Computing Midsurface

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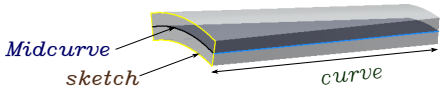
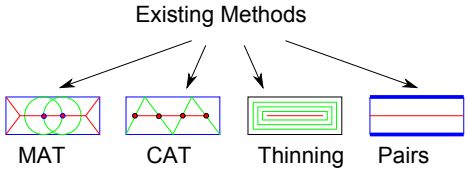
1 Introduction

At early stages of design, CAD parts are often **idealized** before analyzing them in CAE, to save on compute time and resources. Thin-walled parts are idealized to **Midsurface**, a surface running through the part, midway of the thickness.



Getting a connected Midsurface, *representing* the overall shape of the part, with no gaps and overlaps, is still a challenging problem, due to complexity of the shapes.

Typical approaches to compute Midsurface, in academics and commercial are:



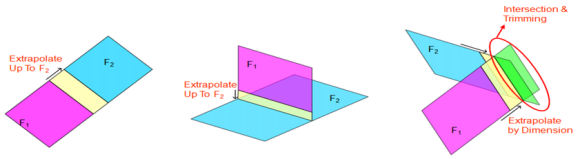
MAT suffers from extraneous branches and MA suffers from complexity in finding the face pairs. CAT and Thinning leave gaps at ends.

These approaches work on the final shape (Boundary representation - Brep) and thus find challenging to compute in case of complex surfaces, interactions etc. If this final shape is decomposed into smaller-simpler shapes, it would be easier and more deterministic to compute the Midsurface. Such decomposition is readily available in form of the **feature tree**.

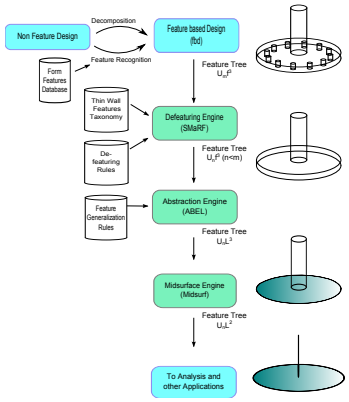
2 Proposed Approach

Many commercial CAD applications provide *Design-by-Features* approach. Part is built using features one-by-one in time-line order, almost in a Constructive-Solid-Geometry (CSG) like tree way. Leaves represent Primitives/Tool-Bodies and internal nodes represent booleans. At each level of the tree, starting from first feature, shapes are simpler than the final shape. Boolean type is known. So computing Midsurface of the Tool-bodies and their boolean to the Midsurface-shape built till that level, is a more advantageous than detecting/computing Midsurface in the final shape. So, the proposed idea is:

- Concurrently build mid-surfaces per feature
- At each feature, shapes are relatively simple,
- Compute extensions at the interface nodes



3 Overall System Architecture



4 Novelty

- Sheet Metal features Taxonomy for De-featuring
- Remnant feature volumes for suppressibility
- Midcurves using improved 2D Decomposition
- Sweep based feature abstraction
- Features for computation of Midsurface patches
- Cells for connection logic for patches

5 Papers Published/*Selected

- **Intl Conf, CoEP, 2013**: Feature Midsurface
- **Intl Conf, IITM, 2013**: Model Simplification
- **Intl Conf, IITG, 2014**: Feature Abstraction
- **Intl Jrnl, IJCAET, 2017***: Midcurves
- **Intl Jrnl/Conf, London, 2015**: De-featuring