Computing Midsurface

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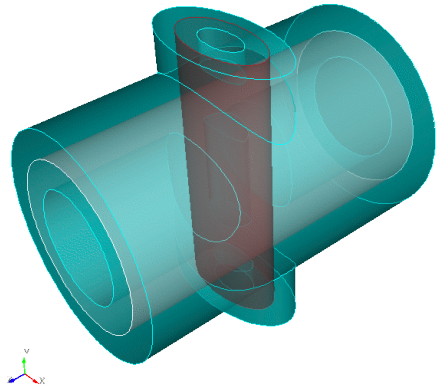
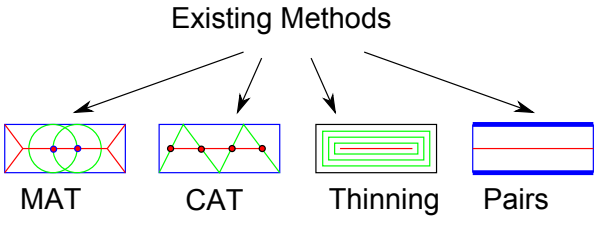
1 Introduction

Thin-walled Computer-aided Design (CAD) models of sheet metal/plastic parts are often simplified and reduced dimensionally to **Midsurface** (a surface running through the part, midway of the thickness) before analyzing them in Computer-aided Engineering (CAE), to save on compute time and resources.



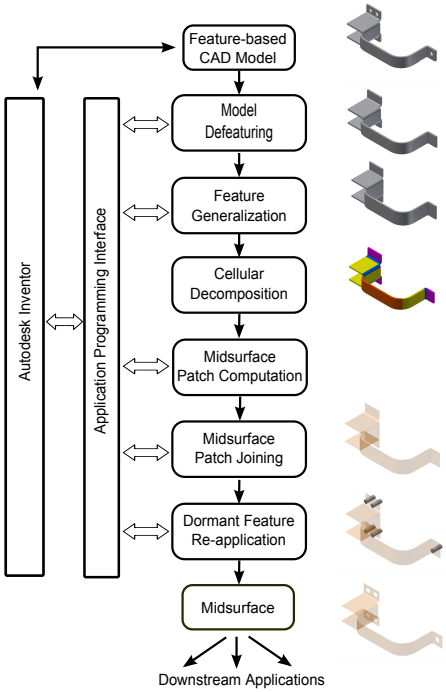
Extraction of the midsurface is still, mostly, a manual and time-consuming process due to lack of robust and automated methods, especially for the complex models. Existing methods result in failures such as gaps, overlaps, voids, etc., which take hours or even days to correct manually.



Methods shown above have quite a few problems. MAT suffers from extraneous branches and "Pairs" suffers from complexity in finding the face pairs. CAT and Thinning leave gaps at ends. Fundamental reason for these problems is that these methods work on the final shape, in which it is challenging to decipher interactions amongst the sub-shapes needed for the computation of well-connected midsurface.

2 Proposed Approach

Decomposing the final shape into smaller-simpler shapes, in form of cellular features, makes computation of midsurface more deterministic.



- **Input**: Feature-based CAD model
- **Defeaturing**: Removes small features
- **Abstraction**: Transforms to generic Sweeps
- **Decomposition**: Forms cellular bodies' graph
- **Midsurface** Interfaces nodes connect midsurface patches created at the non-interface nodes.

The output midsurface is far well-connected.

3 Papers Published

- **Intl Conf, CoEP, 2013**: Feature Midsurface
- **Intl Conf, IITM, 2013**: Defeaturing
- **Intl Conf, IITG, 2014**: Feature Abstraction
- **Intl Conf, London, 2016**: Defeaturing
- **Intl Jrnl, Taylor & Francis, 2015**: Topology
- **Intl Jrnl, T & Francis, 2015**: Defeature
- **Intl Jrnl, Inderscience, 2017**: Midcurve
- **Intl Jrnl, ASME, 2017**: Midsurface
- **Intl Jrnl, Springer, 2017**: Midsurface