DRD TECHNOLOGY

Shell Modeling & Meshing Webinar

Andrew Saliba – Structures Application Engineer

1-13-2026

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Agenda

Shell Modeling in Discovery & Meshing in Mechanical

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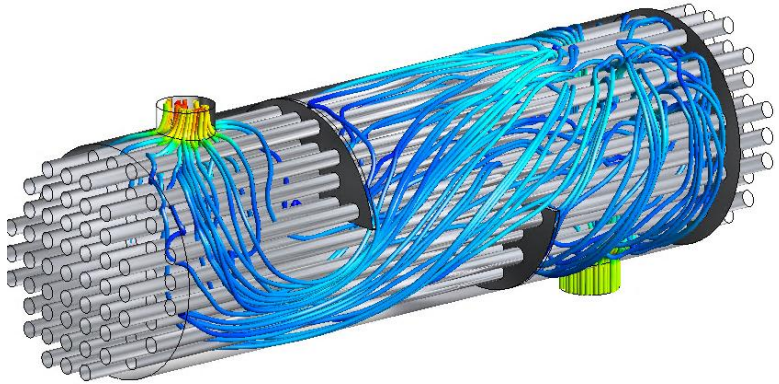
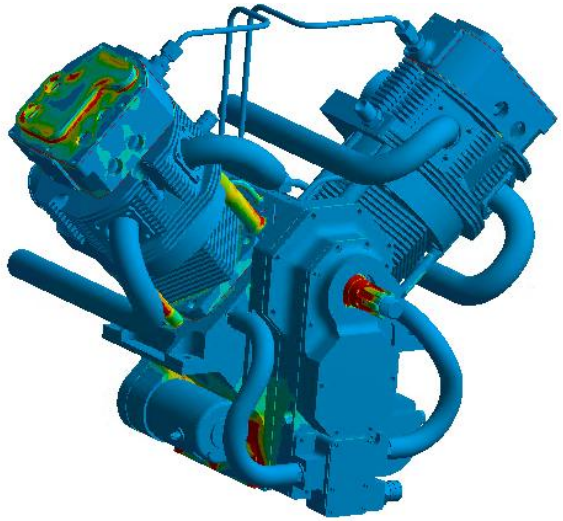
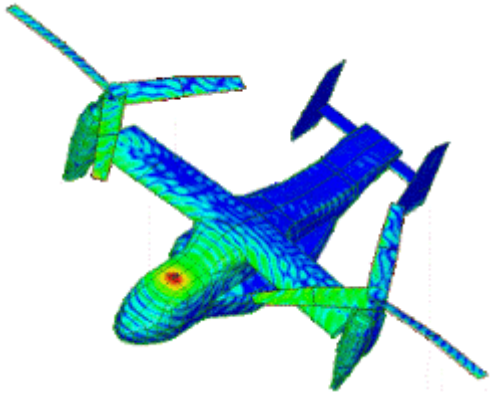
Mission Statement

DRD Technology helps engineering teams accelerate product development. With in-house expertise spanning the entire range of physics, we ensure customers succeed when using Ansys simulation tools for virtual prototyping and design verification.







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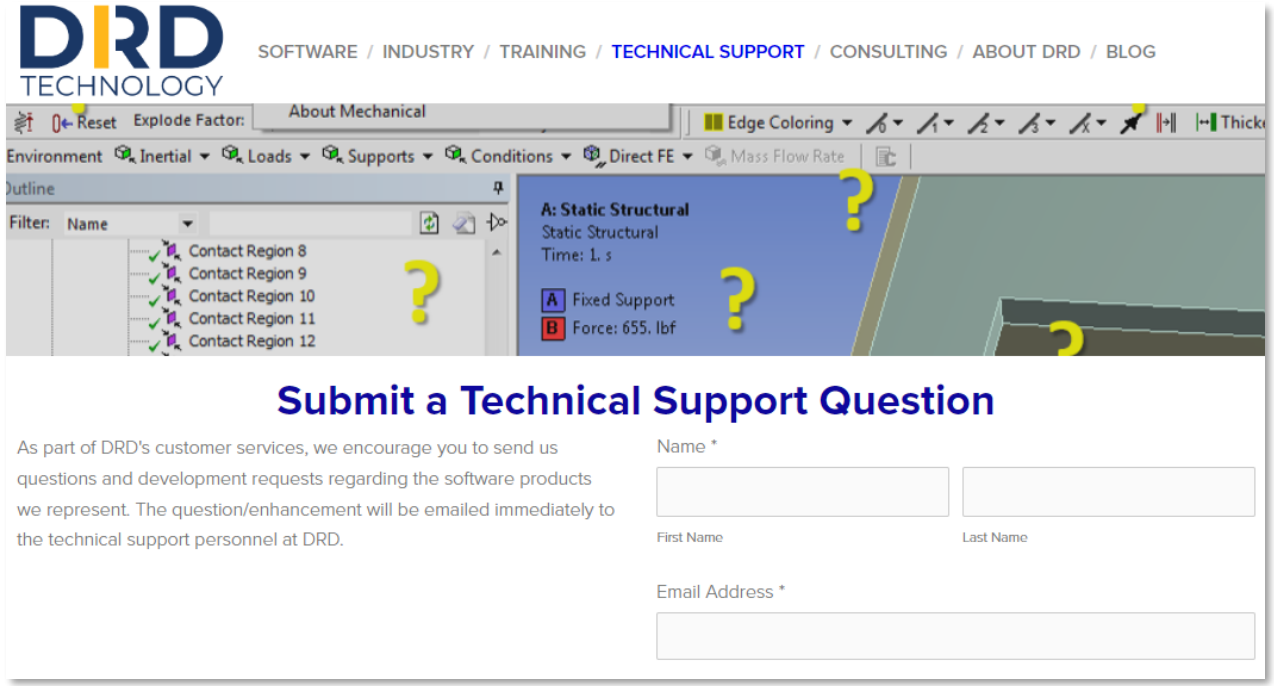
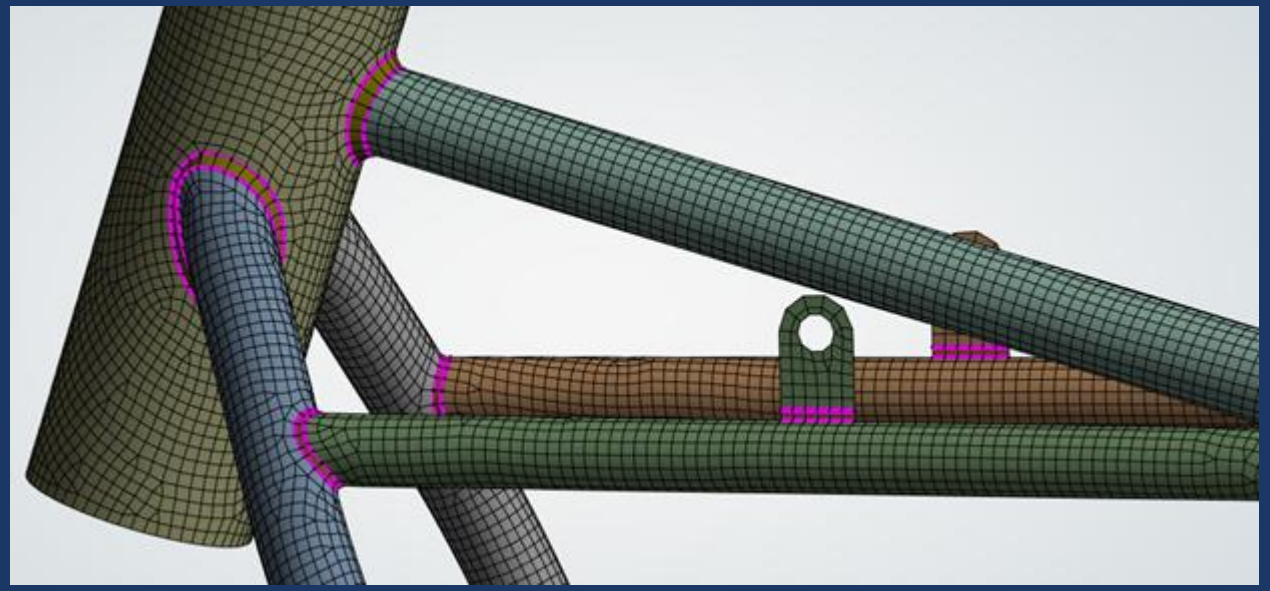


For more than five years, I have worked closely with DRD Technology to execute tactical and strategic initiatives here at EaglePicher due to our unprecedented growth. We've been very happy with DRD and will continue to work with them as our business partner for using Ansys tools effectively and efficiently.

- Doug Austin
Director of Research and Development
EaglePicher™ Technologies, LLC

Objective

- Model solid bodies as shells and provide the associated advantages
- Compare three different methods of extending and connecting surfaces for load transfer
  - Extensions and Shared Topology
  - Connect Mesh Tool
  - Weld Mesh Tool
- Identify the advantages of each method and when they should be used.



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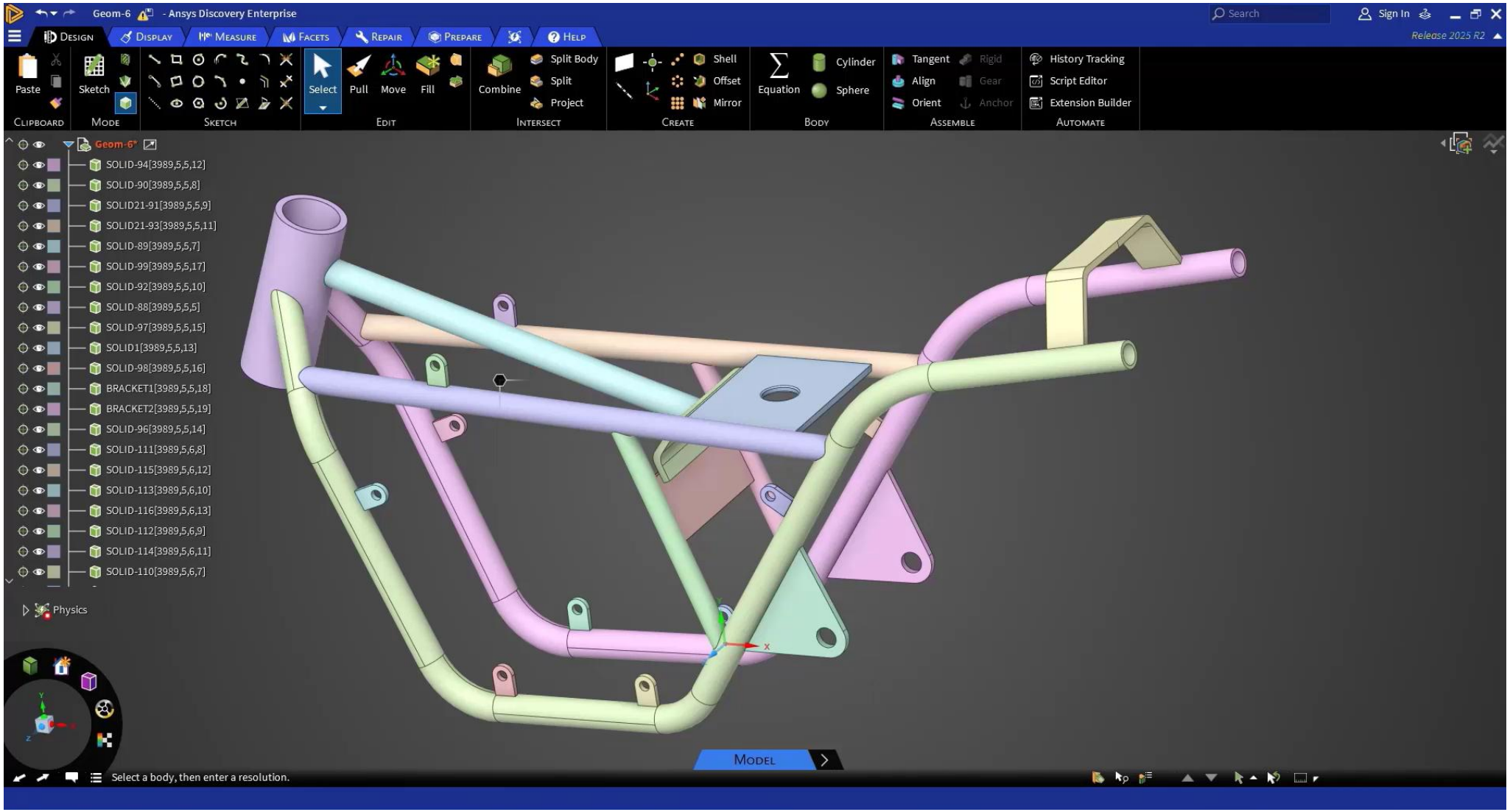
Shell Modeling Overview

- Convert’s solid components into surfaces, particularly beneficial for thin-walled bodies
- Improves computational efficiency and streamlines model preparation for analysis
- Quicker meshing and a significant decrease in node/elements
- For thin structures, shell elements can produce accurate results with fewer nodes/elements compared to solids in bending cases
- Thickness can be used as a parameter for iterative studies

Mid-surfacing, Extending, and Shared Topology

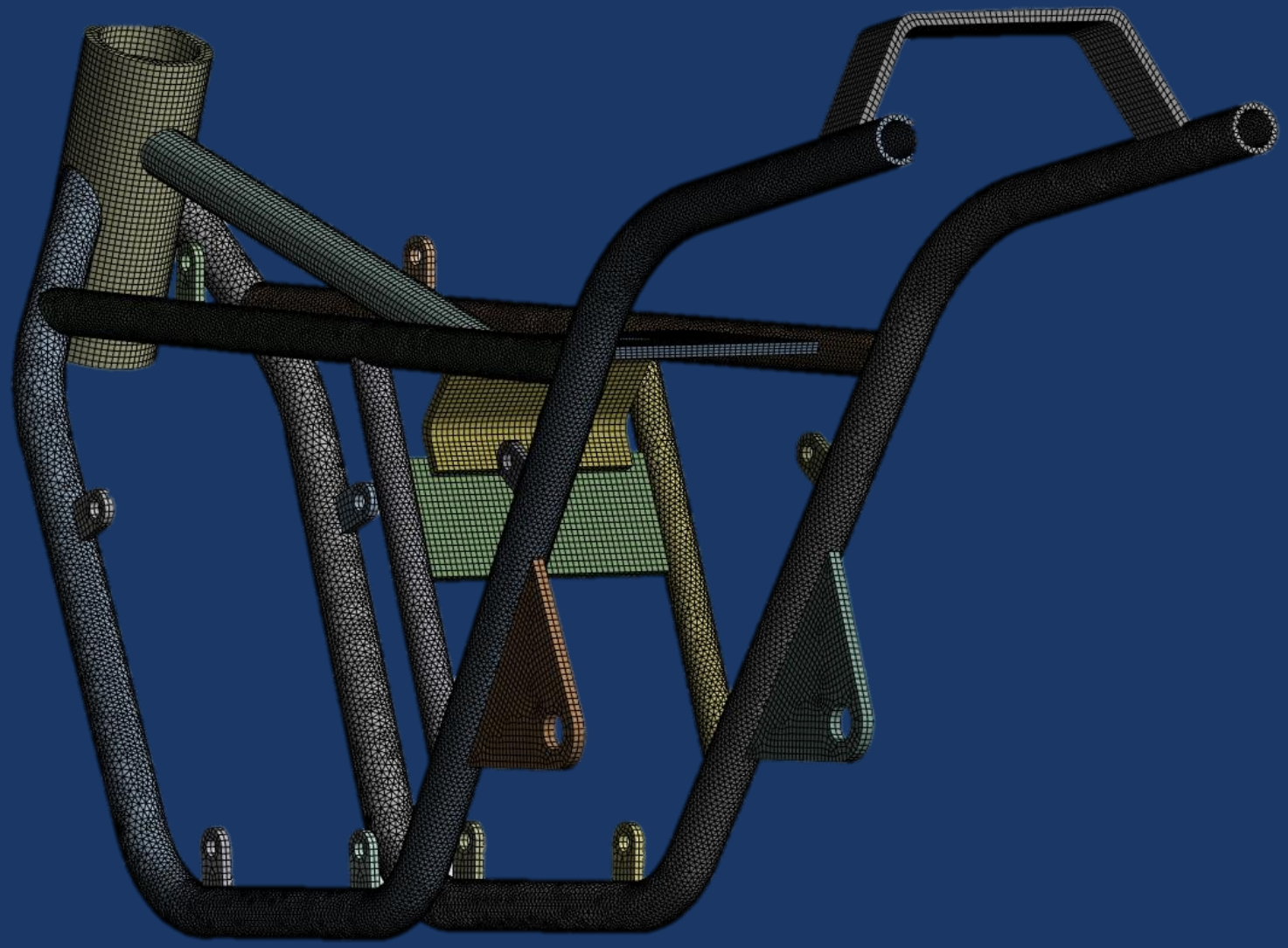
Part I

Discovery to Mechanical Workflow



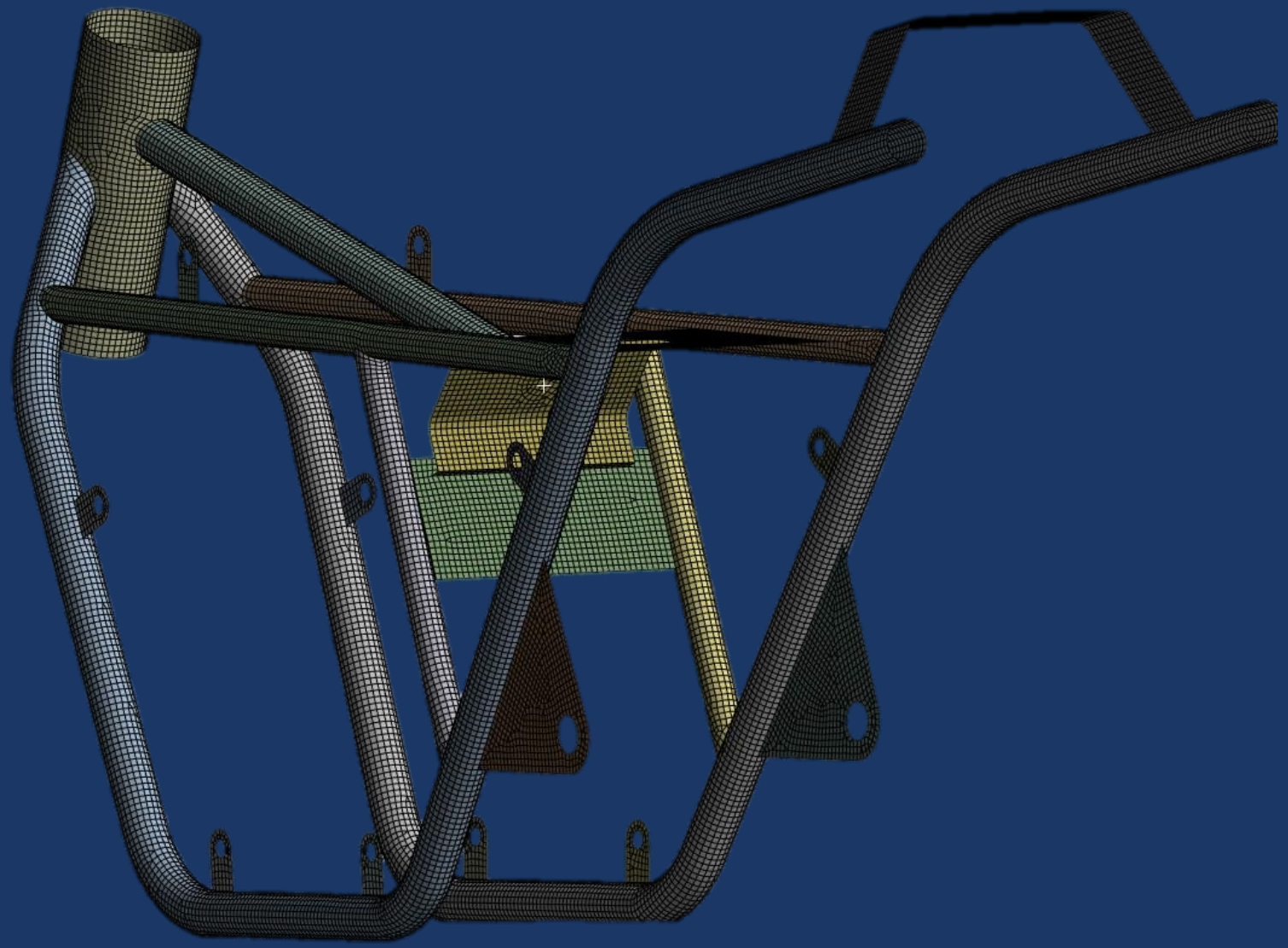
Solid/Shell Comparison

- Solid Assembly (0.2 in Global Element Size)



Solid/Shell Comparison

- Shell Assembly (0.2 in Global Element Size)



Solid/Shell Comparison

- Solid Model Mesh Statistics

Details of "Mesh"

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	544930
Elements	244569
Show Detailed Statistics	Yes
Corner Nodes	103207
Mid Nodes	441723
Solid Elements	244569
Tet10	220650
Hex20	23233
Wedge15	686

- Shell Model Mesh Statistics

Details of "Mesh"

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	37734
Elements	37685
Show Detailed Statistics	Yes
Corner Nodes	37734
Shell Elements	37685
TriShell3	419
QuadShell4	37266

Node Count Ratio: $N_{shell}/N_{solid} \approx 0.07 \approx 1/14$

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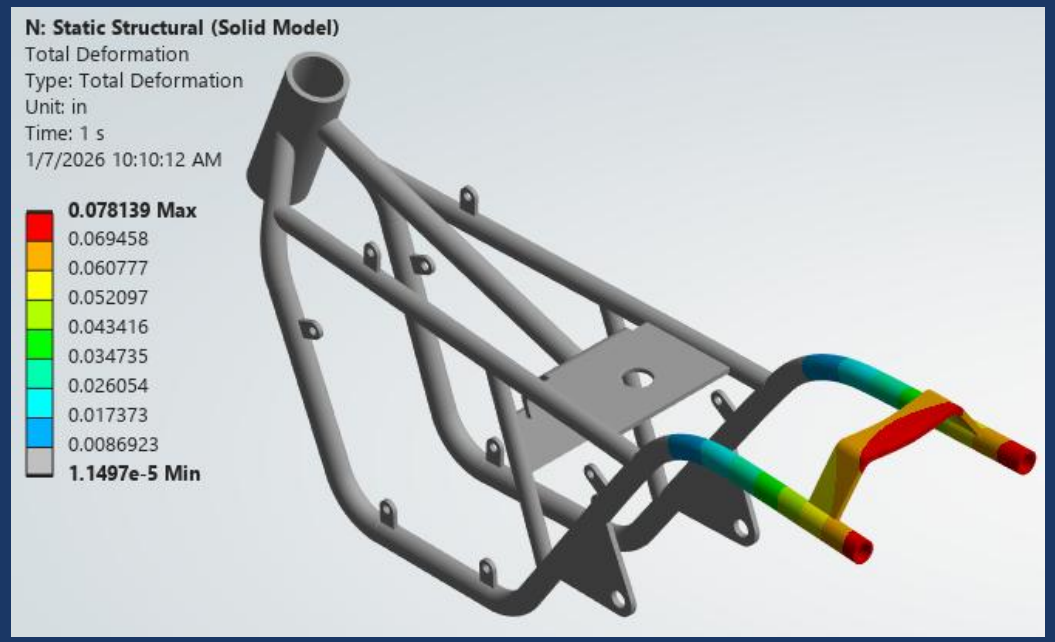
Solid/Shell Comparison

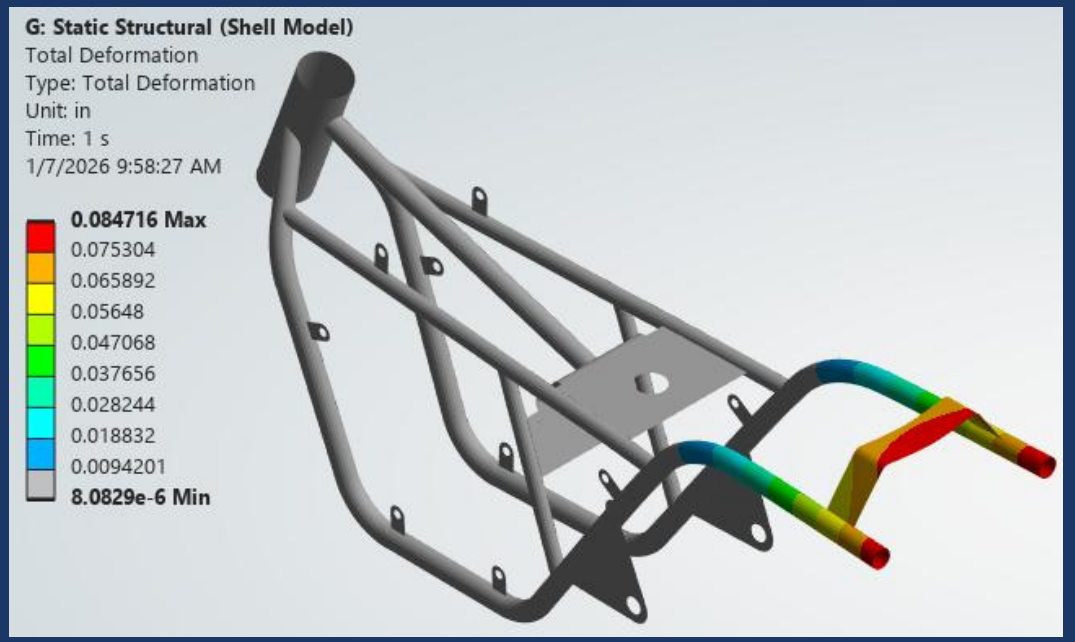
Solid Model Analysis Test

- Solve Time: 1 m 15 s (4 cores)
- Mesh set to 0.2 in (not refined further)

Shell Model Analysis Test

- Solve Time: 22 s (4 cores)
- Mesh set to 0.2 in (not refined further)





Solve Time Ratio: $t_{solid}/t_{shell} \approx 3.4$

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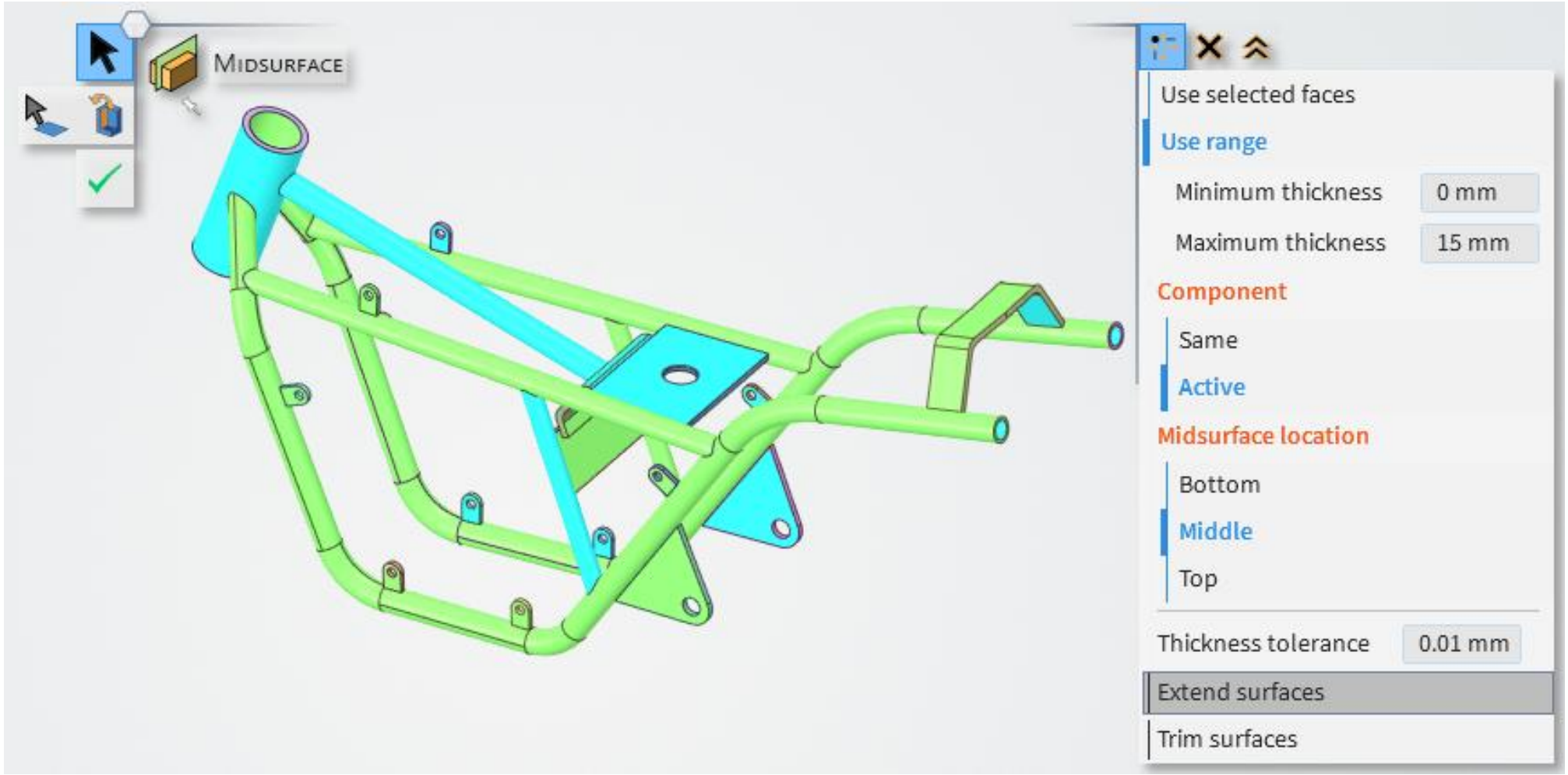
Part I Conclusion

- Quick workflow and problematic geometry is easy to deal with
- Very customizable in how surfaces extend and which edges to apply shared topology
- No contacts needed; the solid model required 30 and took time to ensure scoping was correct
- You can view shared nodes with Display | Color | By Body Connection
- Workflow is very straightforward, especially for those familiar with CAD
- Shared Topology prevents parallel part meshing

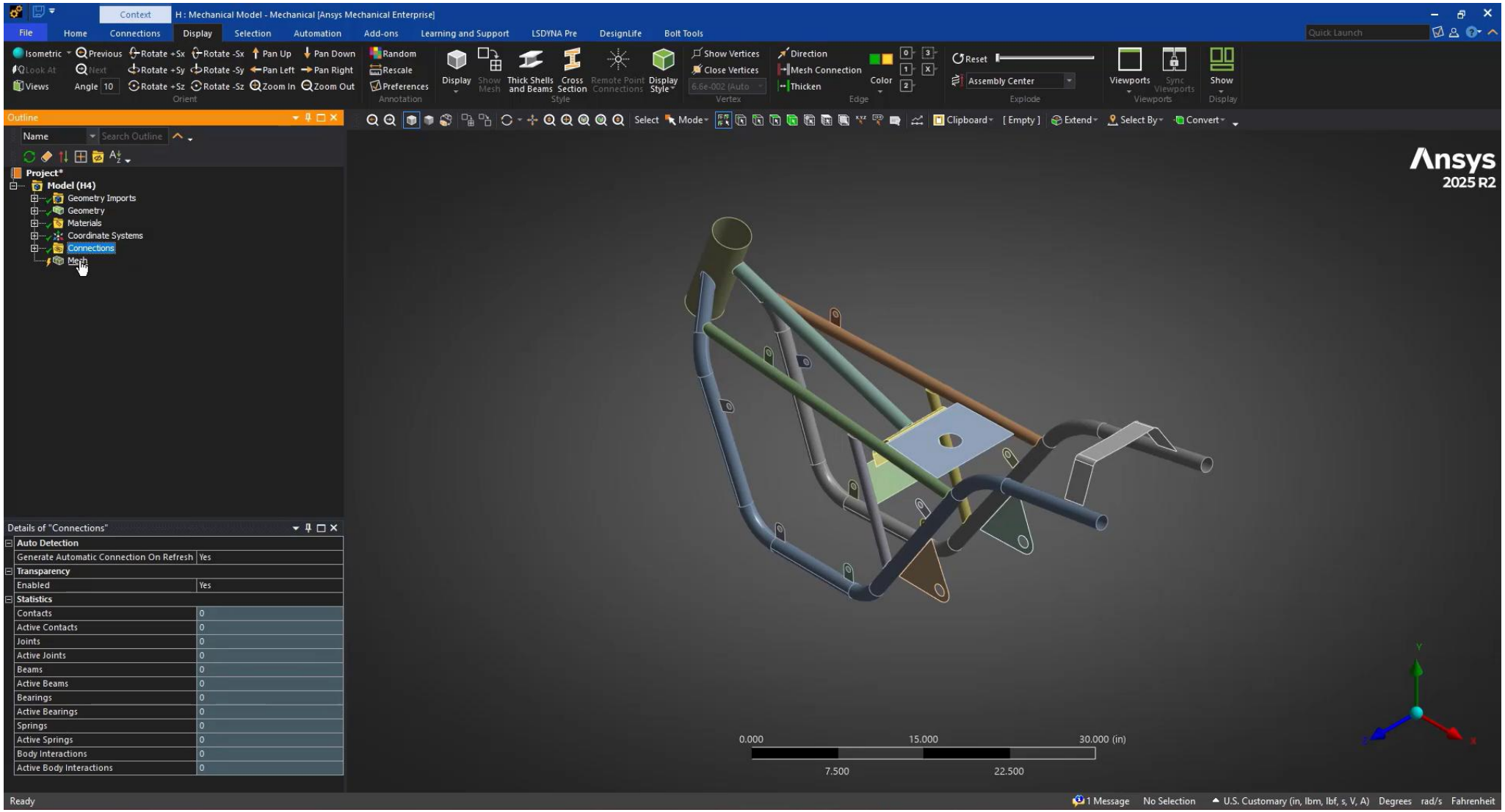
Mid-surfacing and Connect Mesh Tool

Part II

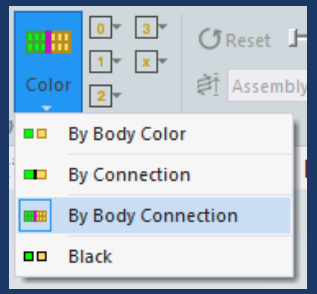
Using Mid-surface without Extension

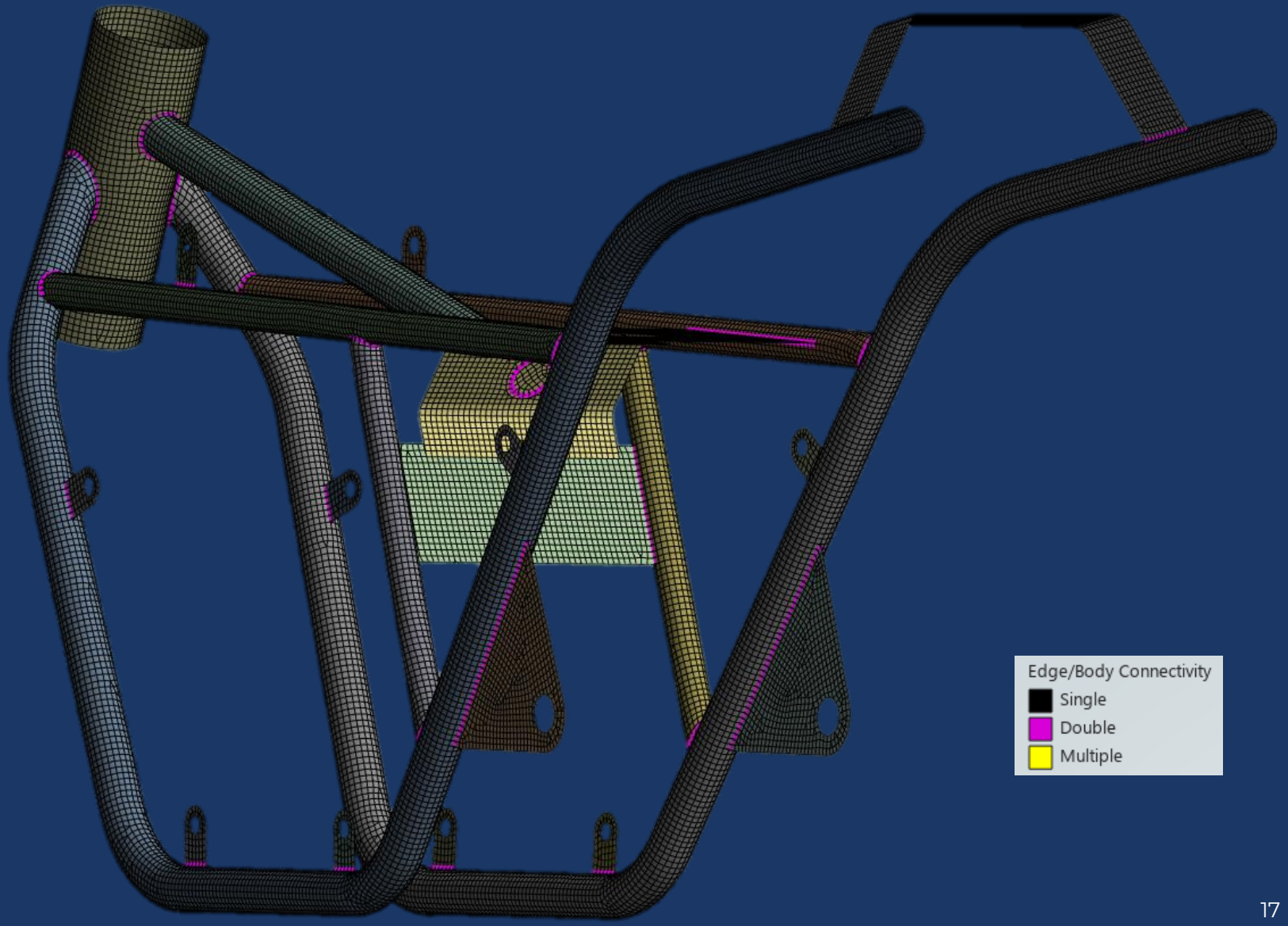


Meshing using the Connect Tool



Connect Shell Mesh





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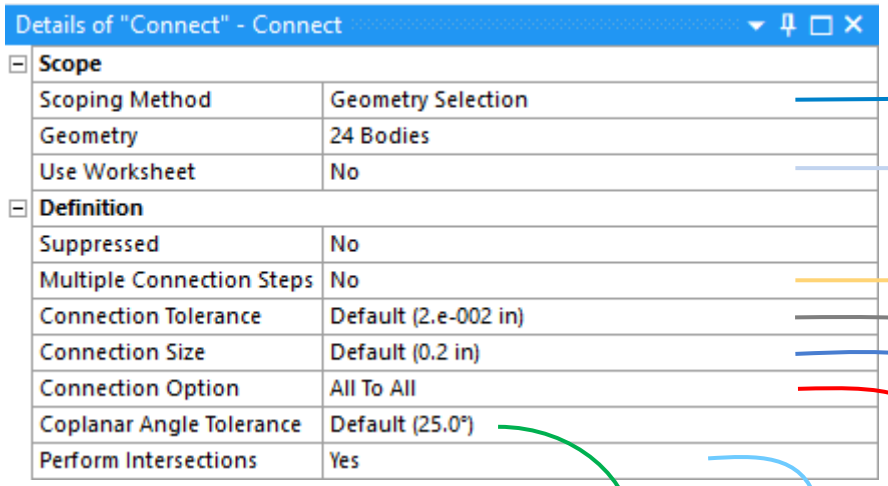
Connect Settings



Geometry/Named Selection

Define order of connections with variability in Scoped Bodies, Connection Option, and Connection Tolerance

Yes/No; Yes - allows for multiple Connection Tolerance values

≤ Connection Size; Used to determine which bodies should connect to other bodies. Higher values connect more bodies together while small values may cause some connections to be missed

Size to discretize edges before connecting them; Default is the Global Element Size

All to All: Connects all possible entities within the scope
Free to All: Connects only unconnected edges to the rest of entities within the scope
Free to Free: Connects only unconnected edges within the scope

Checks if the 2 faces to be connected are in the same plane; if so, intersection is not performed

Yes/No; No - skips intersecting the connecting entities

Documentation Link:
https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v252/en/wb_msh/msh_connect.html

Part I/Part II Comparison

- Part I Mesh Statistics

Details of "Mesh"

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	37734
Elements	37685
Show Detailed Statistics	Yes
Corner Nodes	37734
Shell Elements	37685
TriShell3	419
QuadShell4	37266

- Part II Mesh Statistics

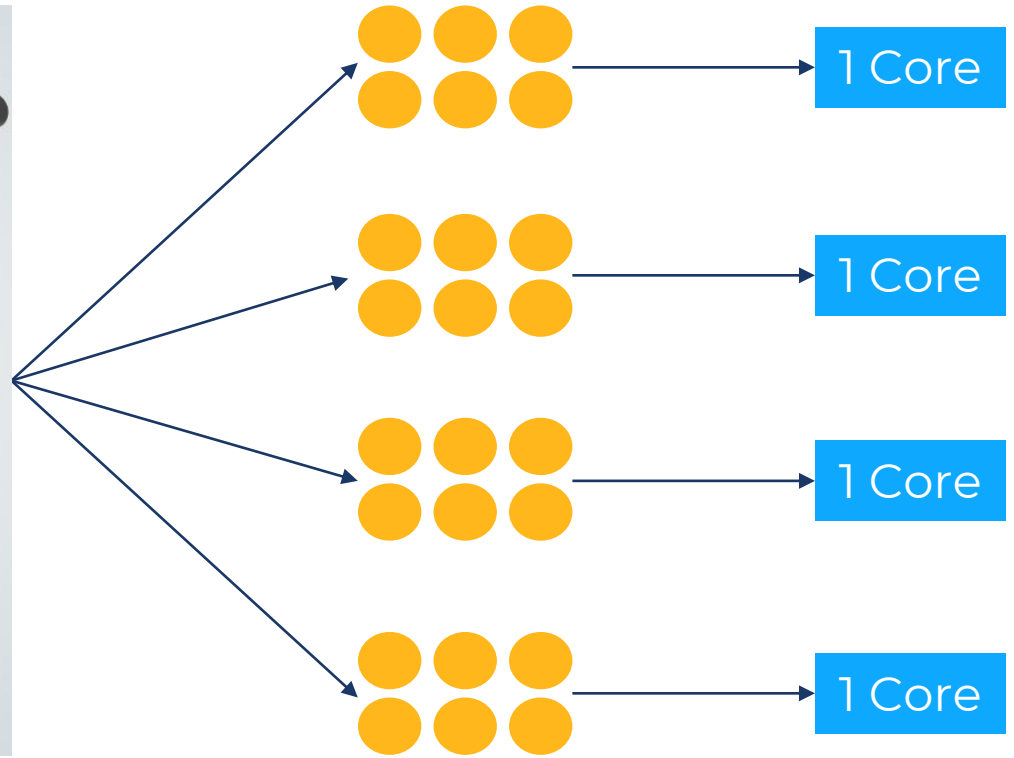
Details of "Mesh"

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Statistics	
Nodes	37444
Elements	37333
Show Detailed Statistics	Yes
Corner Nodes	37444
Shared Nodes	525
Shell Elements	37333
TriShell3	384
QuadShell4	36949

Part II Conclusion

- Less customizability compared to Part I, but much quicker
- Does not create additional connection bodies, just extends surfaces
- No need to extend surfaces or create additional surface bodies for connections
- Highly automated and easy to implement
- Handled at the mesh level, opening the door for parallel part meshing
- Simple process for cases where parts just need to be connected for load transfer
- Gets past problematic geometry with ease

Parallel Part Meshing



24 Total Bodies

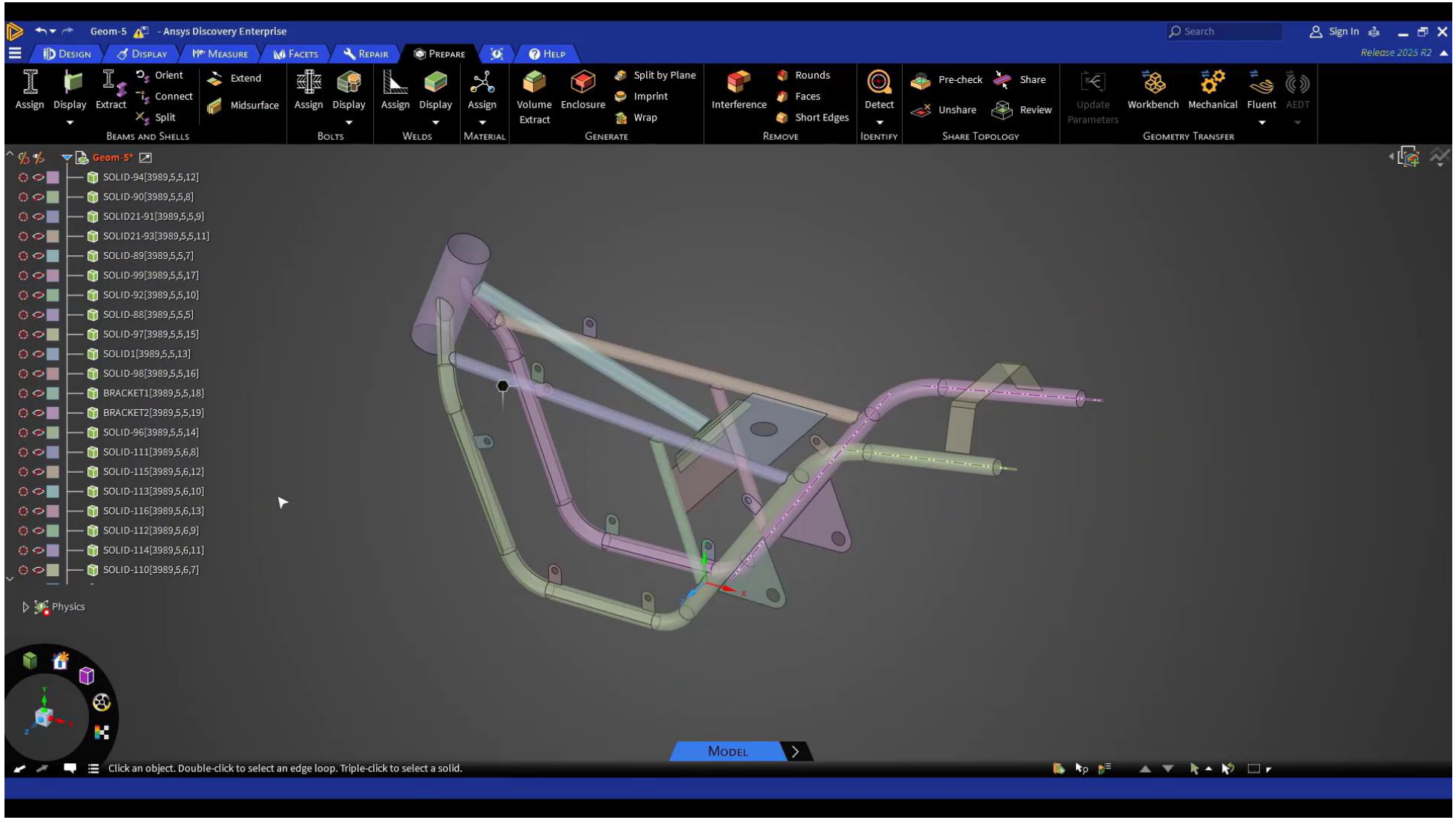
6 Bodies Each

4 Total Cores

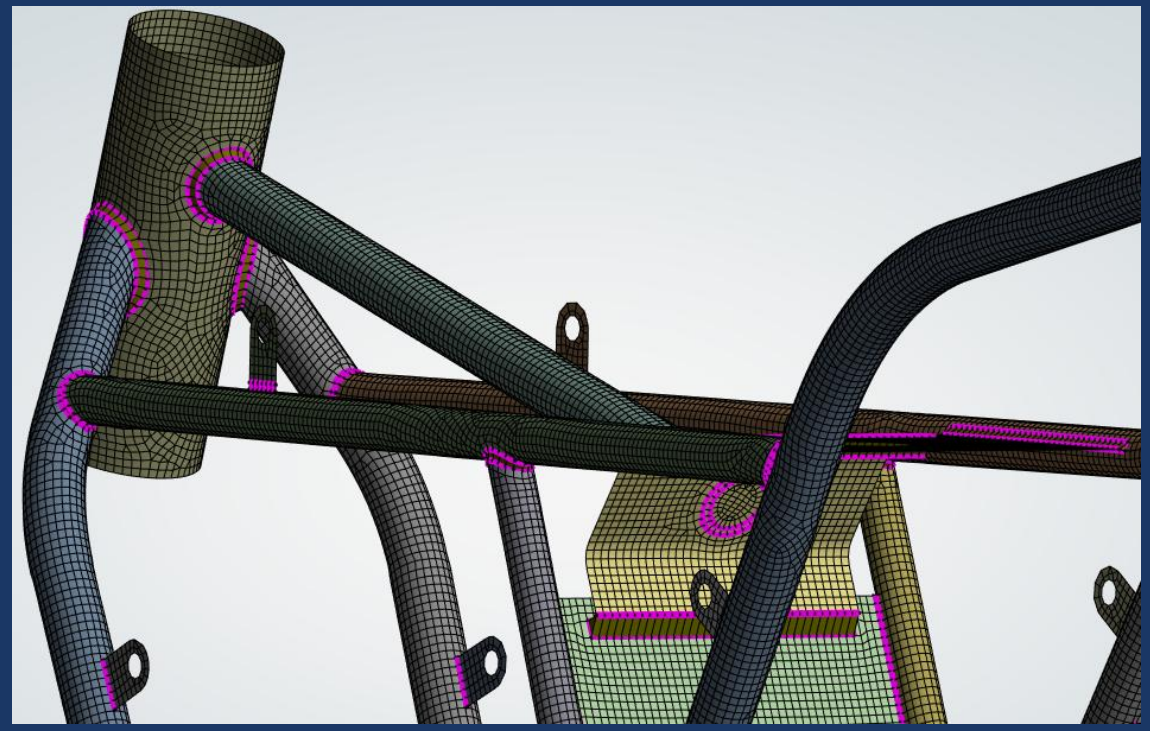
Mid-surfacing, Assigning Welds, and Weld Mesh Tool

Part III

Discovery to Mechanical Workflow



Welded Shell Mesh

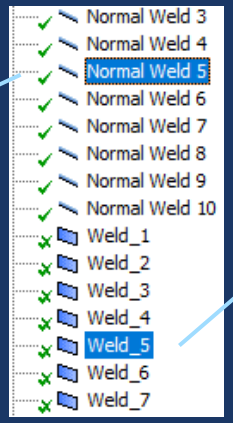


Details of "Weld_5"

Graphics Properties	
Definition	
Suppressed	No
ID (Beta)	1163
Dimension	3D
Model Type	Shell
Stiffness Behavior	Flexible
Stiffness Option	Membrane and Bending
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Thickness	0.18095 in
Thickness Mode	Manual
Offset Type	Middle
Treatment	None
Material	
Assignment	Structural Steel
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
Bounding Box	
Properties	
Statistics	

Details of "Normal Weld 5"

Graphics Properties	
Definition	
Suppressed	No
Treatment	Construction Body
CAD Attributes	
MODEL_ASSEMBLY_SKIP_PART_FLAG	
PartTolerance:	0.00000001
SCRootPartComponent	
Geom-8\Fillet Weld Id -1	
Color:0.0.0	



Weld Settings

Details of "Weld 3" - Weld

Scope	
Type	Continuous Seam
Source	Mesh
Modeled As	Normal
Weld Element Rows	Default (1)
Create Using	Curves
Use Worksheet	No
Curve Scoping	Body Selection
Weld Curve	Fillet Weld 1
Definition	
Suppressed	No
Adjust Weld Height	No
Creation Criteria	Width Based
Weld Width (Leg01) Assignment	User Defined
Weld Width (Leg01)	Default
Edge Mesh Size Assignment	User Defined
Edge Mesh Size	Default (0.2 in)
Create HAZ Layer	Yes
HAZ Distance Option	Distance Per HAZ
HAZ Distance Assignment	User Defined
HAZ Distance Top Plate	Default (0.2 in)
HAZ Distance Bottom Plate	Default (0.2 in)
Number Of HAZ	Default (1)
HAZ Growth Rate	1.2
Generate Named Selection	No
Intersection Tag (Beta)	
Mechanical Properties	
Material	None
Thickness Assignment	Program Controlled
Advanced	
Relaxation	Conservative
Sharp Angle	Default (90.0°)
Connection Tolerance	Default (Program Controlled)
Smoothing	Yes
Weld Detection Method	Automatic

Continuous Seam/Intermittent Seam

- Normal and Angled
- Angled
- Normal
- 1D
- Mesh Independent

Element through the weld's thickness

- Curves
- Curves and Bodies
- Curves and Faces
- Edges
- Edges and Bodies
- Edges and Faces

Helpful when assigning multiple welds at once

Default is the Global Element Size; should be reduced for welds with high curvature

HAZ (Heat Affected Zone); creates a layer with heat-affected reduction in properties

Generates Named Selections for Weld and HAZ created bodies/layers

Allows material definition for weld bodies created during meshing

Allows thickness definition for weld bodies created during meshing

When two parts to be welded together are close, the Connection Tolerance value should be less than the gap between the parts to be welded

Documentation Link:
https://ansyshelp.ansys.com/account/secured?returnurl=/Views/Secured/corp/v252/en/wb_msh/msh_Weld.html

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Part I/Part III Comparison

- Part I Mesh Statistics

Details of "Mesh"

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	37734
Elements	37685
Show Detailed Statistics	Yes
Corner Nodes	37734
Shell Elements	37685
TriShell3	419
QuadShell4	37266

- Part III Mesh Statistics

Details of "Mesh"

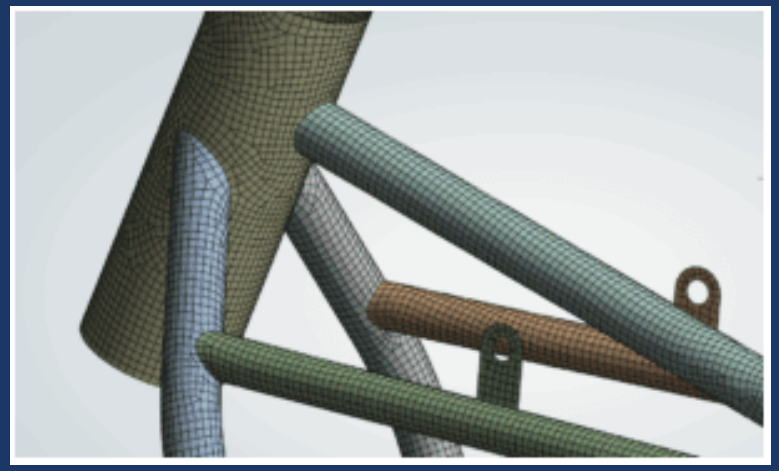
Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	0.2 in
Sizing	
Quality	
Inflation	
Advanced	
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	38040
Elements	38754
Show Detailed Statistics	Yes
Corner Nodes	38040
Shared Nodes	1797
Shell Elements	38754
TriShell3	753
QuadShell4	38001

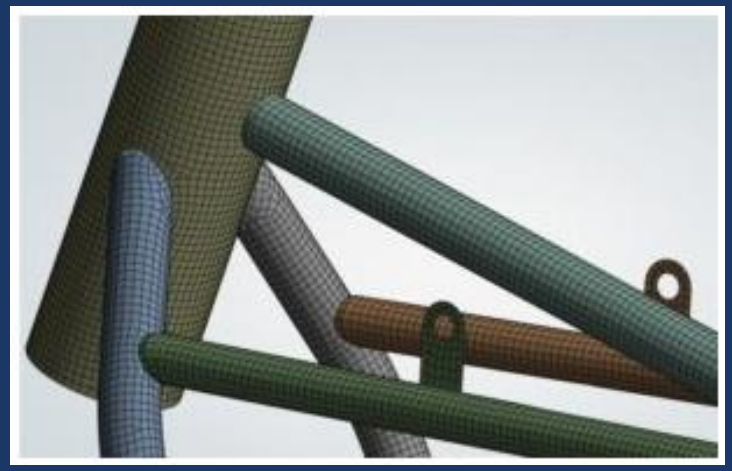
Part III Conclusion

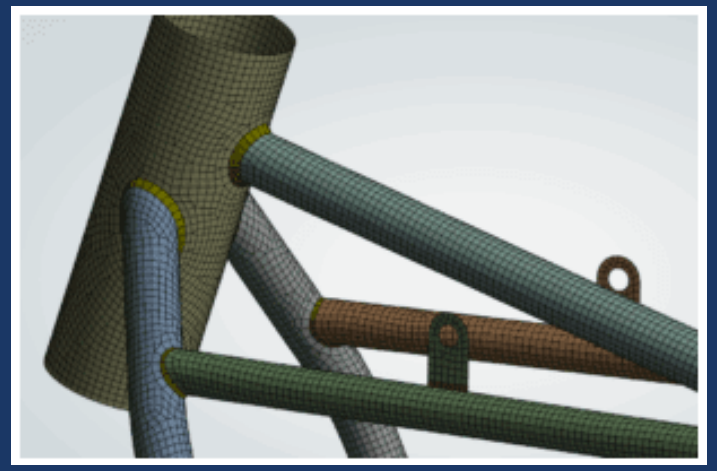
- Discovery Premium is required to utilize the automatic Weld curve creation tool
- Highly automated workflow vs designing/meshing solid welds; especially for models with a great amount of welds
- Handles bad geometry and overlap with ease (no need for extra steps)
- Welds can be defined as normal/angled/normal&angled, and can be controlled with various settings to customize as required
- The mesher creates unique weld bodies which can be assigned their own materials and properties, and can easily feed into additional workflows
- Mainly handled at the mesh level, allowing for parallel part meshing

Which Method Should You Use?

- Use Method 1 (Extensions & Shared Topology) for direct control or complex connections
- Use Method 2 (Connect Mesh Tool) for quick connections between parts for load transfer
- Use Method 3 (Weld Mesh Tool) for weld fatigue analysis. Stay tuned for a future webinar on this topic.







Wrap Up

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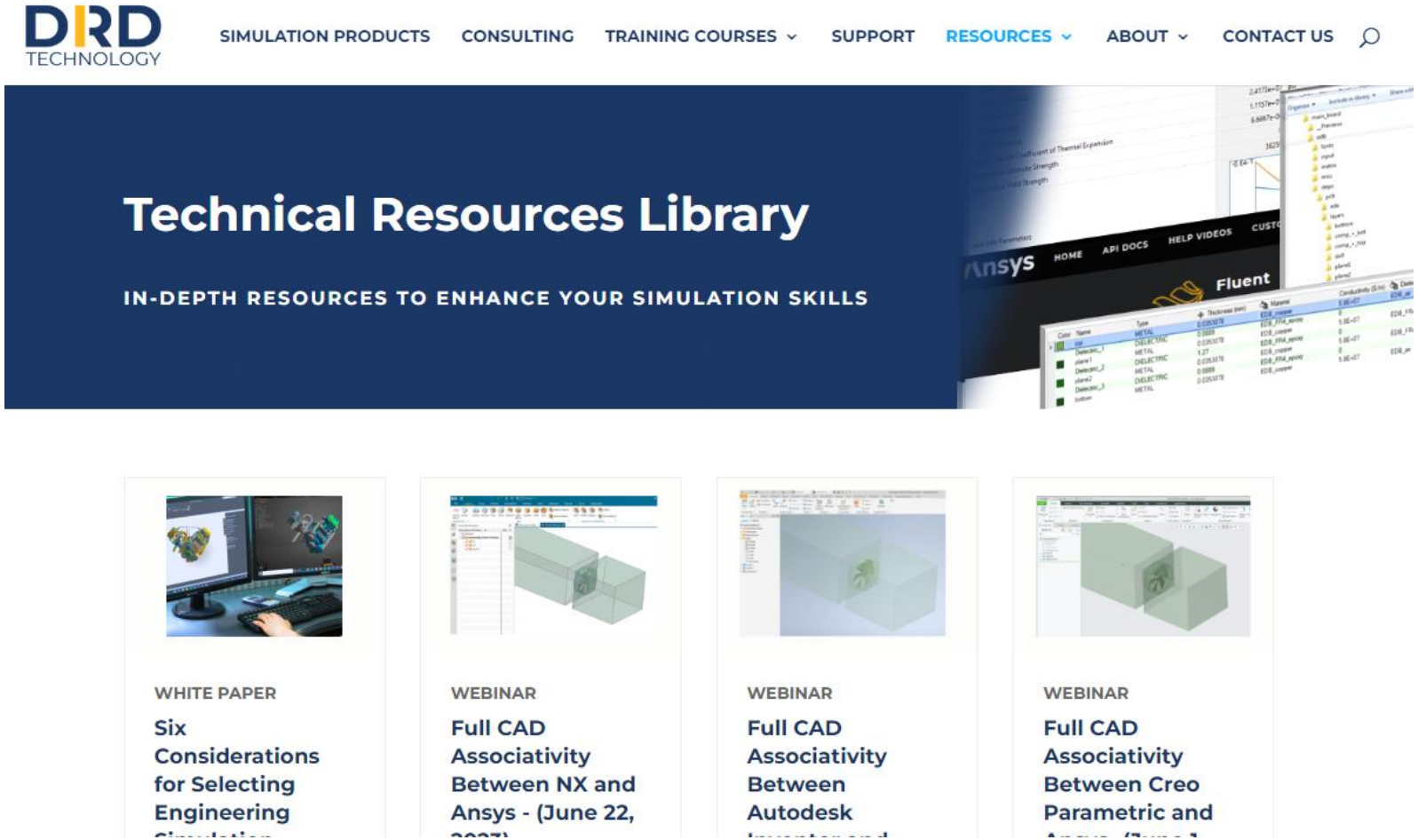

Wrap Up

Whether you're onboarding with the Ansys platform or looking to take your simulation proficiency to the next level, we have a training course carefully designed to fit your needs. With frequent introductory and advanced courses conducted live virtually and in-person or on-demand, we offer many opportunities for you to get the training experience that best suits your needs. Additionally, since our trainings are conducted by our in-house engineering and physics experts, we have the unique opportunity to carefully listen to your requirements and further refine our custom training materials to help you continually meet your goals.

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Thank-you for Watching!

Questions?