

## Dramatically accelerate mid-surface modeling to validation

### Mid-Surface Modeling Overview

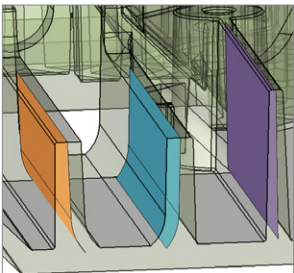
MSC Apex is reinventing the process through the creation of a technology foundation which includes direct modeling integrated with meshing, and a new flexible approach to setting up mid-surfacing. This technology dramatically accelerates the time that it takes while reducing the skill level required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

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

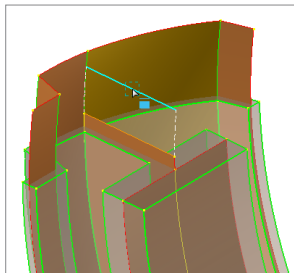
### The MSC Apex Advantage

#### Traditional Mid-Surface Modeling Challenges

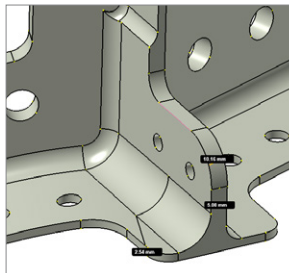
- Mid-Surface repair is tedious and manual
- Meshes must be deleted and re-created with each geometry change
- Creating thickness and offset properties is an elaborate process
- Final meshed mid-surface models may fail during analysis due to missing model definitions



Extract Mid-Surfaces



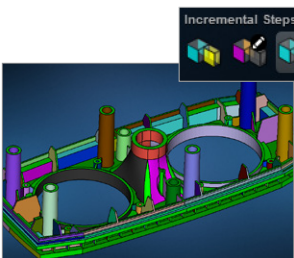
Repair Mid-Surfaces



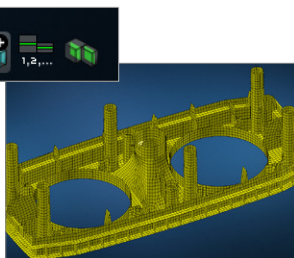
Define Thickness Properties

#### New MSC Apex Mid-Surfacing Approach

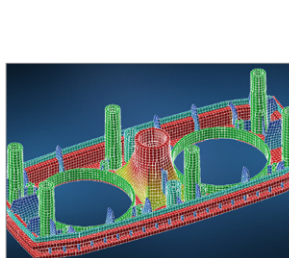
- Incrementally build mid-surface models based on a semi-automated, flexible 'person in the loop' process to prevent time consuming manual repair
- Regenerate meshes automatically with direct modeling
- Rapidly create dozens of thickness and offset properties in seconds
- Ensure mid-surface models can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



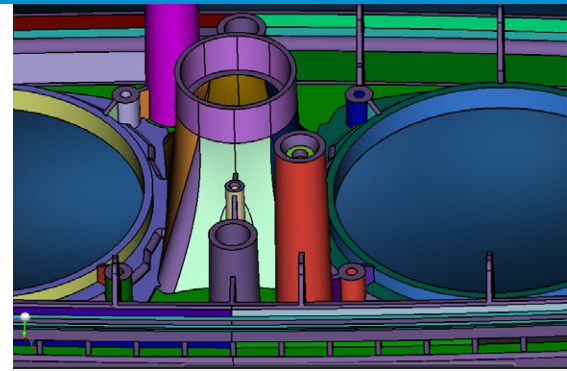
Identify Face Pairs



Incrementally Extract and Repair Mid-Surfaces



Rapid Thickness Property Creation

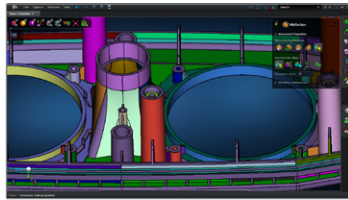


### Capabilities

- **Assembly Management**
  - Interactively translate, rotate, and duplicate objects
  - Manage parts and assemblies based on model hierarchy
  - Execute model search queries
  - Control model appearance with color, transparency, and visibility
- **Geometry Edit Tools**
  - Identify features and defeature
  - Geometry cleanup and check
- **Mid-Surface Extraction and Surface Edit 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
  - Split and fill surfaces
  - Add/Remove and Suppress/Un-suppress vertices or edges
- **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 or mesh Seeding
  - Visually inspect element quality
  - Construct Hard Points to facilitate part connection
  - Mesh surfaces via paver, 4 side map, or 4+ side map mesh methods
- **Model Attribution**
  - Material Creation and Assignment
  - Behavior Creation and Assignment
  - Automatic thickness and offset creation for uniform and non-uniform sections
- **Sketching**
  - Sketch lines, squares, circles, ellipsoids, fillets, and chamfers
  - Project, split, and edit existing sketches
- **Direct Modeling**
  - Interactively edit solids and surfaces with Push/ Pull or Vertex/Edge drag
- **Interactions**
  - Glue Connections
- **Incremental Validation**
  - Analysis readiness for mesh, materials, properties, LBCs, interactions, and simulation settings
  - Context specific (Part, Sub-assembly, Assembly)
- **Post-Processing**
  - Results display for static and normal modes
  - Results animation, including modes navigator
  - Spectrum controller

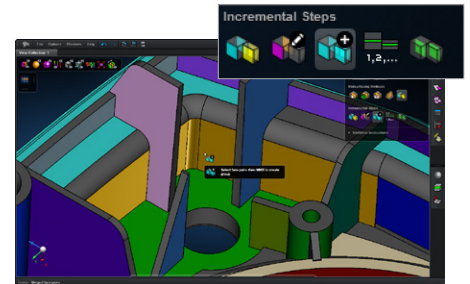
## 1 Identify Mid-Surface Pairs

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



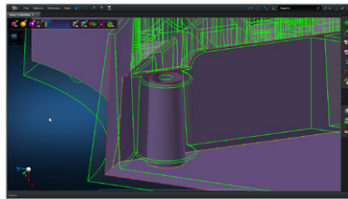
## 2 Use Flexible Incremental Tools

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



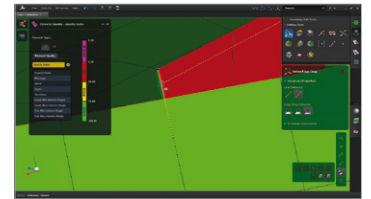
## 3 Extract Mid-Surfaces and Repair

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.



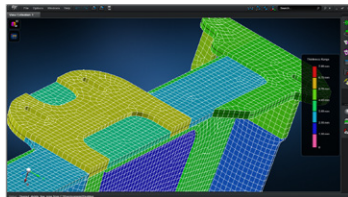
## 4 Continue repairing with direct modeling and meshing

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.



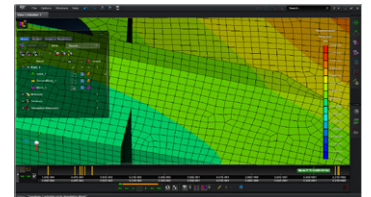
## 5 Automatically create thickness and offset assignments

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



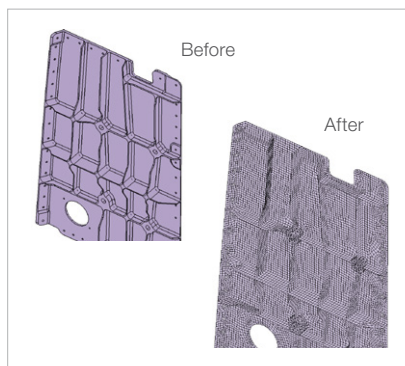
## 6 Validate for Analysis

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
<b>Complete entire scenario</b>	<b>10.5h</b>	<b>1.31h</b>

**Corporate**  
MSC Software Corporation  
4675 MacArthur Court  
Suite 900  
Newport Beach, CA 92660  
Telephone 714.540.8900  
[www.msccsoftware.com](http://www.msccsoftware.com)

**Europe, Middle East, Africa**  
MSC Software GmbH  
Am Moosfeld 13  
81829 Munich, Germany  
Telephone 49.89.431.98.70

**Japan**  
MSC Software LTD.  
Shinjuku First West 8F  
23-7 Nishi Shinjuku  
1-Chome, Shinjuku-Ku  
Tokyo, Japan 160-0023  
Telephone 81.3.6911.1200

**Asia-Pacific**  
MSC Software (S) Pte. Ltd.  
100 Beach Road  
#16-05 Shaw Towers  
Singapore 189702  
Telephone 65.6272.0082



The MSC Software corporate logo, MSC, and the names of the MSC Software products and services referenced herein are trademarks or registered trademarks of the MSC Software Corporation in the United States and/or other countries. All other trademarks belong to their respective owners.  
© 2015 MSC Software Corporation. All rights reserved.