

Ansys Tutorial 1: “What If” Study for Bracket

Overview

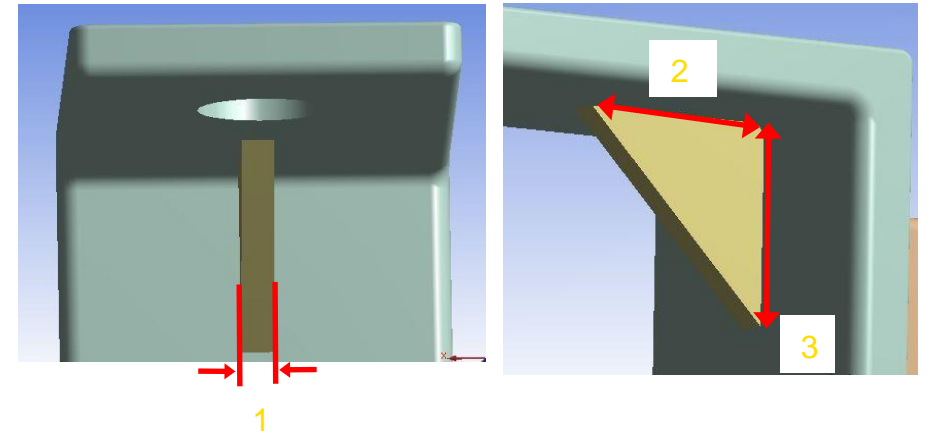
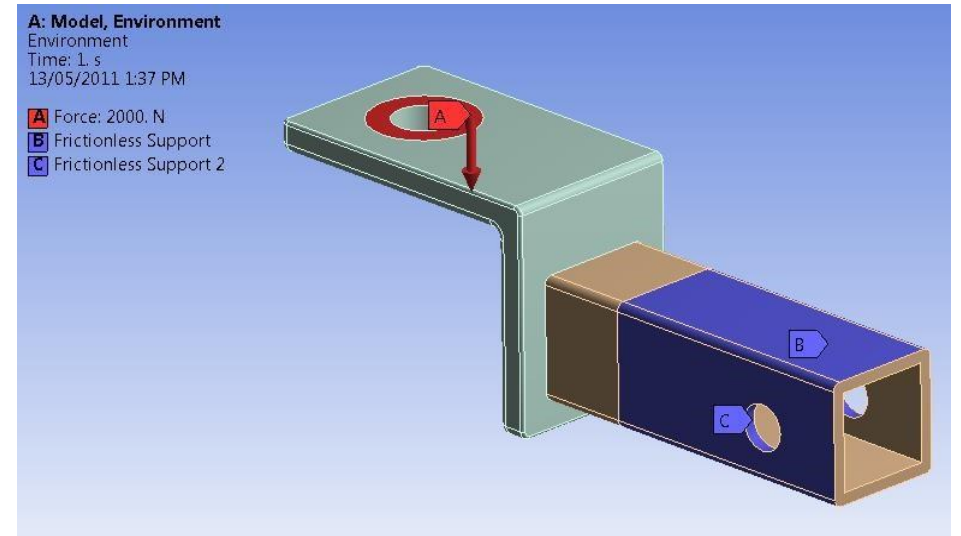
- **Goal**

- Using Parameter Manager to investigate the behavior of stress, mass, and deformation in the hitch receiver shown here as geometry parameters are changed during vertical loading

*[note: This workshop uses functionality inherent to WB.
A DX license is not required to complete this workshop]*

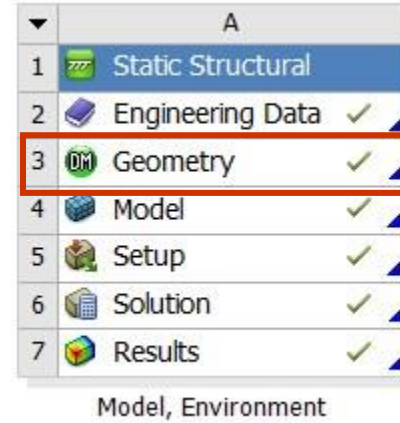
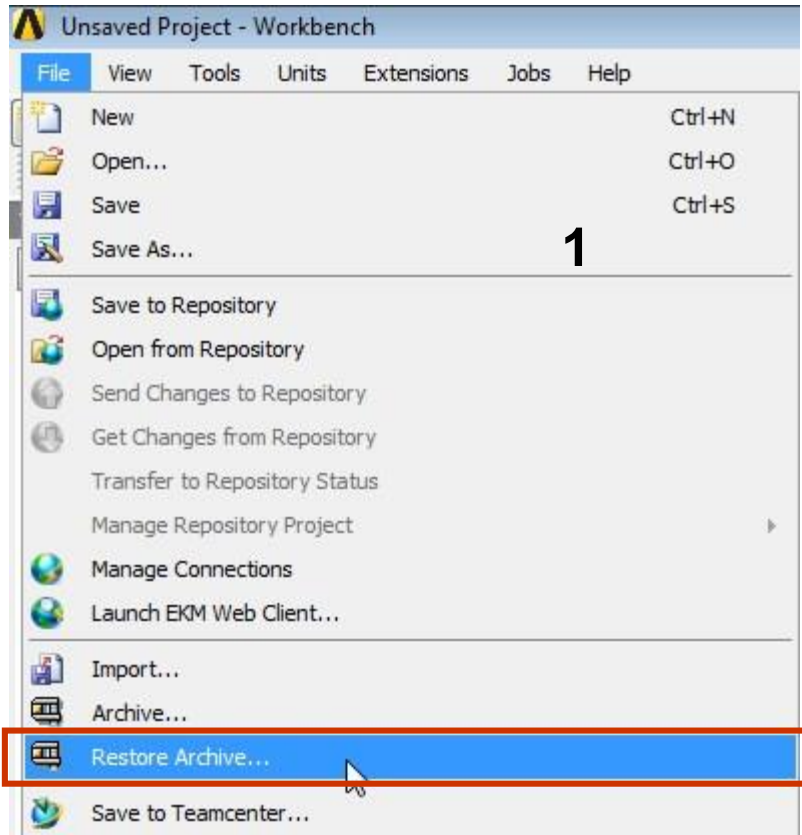
- **Model Description**

- The model is composed of a multibody part (3 bodies) created in DesignModeler. Constraints and loads are shown in the top figure
- The dimensions labeled 1, 2, and 3 in the bottom figures will be promoted to input parameters



Project Startup

1. File>Restore Archive >receiver.wbpz



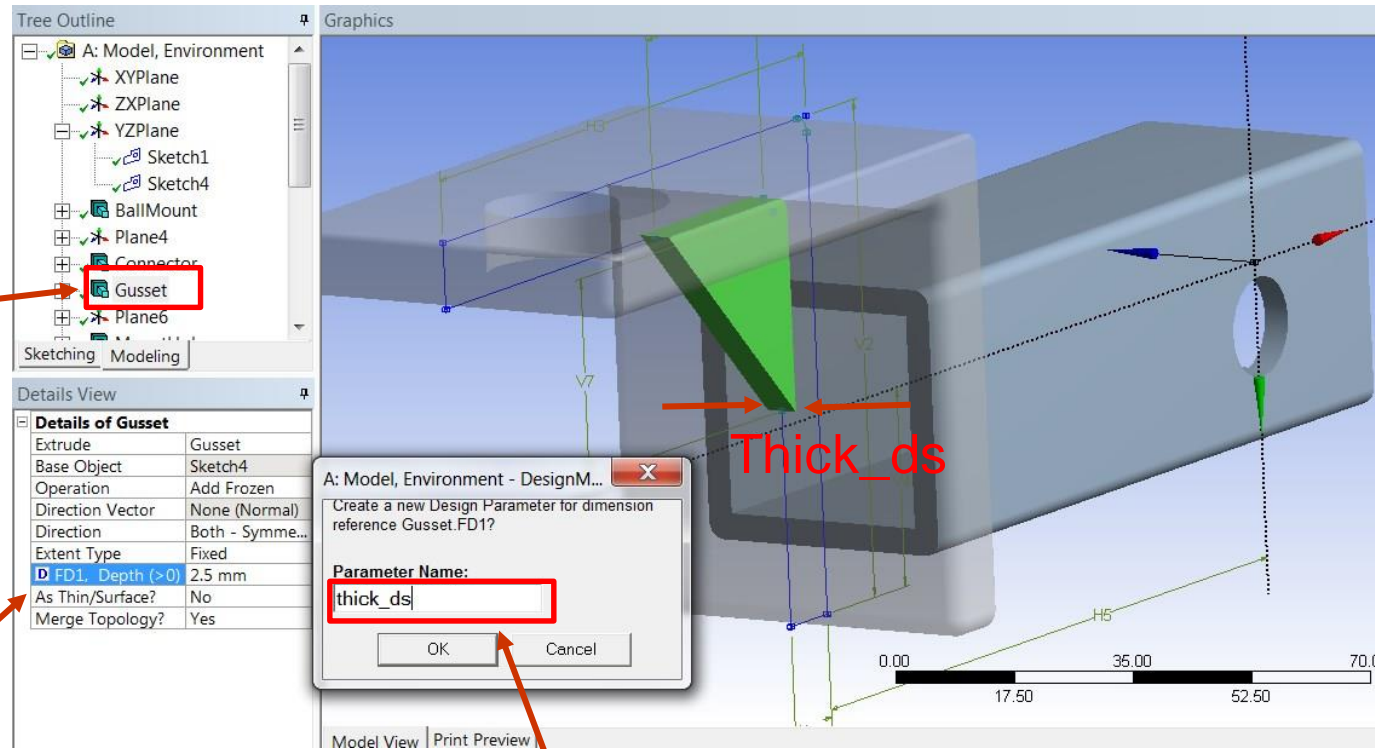
2. Double click on Geometry to promote dimensions to input parameters

Parameterize Project in DesignModeler

3. Click
"Gusset" in the
Tree Outline

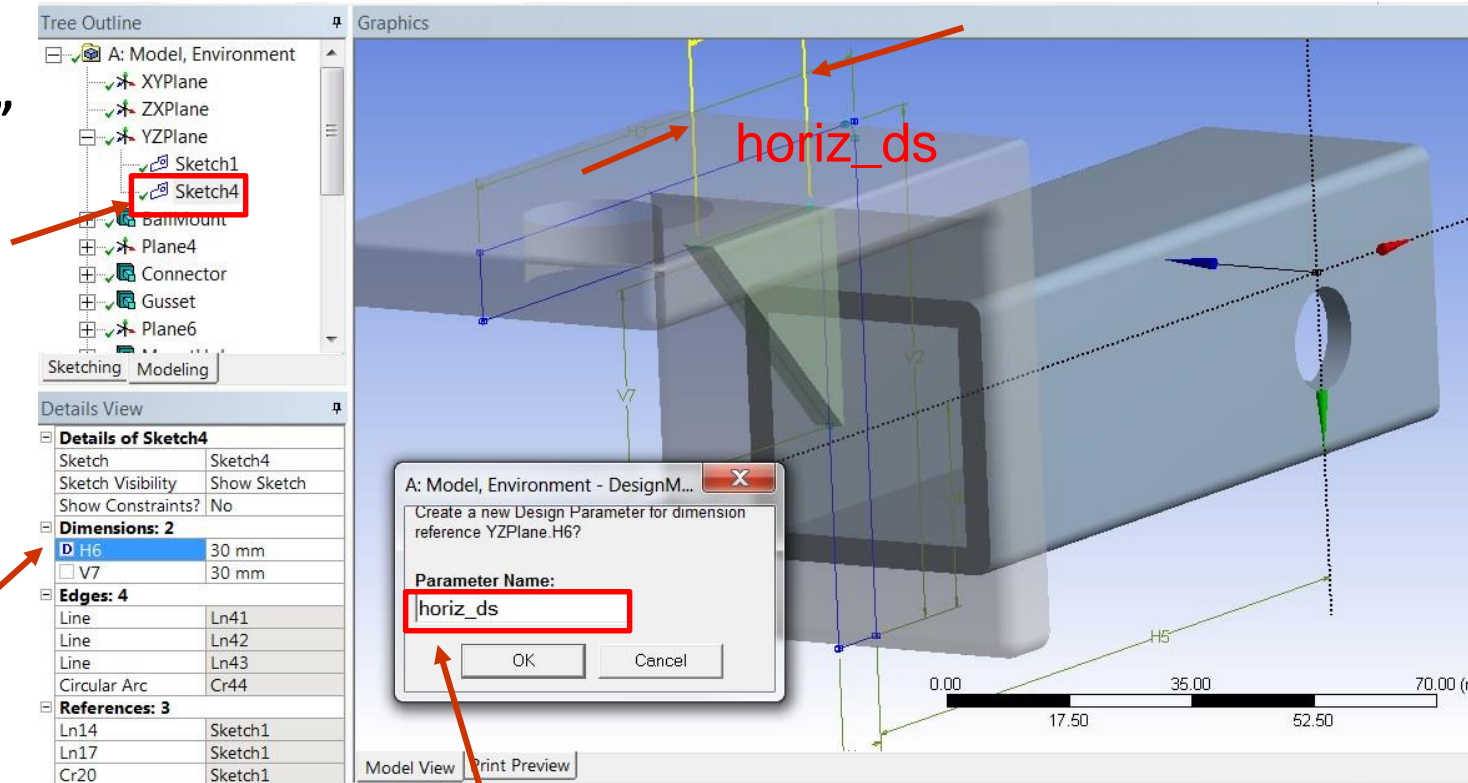
4. Check the
parameter box

5. Set parameter name to next to D1 "thick_ds" and click OK



Parameterize Project in DesignModeler

6. Click “Sketch4” under the YZPlane in the Tree Outline

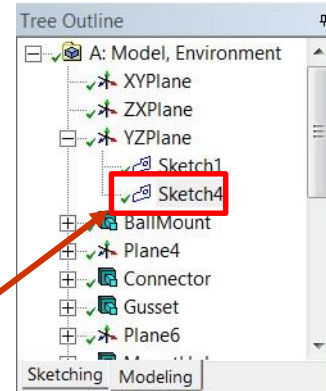


7. Check the parameter box next to H6

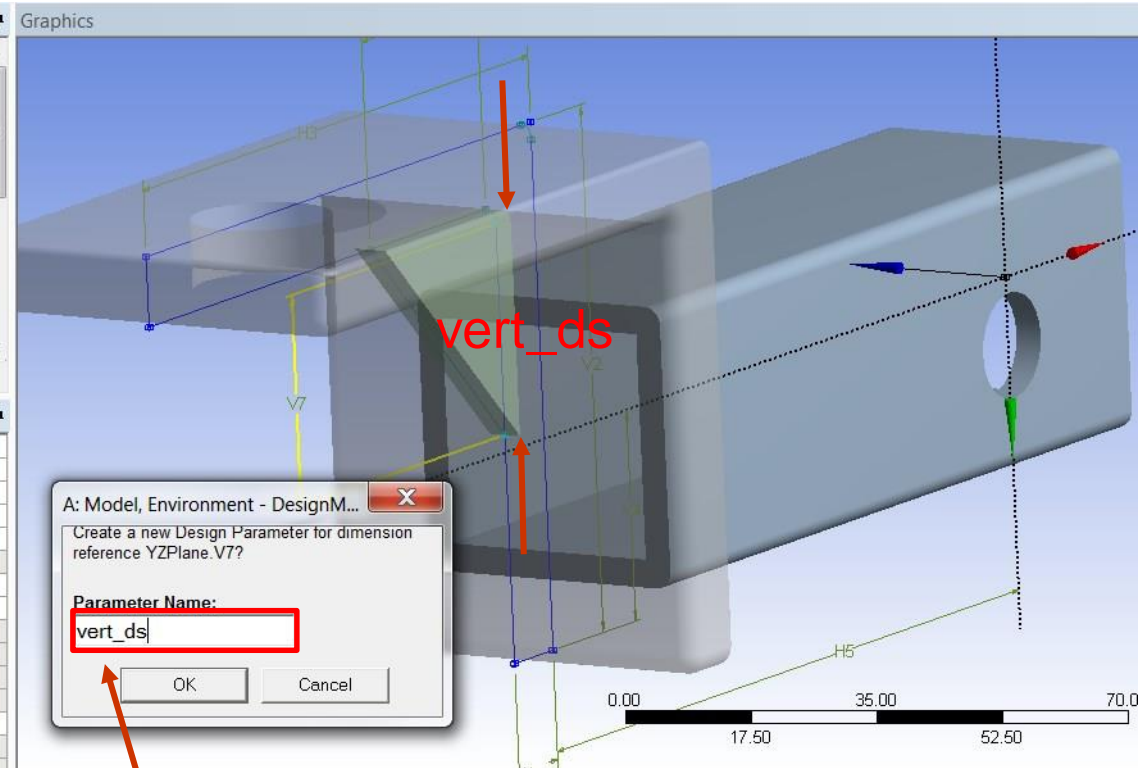
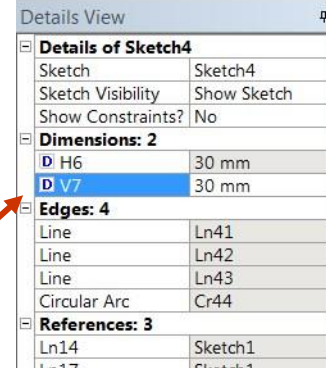
8. Set parameter name to “horiz_ds” and click OK

Parameterize Project in DesignModeler

9. Again, click “Sketch4” under the YZPlane in the Tree Outline

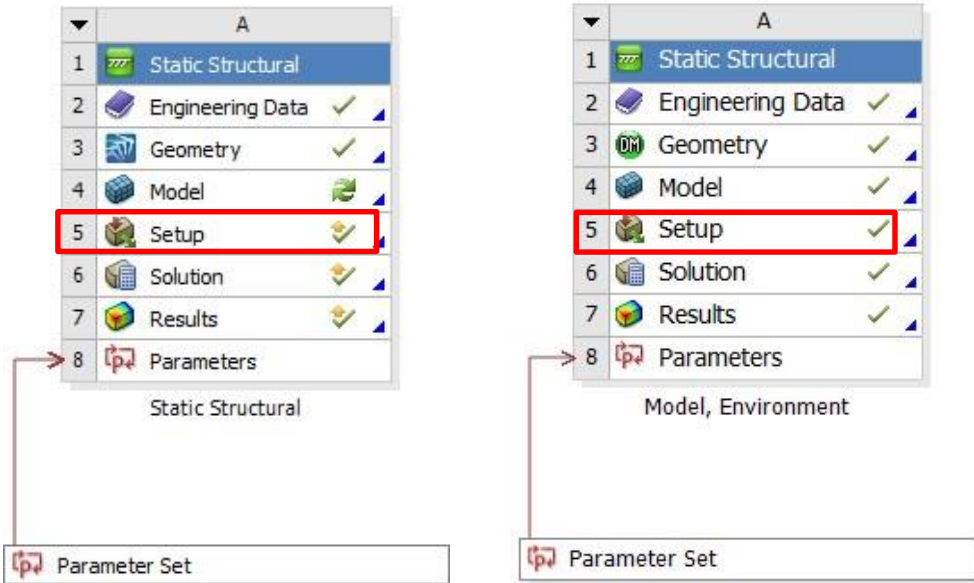


10. Check the parameter box next to V7



11. Set parameter name to “vert_ds” and click OK

Parameterize Project in Mechanical

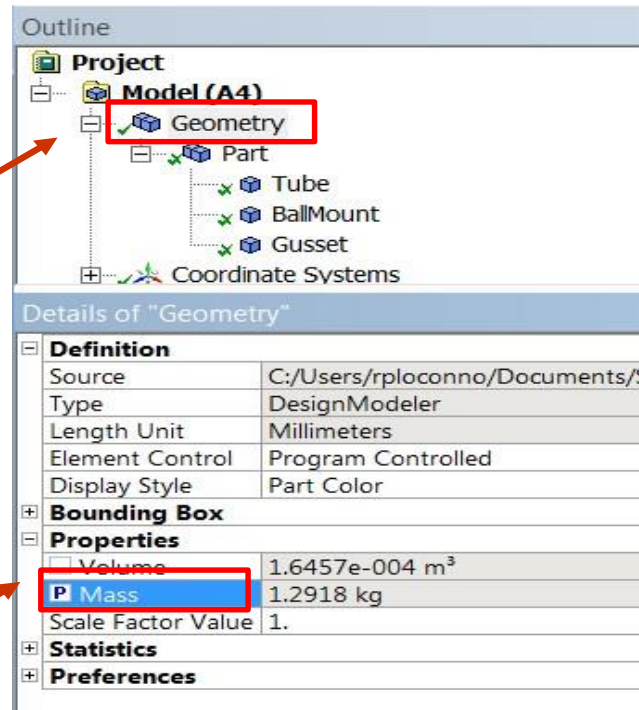


12. Return to the Workbench window. Notice that the Parameter Set bar is now present having an arrow leaving the Parameter Set bar and connected to cell A8. This indicates that input parameters have been defined

13. Double-click on the Setup cell

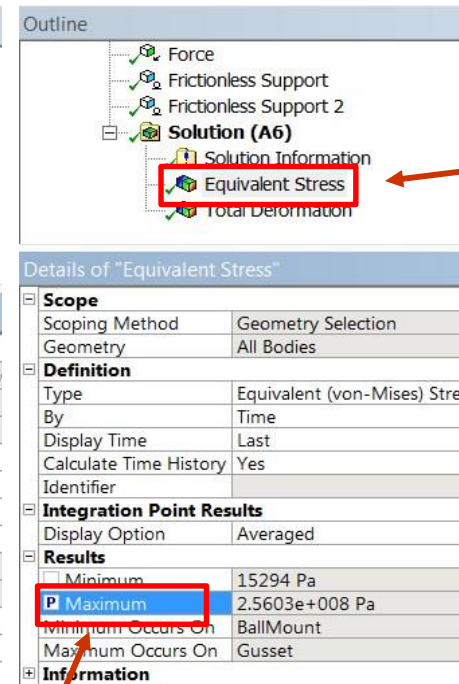
Parameterize Project in Mechanical

14. In the Tree Outline, click Geometry



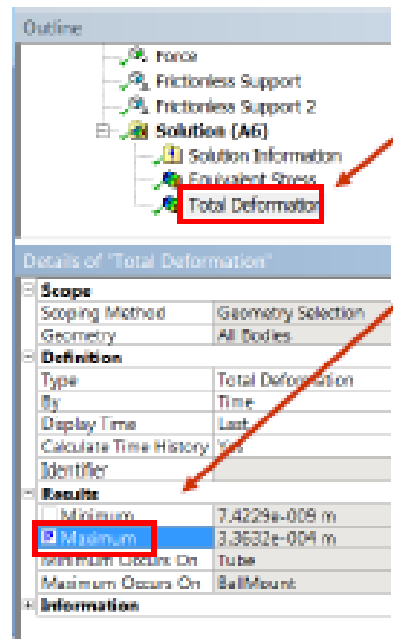
15. In the Details view, click the parameter box next to Mass to promote the mass to an output parameter

16. In the Tree Outline under Solution, click Equivalent Stress



17. In the Details view, click the parameter box next to Maximum to promote the Maximum Equivalent Stress to an output parameter

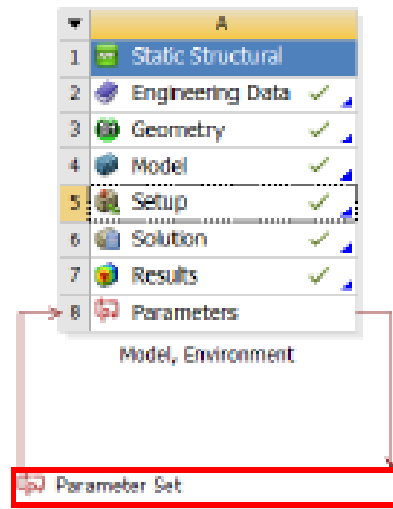
Parameterize Project in Mechanical



18. In the tree outline, click Total Deformation

19. In the Details view, click the parameter box next to Maximum to promote the Maximum Total Deformation to an output parameter

20. Return to the Workbench window. Notice that the Parameter Set bar is now present having an arrow leaving cell A8 bar and connected to Parameter Set bar. This indicates that output parameters have been defined



21. Double-click the Parameter Set bar

Conduct a What If study

22. Add the following 3 design points to the Table of Design Points

Table of Design Points										
	A	B	C	D	E	F	G	H	I	J
1	Name	P1 - thick_ds	P2 - horiz_ds	P3 - vert_ds	P4 - Geometry Mass	P5 - Equivalent Stress Maximum	P6 - Total Deformation Maximum	<input type="checkbox"/> Retain	Retained Data	Note
2	Units	mm	mm	mm	kg	Pa	m			
3	DP 0 (Current)	2.5	30	30	1.2918	2.5896E+08	0.00033775	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	DP 1	2.25	27	33	⚡	⚡	⚡	<input type="checkbox"/>		
5	DP 2	2.75	33	30	⚡	⚡	⚡	<input type="checkbox"/>		
6	DP 3	2.5	33	33	⚡	⚡	⚡	<input type="checkbox"/>		
*								<input type="checkbox"/>		

Values to enter if you are using DesignModeler

Table of Design Points										
	A	B	C	D	E	F	G	H	I	J
1	Name	P1 - thick_ds	P2 - horiz_ds	P3 - vert_ds	P4 - Geometry Mass	P5 - Equivalent Stress Maximum	P6 - Total Deformation Maximum	<input type="checkbox"/> Retain	Retained Data	Note
2	Units				kg	Pa	m			
3	DP 0 (Current)	3	32.5	32.5	1.2917	⚡	⚡	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	DP 1	4.5	29.5	35.5	⚡	⚡	⚡	<input type="checkbox"/>		
5	DP 2	5.5	35.5	32.5	⚡	⚡	⚡	<input type="checkbox"/>		
6	DP 3	5	35.5	35.5	⚡	⚡	⚡	<input type="checkbox"/>		
*								<input type="checkbox"/>		

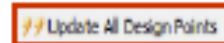
Values to enter if you are using SpaceClaim

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24. Click Show Progress in the Status Bar

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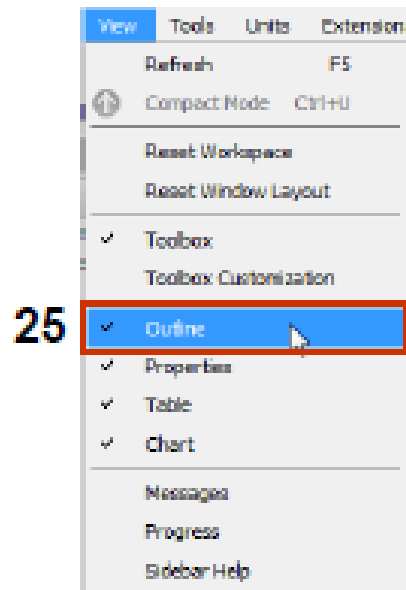
23. Update all Design Points

Progress		
	A	B
1	Status	Details
2	Updating the Model component in Model Environment for design point 1	Progress

Conduct a What If study

Table of all design points – results

Table of Design Points										
	A	B	C	D	E	F	G	H	I	J
1	Name	P1 - thick_ds	P2 - horiz_ds	P3 - vert_ds	P4 - Geometry Mass	P5 - Equivalent Stress Maximum	P6 - Total Deformation Maximum	Retain	Retained Data	Note
2	Units	mm	mm	mm	kg	Pa	m			
3	DP 0 (Current)	2.5	30	30	1.2918	2.8895E+08	0.00033775	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4	DP 1	2.23	27	33	1.2956	2.6935E+08	0.00034845	<input type="checkbox"/>		
5	DP 2	2.75	33	30	1.206	2.6346E+08	0.00033454	<input type="checkbox"/>		
6	DP 3	2.5	33	33	1.2958	2.2912E+08	0.00030385	<input type="checkbox"/>		
=								<input type="checkbox"/>		



25. Charts, Properties, Tables may not all be available by default, go to Main menu>View>Outline

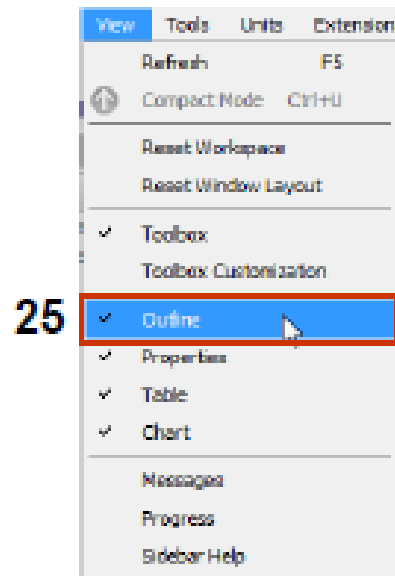
Note: you may have slight differences in the output parameters values if you are using SpaceClaim

Note: the rest of the screenshots are shown with the model using DesignModeler, if you are using SpaceClaim you may not have the same input parameters values but there is no change in the procedure

Conduct a What If study

Table of all design points – results

Table of Design Points										
	A	B	C	D	E	F	G	H	I	J
1	Name	P1 - thick_da	P2 - horiz_da	P3 - vert_da	P4 - Geometry Mass	P5 - Equivalent Stress Maximum	P6 - Total Deformation Maximum	Retain	Retained Date	Note
2	Units	mm	mm	mm	kg	Pa	m			
3	DP 0 (Current)	2.5	30	30	1.2918	2.5895E+08	0.00032775	<input checked="" type="checkbox"/>		✓
4	DP 1	2.25	27	33	1.2896	2.4935E+08	0.00034645	<input type="checkbox"/>		
5	DP 2	2.75	33	30	1.2965	2.6346E+08	0.00031454	<input type="checkbox"/>		
6	DP 3	2.5	33	33	1.2958	2.2912E+08	0.00030385	<input type="checkbox"/>		
*								<input type="checkbox"/>		



25. Charts, Properties, Tables may not all be available by default, go to Main menu>View>Outline

Note: you may have slight differences in the output parameters values if you are using SpaceClaim

Note: the rest of the screenshots are shown with the model using DesignModeler, if you are using SpaceClaim you may not have the same input parameters values but there is no change in the procedure

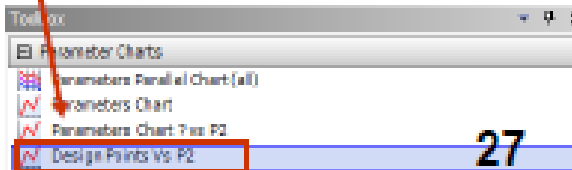
Conduct a What If study

26. Highlight parameter for Total Deformation Maximum in the Outline of all parameters

Outline of All Parameters				
	A	B	C	D
1	□	Parameter Name	Value	Unit
2	□	Input Parameters		
3	□	Model, Environment (A1)		
4	⊗	P1	thick	2.5
5	⊗	P2	vert_dis	30
6	⊗	P3	horiz_dis	30
7	⊗	New input parameter	New name	New expression
8	□	Output Parameters		
9	□	Model, Environment (A1)		
10	⊗	P1	Equivalent Stress Maximum	3.5602E+08 Pa
11	⊗	P2	Total Deformation Maximum	8.80832E-02 m
12	⊗	P3	Geometry Mass	1.2818 kg
13	⊗	New output parameter	New expression	
14	□	Charts		

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27. Double click on Design Point vs P2 to create a Chart

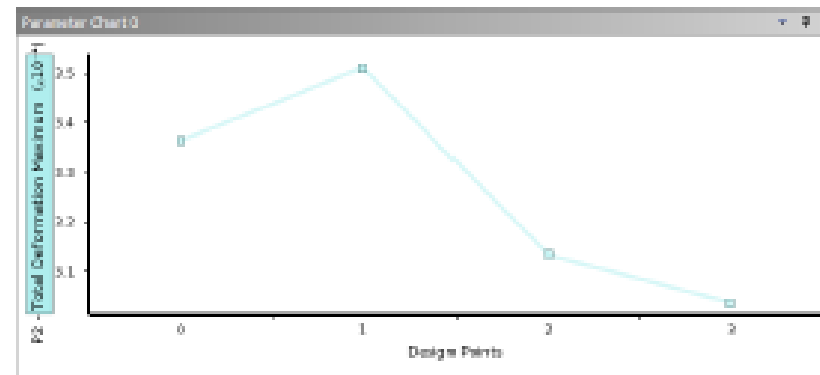


27

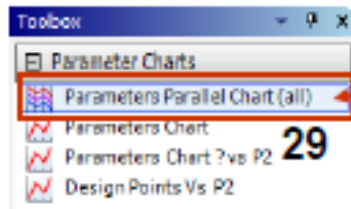
28. Select Parameter Chart 0 to view the created Chart

8	□	Output Parameters		
9	□	Model, Environment (A1)		
10	⊗	P1	Equivalent Stress Maximum	3.5602E+08 Pa
11	⊗	P2	Total Deformation Maximum	8.80832E-02 m
12	⊗	P3	Geometry Mass	1.2818 kg
13	⊗	New output parameter	New expression	
14	□	Charts		
15	□	Parameter Chart 0		

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Conduct a What If study

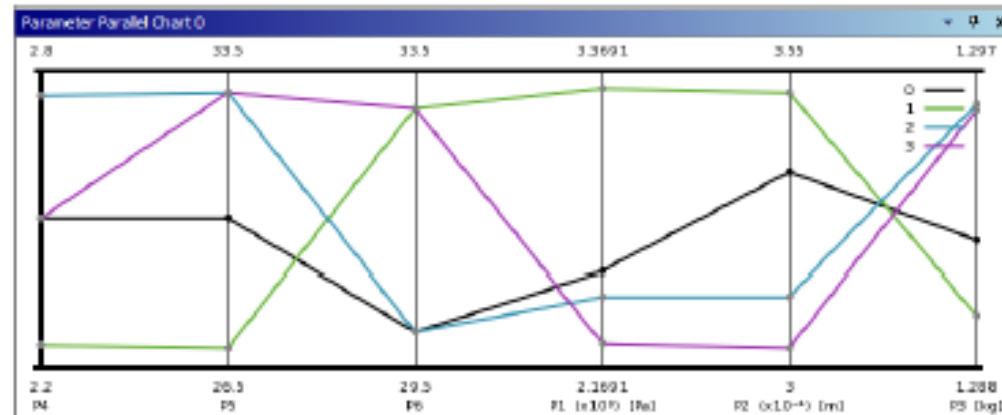


29. Double click on Parameters Parallel Chart (all)

The screenshot shows a table titled 'Outline of All Parameters'. The table has columns for ID, Parameter Name, Value, and Unit. The row 'Parameter Parallel Chart 0' is highlighted with a red box and a red arrow pointing to it. A large number '29' is overlaid on the left side of the table.

ID	Parameter Name	Value	Unit
1			
2	Input Parameters		
3	Model, Environment (A1)		
4	P4	thk_db	2.5
5	P5	vert_db	30
6	P5	horiz_db	30
*	New input parameter	New name	New expression
8	Output Parameters		
9	Model, Environment (A1)		
10	P1	Equivalent Stress Maximum	2.9603E+08 Pa
11	P2	Total Deformation Maximum	8.09032632 m
12	P3	Geometry P120	1.2918 kg
*	New output parameter	New expression	
14	Charts		
15	Parameter Parallel Chart 0		
15	Parameter Chart 0		

Top and bottom values on the chart indicate the range relative to each parameter

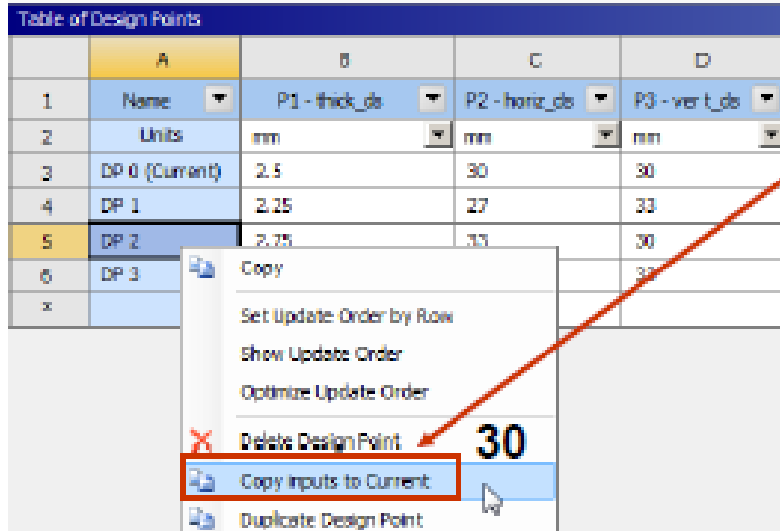


Each color coded line on the plot represents one of the design points. Individual parameters are displayed along the bottom of the chart

Conduct a What If study

Table of Design Points

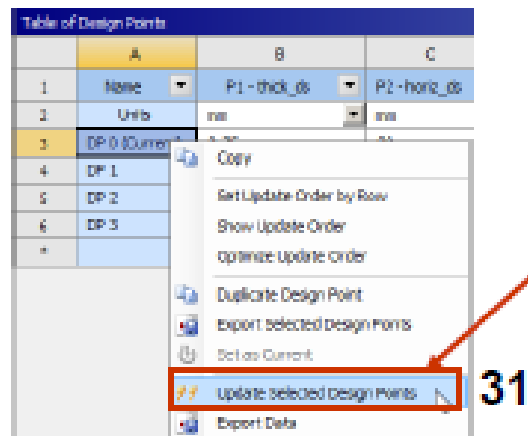
	A	B	C	D
1	Name	P1 - thick_db	P2 - horiz_db	P3 - vert_db
2	Units	mm	mm	mm
3	DP 0 (Current)	2.5	30	30
4	DP 1	2.25	27	33
5	DP 2	2.25	33	30
6	DP 3			33
*				



30. Copy design point DP2 to Current by clicking RMB on DP 2 and selecting “Copy inputs to Current”, notice how current changes

Table of Design Points

	A	B	C
1	Name	P1 - thick_db	P2 - horiz_db
2	Units	mm	mm
3	DP 0 (Current)		
4	DP 1		
5	DP 2		
6	DP 3		
*			



31. RMB on Current and select “Update Selected Design Points”

Model Review

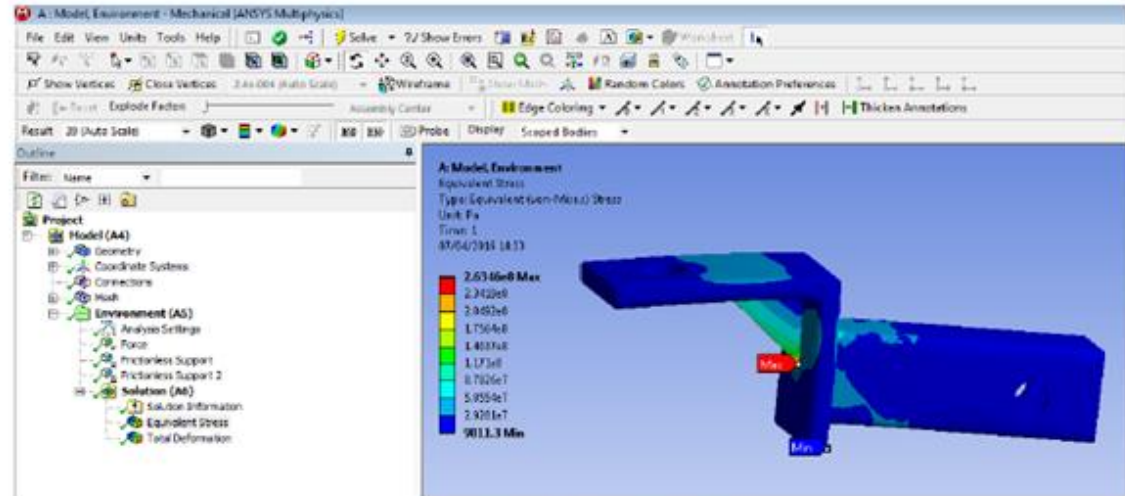
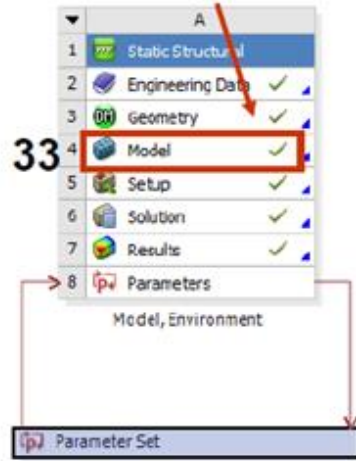
Solution for the current design point

1	Name	P1 - thick_ds	P2 - horiz_ds	P3 - vert_ds	P4 - Geometry Mass	P5 - Equivalent Stress Maximum	P6 - Total Deformation Maximum	Retain	Retained Data
2	Units	mm	mm	mm	kg	Pa	m		
3	DP 0 (Current)	2.75	33	30	1.296	2.6346E+08	0.00031454	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



32. Switch to the Project tab

33. Double click on Model



Check the results