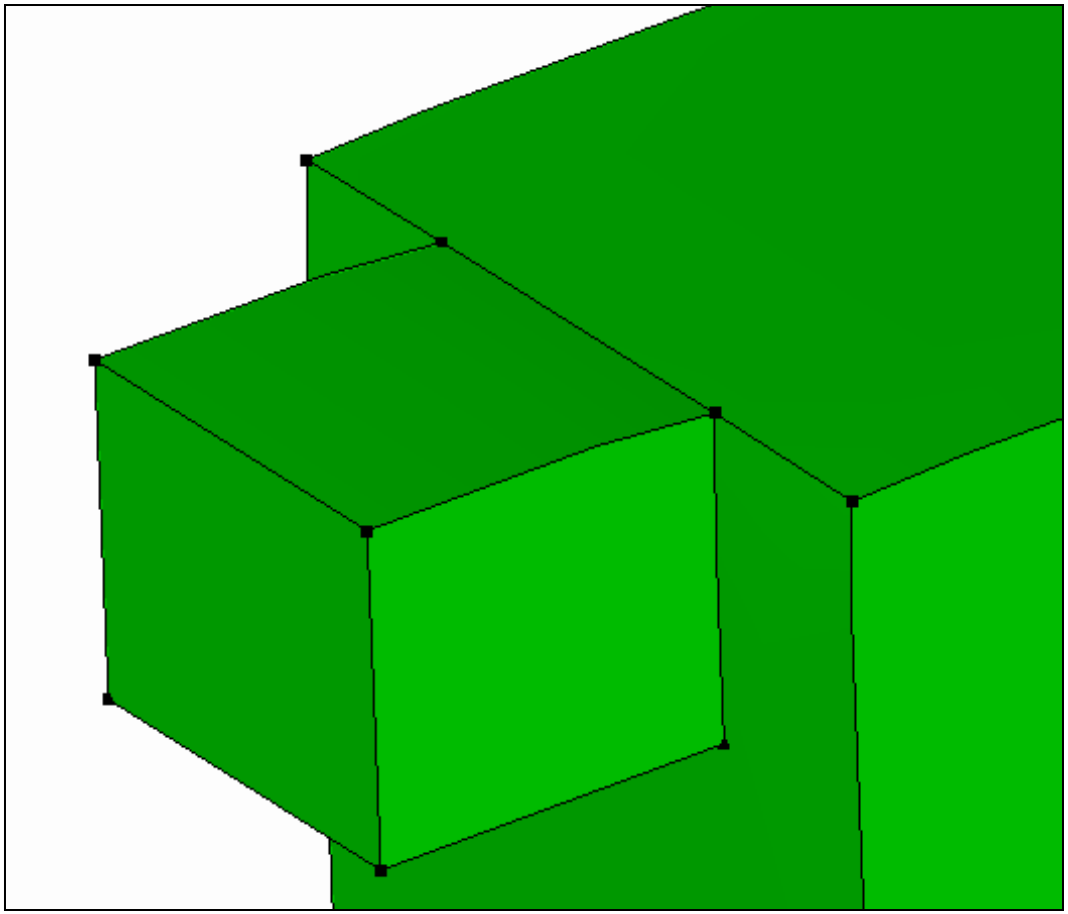
Utilizes solid modeling kernel “split surface” functionality.

Stitch in New Topology



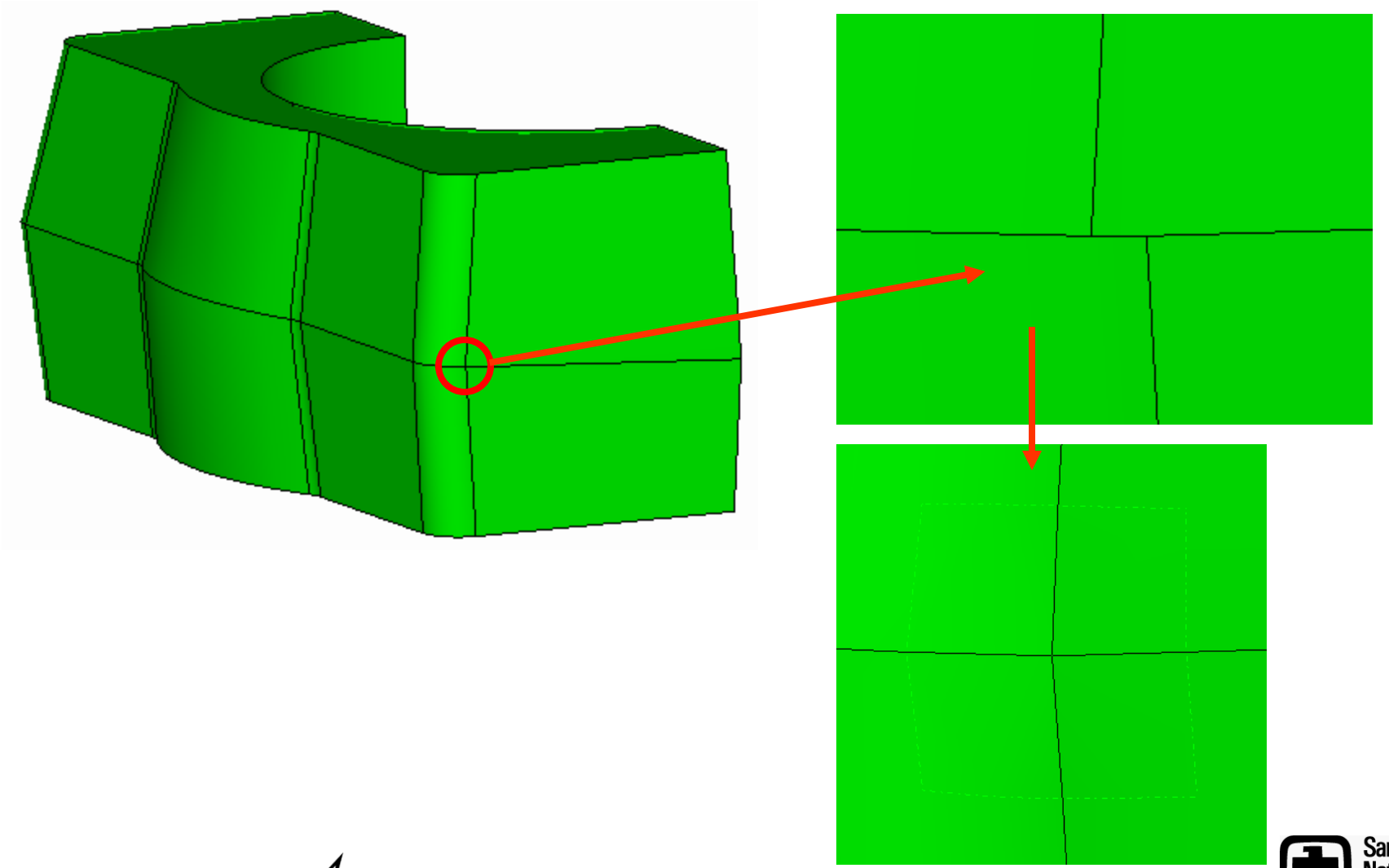
Utilizes solid modeling kernel “stitch” functionality.

Regularize or Composite Unwanted Curves

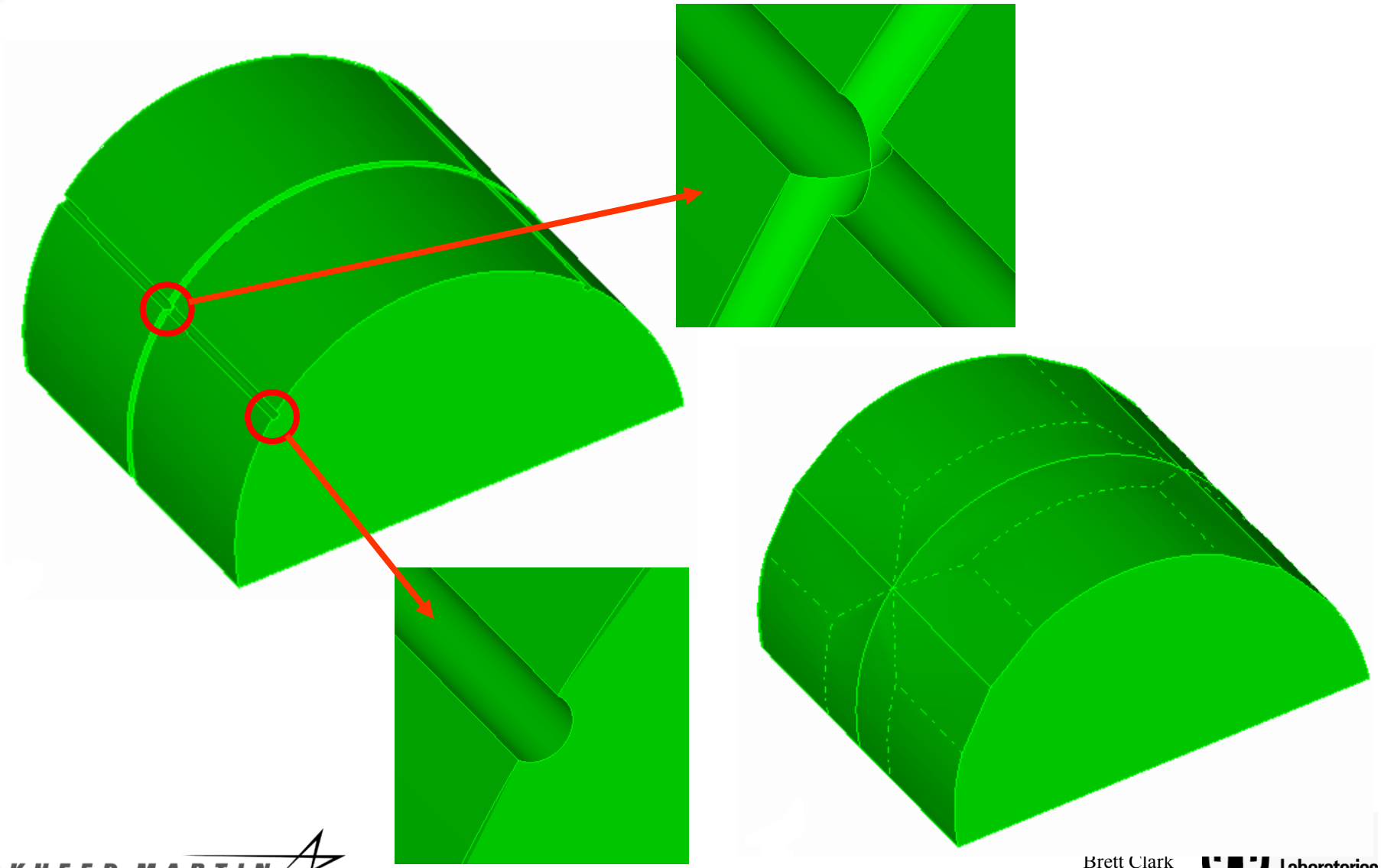


Utilizes solid modeling kernel “regularize” functionality or virtual composite functionality.

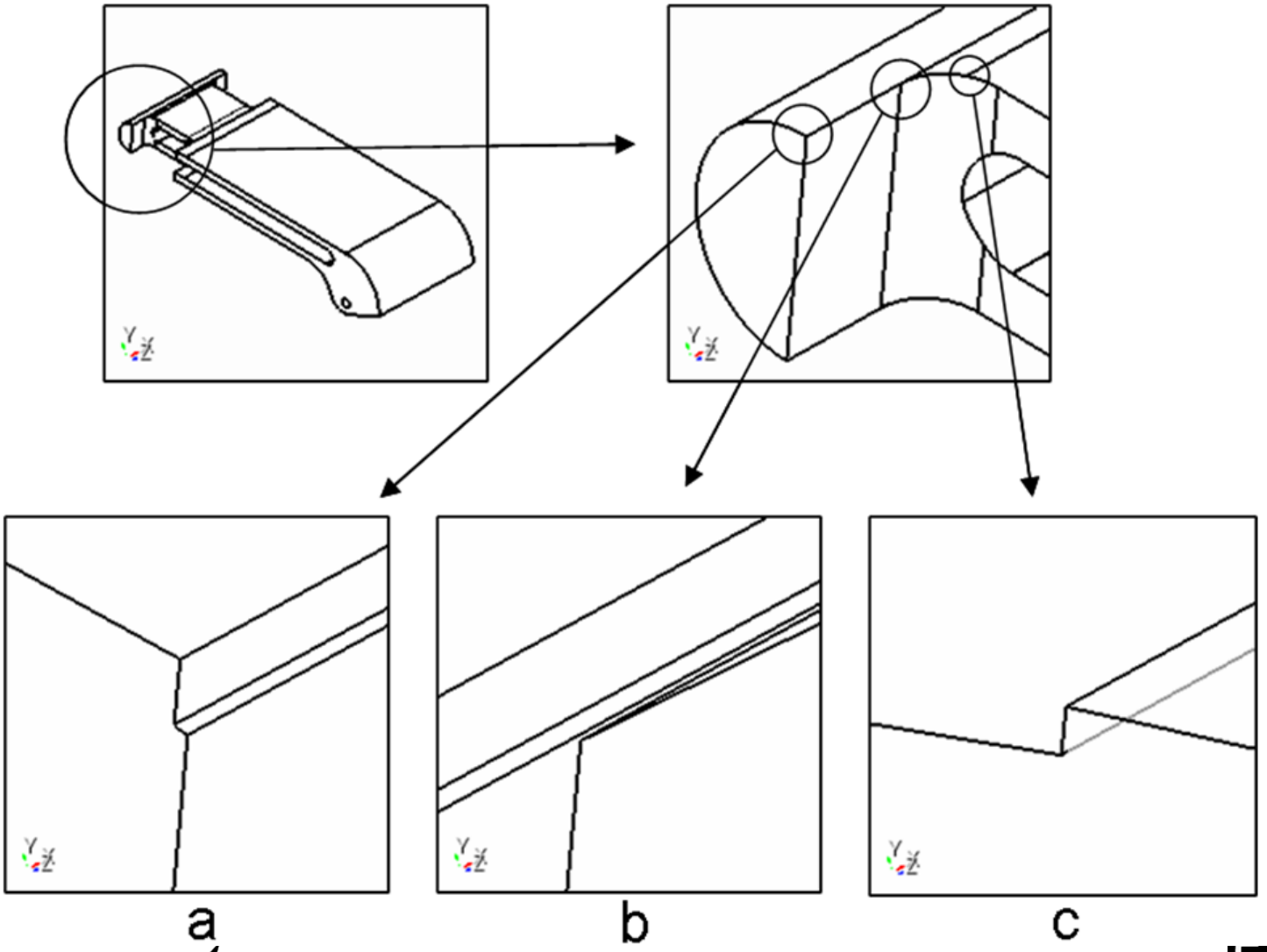
Example1: Small Curve Removal



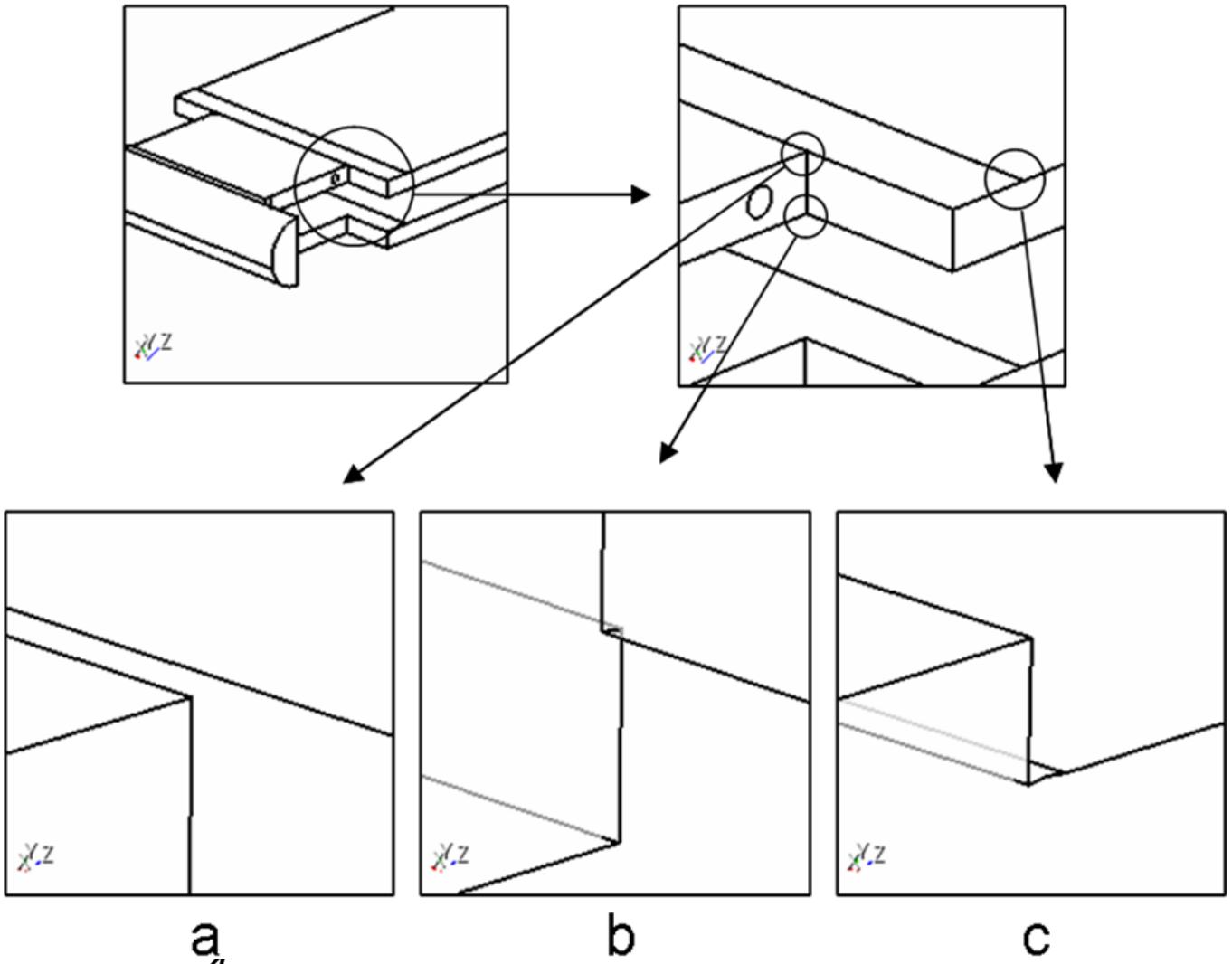
Example 2: Remove Network of Small Surfaces



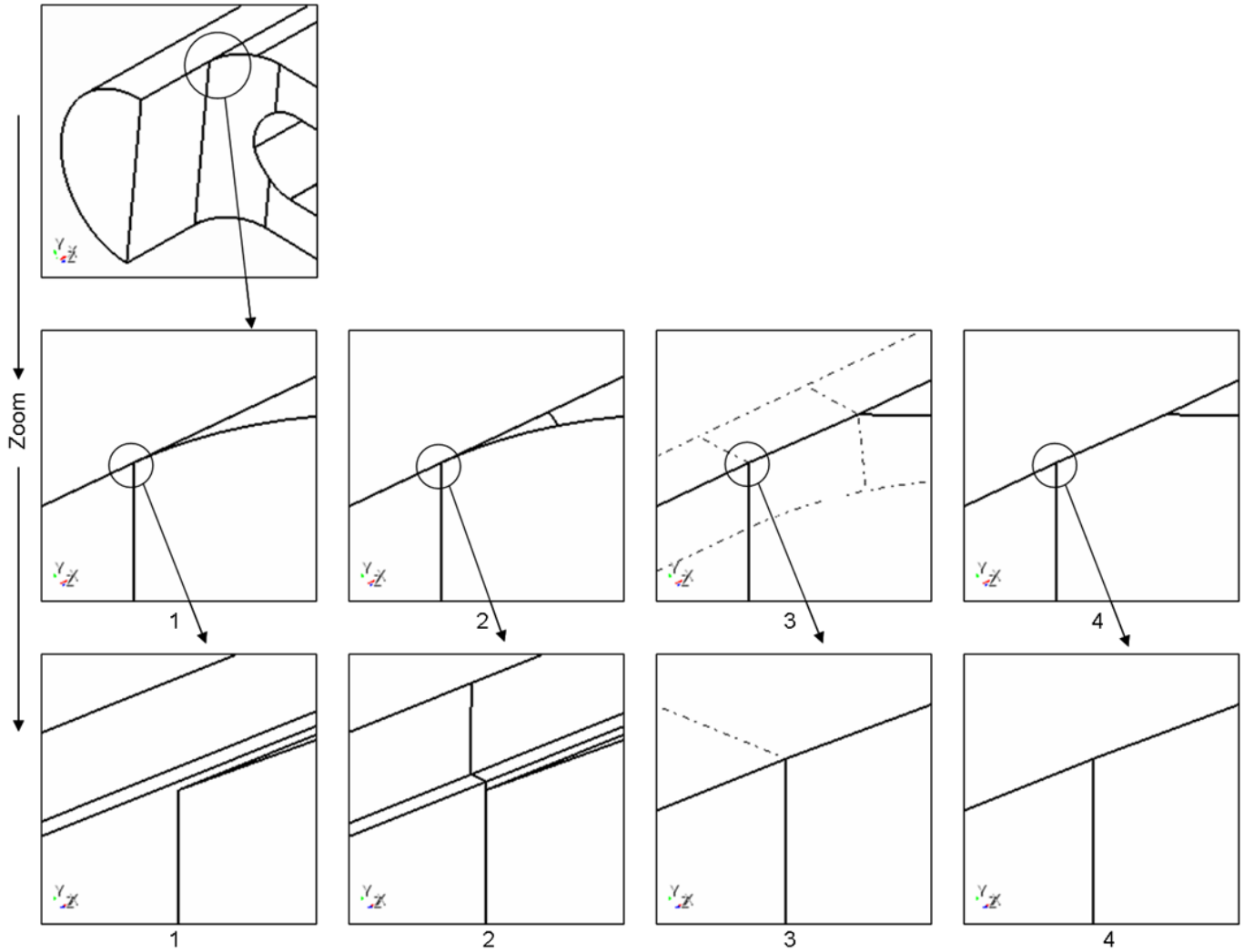
Example 3: Remove Misc. Small Features



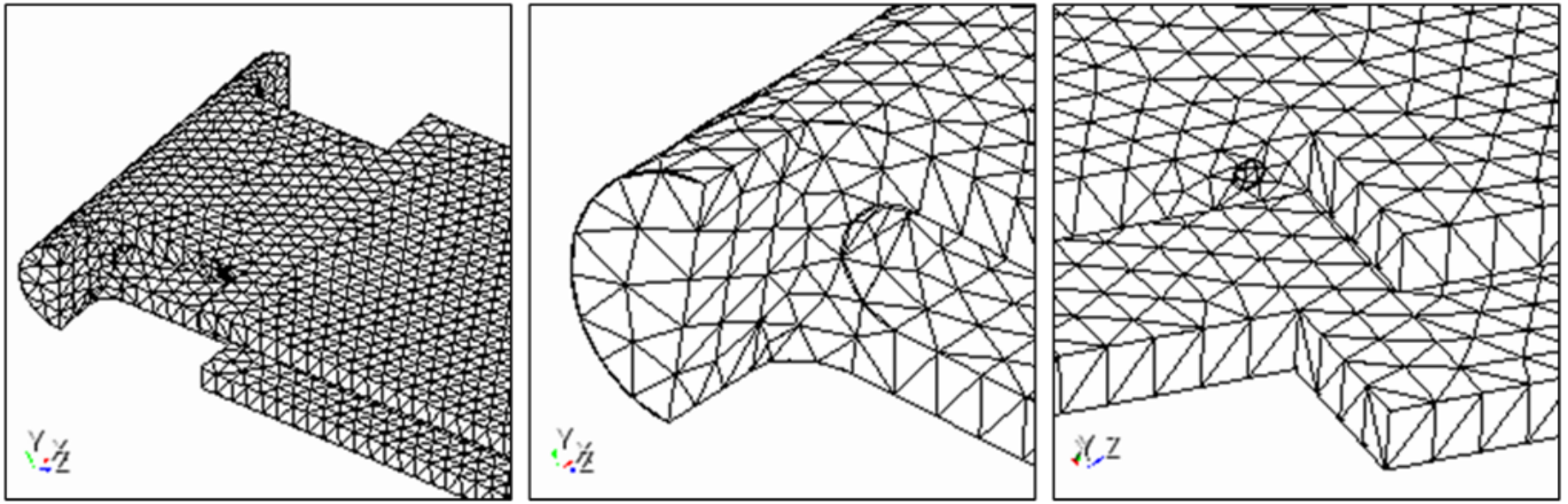
Examples



Examples



Examples



Summary

- New approach to remove topology that uses almost exclusively “real” operations
- Modifies both topology and geometry
- Can propagate to handle networks of small features
- Currently implemented with ACIS and CAA solid modeling kernels