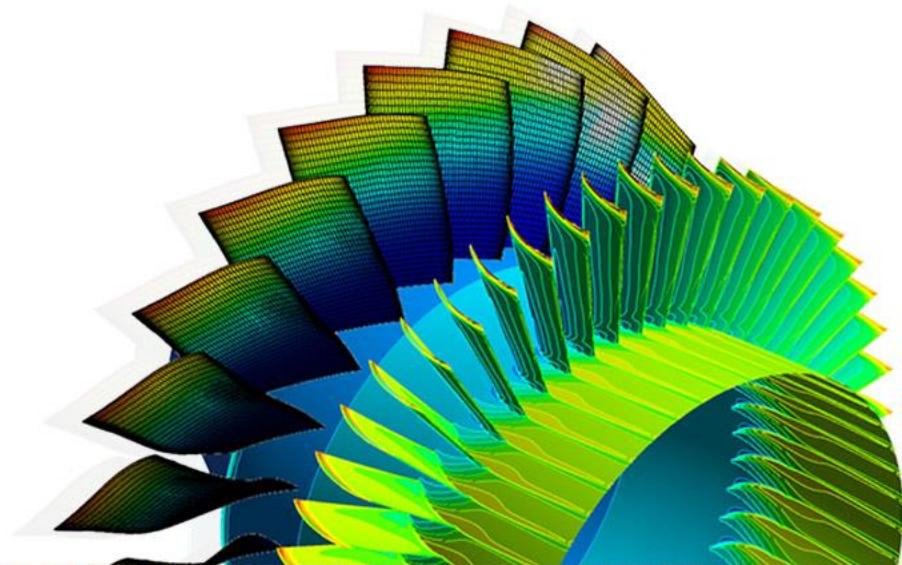




ANSYS Composite PrepPost 19.0

Workshop 08.1 – Parameters in ANSYS Composite PrepPost



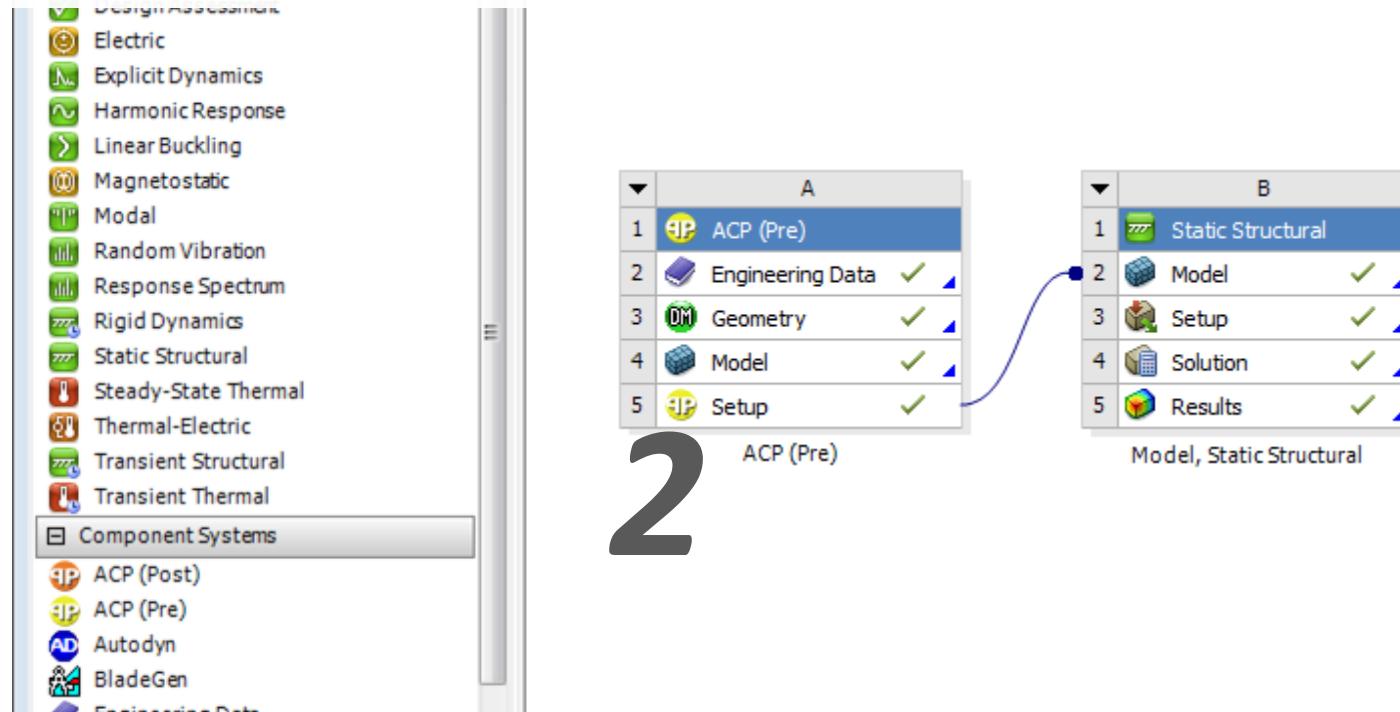
9. Workshop Parameters in ANSYS Composite PrepPost

Agenda

- Define input parameters for the ply angle of all six defined plies
- Solve the model and define output parameter for bending and torsion stiffness of the model
- Define output parameter for composite specific failure evaluation
- Specify design variations in ANSYS Workbench and update all design points

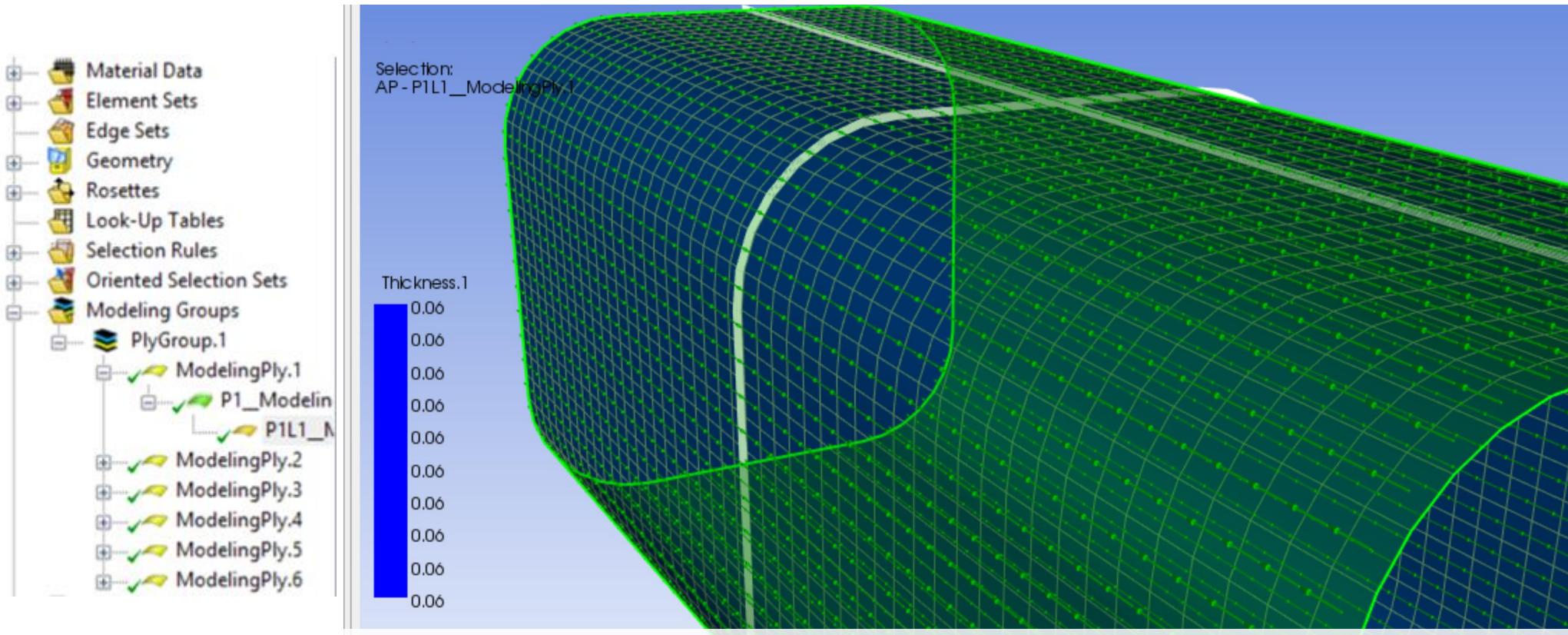
9. Workshop Parameters in ANSYS Composite PrepPost

Start ANSYS Workbench and Restore Archive



1. Start ANSYS Workbench and restore Archive
Parameters_in_ACP_FROM_START_19.0.wbpz
2. Open ANSYS Composite PrepPost Model (ACP Pre)

9. Workshop Parameters in ANSYS Composite PrepPost



- The composite layup for the model is already defined.
- Six plies have been defined. In the current design point they all have a zero degree fiber angle.

9. Workshop Parameters in ANSYS Composite PrepPost

- In the next step we will add input parameter for the fiber angles of all plies:

Input
Parameter

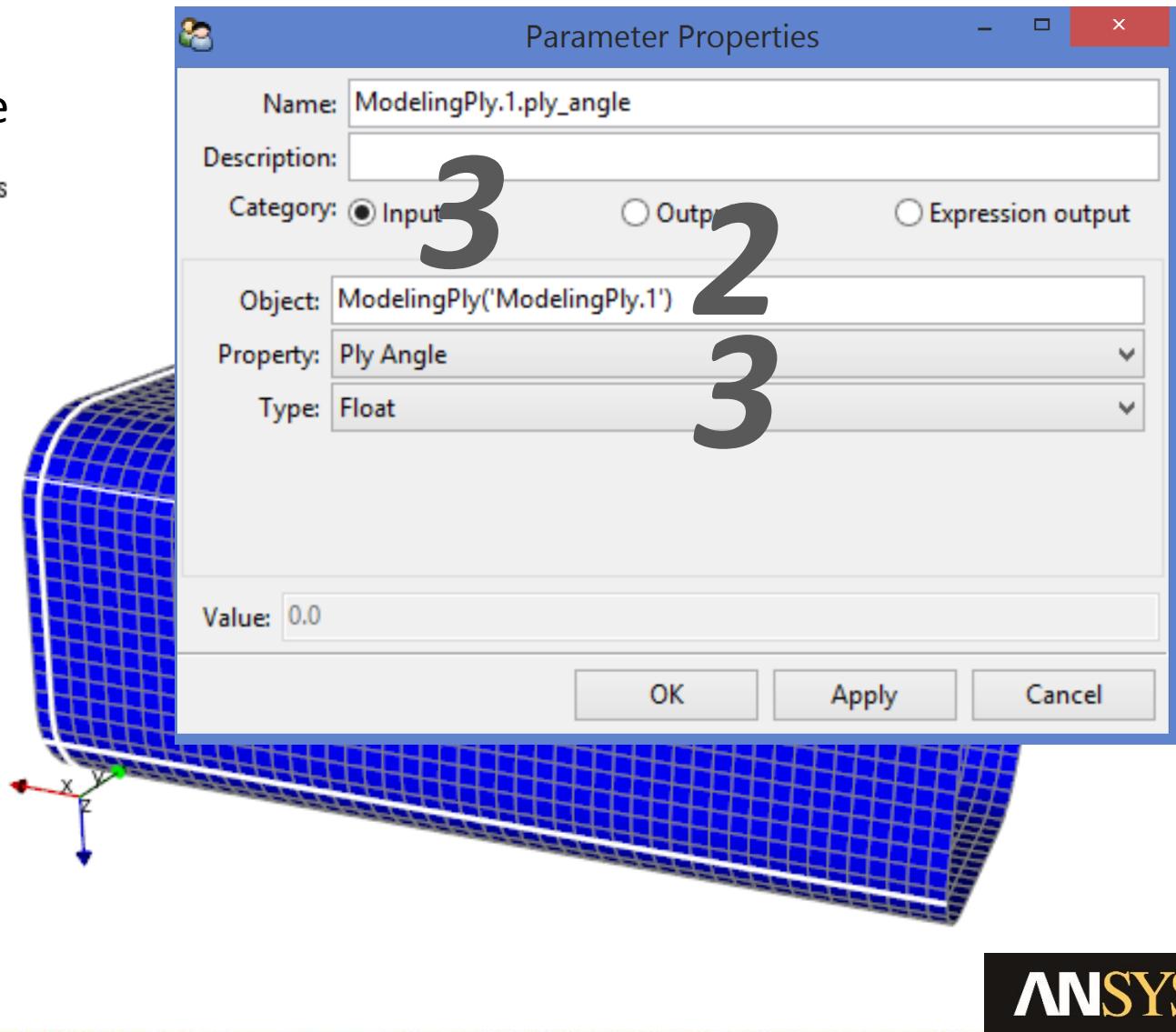
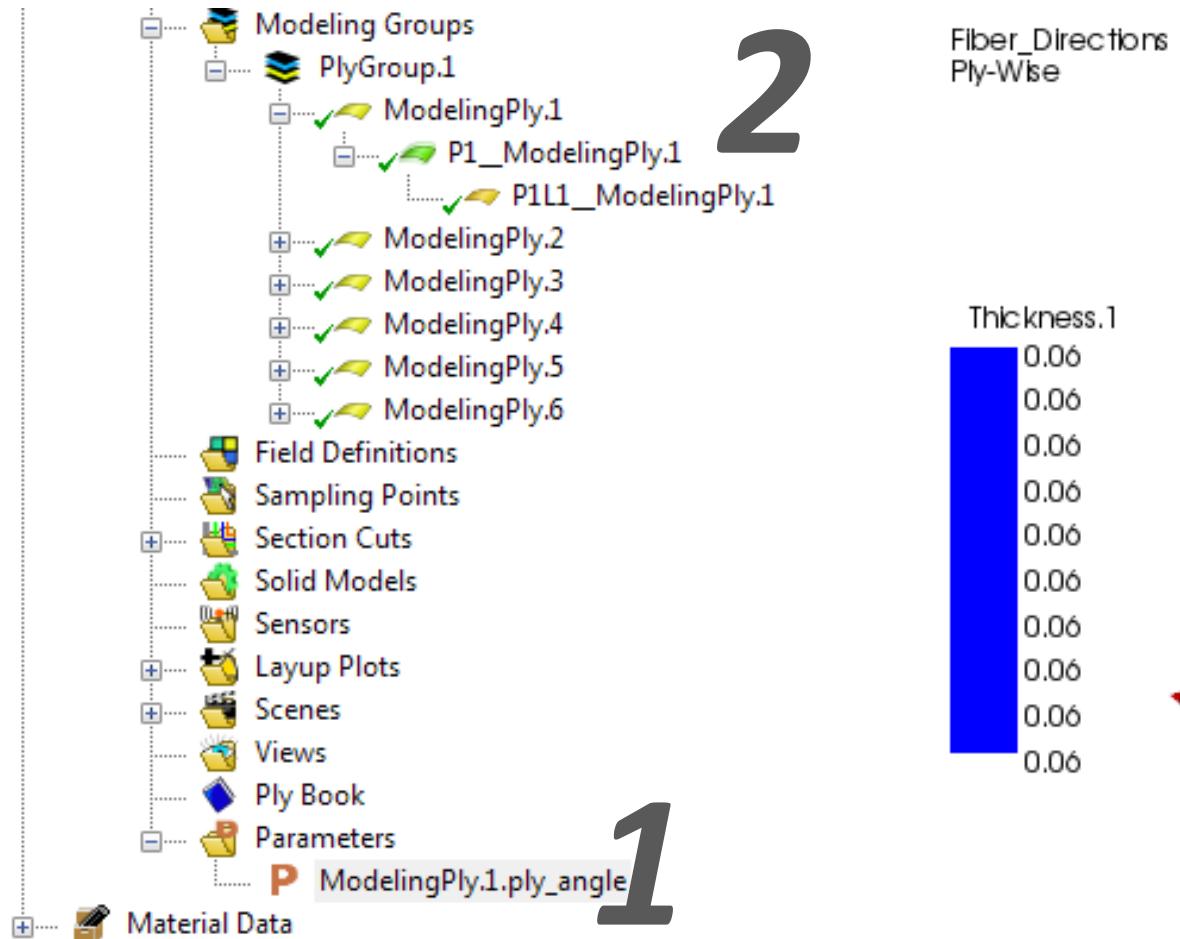
The screenshot shows the ANSYS Composite PrepPost software interface. On the left, there is a tree view labeled "Outline: No data". Below it is a table titled "Input Parameter" with columns A, B, C, and D. The table lists various parameters such as ModelingPly.1.ply_angle, ModelingPly.2.ply_angle, etc. On the right, there is a table titled "Table of Design Points" with columns A through I. This table contains data for six design points (DP 1 to DP 3) across different parameters like Name, Units, Current values, and calculated results like Sensor.1.Price and Torsion Stiffness.

	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
3	ACP (Pre) (A1)			
4	P1	ModelingPly.1.ply_angle	0	
5	P2	ModelingPly.2.ply_angle	0	
6	P3	ModelingPly.3.ply_angle	0	
7	P4	ModelingPly.4.ply_angle	0	
8	P5	ModelingPly.5.ply_angle	0	
9	P6	ModelingPly.6.ply_angle	0	
*	New input parameter	New name	New expression	
11	Output Parameters			
12	ACP (Post) (C1)			
13	P13	Sensor.1.Price	2.5816	
14	Static Structural (B1)			
15	P9	Moment Reaction Torsion Minimum Z Axis	-3897.4	N m
16	P10	Moment Reaction Bending Minimum X Axis	-12260	N m
17	P11	Torsion Stiffness	-2998	N m
18	P12	Bending Stiffness	-6130	N m
*	New output parameter		New expression	
20	Charts			

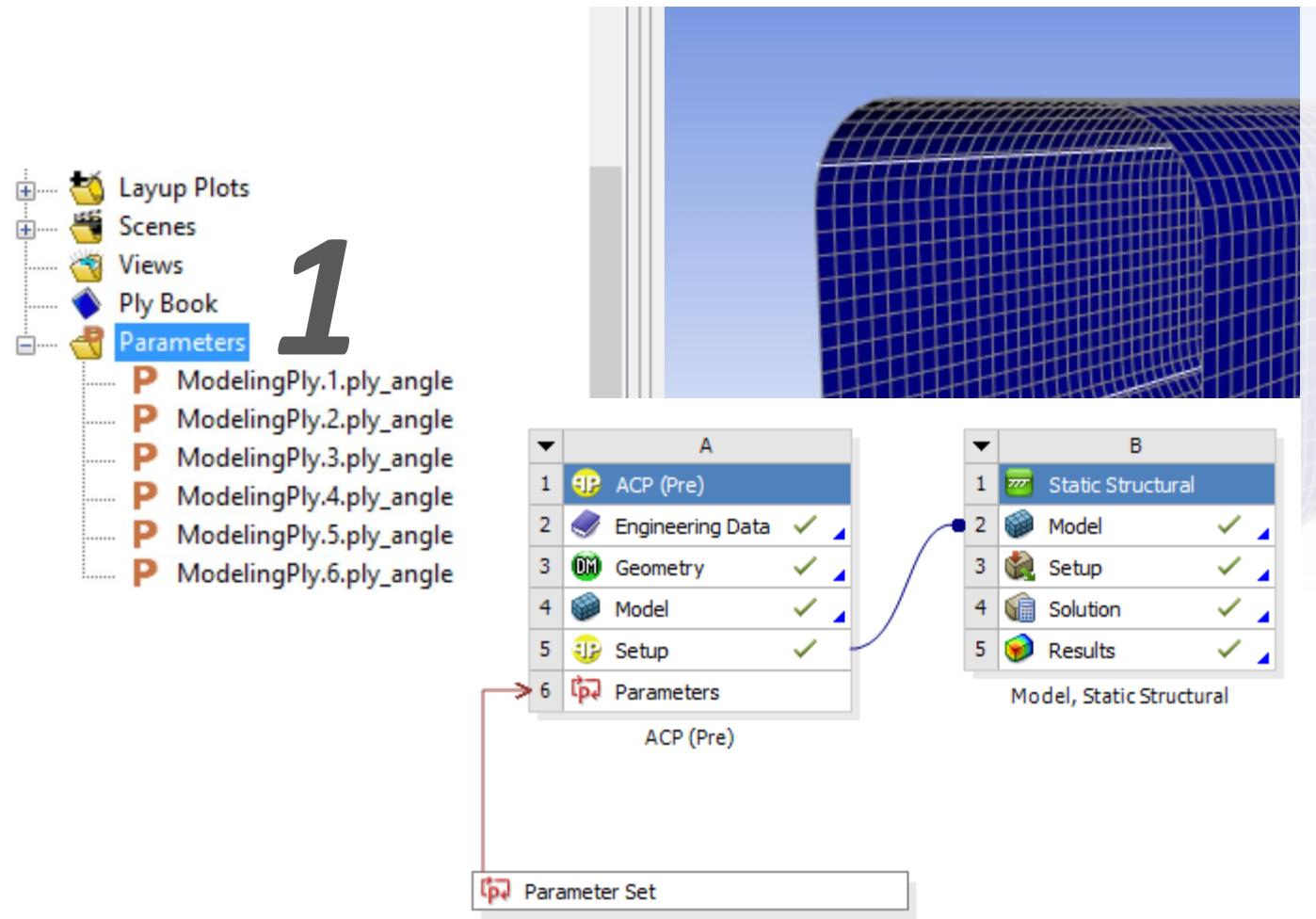
	A	B	C	D	E	F	G	H	I
1	Name							P13 - Sensor.1.Price	P11 - Torsion Stiffness
2	Units								N m
3	Current	0	0	0	0	0	0	2.5816	-2998
4	DP 1	45	-45	45	-45	45	-45	2.5816	-4235.5
5	DP 2	45	-45	0	0	45	-45	2.5816	-3852.2
6	DP 3	30	30	0	0	-30	-30	2.5816	-3618.4
*									

9. Workshop Parameters in ANSYS Composite PrepPost

1. Create a new parameter (Right mouse button on parameters → Create parameter)
2. As object choose the first Modeling Ply
3. Select Category Input and Property Ply Angle



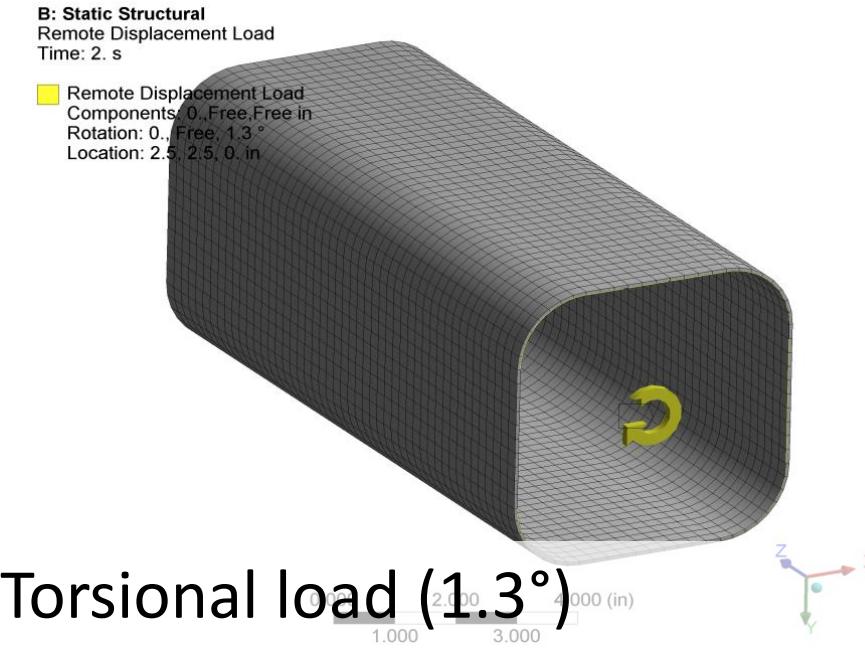
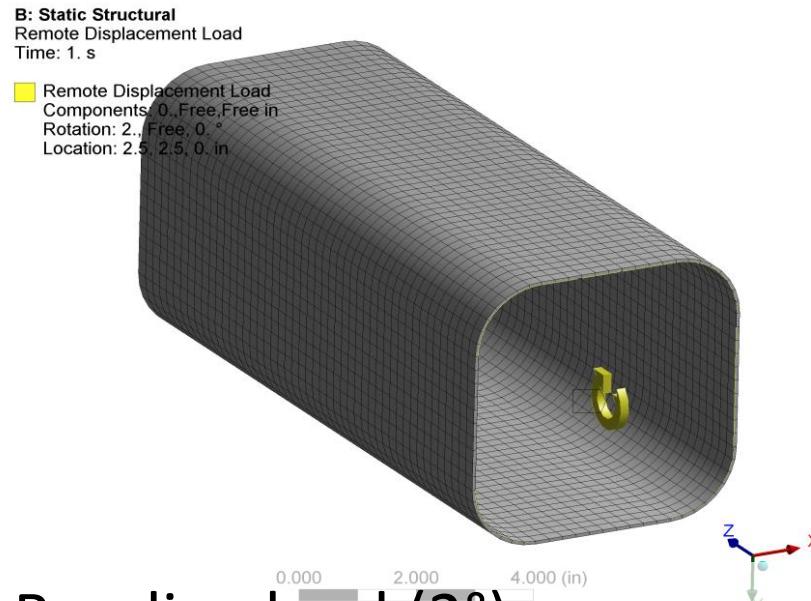
9. Workshop Parameters in ANSYS Composite PrepPost



- Create 5 more input parameter for the ply angles of the next five modeling plies
- The input parameter are now accessible in the project overview
- In the next step we will add output parameter in ANSYS Mechanical for bending and torsion stiffness
- Update the setup in ACP (Pre) and open ANSYS Mechanical

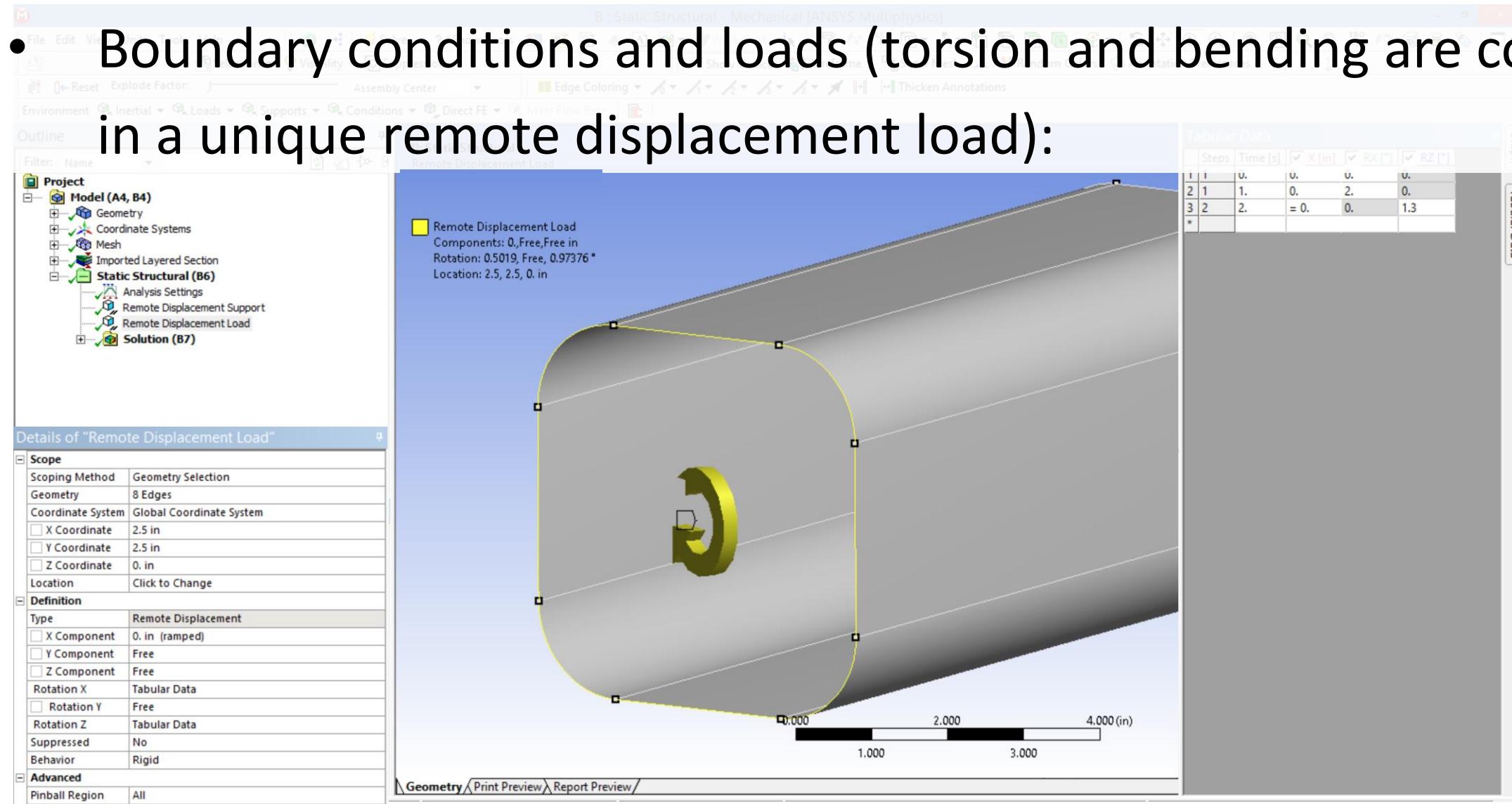
9. Workshop Parameters in ANSYS Composite PrepPost

- The boundary conditions and loads have already been defined.
- Two loadsteps are defined in the analysis setup:
 - 1 The first loadstep will be a bending load
 - 2 The second loadstep will be a torsional load



9. Workshop Parameters in ANSYS Composite PrepPost

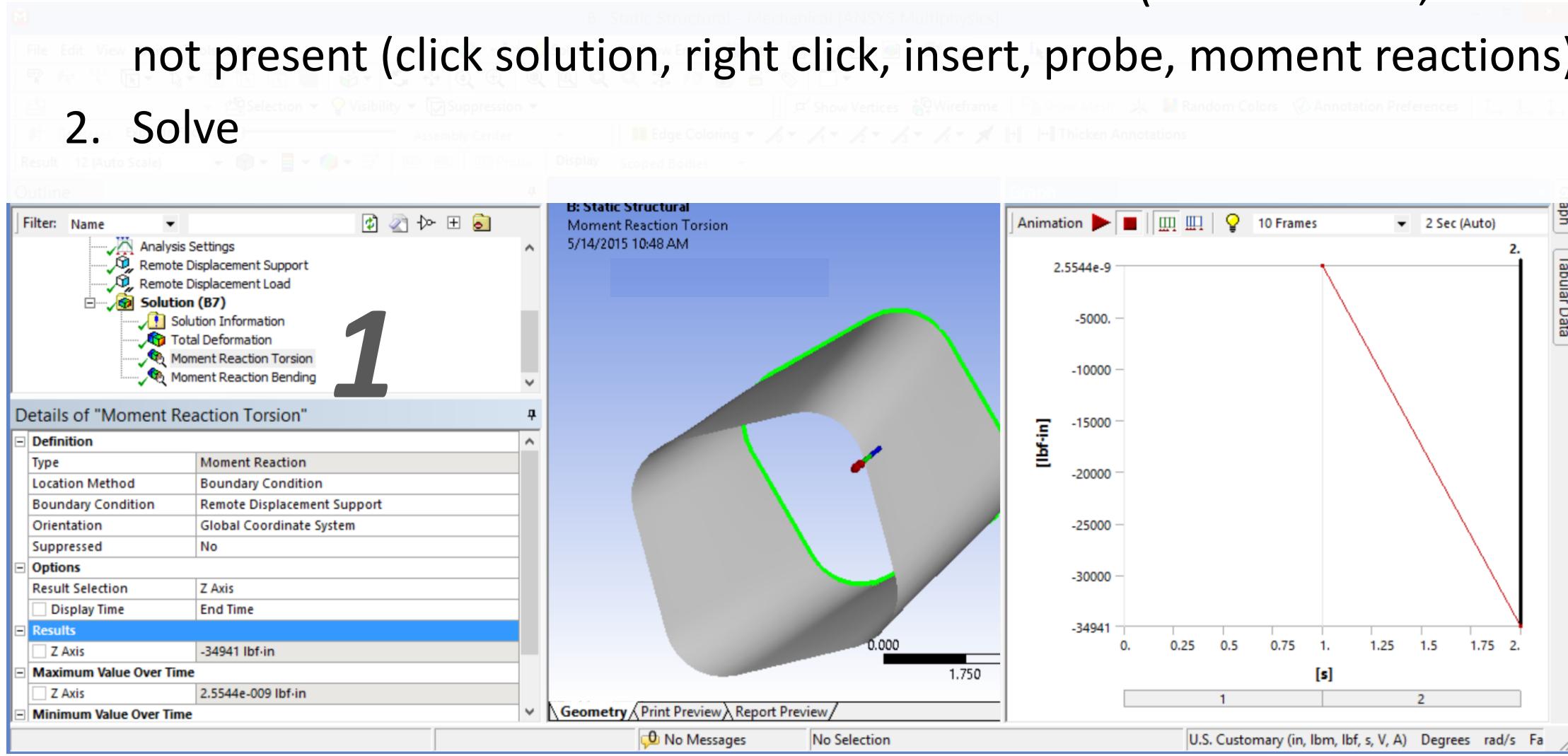
- Boundary conditions and loads (torsion and bending are combined in a unique remote displacement load):



9. Workshop Parameters in ANSYS Composite PrepPost

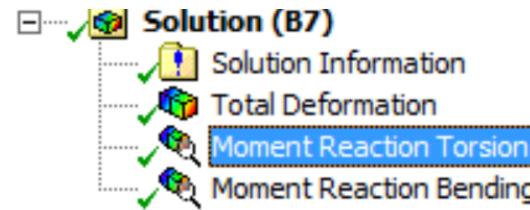
1. Add to the solution results for moment reactions (torsion Z axis, bending x axis) if not present (click solution, right click, insert, probe, moment reactions)

2. Solve



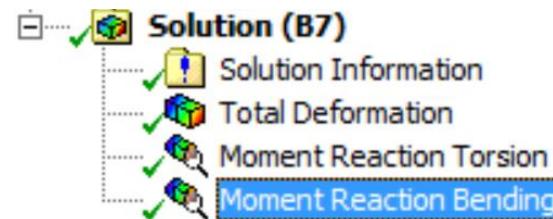
9. Workshop Parameters in ANSYS Composite PrepPost

1. Add a new parameter for the minimum reaction moment of the bending and torsional load case



Details of "Moment Reaction Torsion"

Location Method	Boundary Condition
Boundary Condition	Remote Displacement Support
Orientation	Global Coordinate System
Suppressed	No
Options	
Result Selection	Z Axis
<input type="checkbox"/> Display Time	End Time
Results	
Maximum Value Over Time	
<input type="checkbox"/> Z Axis	2.5544e-009 lbf·in
Minimum Value Over Time	
P Z Axis	-34941 lbf·in
Information	

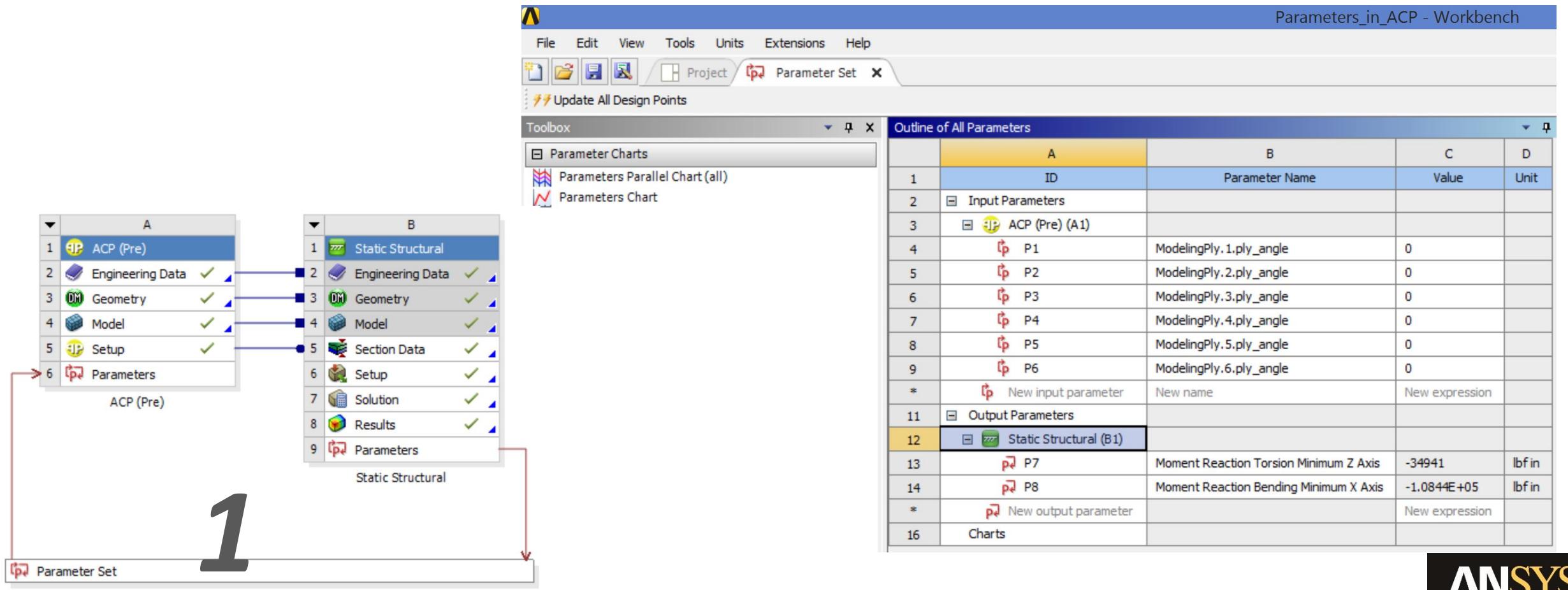


Details of "Moment Reaction Bending"

Definition	
Type	Moment Reaction
Location Method	Boundary Condition
Boundary Condition	Remote Displacement Support
Orientation	Global Coordinate System
Suppressed	No
Options	
Result Selection	X Axis
<input type="checkbox"/> Display Time	End Time
Results	
Maximum Value Over Time	
<input type="checkbox"/> X Axis	4.3346e-009 lbf·in
Minimum Value Over Time	
P X Axis	-1.0844e+005 lbf·in

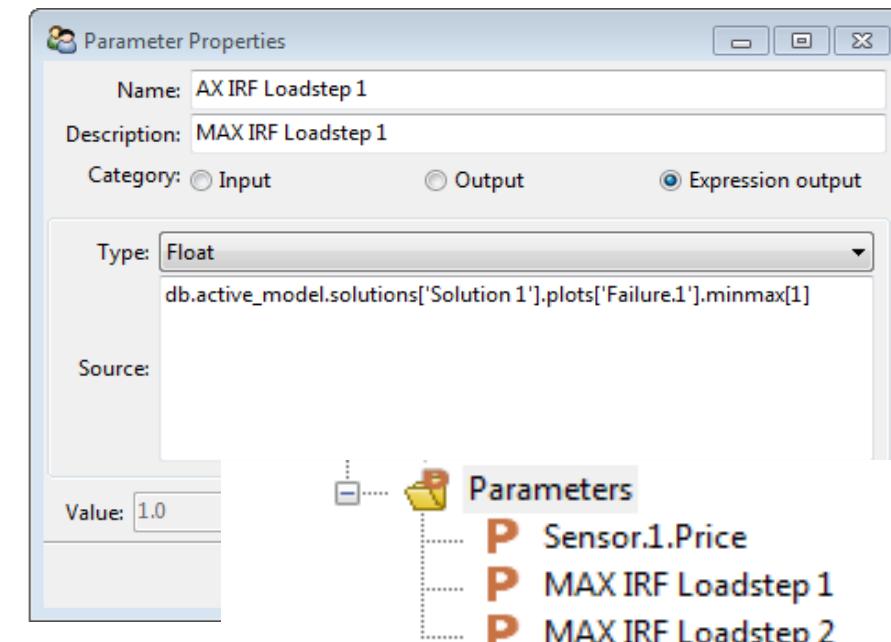
9. Workshop Parameters in ANSYS Composite PrepPost

- Both, input and output parameter, are now available in the parameter set (Double click on parameter set in Workbench project overview)



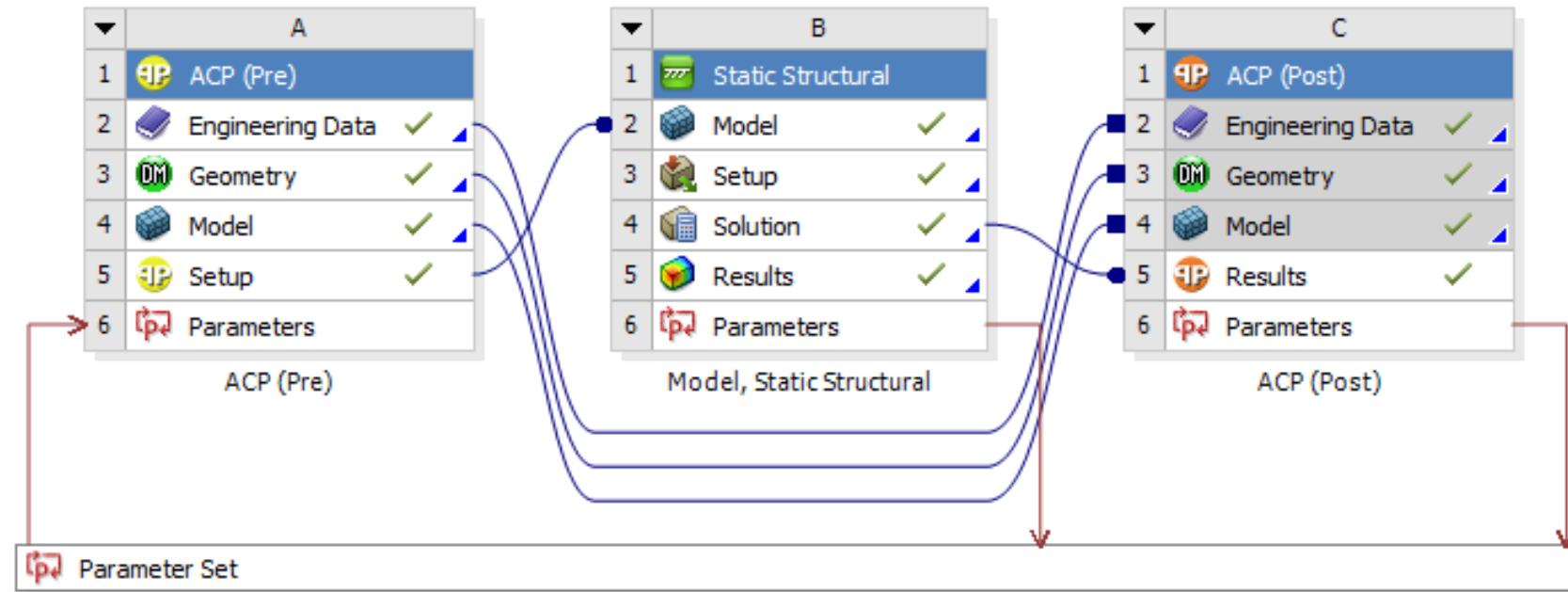
9. Workshop Parameters in ANSYS Composite PrepPost

- In the next step we will add output parameters in ANSYS Composite PrepPost.
- Output parameters are either available from sensors, modeling ply information or by so called expressions. Expressions allow the definition of failure criteria and other results as output parameter.
- Add a new ACP postprocessing system (ACP Post) and connect it to the ACP (Pre) model and the solution of ANSYS Mechanical.



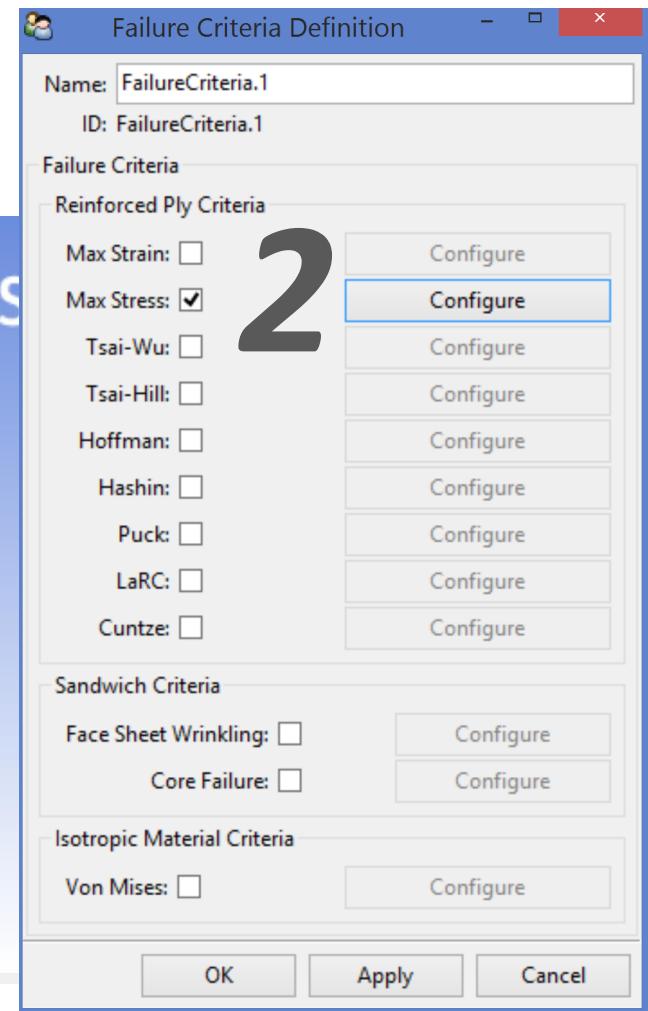
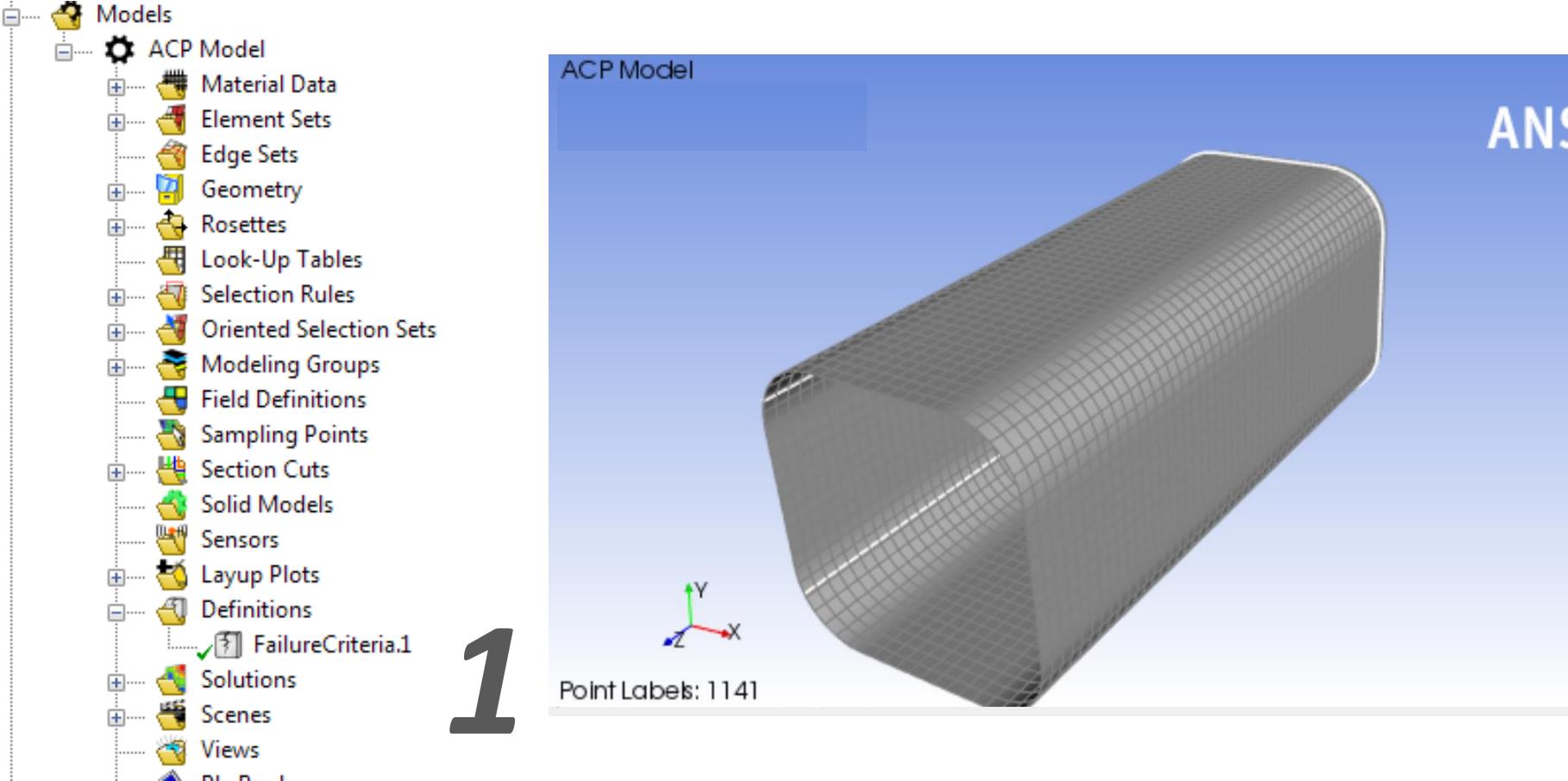
9. Workshop Parameters in ANSYS Composite PrepPost

Add a new ACP postprocessing system (ACP Post) and connect it to the ACP (Pre) model and the solution of ANSYS Mechanical:



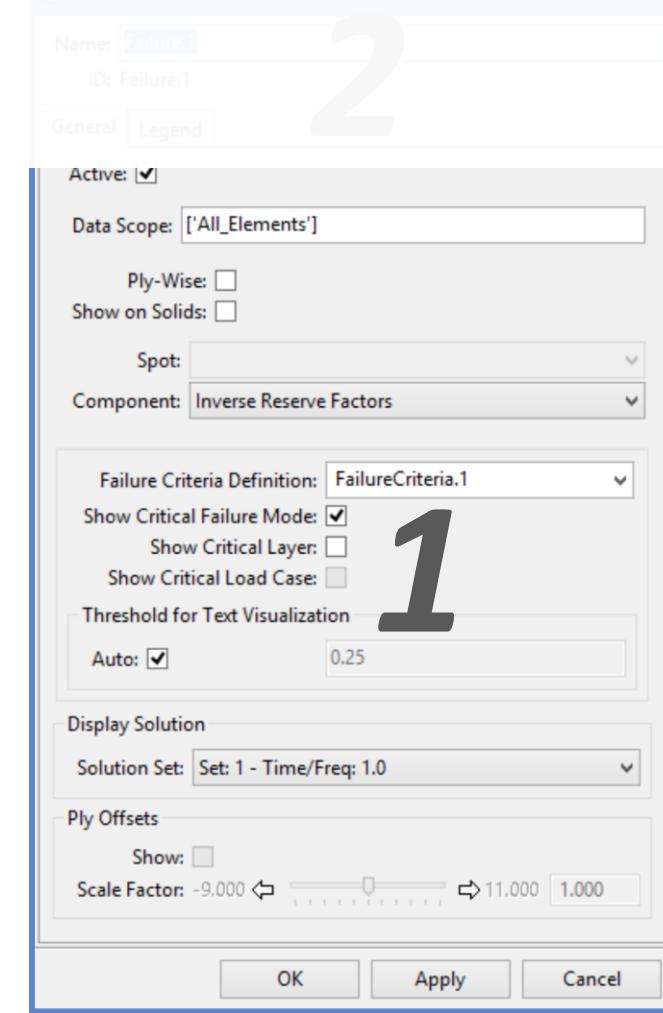
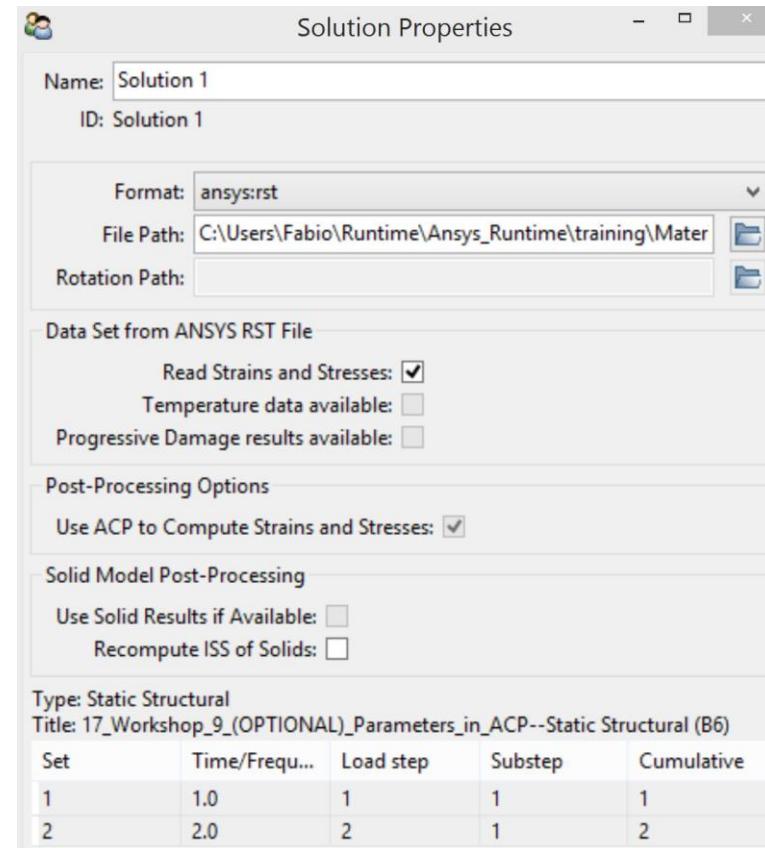
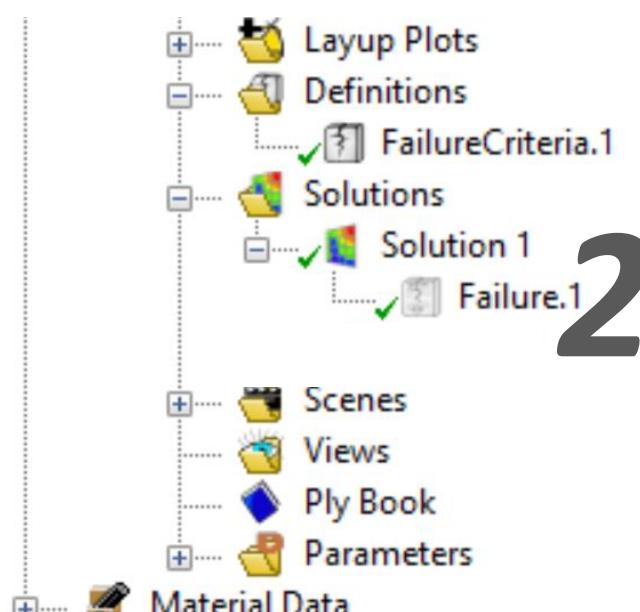
9. Workshop Parameters in ANSYS Composite PrepPost

1. Add failure criteria to definitions
2. Select all Max Stress failure criteria



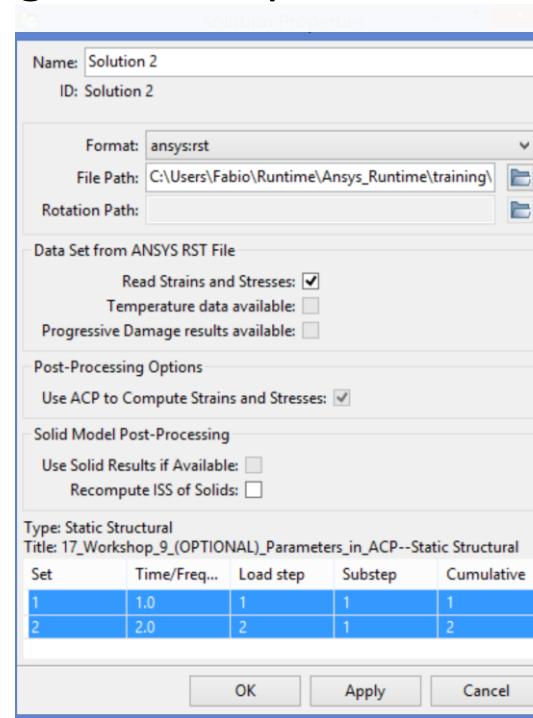
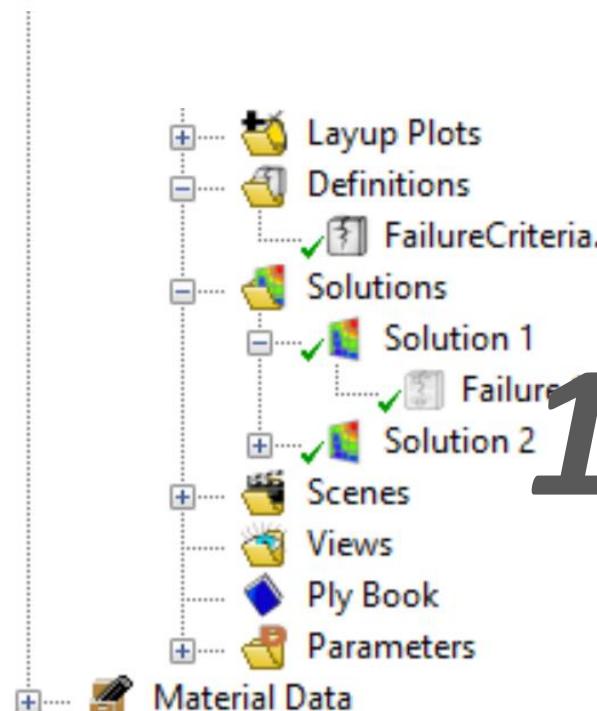
9. Workshop Parameters in ANSYS Composite PrepPost

1. Both loadsteps are available in the solution. Selecting a loadstep in the solution properties will select it for postprocessing
2. Add a Failure plot to the solution

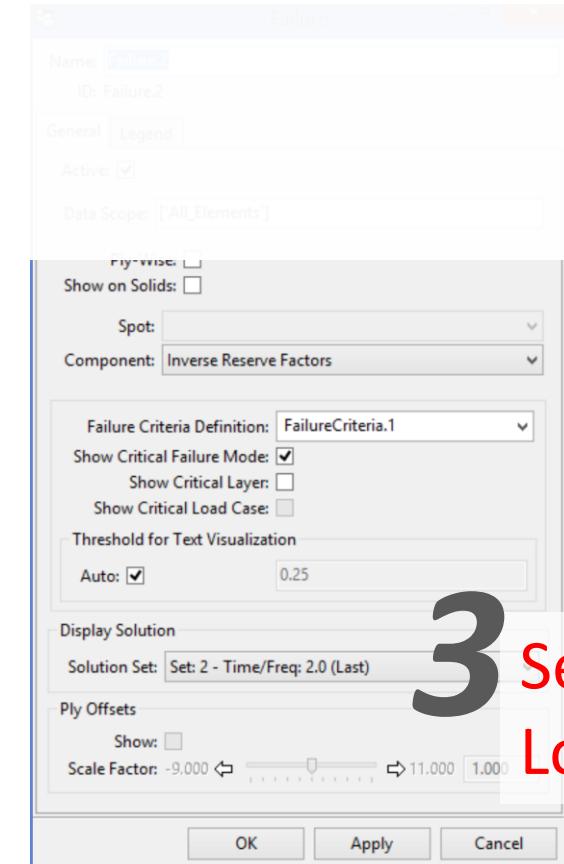


9. Workshop Parameters in ANSYS Composite PrepPost

1. We will need both loadsteps simultaneously. Therefore we will have to add a new solution manually (Right mouse button on Solutions → Import Results)
2. Copy the file path from the first solution and rename the new solution to Solution 2. Add a Failure plot to both solutions
3. Select the first loadstep in Solution 1 and the second loadstep in Solution 2 when adding a Failure plot



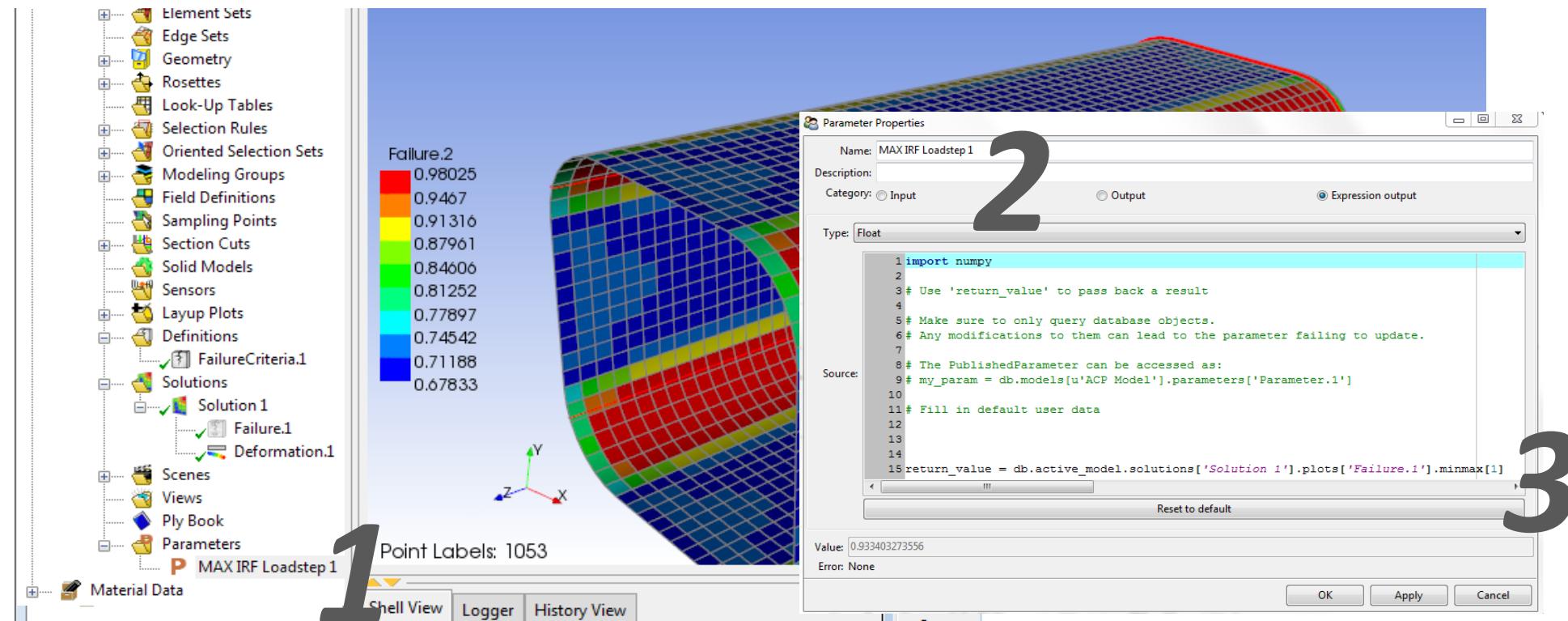
2



3 Select
Loadstep

9. Workshop Parameters in ANSYS Composite PrepPost

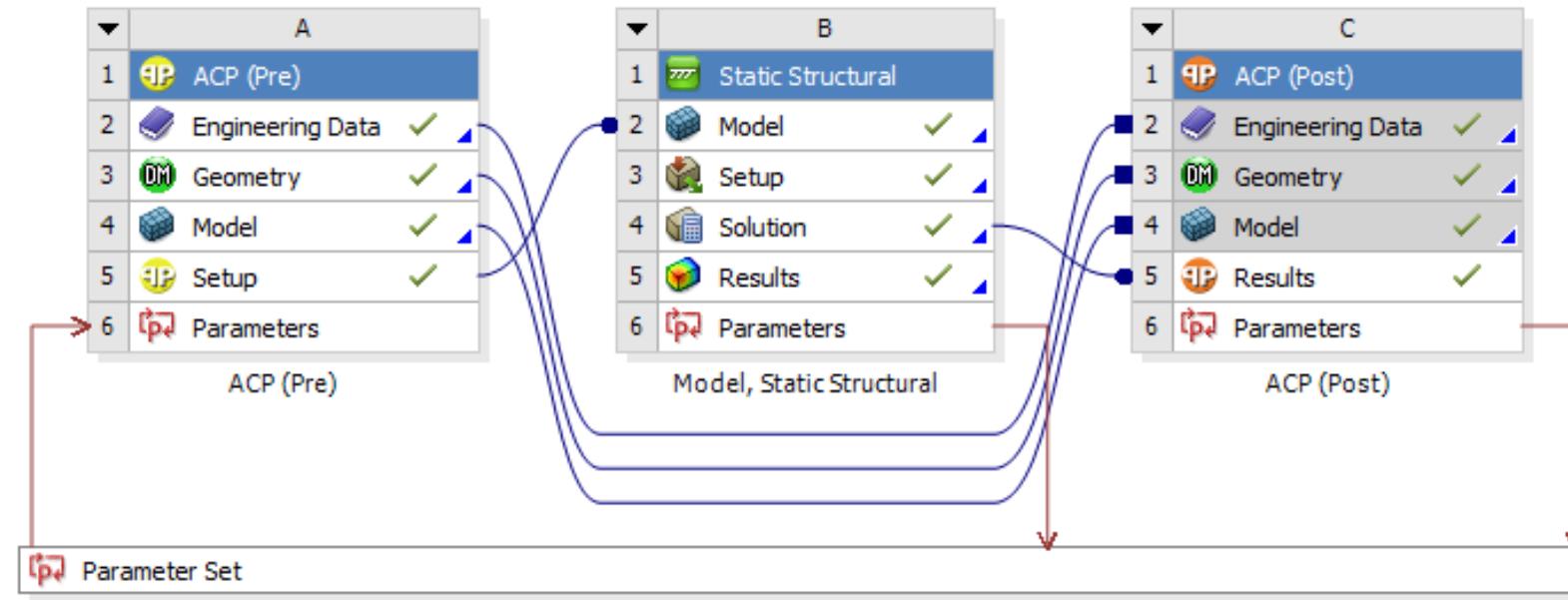
1. Create a new parameter for each failure plot
2. Rename the parameter to MAX IRF Loadstep 1 (2) and switch to output expression
3. Define expression : db.active_model.solutions['Solution 1'].plots['Failure.1'].minmax[1]
db.active_model.solutions['Solution 2'].plots['Failure.2'].minmax[1]



9. Workshop Parameters in ANSYS Composite PrepPost

- The defined expression will retrieve the maximal value of the result shown on plots.
- This can be used to define parameters for ply wise results or as shown here for overall plots.

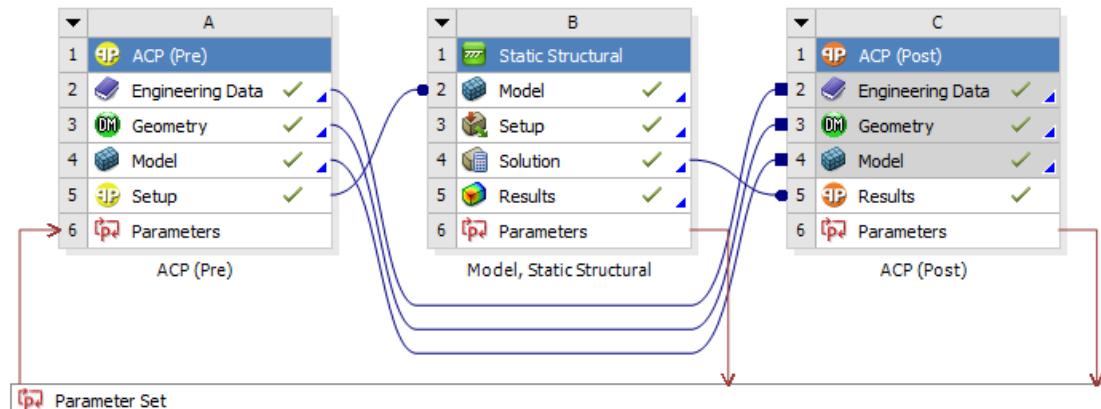
9. Workshop Parameters in ANSYS Composite PrepPost



Outline of Schematic C6: Parameters				
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	Input Parameters			
*	New input parameter	New name	New expression	
4	Output Parameters			
5	ACP (Post) (C1)			
6	P9	MAX IRF Loadstep 1	0.9334	
7	P10	MAX IRF Loadstep 2	0.98069	
*	New output parameter		New expression	
9	Charts			

9. Workshop Parameters in ANSYS Composite PrepPost

- All input and output parameter are now available in the parameter set.
- Update the project to refresh the values in the parameter view.



Output
Parameter

The screenshot shows the 'Outline of All Parameters' table. The columns are ID, Parameter Name, Value, and Unit. The table includes sections for Input Parameter (highlighted in blue), Output Parameters (highlighted in pink), and ACP (Post) (C1) (highlighted in yellow).

ID	Parameter Name	Value	Unit
6	P3	0	
7	P4	0	
8	P5	0	
9	P6	0	
*	New input parameter	New name	New expression
11	Output Parameters		
12	Static Structural (B1)		
13	P7	Moment Reaction Torsion Minimum Z Axis	-3.9478E+06 N mm
14	P8	Moment Reaction Bending Minimum X Axis	-1.2253E+07 N mm
15	ACP (Post) (C1)		
16	P9	MAX IRF Loadstep 1	0.9334
17	P10	MAX IRF Loadstep 2	0.98069
*	New output parameter	New expression	

Input
Parameter

9. Workshop Parameters in ANSYS Composite PrepPost

- Define new design points in the Parameter Set by entering values for the ply angles in the line below current in Table of Design Points
- Update all design points to solve the defined design points and evaluate the results

The screenshot shows the ANSYS Composite PrepPost software interface. At the top, there's a menu bar with File, View, Tools, Units, Extensions, and Help. Below the menu is a toolbar with icons for Project, Parameter Set, and other functions. The main area has two windows: 'Outline of All Parameters' on the left and 'Parameter Chart 0' on the right. The 'Outline of All Parameters' window contains a table with columns for ID, Parameter Name, Value, and Unit. It lists parameters P1 through P7, along with some output parameters and a static structural parameter. The 'Table of Design Points' window at the bottom shows rows of data corresponding to the parameters in the outline. The first row (DP 0) is highlighted in blue and labeled 'Current'. The second row (DP 1) has a value of 45 in column B. The third row (DP 2) has a value of 30 in column B. The fourth row (DP 3) has a value of 0 in column B. The fifth row (*) is a header row.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Name	P1 - ModelingPly.1 .ply_angle	P2 - ModelingPly.2 .ply_angle	P3 - ModelingPly.3 .ply_angle	P4 - ModelingPly.4 .ply_angle	P5 - ModelingPly.5 .ply_angle	P6 - ModelingPly.6 .ply_angle	P7 - Moment Reaction Torsion Minimum Z Axis	P8 - Moment Reaction Bending Minimum X Axis	P9 - MAX IRF Loadstep 1	P10 - MAX IRF Loadstep 2	Retain	Retained Data
2	Units							N mm	N mm				
3	DP 0 (Current)	0	0	0	0	0	0	-3.9478E+06	-1.2253E+07	0.9334	0.98069	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	DP 1	45	45	0	0	-45	-45	-5.0786E+06	-1.0657E+07	1.3703	0.76182	<input type="checkbox"/>	
5	DP 2	30	45	0	0	-45	-30	-4.9285E+06	-1.0873E+07	1.3418	0.76176	<input type="checkbox"/>	
6	DP 3	0	0	45	45	0	0	-4.5007E+06	-1.1498E+07	1.2733	1.0075	<input type="checkbox"/>	
*													