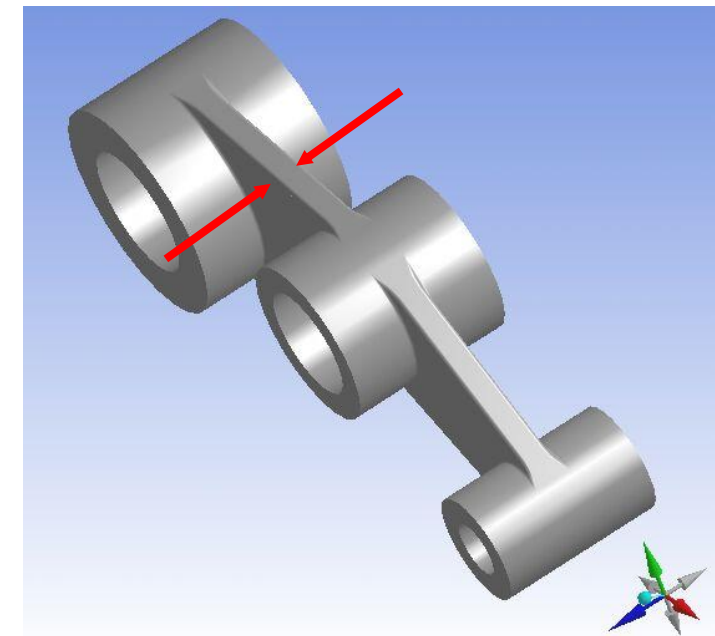
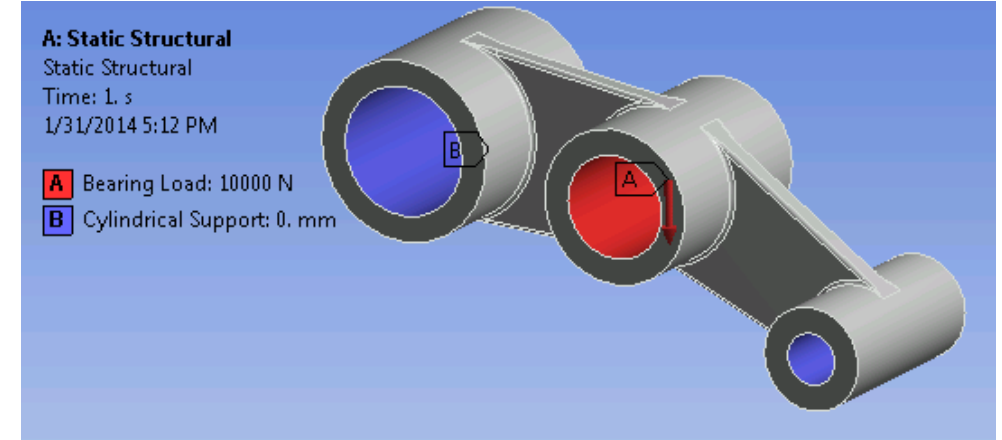


Ansys Tutorial 5

Cylindrical Support

Overview

- **Goal**
 - Attempt to minimize the mass of the part while keeping the equivalent stress maximum below 32 MPa
- **Model Description**
 - The boundary conditions have been applied as shown here
 - The 2 cylindrical supports are configured as:
 - Radial = Fixed
 - Axial = Fixed
 - Tangential = Free
 - The model is set up to parametrically vary the web thickness (see figure at right)



Project Startup

1. File > Open> Crank_Arm.wbpj

2. Double click on Parameter Set, review parameter table

Input Parameters			
Static Structural (A1)			
P2	ds_web	20	
New input parameter	New name	New expression	
Output Parameters			
Static Structural (A1)			
P3	Solid Mass	25.353	kg
P4	Total Deformation Maximum	0.019707	mm
P5	Equivalent Stress Maximum	24.339	MPa
New output parameter		New expression	
Charts			

3. Switch to Project

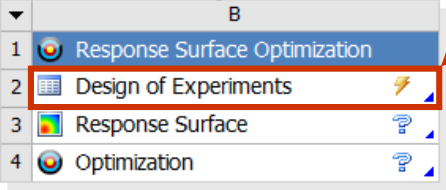
4. Double click on Response Surface Optimization

Response Surface Optimization	
1	Response Surface Optimization
2	Design of Experiments
3	Response Surface
4	Optimization

Conduct a DOE study

5

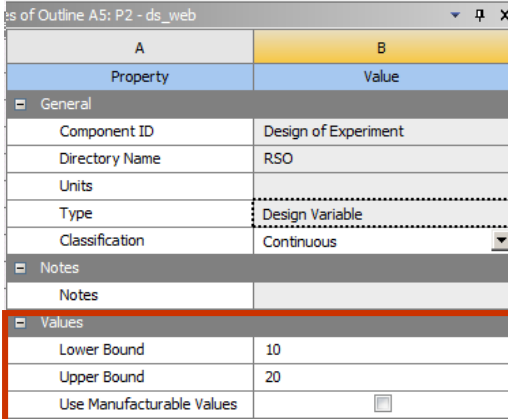
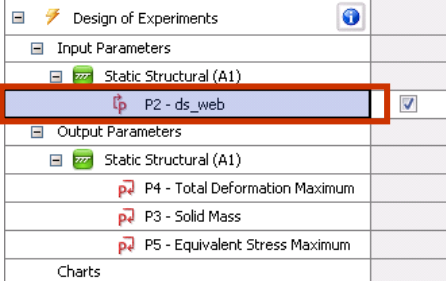
5. Double click on DOE



Response Surface Optimization

1	Response Surface Optimization
2	Design of Experiments
3	Response Surface
4	Optimization

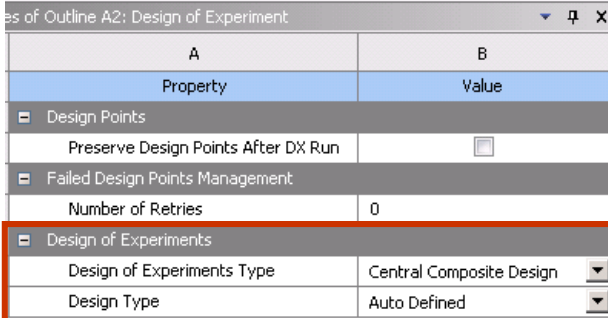
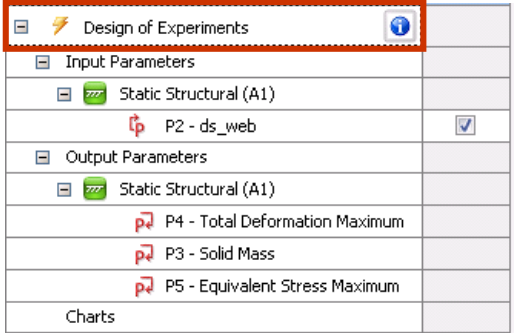
By default DOE type is set to CCD



A	B
Property	Value
General	
Component ID	Design of Experiment
Directory Name	RSO
Units	
Type	Design Variable
Classification	Continuous
Notes	
Notes	
Values	
Lower Bound	10
Upper Bound	20
Use Manufacturable Values	<input type="checkbox"/>

6

6. Select P2 – ds_web parameter and set the bounds as shown



A	B
Property	Value
Design Points	
Preserve Design Points After DX Run	<input type="checkbox"/>
Failed Design Points Management	
Number of Retries	0
Design of Experiments	
Design of Experiments Type	Central Composite Design
Design Type	Auto Defined

Conduct a Response Surface study



7

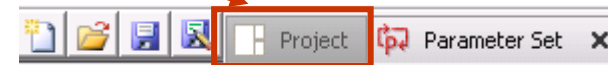
7. Click Preview to see if the design points generated by the DOE are acceptable. Then, click Update to solve the design points

Table of Schematic B2: Design of Experiment

	A	B
1	Name	P2 - ds_web
2	1	15
3	2	10
4	3 DP 0	20
5	4	12.5
6	5	17.5

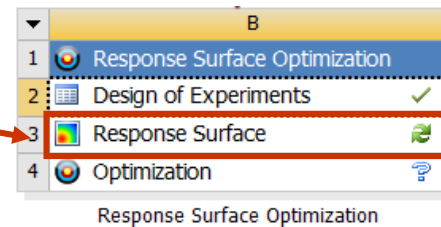
8. Switch to Project

8



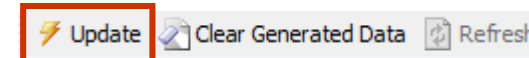
9. Double click on Response Surface

9



10. Set the Response Surface Type to Standard Response Surface... and Update

6	Meta Model	
7	Response Surface Type	Genetic Aggregation
8	Refinement	Genetic Aggregation
9	Refinement Type	Standard Response Surface - Full 2nd Order Polynomials
10	Verification Points	Kriging

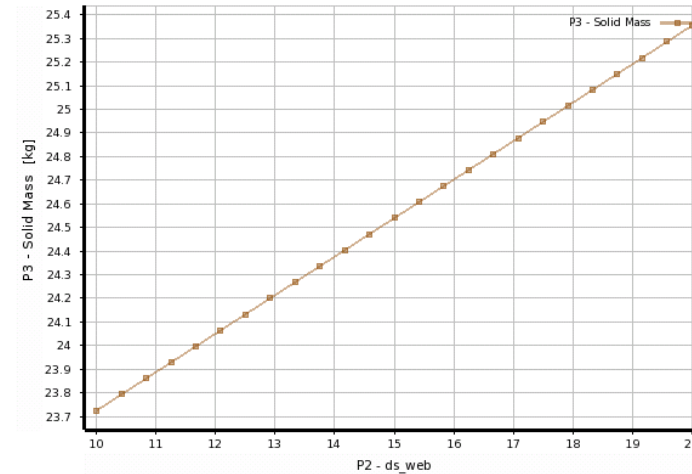
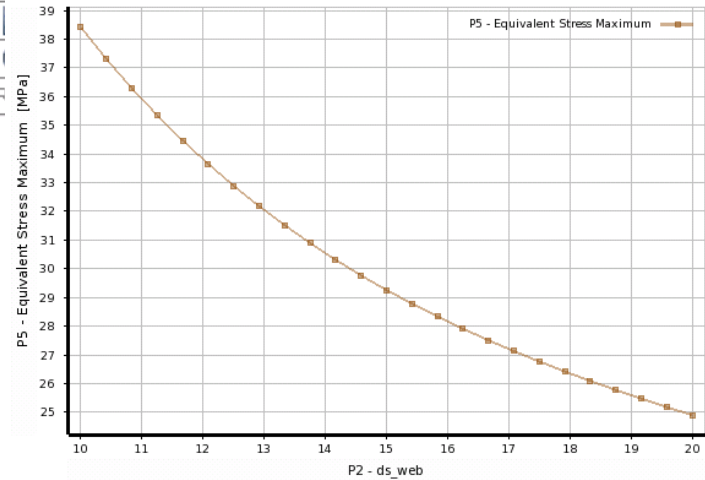


Conduct a Response Surface study

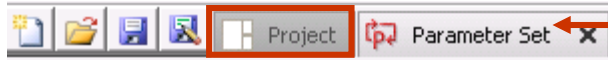
	Enabled
Response Surface	Enabled
Input Parameters	
Static Structural (A1)	
P2 - ds_web	<input checked="" type="checkbox"/>
Output Parameters	
Static Structural (A1)	
P4 - Total Deformation Maximum	
P3 - Solid Mass	
P5 - Equivalent Stress Maximum	
Min-Max Search	<input checked="" type="checkbox"/>
Metrics	
Goodness Of Fit	
Response Points	
Response Point	
Response	
Local Sensitivity	

11. Highlight Response
Set Y axis to Equivalent Stress Maximum

12. Review the response chart
Change the Y axis to Solid Mass

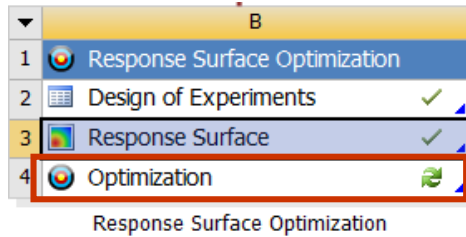


Conduct a Response Surface Optimization

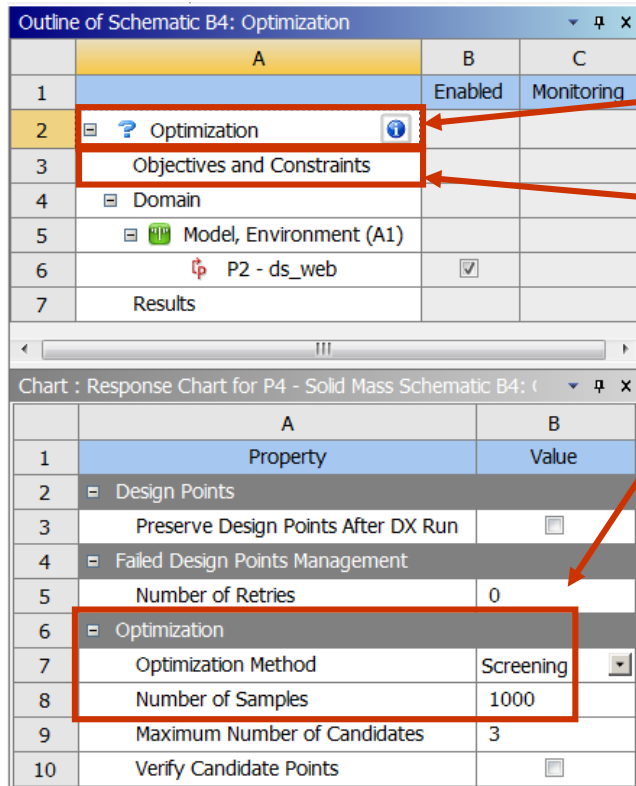


13. Switch to Project

14



14. Double click on Optimization



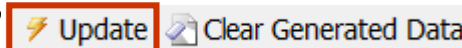
15. Highlight optimization and generate 1000 screening samples

16. Highlight Objectives and Constraints and Set the goals as shown in the table

16

Name	Parameter	Objective		Constraint		
		Type	Target	Type	Lower Bound	Upper Bound
Minimize P3	P3 - Solid Mass	Minimize		No Constraint		
P5 <= 32 MPa	P5 - Equivalent Stress Maximum	No Objective		Values <= Upper Bound		32
	Select a Parameter					

17



17. Update Optimization

Conduct a Response Surface Optimization

Candidate Points			
	Candidate Point 1	Candidate Point 2	Candidate Point 3
P2 - ds_web	13.035	13.735	14.435
P3 - Solid Mass (kg)	★ 24.22	★ 24.334	— 24.448
P5 - Equivalent Stress Maximum (MPa)	★★★ 31.986	★★★ 30.916	★★★ 29.958



Table of optimization gives three candidates based on specified goal and constraint

	Enabled	Monitoring
✓ Optimization		
▢ Objectives and Constraints		
🎯 Minimize P3		
🎯 P5 <= 32 MPa		
▢ Domain		
🟢 Static Structural (A1)		
📍 P2 - ds_web	<input checked="" type="checkbox"/>	
Parameter Relationships		
▢ Results		
✓ 📄 Candidate Points		
✓ 📊 Tradeoff		
✓ 📄 Samples		
✓ 📄 Sensitivities		

18. Click on Tradeoff to obtain Trade Off Plot

18

View the Optimization Results

19. Review the tradeoff plot after setting the X Axis to Solid Mass and the Y axis to Equivalent Stress Maximum

