Tips and Tricks for Moldflow Experts!

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INSIGHT 2014

Class Summary

This class will be a live demonstration of some tips and tricks for Moldflow experts. We'll look at using some API tools. We'll also look at the use of constraints for warpage.

Key Learning Objectives

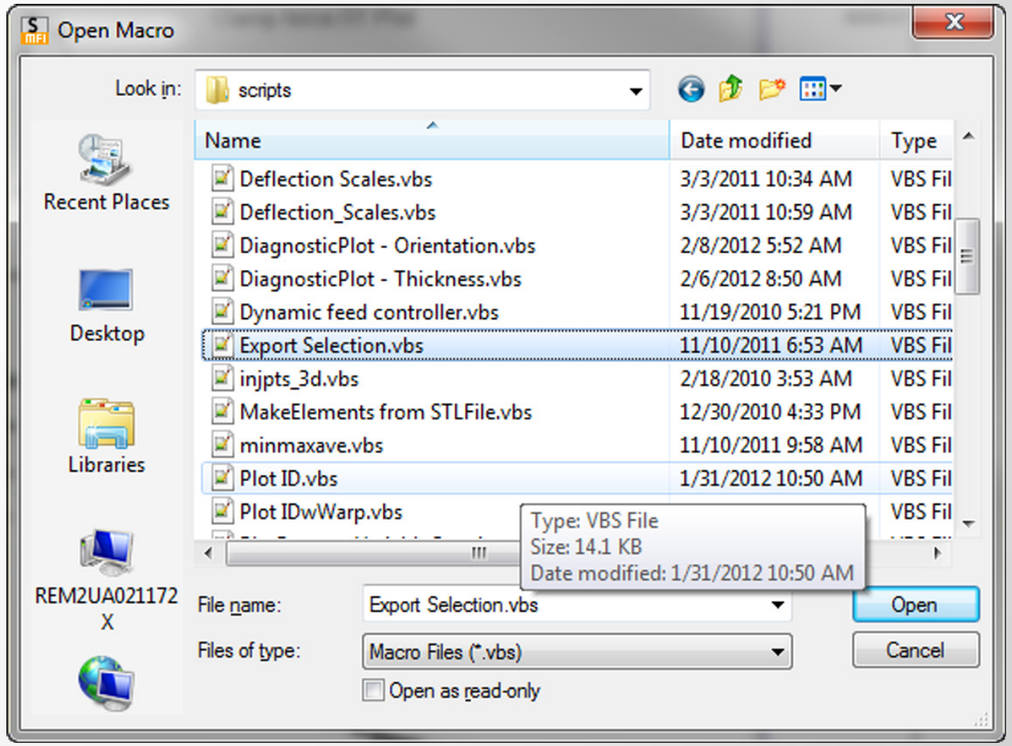
At the end of this class, you will be able to:

- Use API tools
- Understand Different Approaches to Comparing Warpage Results Using Anchors/Constraints
- Have Fun at Jay's expense

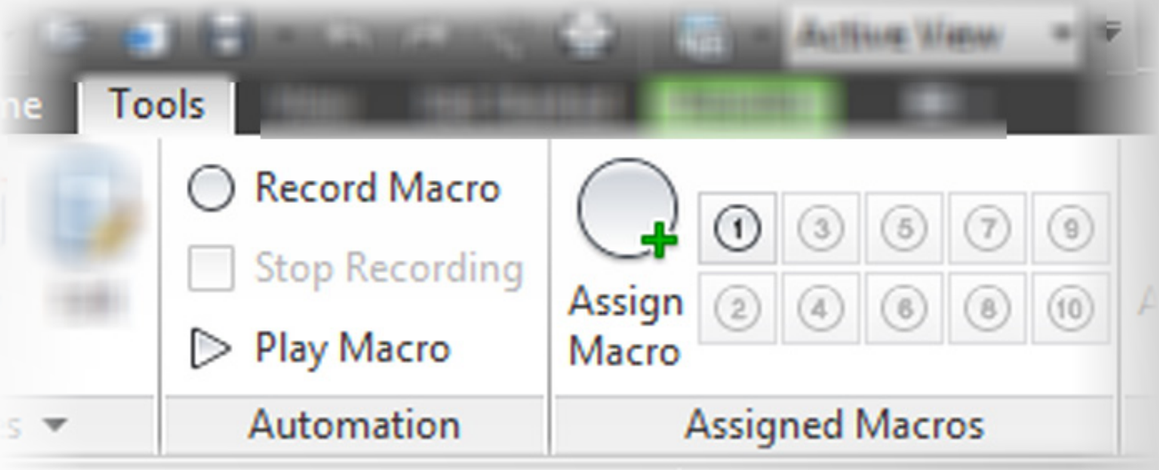
Using API Tools

API

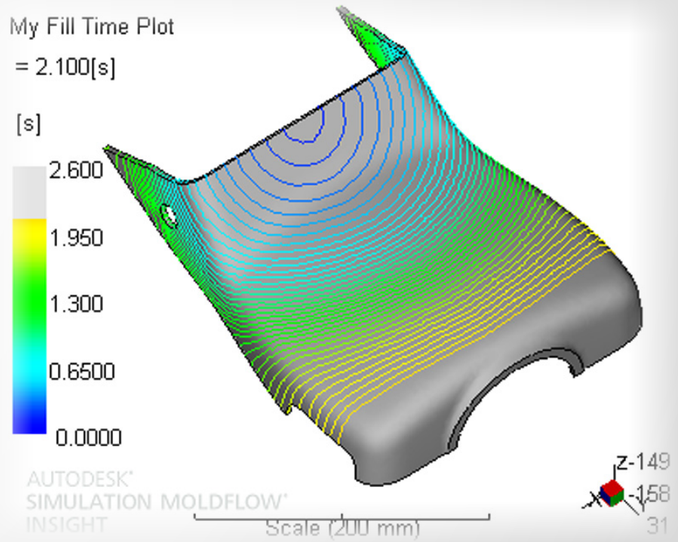
- The Application Programming Interface
  - An Object Linking and Embedding (OLE) programming interface
  - Enables functionality of Synergy to be automated
- Control Synergy commands by
  - Command line
  - Macros (scripts)
  - External programs such as Excel
- What can you do with the API?
  - Only limited by your imagination
    - Well almost!



Macros

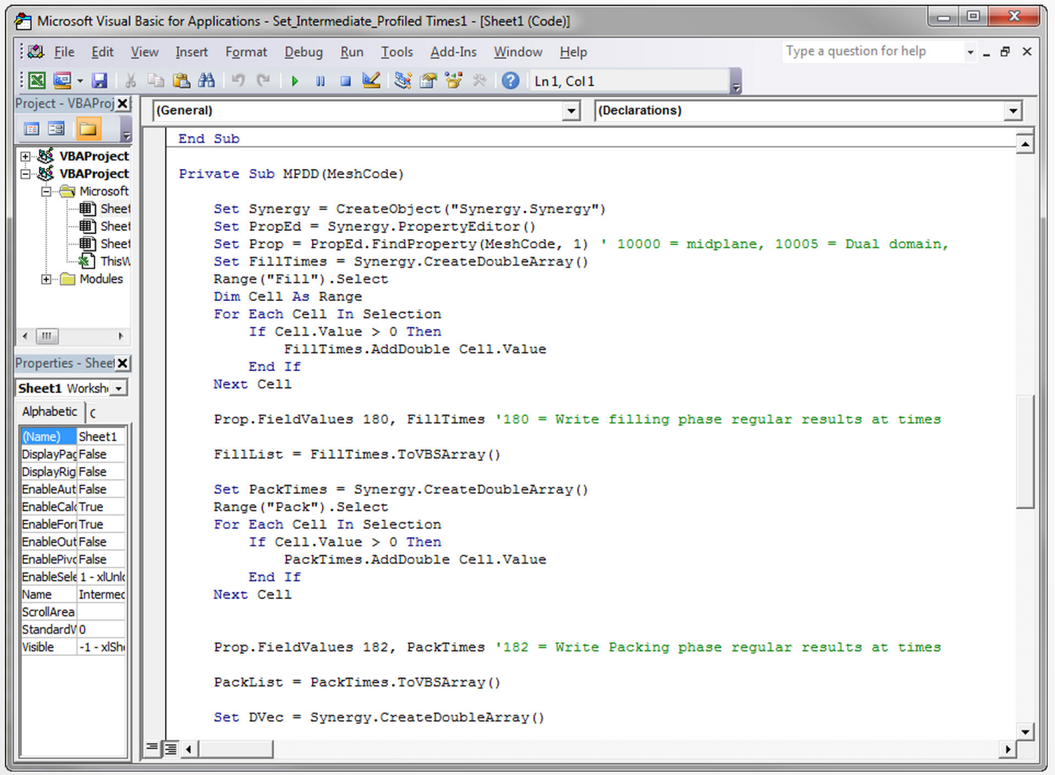


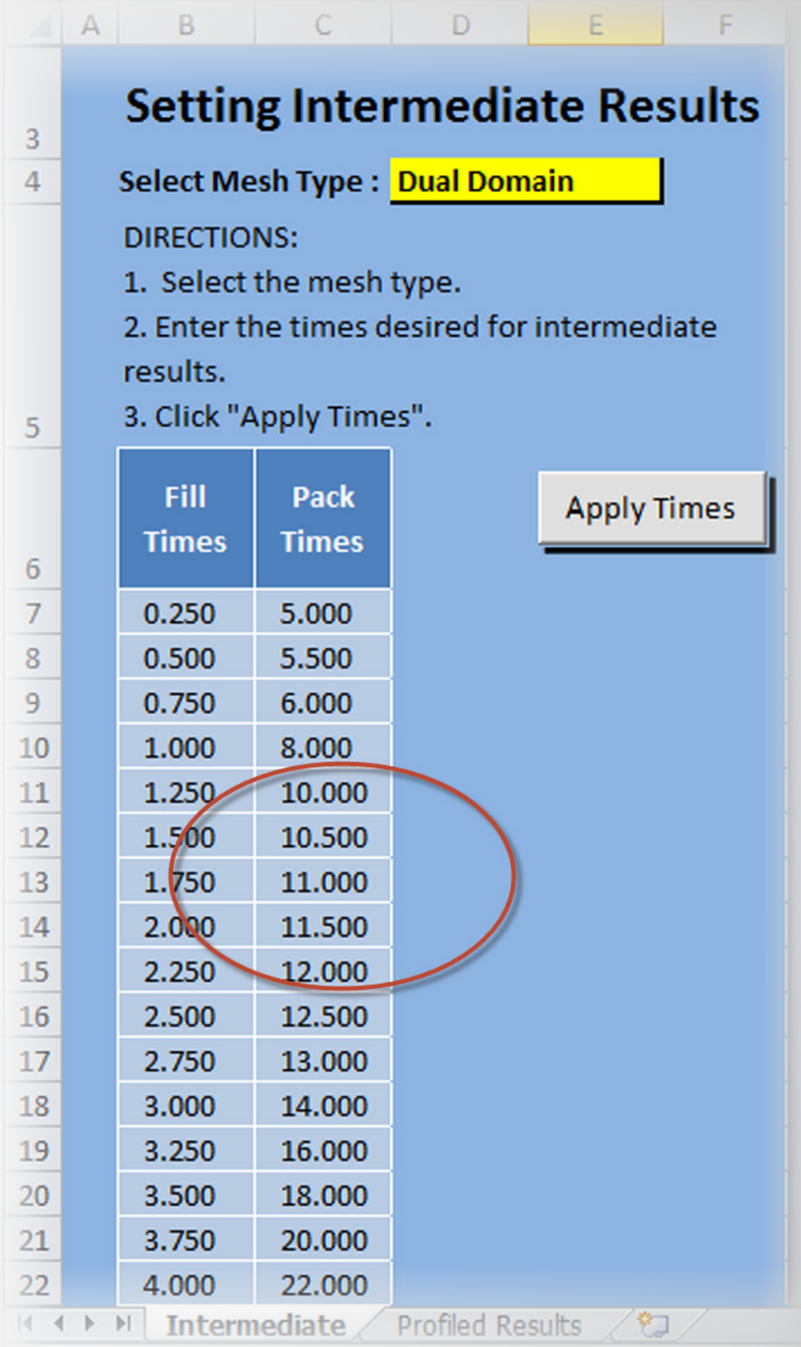
- Scripts manually executed
- Don’t have input at execution
- Default location of scripts
  - ..\My ASMI 2014 Projects\scripts
- Scripts can be in any folder
- Execute with Play Macro on Tools tab
- Can assign macros to a button for one click access



Macros in Other Applications

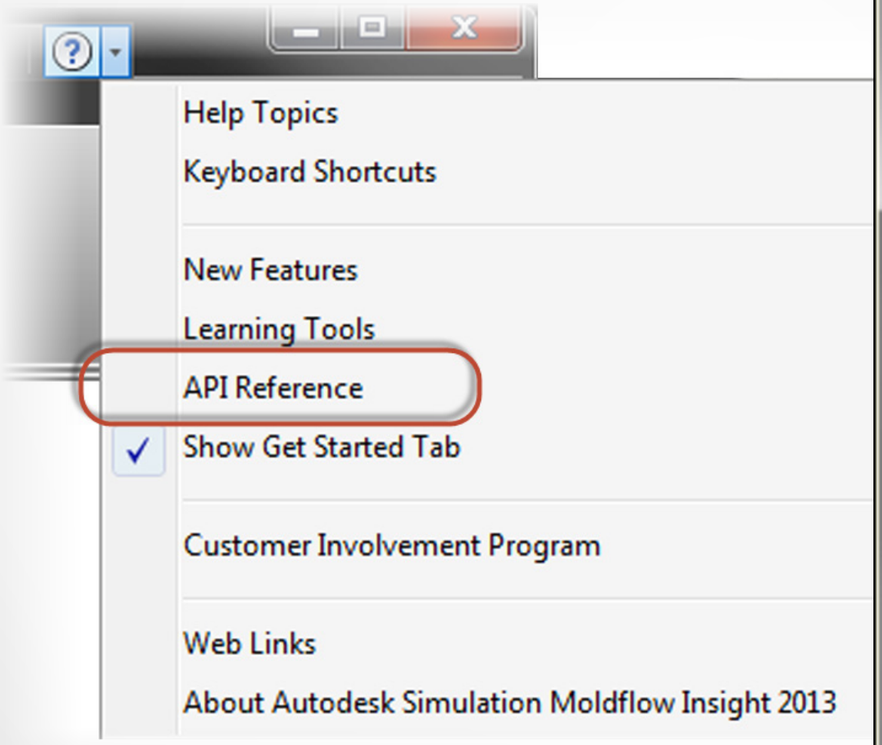
- Scripts written in Excel

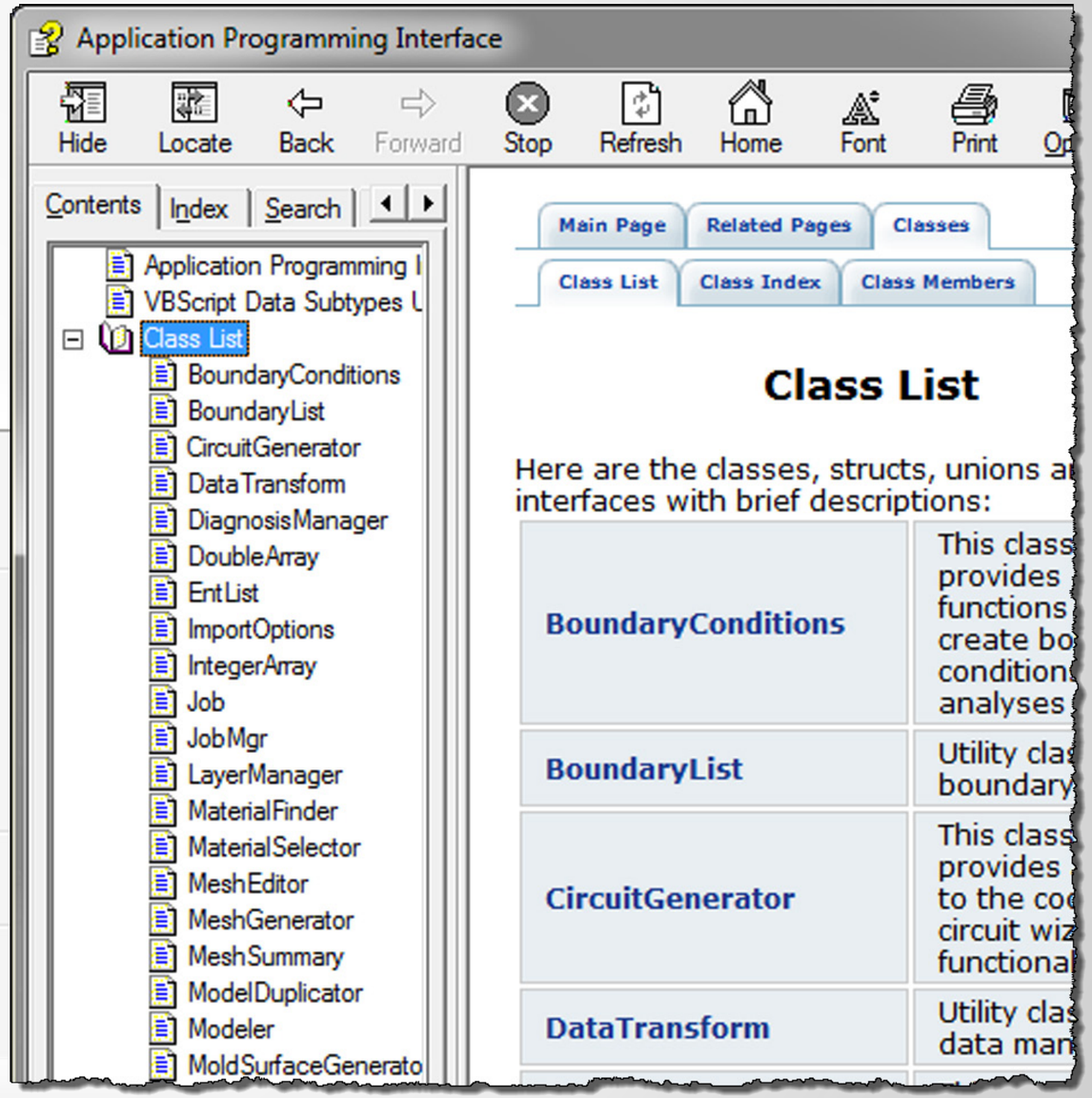




API Help

- API Reference
- Insight help contents - Application Programming Interface (API)





API/Script Examples

- XY Plot Creator
- Setting Intermediate Results
- Setting Result Properties
- Mesh Diagnostics as a Result

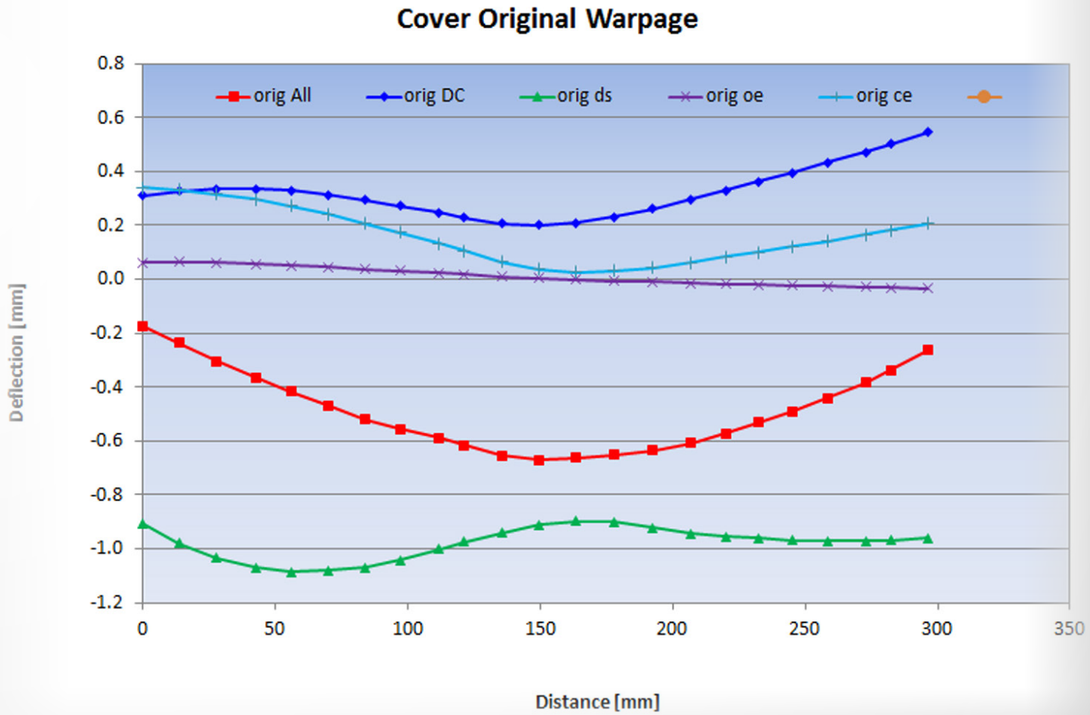
API: XY Plot Creator

- Excel file with macros make it easy to grab and compare XY data

Save XY Plot Text File | Import XY Plot Text File | Clear Data

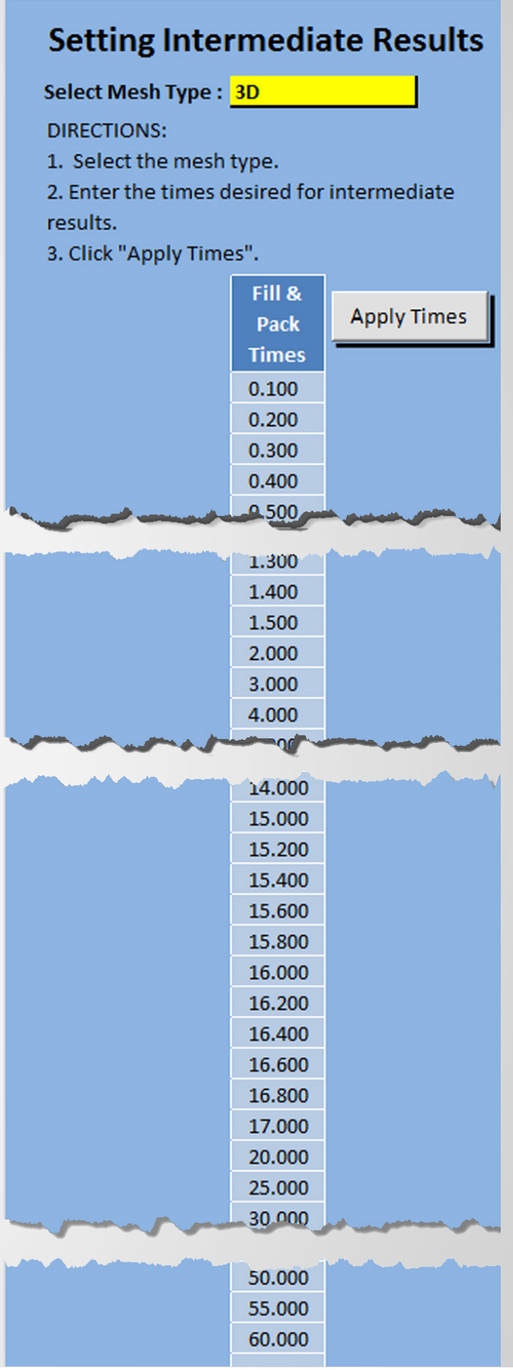
Start with cursor in a yellow cell for importing

Min	-0.670	Min	0.200	Min	-1.085	Min	-0.033	Min	0.028
Max	-0.173	Max	0.545	Max	-0.896	Max	0.064	Max	0.340
Diff	0.497	Diff	0.345	Diff	0.189	Diff	0.097	Diff	0.312
Std Dev	0.150	Std Dev	0.094	Std Dev	0.059	Std Dev	0.034	Std Dev	0.101
Avg	-0.484	Avg	0.324	Avg	-0.979	Avg	0.012	Avg	0.160
Dist [mm]	orig All	Dist [mm]	orig DC	Dist [mm]	orig ds	Dist [mm]	orig oe	Dist [mm]	orig ce
0.000	-0.173	0.000	0.311	0.000	-0.906	0.000	0.063	0.000	0.340
13.994	-0.237	13.994	0.327	13.994	-0.978	13.994	0.064	13.994	0.333
28.109	-0.304	28.109	0.335	28.109	-1.034	28.109	0.061	28.109	0.317
42.959	-0.365	42.959	0.335	42.959	-1.070	42.959	0.057	42.959	0.297
56.198	-0.416	56.198	0.329	56.198	-1.085	56.198	0.052	56.198	0.273
70.129	-0.467	70.129	0.313	70.129	-1.081	70.129	0.046	70.129	0.242
84.316	-0.519	84.316	0.293	84.316	-1.069	84.316	0.038	84.316	0.207
97.241	-0.554	97.241	0.273	97.241	-1.042	97.241	0.032	97.241	0.175
112.008	-0.589	112.008	0.248	112.008	-1.001	112.008	0.024	112.008	0.134
121.537	-0.616	121.537	0.230	121.537	-0.974	121.537	0.019	121.537	0.105
135.761	-0.654	135.761	0.208	135.761	-0.940	135.761	0.011	135.761	0.065



API: Setting Intermediate Results

- Excel spreadsheet
- Easy way to set intermediate times
- Useful for looking in greater detail at specific events
  - Gate freeze
  - Packing profile transitions
  - Weld line creation



API: Setting Result Properties (aka - Jay's Cool Tool)

- Mesh display
  - Background & feature lines
- Nodal Averaging
- Scaling
  - Normal
  - All Deflection plots at once
  - Banded & scaled plots
    - One for all deflection plots at once
  - Symmetric banded & scaled for deflection plots
- 3 bands within tolerance

Opaque Background and Feature Lines

Off All Plot	Off Active Plot	Off Trans 0	On Active Plot

Set Nodal Averaging Active Plot

Off	On

Simple Result Scale Active Plot

Maximum	0.380	Set Scale	Contour Line
Minimum	0.150	Reset Scale	Banding
Extended Color (T/F)	F		Shaded

Scale All Deflection Variants

Maximum	4.000	Set Scale
Minimum	-3.700	
Extended Color (T/F)	T	Reset Scale
Component	X	

Set Asymmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Maximum	84.000	Maximum	84.50
Minimum	33.000	Minimum	32.50
Difference	51.000		
Manually set increment	1	Half increment	0.500
Number of bands	51.00	Number of bands	52.0
Extended Color (T/F)	T	Orig Scale	Query Scale

Set Symmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Symmetric Value	15.000		
Maximum	15.000	Maximum	15.500
Minimum	-15.000	Minimum	-15.500
Difference	30.000		
Manually set increment	1	Half increment	0.500
Number of bands	30	Number of bands	31
Extended Color (T/F)	F		Set Scale

Set Asymmetric Banded Scale for All Deflection Variants

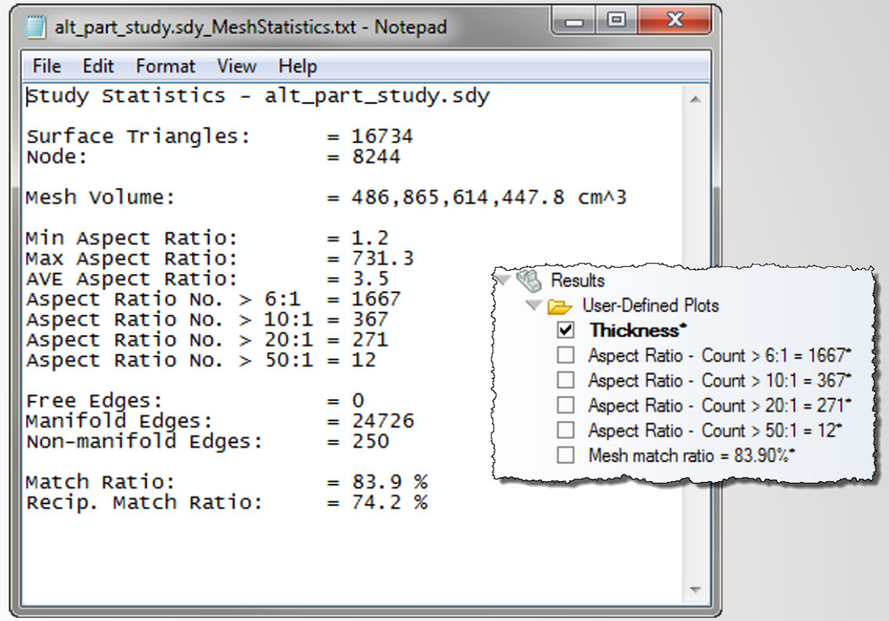
Original settings		Settings w even Query	
Maximum	0.800	Maximum	0.825
Minimum	-0.650	Minimum	-0.675
Difference	1.450		
Manually set increment	0.05	Half increment	0.025
Number of bands	29.00	Number of bands	30.0
Extended Color (T/F)	T	Set Scale	
Component	Z	Reset Scale	

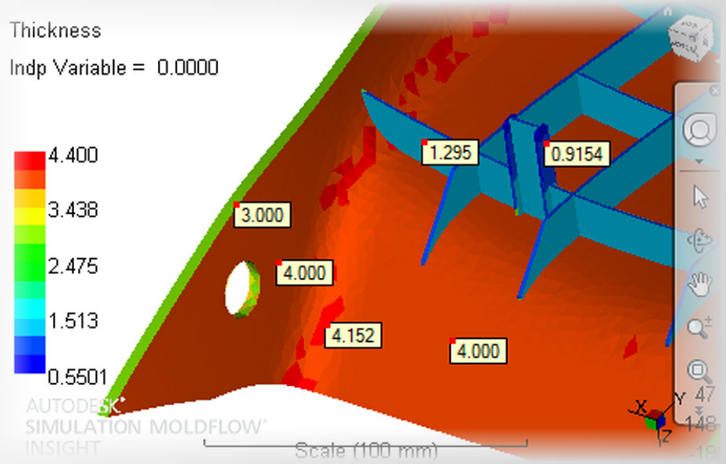
Show part within tolerance

Maximum	70.000	Set Tolerance	Reset Plot
Minimum	50.000		

Scripts: Mesh Diagnostics as a Result

- Checks a number of mesh diagnostics and outputs them as results
- Why would you use this?
  - To double check others work
    - New analysts
    - Out sourced work
    - Suppliers
  - To compare work on similar projects





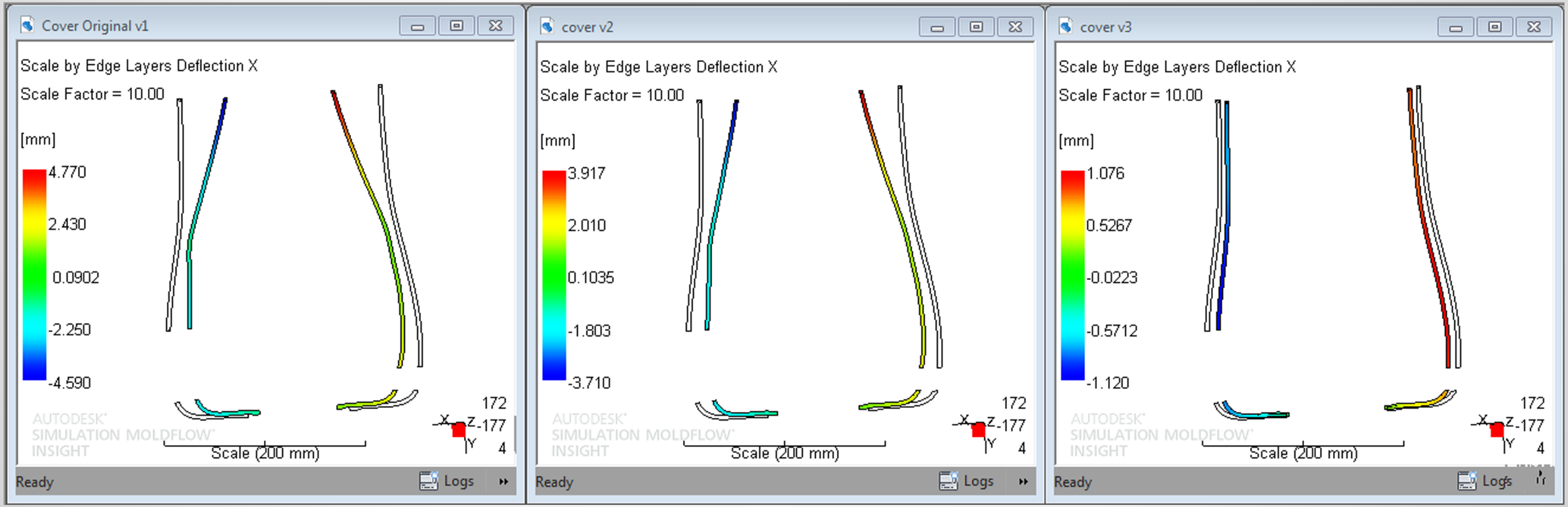
Different Approaches to Comparing Warpage Results

Different Approaches to Comparing Warpage Results

1. Use of layers
2. Free form/Best fit
3. Anchors
4. Local coordinate system
5. Cylindrical Coordinate system
6. Constraints in warpage analysis
7. Warp then “Stress” with post warpage constraints
8. External code for post warpage constraints

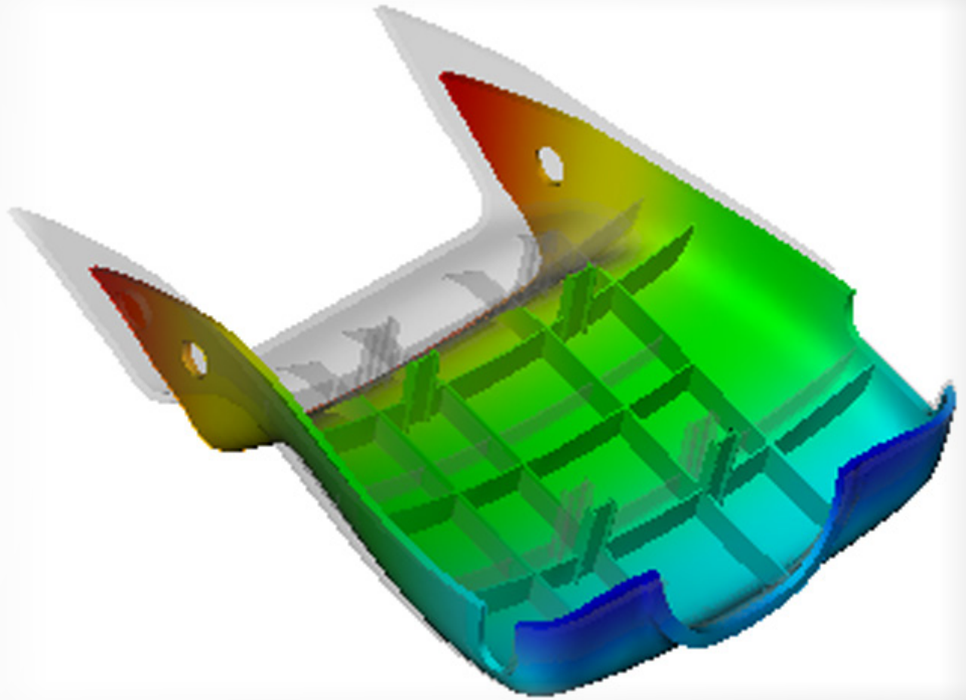
Different Approaches to Comparing Warpage Results

1. Use of layers
   - Easy to isolate a feature and is scaled by display



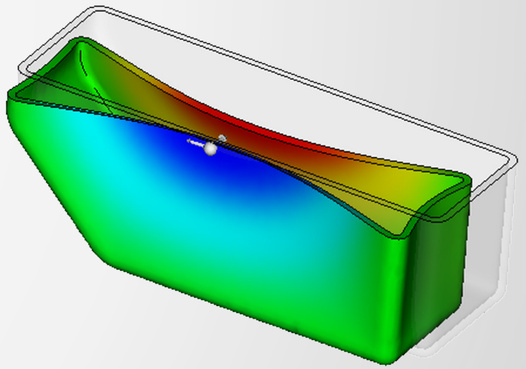
Different Approaches to Comparing Warpage Results

2. Free form/Best fit
   - Best fit all (default)
     - Will position part to reduce overall warpage
     - Good overall view
     - Not specific to any feature
   - Best fit nodes – edge, surface, etc
     - Good for isolating feature of interest
     - Good for cylindrical coordinate systems



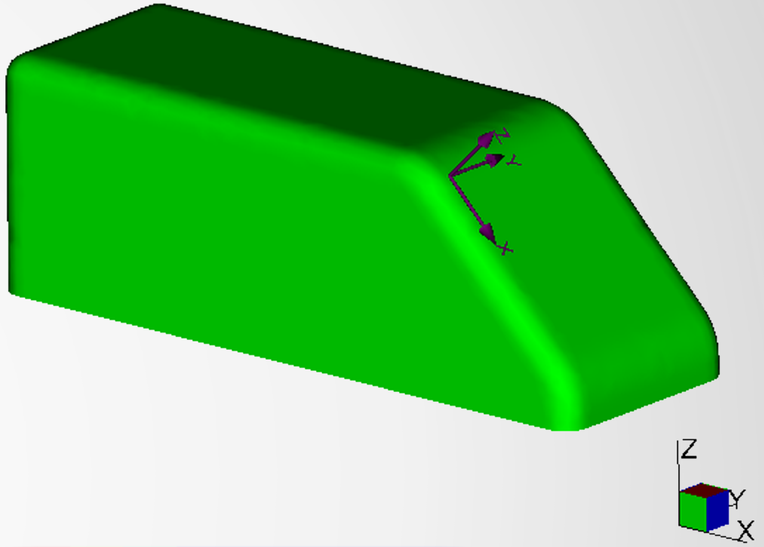
Different Approaches to Comparing Warpage Results

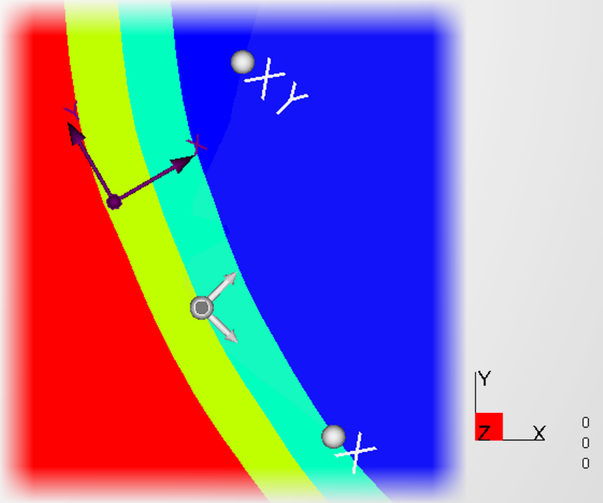
3. Anchors – Define the reference plane that the warpage will be measured against
   - What does 1 point do for you?
     - Keeps same global coordinate system, it just defines a common zero point
     - Doesn't fully define a reference plane
     - Still best fit in 3 axes, but common zero
   - 2 points?
     - Defines an X axis – good for a single direction
     - Not commonly used
   - 3 points?
     - Fully defined reference plane (no best fit)
     - Need to be careful where you pick, especially if those points warp



Different Approaches to Comparing Warpage Results

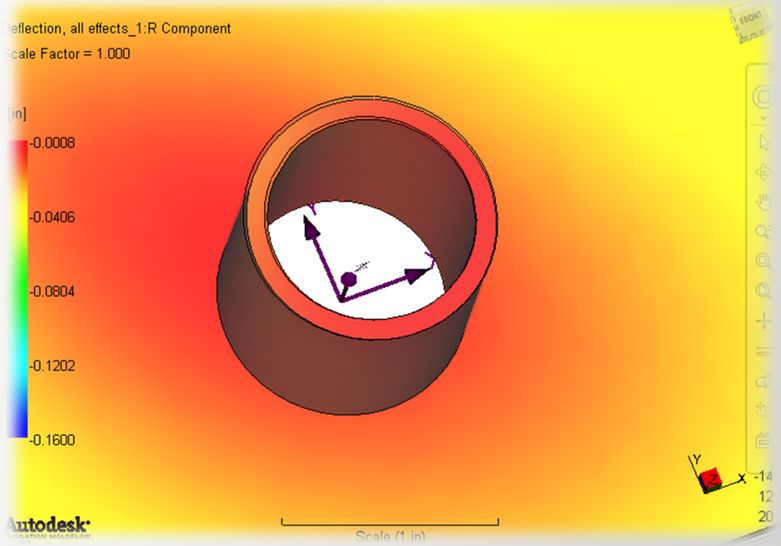
4. Local coordinate system
   - Use with features that are not aligned with the Global XYZ
   - LCS can be defined by any coordinates
     - They do not need to be on the part
   - Works with best fit or anchor(s)





Different Approaches to Comparing Warpage Results

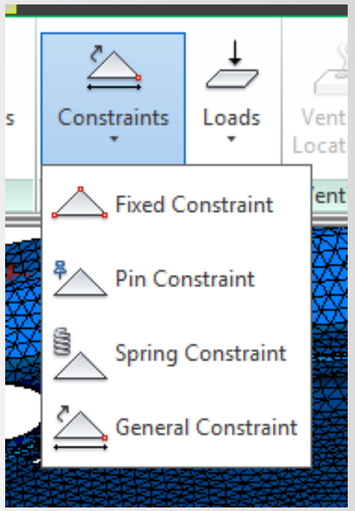
5. Cylindrical Coordinate System Workflow
   - Set deflection part with cylindrical coordinate system
   - Set magnitude/component to Radial component
   - Set reference coordinate system (center of feature)
     - Anchor - if center node available
     - LCS – if no center node available
       - Best fit selected nodes

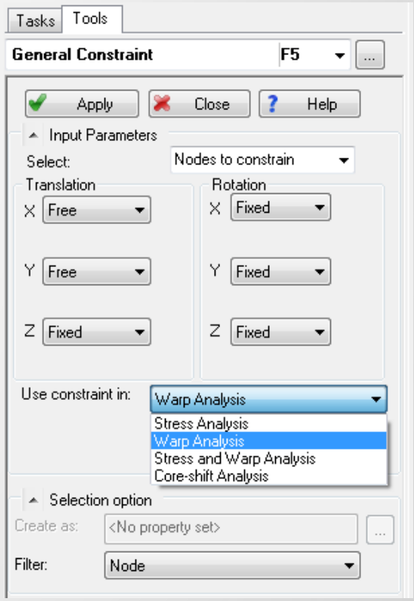


Different Approaches to Comparing Warpage Results

6. Constraints in warpage analysis

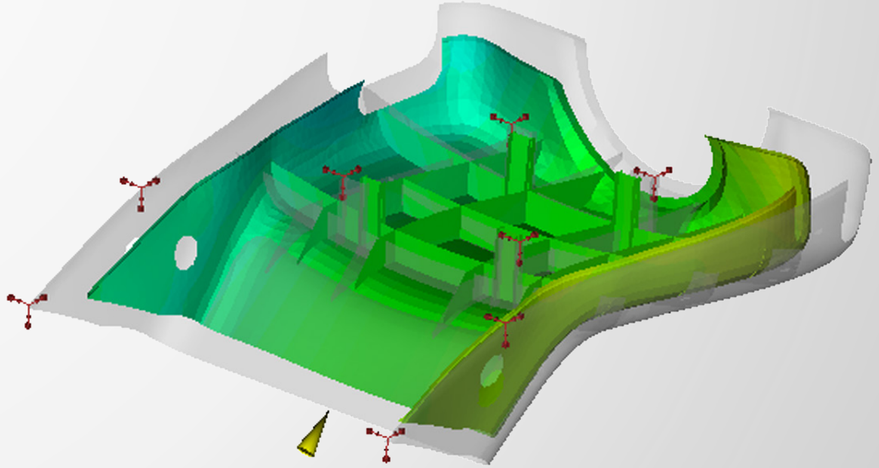
- Must apply before solve
- Can use to approximate attachment features
  - Not exactly correct, it's *pre-warp constraints*
- Considerations
  - Use General Constraints
    - Allows you to specify the DOF
  - Must constrain enough to prevent ridged body motion
  - Easy to over constrain preventing shrinkage





Different Approaches to Comparing Warpage Results

7. Warp then “Stress” with post warpage constraints
   - Requirements
     - Midplane model only
     - Requires a Premium license, (same as Warp)
   - Workflow
     - Run Warp analysis, get deflection values for desired nodes
     - Define deflections as displacement loads
       - Subtract shrinkage
     - Run Stress analysis



Different Approaches to Comparing Warpage Results

8. External code for post warpage constraints
   - In external structural software, you can add assemblies, constraints, contacts (sheet metal), etc.
   - Can export internal stress, fiber orientation, etc.

   - Direct export to Autodesk Simulation Mechanical
   - Export ANSYS & LS-Dyna via script
   - Universal export via .xml for export to other codes

Things To Consider When Choosing The Best Approach To Measure Warpage For Your Part

- Is part in design stage?
  - Is it an overall, keep warpage low request?
    - Could use best fit
    - Could use 1 anchor point
    - Could use 3 anchor points
  - Does it have critical dimensions that need to work
    - Use examine command, may use LCS or Anchors to make values orthogonal
- Are you measuring to match a part measurement from a gage or assembly?
  - The 3 anchor points can be good
  - Maybe constraints (pre or post warp) of attachment locations

Things To Consider When Choosing The Best Approach To Measure Warpage For Your Part

- Are the flatness of the attachment features more important than the total warp of the part?
  - Then use path plot with points at all attachment features will give you more useful results than standard All/XYZ plots (you'll still most likely want to use anchor points for consistency)

Everything beyond best fit takes more effort, but if done correctly will give a more precise answer. But will the extra effort help you to make a better decision?

Wish List for Fixturing Constraints Module in Moldflow

- Available for all 3 mesh types
- Constraint would be applied post warpage
- Ability to apply constraints all on, or in order (in order would have to run FEA for each constraint one at a time using results from 1st for input as 2nd.
- Ability to apply -Z only constraint (ie interference with sheet metal)
- Provide options to deal with shrinkage (auto exclude shrink, manual input, etc)

Questions?

Autodesk University Session Feedback

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- ✓ Attendees can complete the session survey on their mobile device, PC, or at a survey station.
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