

Neue Technologien zur schnellen Geometrieaufbereitung und Vernetzung

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MSC Simulation Trends Survey – March 2014

- **800+ Participants**
- **Industry Representation**
 - 23% Aerospace
 - 26% Automotive
 - 11% Machinery
 - 40% Other
- **Focus of Study**
 - Learnability & Usability
 - Process Challenges
 - Supply Chain Collaboration



Simulation Trends

Learnability and Usability

~50%

Need more than a month+
to learn new CAE software

60%

Lack resources and skills
to interpret results

85%

See value in engineers (non-
analysts) using CAE tools

Process Challenges

55%

Spend more than 30% of
time on geometry clean-up
and meshing

~67%

Need 2-4 solver runs to
obtain a converged solution

~80%

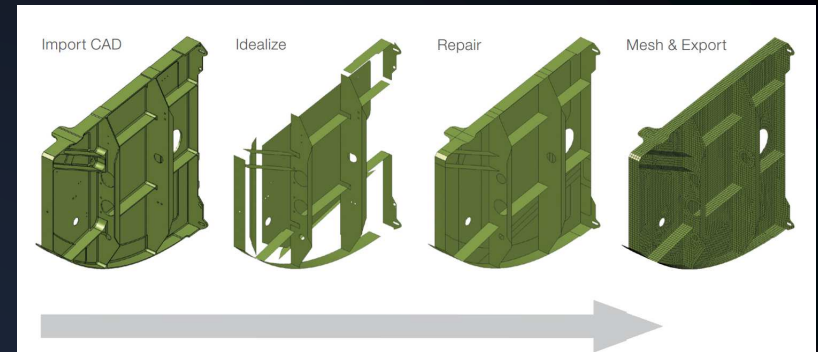
Say obtaining simulation
results is a bottleneck

Modeling Challenges of Today

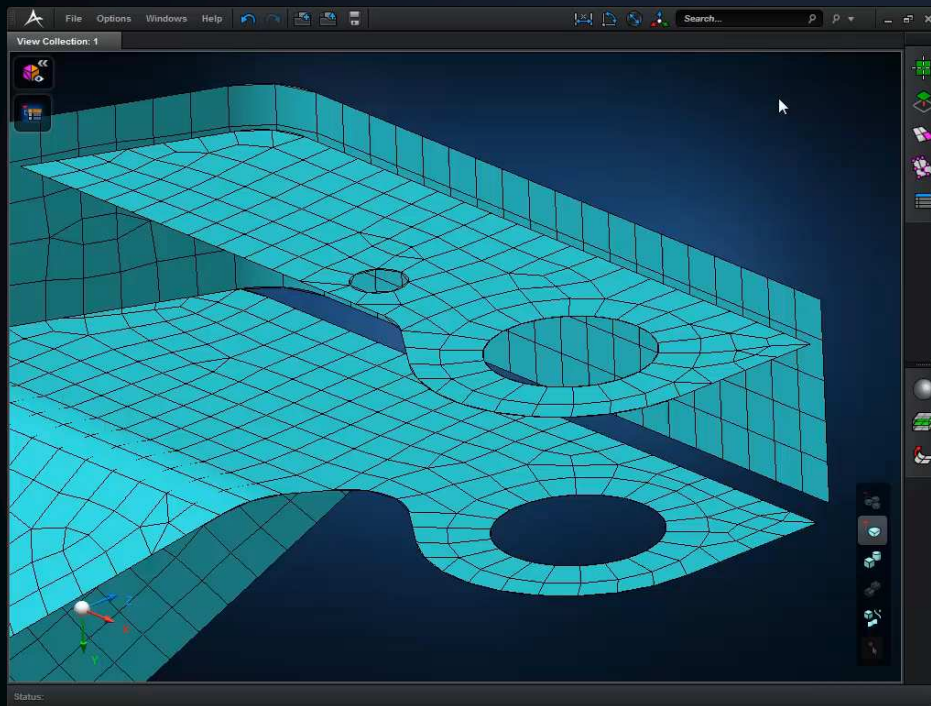
- *“CAD Geometry is not analysis suitable”*
- *“Geometry repair and meshing operations are tedious, error prone, and takes too long”*
- *“Iterations with the Design Team on design improvements take too much time”*
- *“Existing products are too hard to use and take too long to learn. Implementation and support costs are too high”*

What is Apex Modeler?

- Direct Modeling & Meshing
- Reduces the time from CAD model to mesh by a factor of 8
- Automatic midsurface extend
- Automatic shell property creation (thickness attribution)
- Interactive face / edge / vertex drag
- Easy to learn – productive use after one day
- Fun to use!



CAE Specific Direct Modeling and Meshing

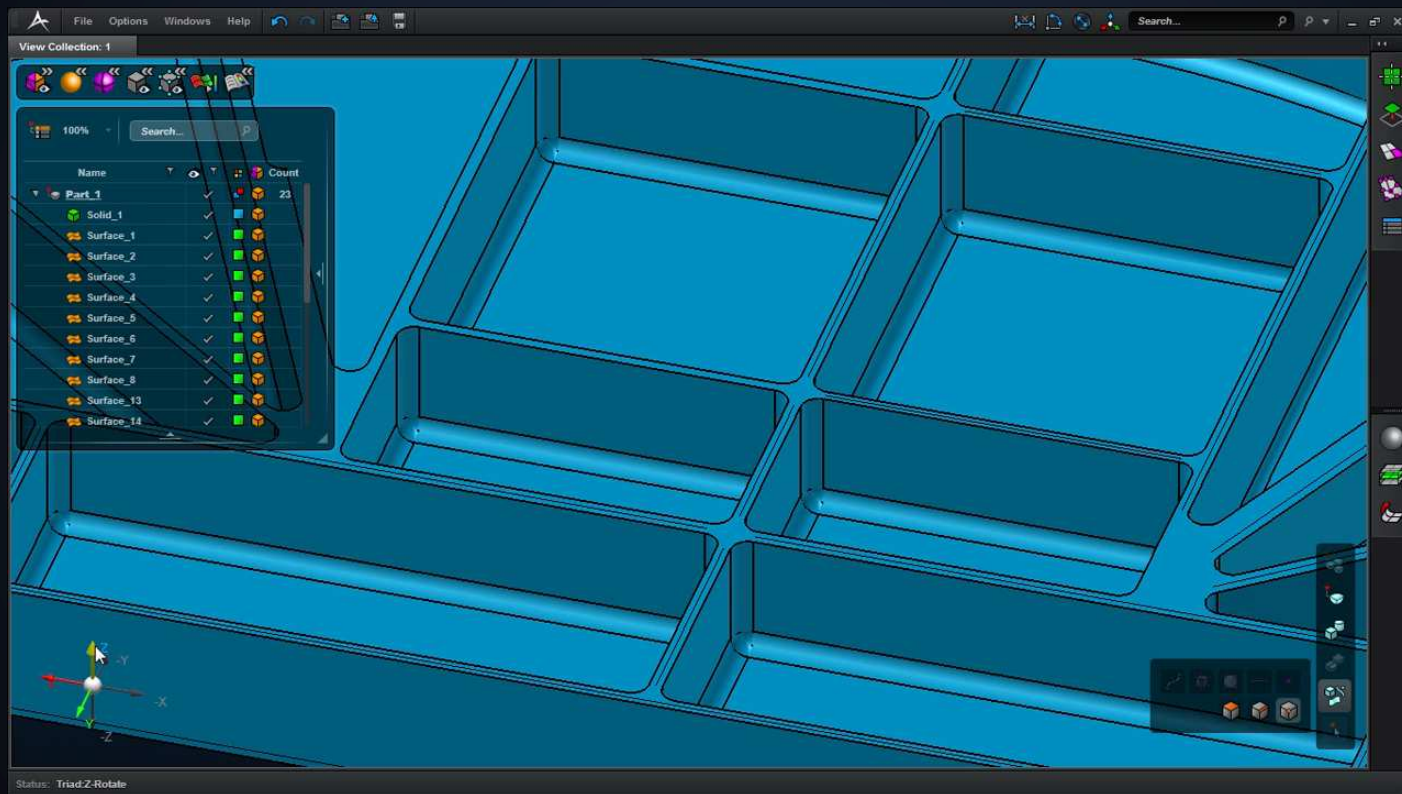


Apex Approach:

- Surface direct modeling and meshing, vertex/edge drag, mid-surfacing, surface extend, surface split
- Solid direct modeling and meshing, push/pull, geometry repair
- 2D sketcher
- Automatic mesh update when geometry changes

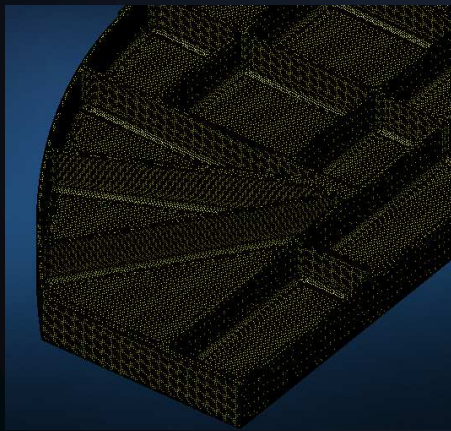
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Entry level User 6

CAE Specific Direct Modeling and Meshing

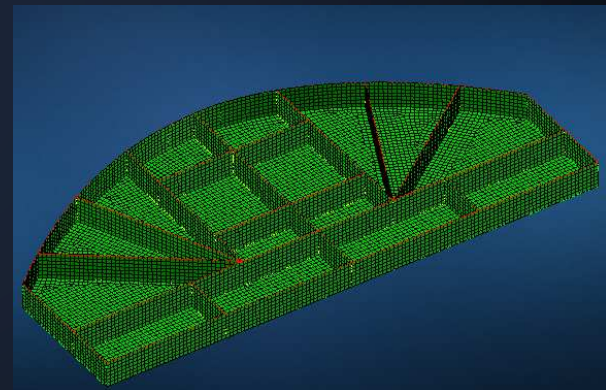
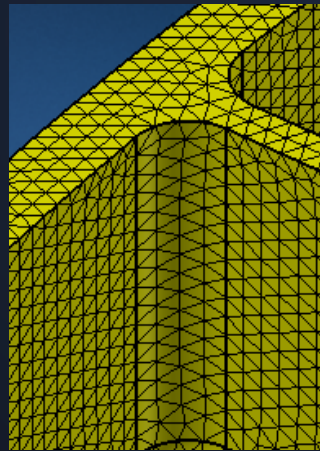


Why are Midsurfaces Used

- *Many models in aerospace, automotive, machinery are thin-walled solids*
- *Need minimum 3 solid elements through the thickness to get accurate bending stresses*
- *This results in very small size of the solid elements – slow performance*
- *Shell models require much less elements – better performance, better overview*

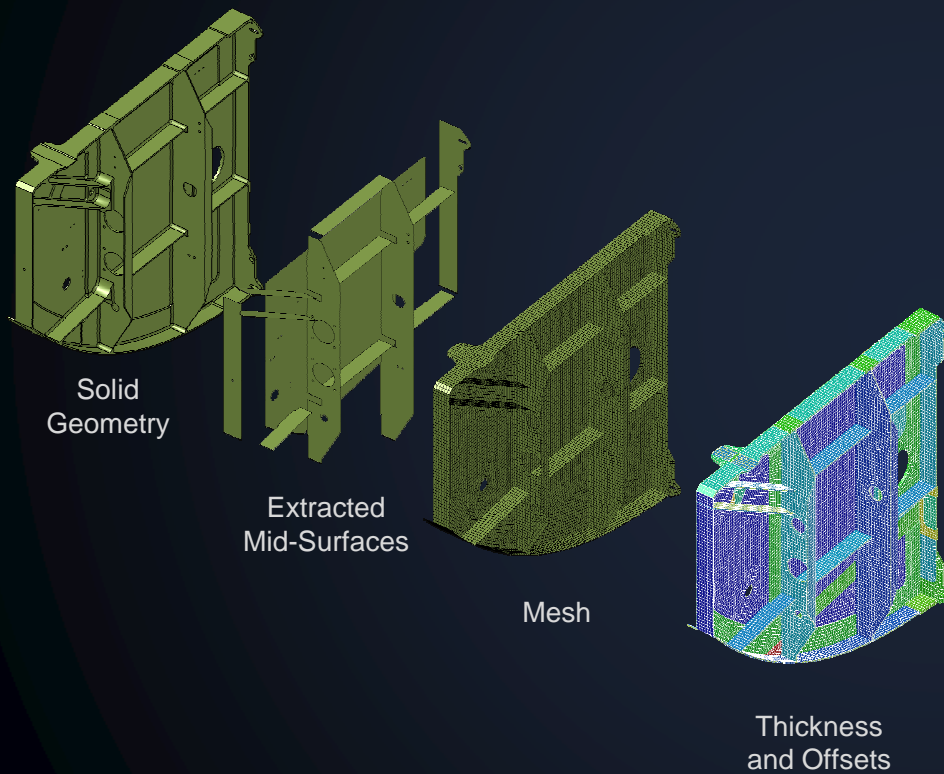


2.200.000 solid elements



13000 shell elements

Benchmark - Bulkhead



	Today's Workflow	MSC Apex Workflow
Expertise Required	High	Low
Analysis Geometry	35 h	3 h
Mesh Creation	3 h	2 h
Property Assignments	12 h	.5 h
Complete Entire Scenario	50 h	5.5 h

ThyssenKrupp Industries Bucket Wheel Analysis:



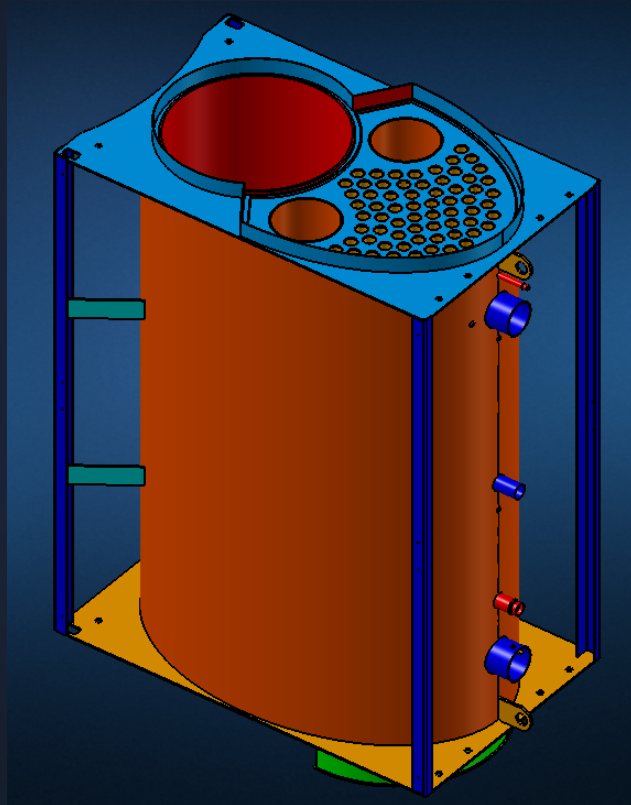
- Key Benefits:**
 - The most useful tools which contribute in time saving is mid-surface automatic extension and splitting techniques. Vertex/Edge drag and splitting geometry are useful tools to achieve this...
 - In comparison to earlier meshing tools, MSC Apex has helped us to reduce pre-processing time by almost 65%.
 - Also with collection set we could easily identify and remove free edges.

Operations	Savings with MSC Apex
Setup & Analysis	65%

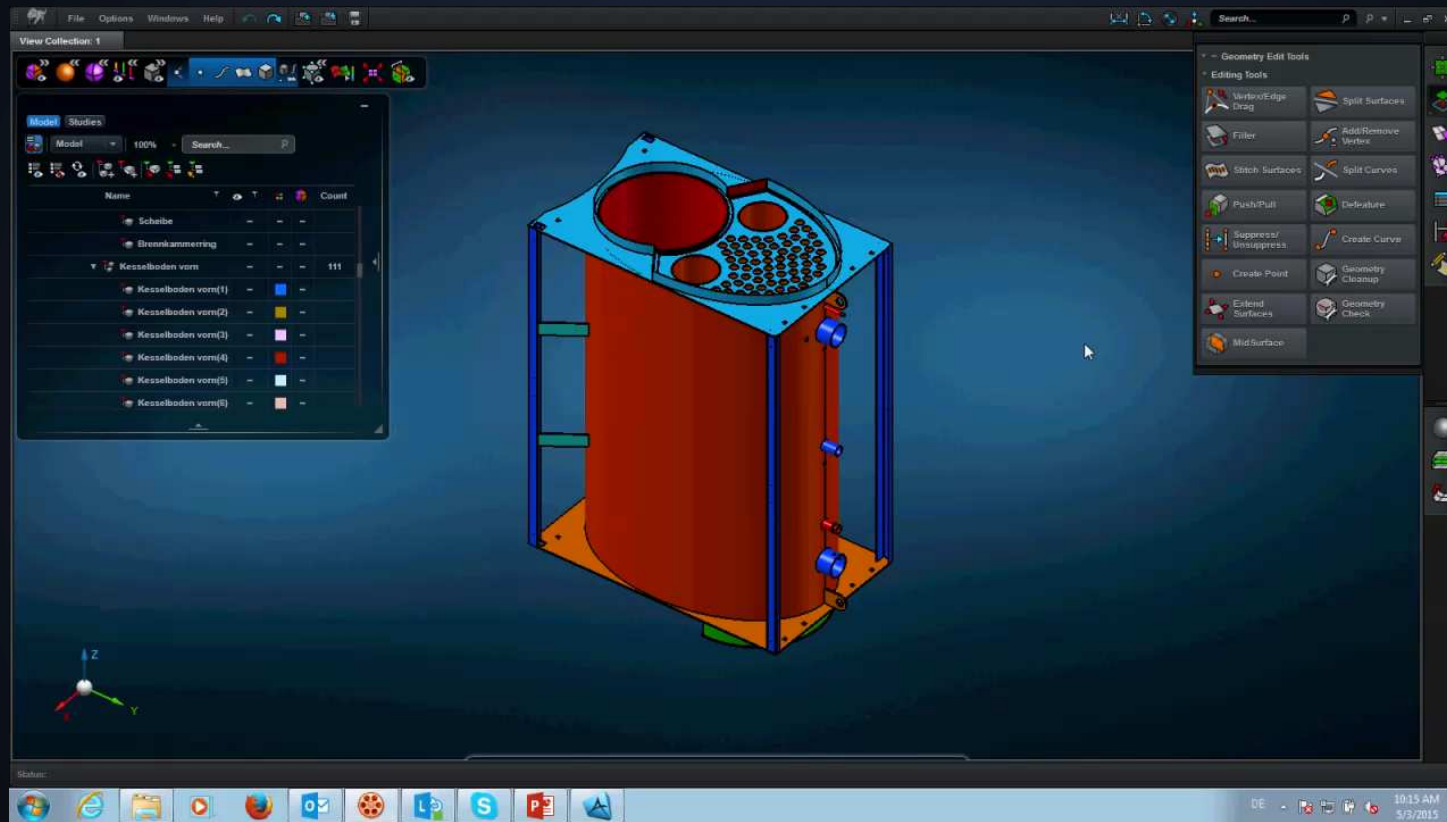
Example Model from Viessmann

114 solids

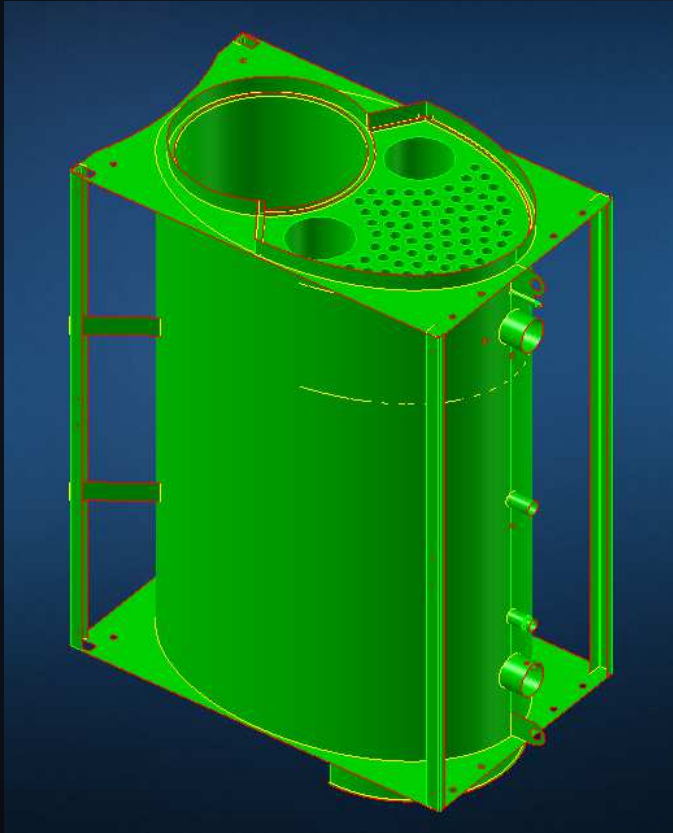
Midsurface model required



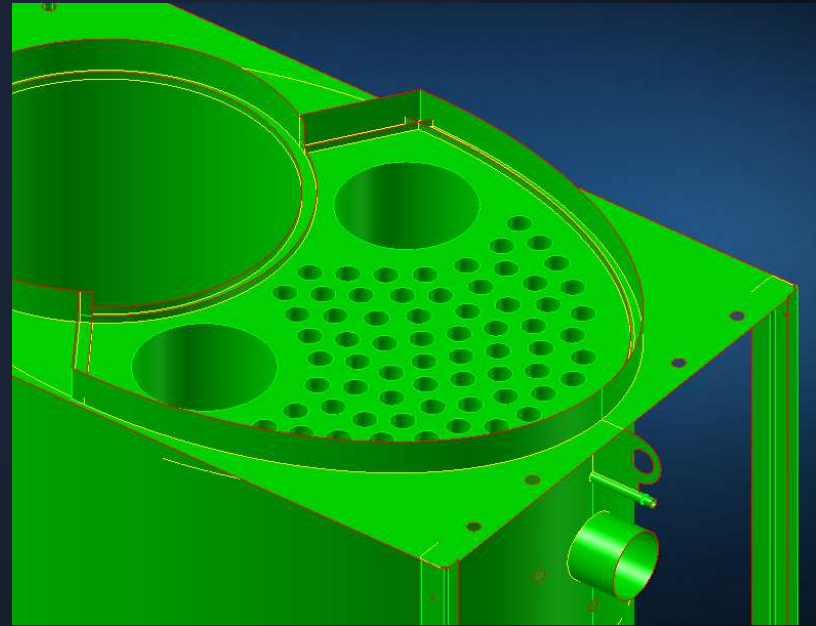
Midsurface Create, Auto-Extend, Cleanup



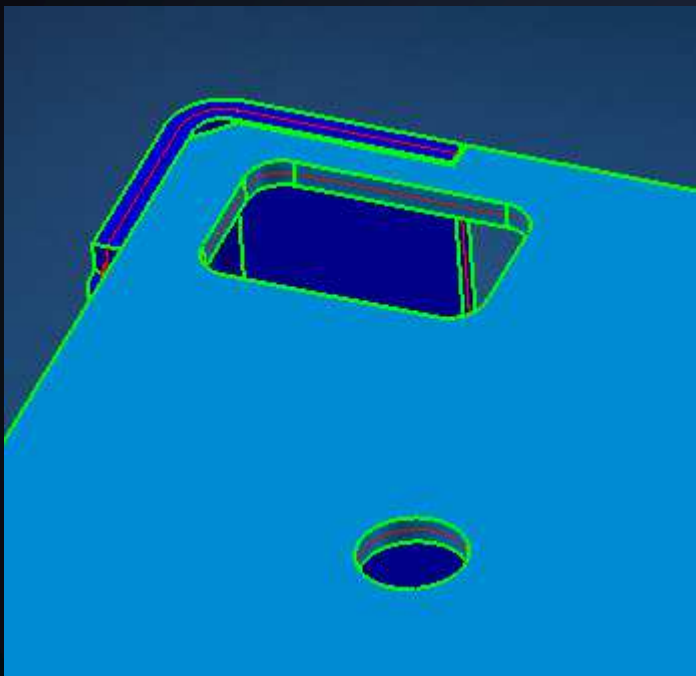
Model after Auto-Extend



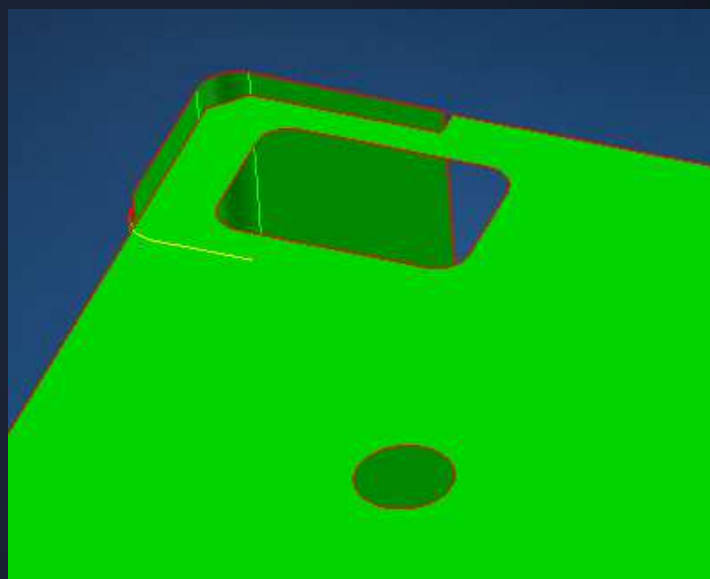
Red edge = free edge, only 1 surface
Green edge = 2 connected surfaces
Yellow edge = more than 2 connected surfaces



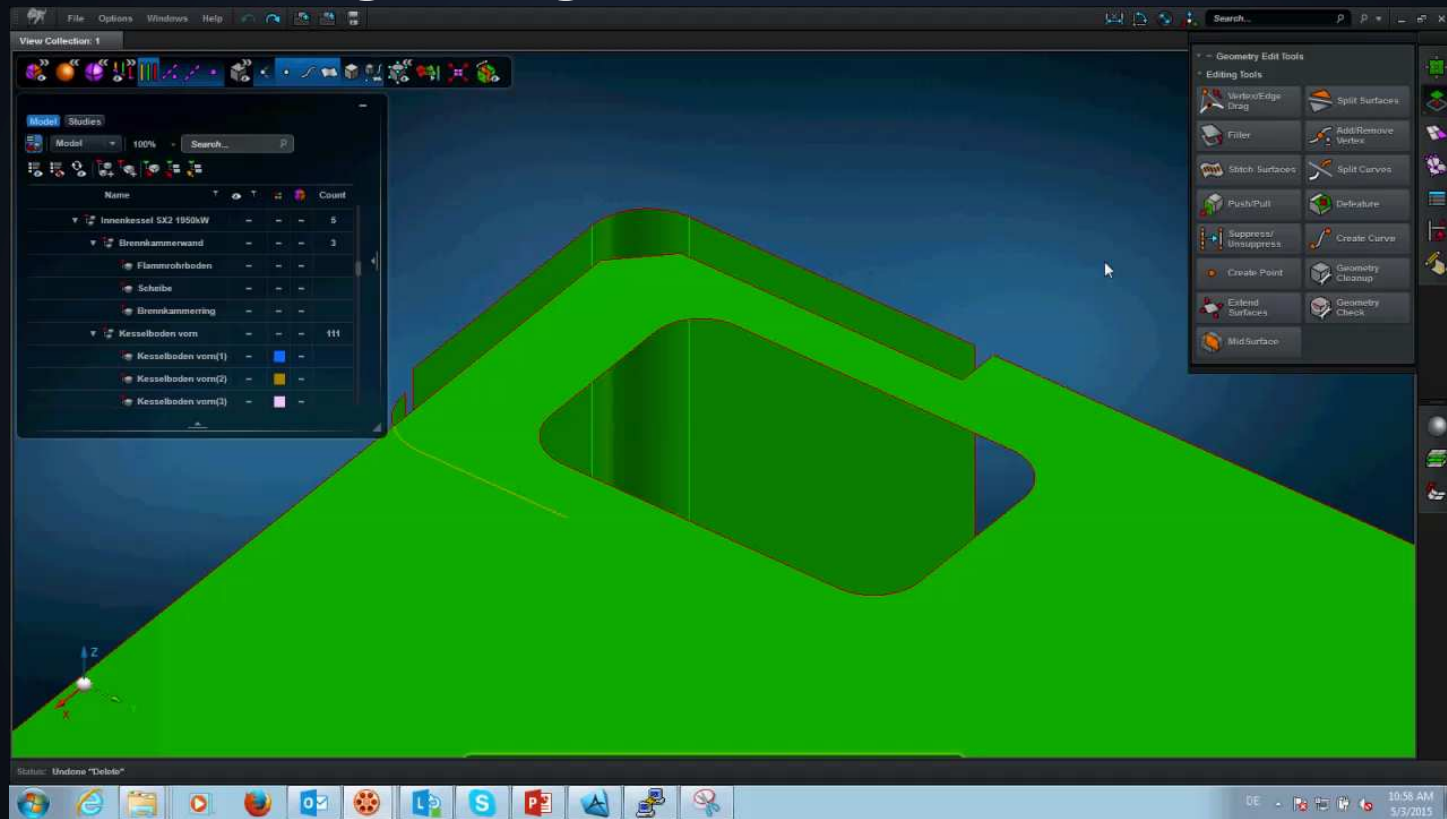
Model after Auto-Extend



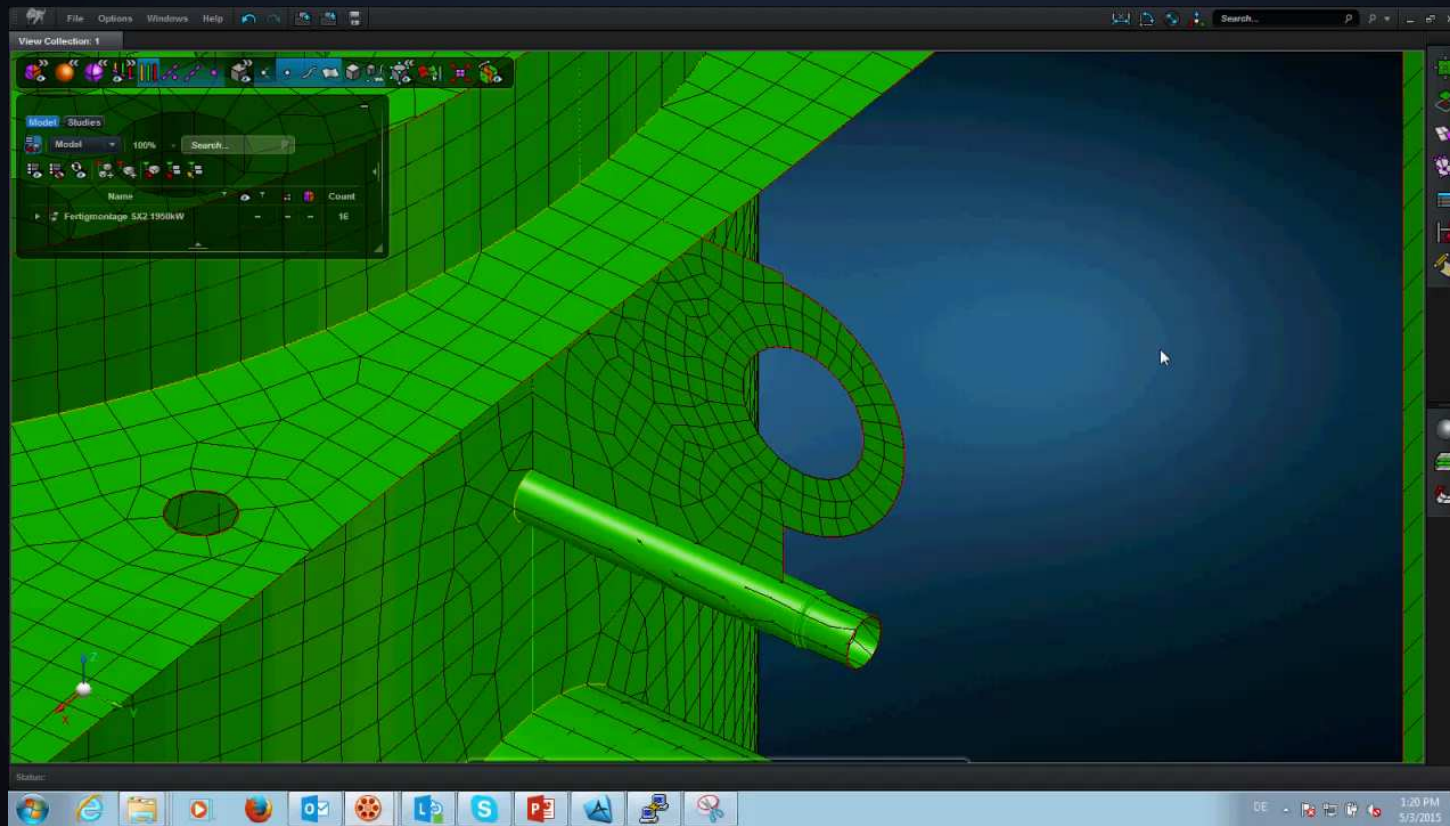
These edges were not connected by Auto-Extend



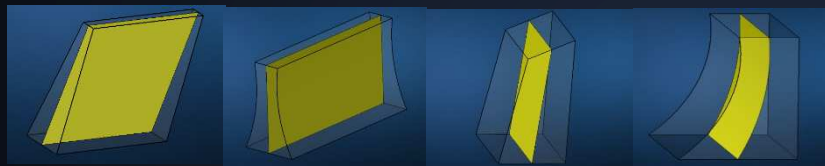
Manual Edge Drag



Automatic Mesh Update when Geometry is Modified



Tapered Mid-surfaces

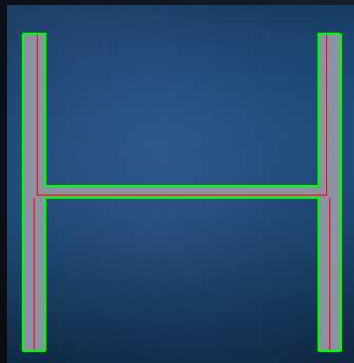


Symmetric
Planar taper

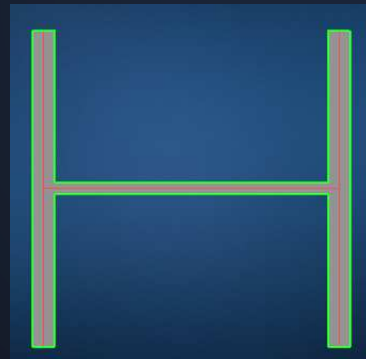
Symmetric
Curved Taper

Asymmetric
Planar taper

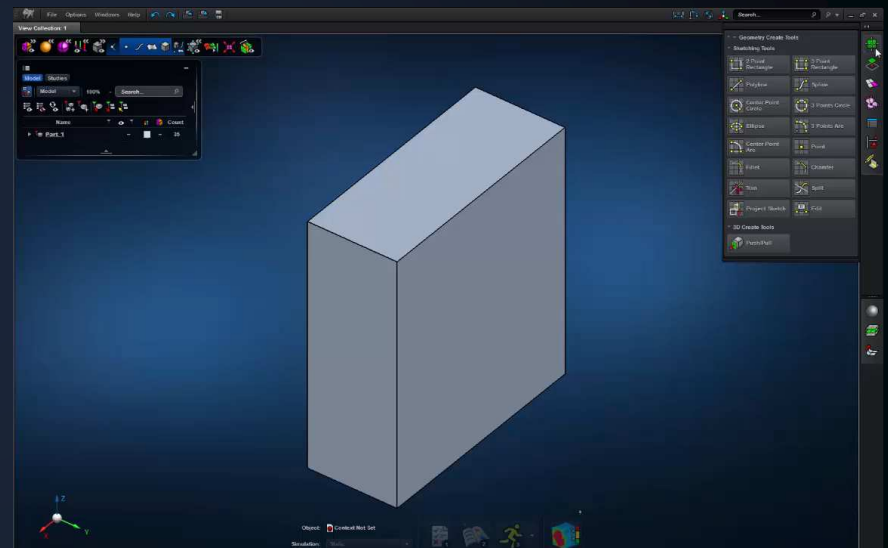
Asymmetric
Planar curved



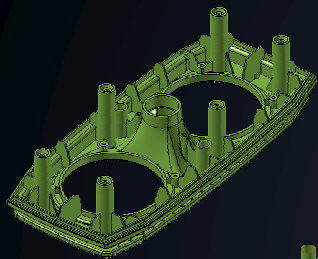
Constant Thickness
Algorithm -> Not Suitable



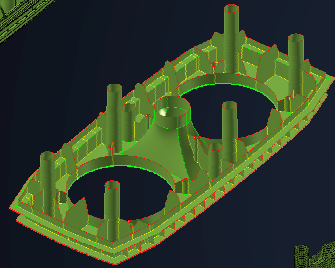
Incremental Midsurface
Algorithm -> Correct



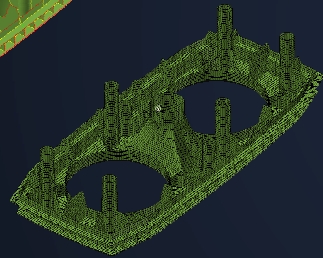
Benchmark – Plastic Part from Audio Package



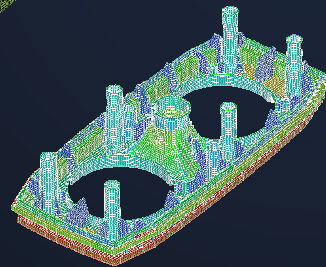
Solid
Geometry



Extracted
Mid-Surfaces



Mesh



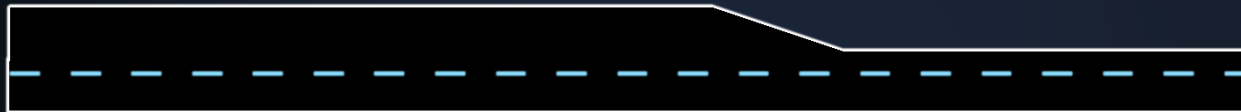
Thickness
and Offsets

	Today's Workflow	MSC Apex Workflow
Expertise Required	High	Low
Analysis Geometry	7 h	.75 h
Mesh Creation	2 h	.17 h
Property Assignments	1 h	.08 h
Complete Entire Scenario	10 h	1 h

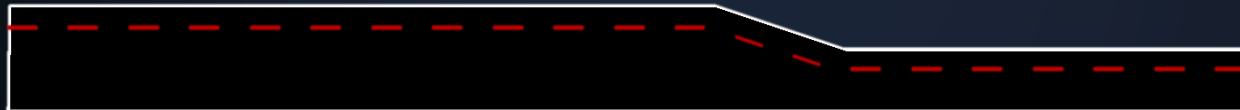
Offset types



Centered



Right Offset

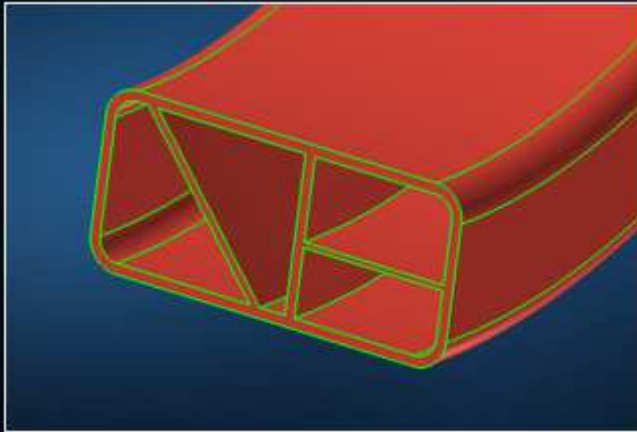


Left Offset

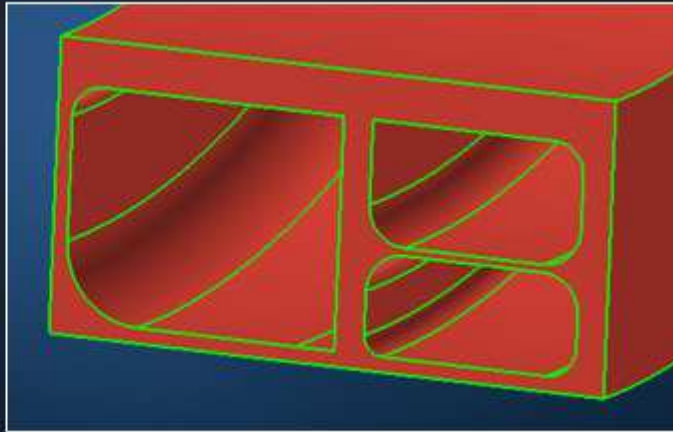


Single Cut
(Planar)

Solid Defeaturing and Modification



Original profile

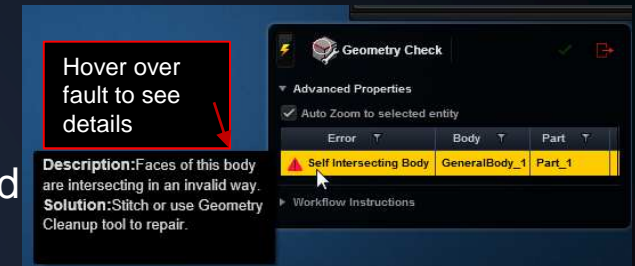


Modified profile



Geometry Repair

- Clean during import
 - default
- Geometry Check
 - identify geometry errors. Most errors need not be fixed
- Remove vertices
 - simplifies the geometry, e.g. for defeaturing
- Geometry cleanup
 - simplifies the geometry, e.g. for defeaturing



Small edges

Small faces

Sliver Surface

Spike surface

Sheet body crack

Available Apex Releases

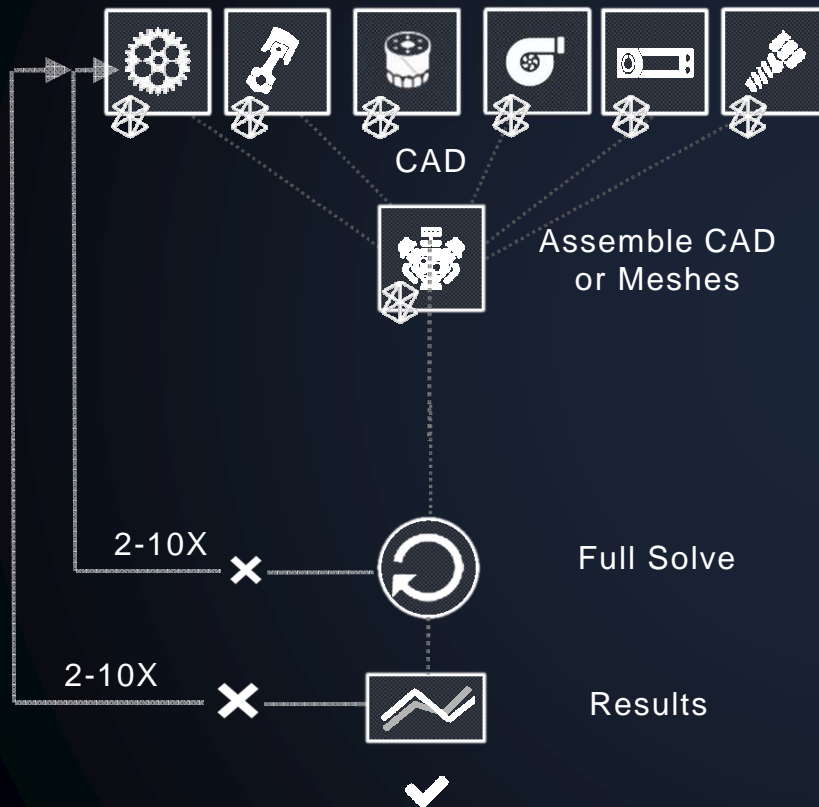


What is MSC Apex Structures?

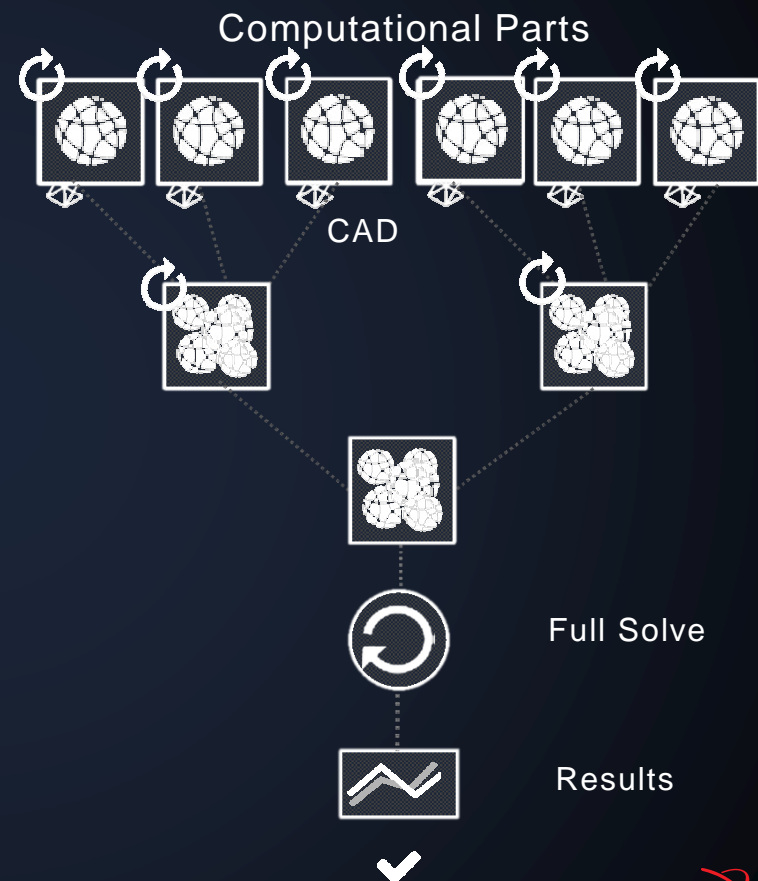
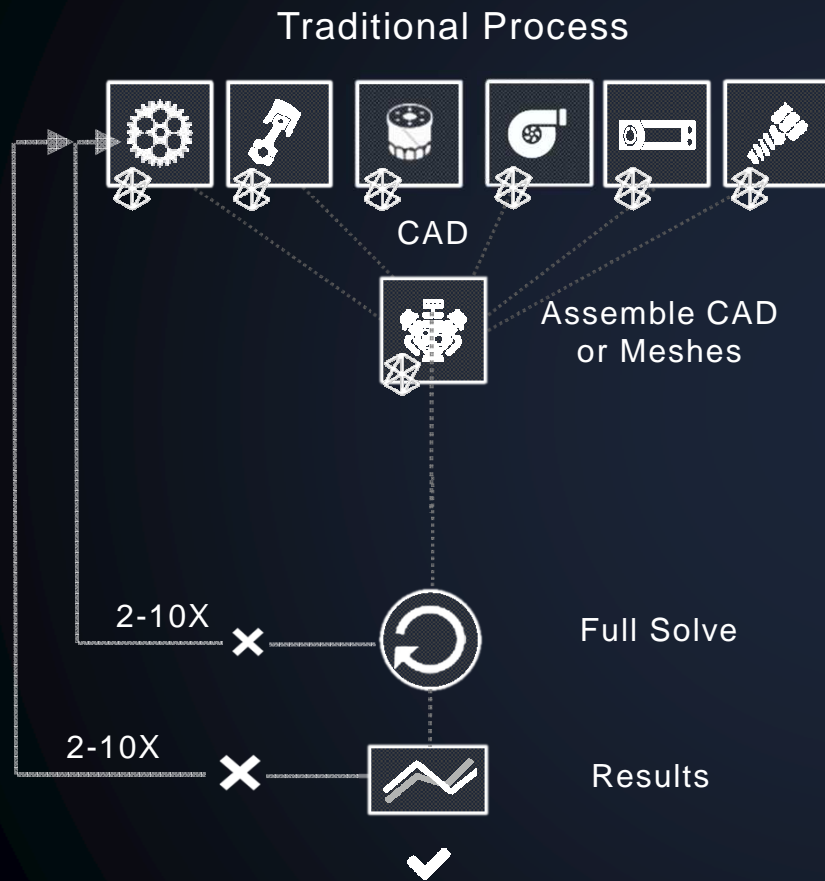
- **Linear Structural Analysis Solution**
- **Integrated and Generative**
- **Computational Parts and Assemblies**
 - Incremental Validation
 - Incremental Solve
- **Complementary to your existing workflow**

Computational Parts – Incremental Validation

Traditional Process



Computational Parts – Incremental Validation



Computational Parts – Incremental Solve (Trade Studies)

