

Dramatically accelerate mid-surface modeling to validation

Mid-Surface Modeling Overview

MSC Apex is reinventing the process through the creation of a technology foundation which includes direct modeling integrated with meshing, and a new flexible approach to setting up mid-surfacing. This technology dramatically accelerates the time that it takes while reducing the skill level required to create solver ready mid-surfaced parts.

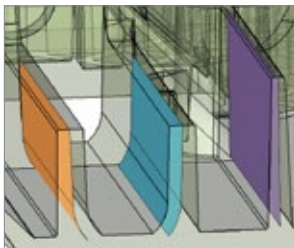
The solution is applicable to injection molded plastics, metals, and composites.

The MSC Apex Advantage

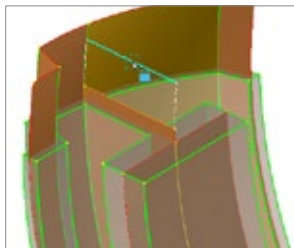
Traditional Mid-Surface Modeling Challenges

- Mid-Surface repair is tedious and manual
- Meshes must be deleted and re-created with each geometry change
- Creating thickness and offset properties is an elaborate process
- Final meshed mid-surface models may fail during analysis due to missing model definitions

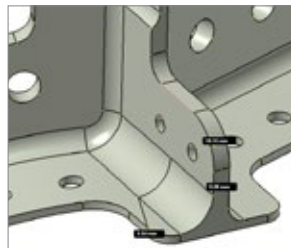
Some mid-surface generators only provides an orphan mesh, that is, without association to geometry. Subsequent changes to the mesh-only models are tedious.



Extract Mid-Surfaces



Repair Mid-Surfaces



Define Thickness Properties

New MSC Apex Mid-Surfacing Approach

- Incrementally build mid-surface models based on a semi-automated, flexible 'person in the loop' process to prevent time consuming manual repair
- Regenerate meshes automatically with direct modeling
- Rapidly create dozens of thickness and offset properties in seconds
- Ensure mid-surface models can be successfully analyzed

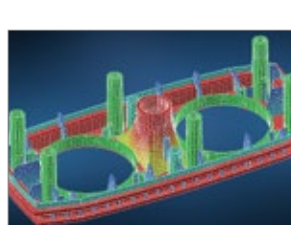
A mid-surface geometry is created with full associativity to the mesh. This enables fast design modifications and what if analyses.



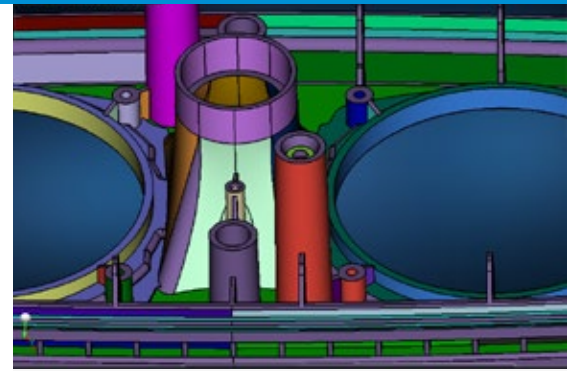
Identify Face Pairs



Incrementally Extract and Repair Mid-Surfaces



Rapid Thickness Property Creation



Capabilities

- **Geometry Edit Tools**
 - Identify features and defeature
 - Automated geometry cleanup
 - Split, fill, stitch and extend surfaces
 - Use Virtual Topology (Suppress/Unsuppress vertices or edges)
 - Slicing, mirroring and Boolean geometry operations
- **Direct Modeling**
 - Interactively edit solids, surfaces and features with intuitive Push/Pull or Vertex/Edge drag tools
- **Midsurface Creation and Repair Tools**
 - Extract mid-surfaces by auto offset, constant thickness, distance offset, or tapered methods
 - Incrementally build mid-surfaces of uniform or non-uniform thickness for planar or curved solids
 - Connect surfaces via direct modeling (Vertex/Edge Drag), auto Surface Extend or stitching
- **Meshing and Mesh Editing**
 - Mesh curves, surfaces, and solids, available element types: beam, quad, tria, tet, hex
 - Regenerate meshes automatically as geometry is modified
 - Refine meshes with Feature Base Meshing and Mesh Seeding
 - Visually inspect element quality
 - Construct Seed Points to facilitate part connection
 - Mesh surfaces via paver, 4 side map, or 4+ side map mesh methods
 - Display element normals and reverse or auto align normal
 - Mesh solid geometry with hex elements using multi-cut, multi-sweep approach.
- **Model Attribution**
 - Define composite plies
 - Material Creation and Assignment
 - Automatic creation of thickness and offset properties for uniform and non-uniform cross sections
 - Interactively position and orient beam spans
 - Define beam cross sections for standard shapes
 - Represent point masses
- **Assembly Connections**
 - Mesh topology display to see unconnected parts
 - Connect structural components via Glue
 - Represent common connection types: springs, dampers, spring-dampers, bushing, rigid links or flexible links
 - Create generative mesh dependent connections across parts (Aligning nodes and rigidly tying nodes)
 - Local coordinate system
- **Easy to Learn and Use**
 - Learn with in-program videos, workflow instructions, at-mouse instructions, and searchable documentation
 - Use the application in one of 5 supported languages: Chinese, English, French, German, and Japanese
 - Submit application enhancement ideas or issues with the Integrated Reporting Tool
 - Undo/Redo actions

1 Identify Mid-Surface Pairs

Use pairing technology to automatically identify guides for mid-surface extraction.



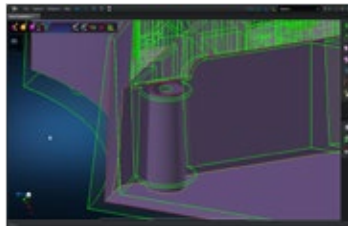
2 Use Flexible Incremental Tools

Add/Remove solid faces to pairs and merge pairs to incrementally guide extraction of mid-surfaces and maintain continuity across mid-surface junctions.



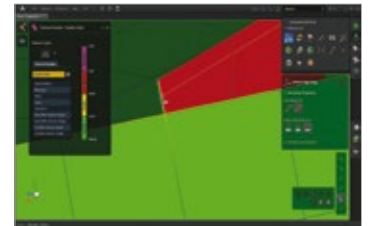
3 Extract Mid-Surfaces and Repair

Create complete mid-surface models by extracting, extending mid-surfaces and trimming mid-surfaces. Extraction is applicable to uniform or non-uniform thicknesses and planar or curved solid faces.



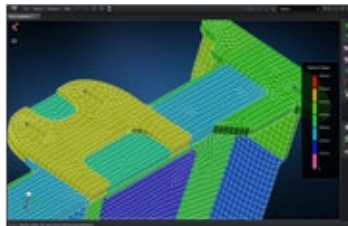
4 Continue repairing with direct modeling and meshing

Use direct modeling to further repair geometry that may already be meshed. Slivers or cracks may easily be resolved and the mesh can be quickly regenerated automatically.



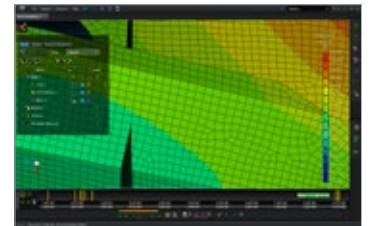
5 Automatically create thickness and offset assignments

Use Auto Thickness and Offset to create numerous property definitions for shell elements, and export to the .bdf file format.



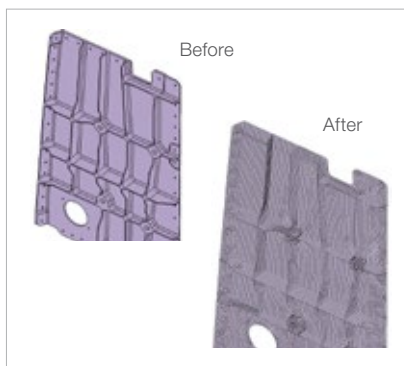
6 Validate for Analysis

Perform an Analysis Readiness check and ensure models have necessary definitions for successful analysis.



Productivity Gains

For this thin structure and with conventional Pre/Post processors, 13.5 hours were required to create its mid-surface model and mesh. In MSC Apex, the process required 1.5 hours.



	Today's Workflow	MSC Apex Workflow
Expertise Required	High	Low
Analysis Geometry Creation	8.5h	.7h
Mesh Creation	1h	.5h
Property Assignments	1h	.1h
Model Validation (Modes Analysis)	n/a	.01h
Complete entire scenario	10.5h	1.31h