

Abstracting Thin-walled Solids to Surfaces

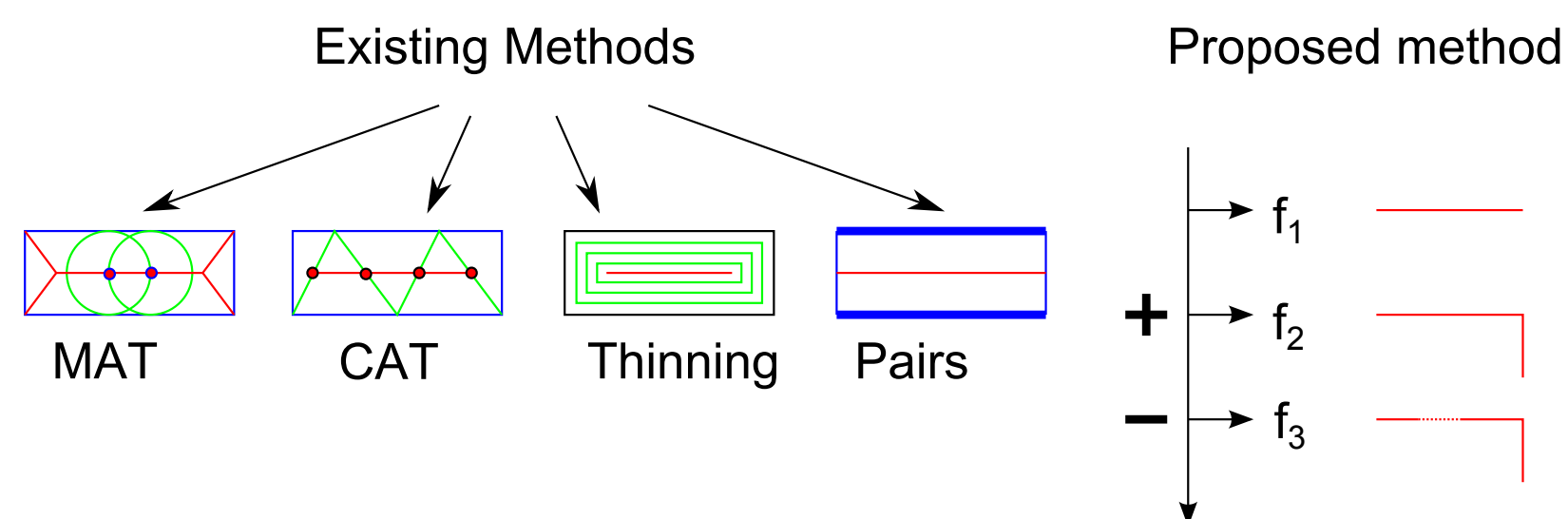
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Why reduce dimension?

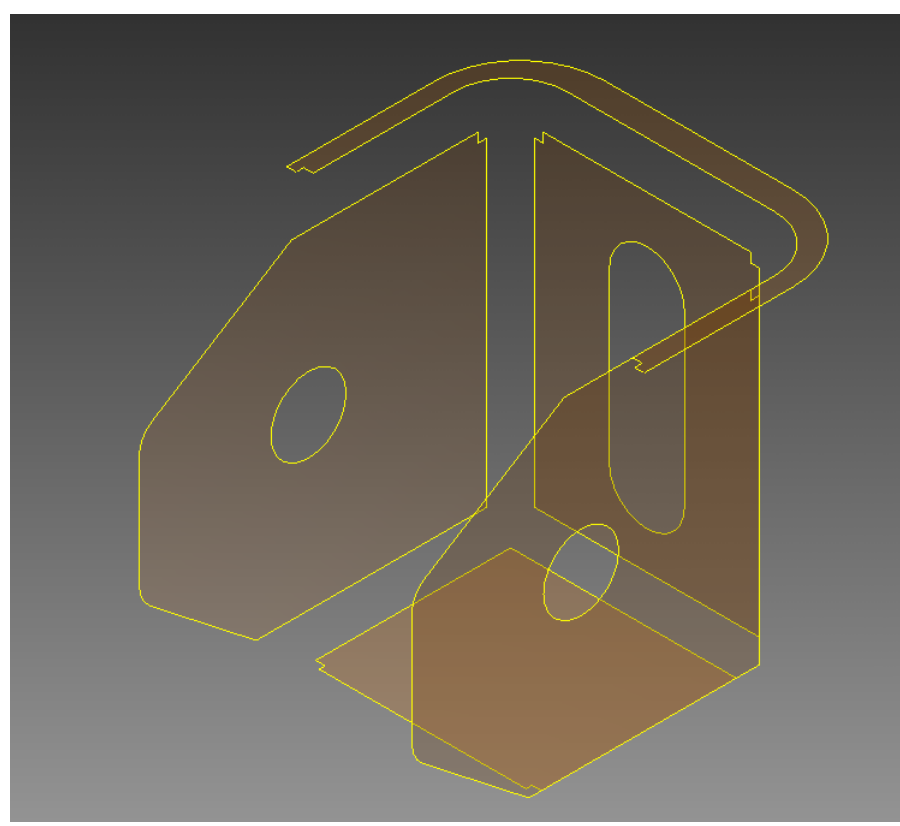
- For quick CAE analysis of Thin-walled parts
 - ▷ 3D meshing is expensive wrt time-resources
 - ▷ Need min 3 levels of elements along thickness;
- Also, to find Principal shape, useful in
 - ▷ Shape matching, Retrieval
 - ▷ Data transmission, Level of Details

Midsurface represents idealized thin-walled solid

How to reduce dimension?

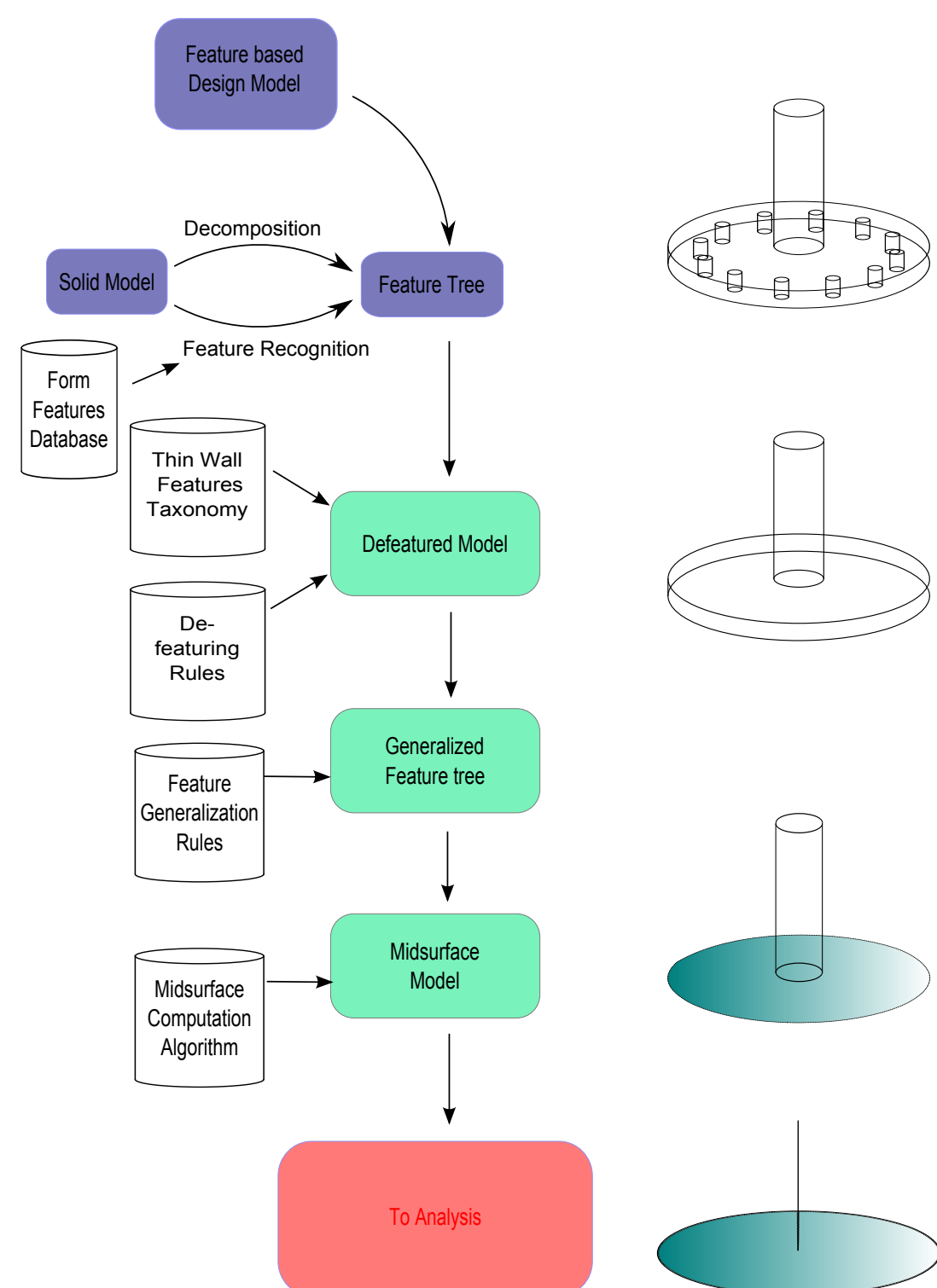


Whats the problem?



Need the **Midsurface** to mimic the original shape continuously, with no gaps, overlaps

Workflow



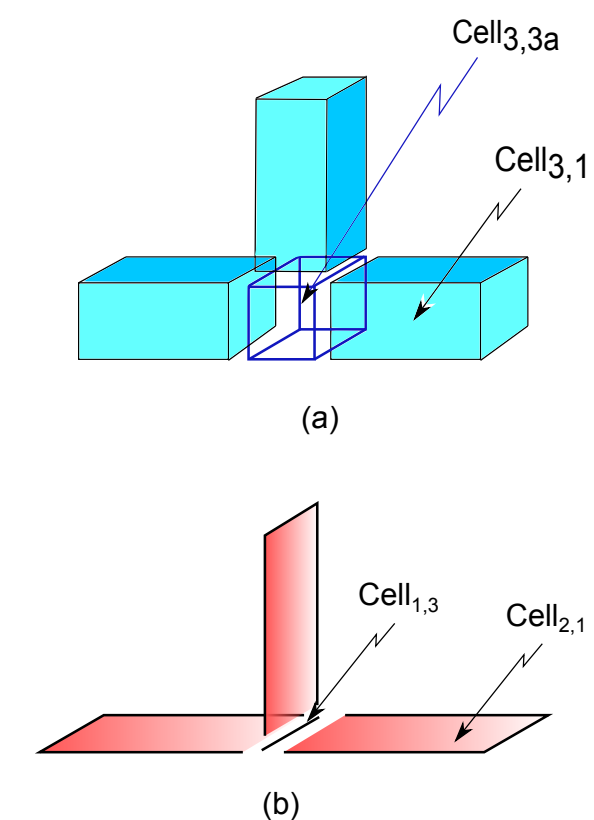
What's the approach?

Divide and Conquer

- Divide the shape into sub-shapes
- Find Midsurface for individual sub-shapes
- Connect individual Midsurfaces at the interfaces

How to get sub-shapes?

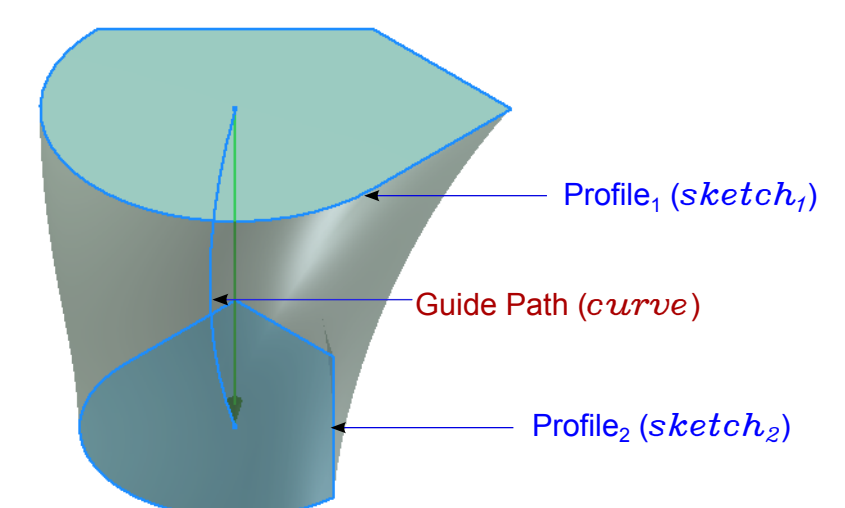
- **2D-Profile:** Polygon Decomposition
- **3D-Shapes, 1st level:** Feature-tree
- **3D-Shapes, 2nd level:** Remnant Faces, Cellular Decomposition



Abstracting features

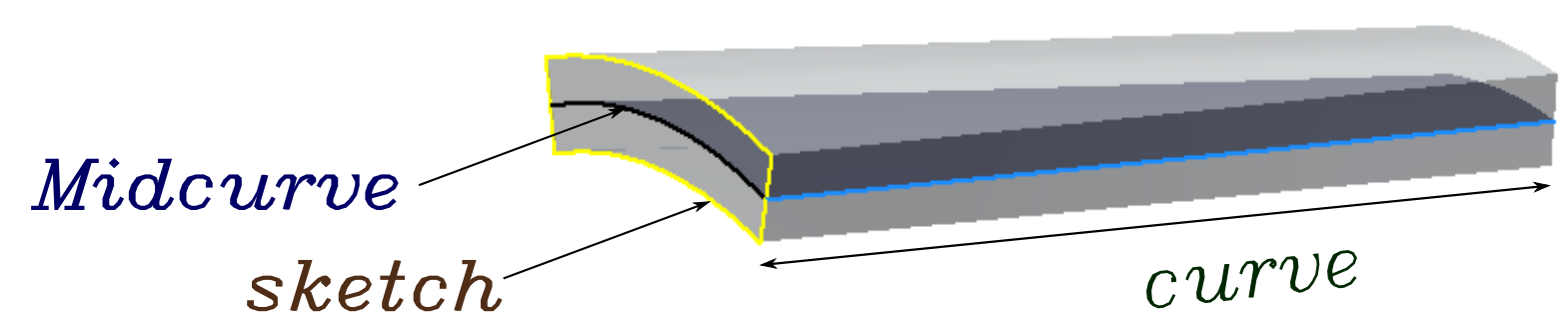
Loft is a generic operator capable of generating most of the basic shapes. It joins *profiles* along a guide *curve*. Represented as:

$\Omega \mathcal{L}^{subtype,3}[\{0, curve, 0|C_{0,1,2}\}((sketc$



Midsurface

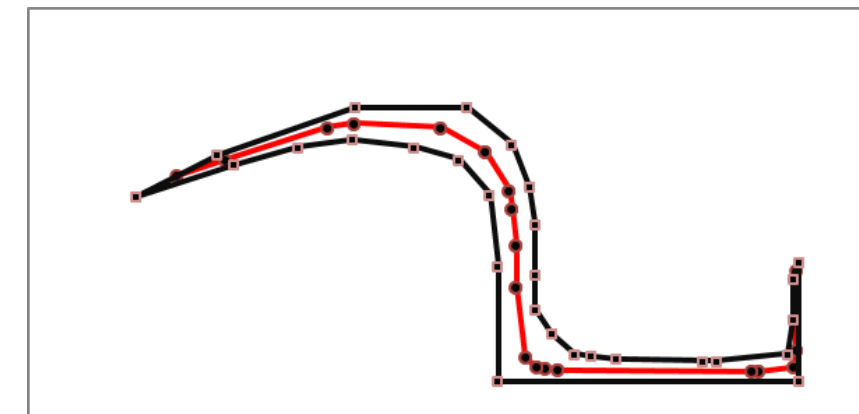
To generate Midsurface of a Swept volume, Midcurves of the profile are calculated first and then swept similar to that of parent volume.



$\Omega \mathcal{L}^{subtype,2}[\{0, curve, 0|C_{0,1,2}\}(midcurve^{1-n})]$

How is Midcurve looking?

Glass profile



Cross Channel profile

