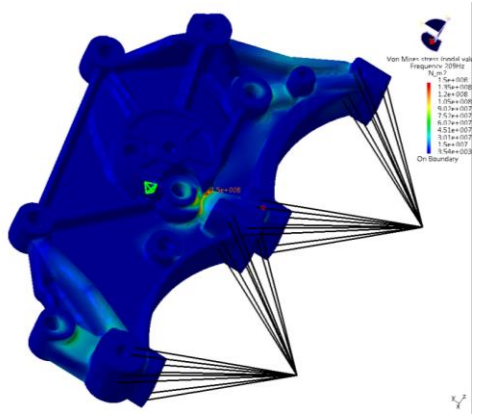
Topology Optimization at Scania

Mikael Thellner

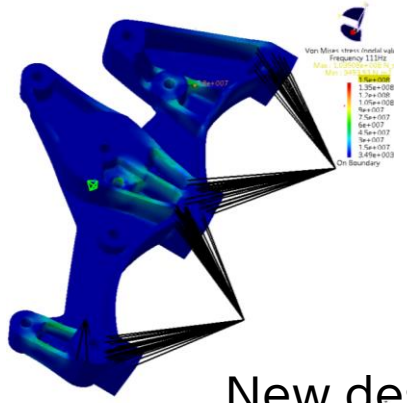
Agenda

- The gains with topology optimization
- Challenges with topology optimization

Example Bracket: Stop hunting the red spot



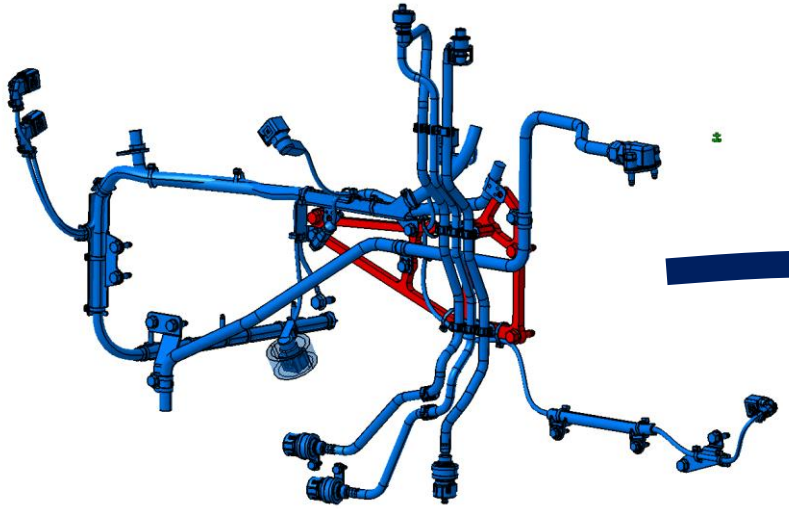
Reference

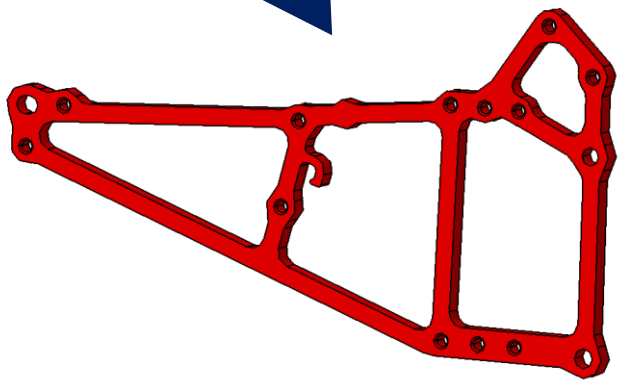


New design
Based on topology optimization

	Failure probability	Weight(kg)	Cost(kr)	Development Time (days)
Reference	0,28 %	6.4	N/A	200
New	0,00045 %	1.6	N/A	2
Relative (%)	600 times	25%	Lower	1%
Absolute		4.8		198

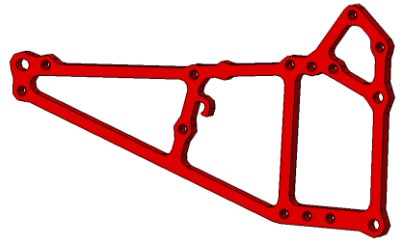
Scania Super 13-liter engine



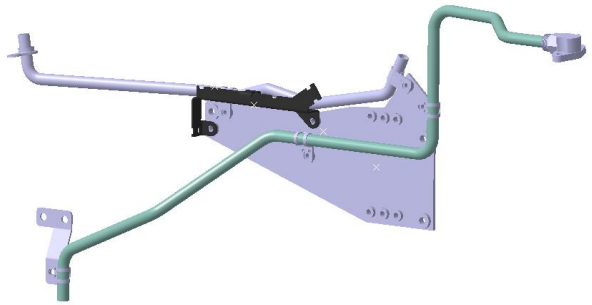


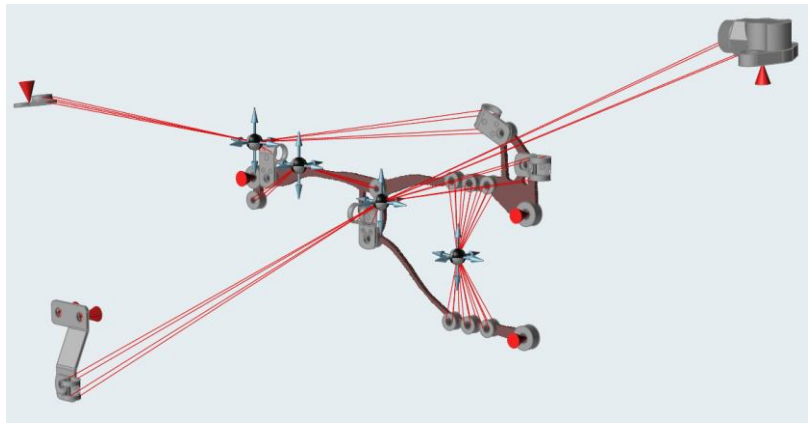
m = 1050 g

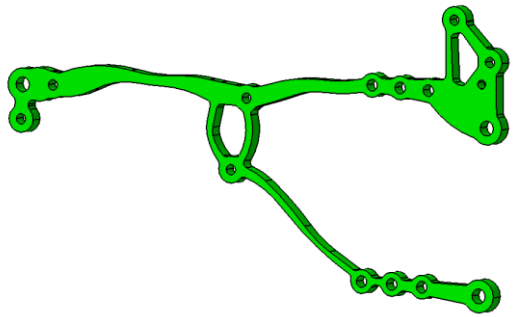
Empower the designer



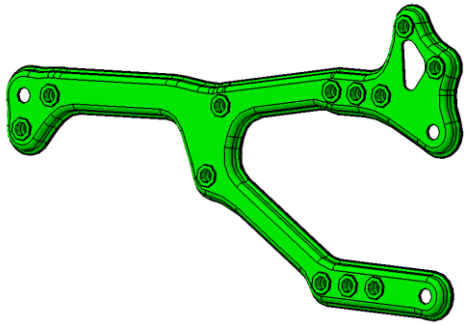
m = 1050 g







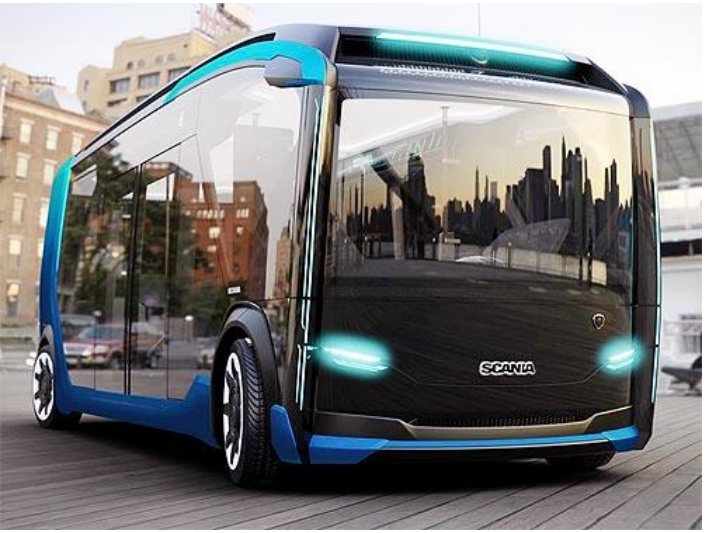
m = 670 g
-40 %

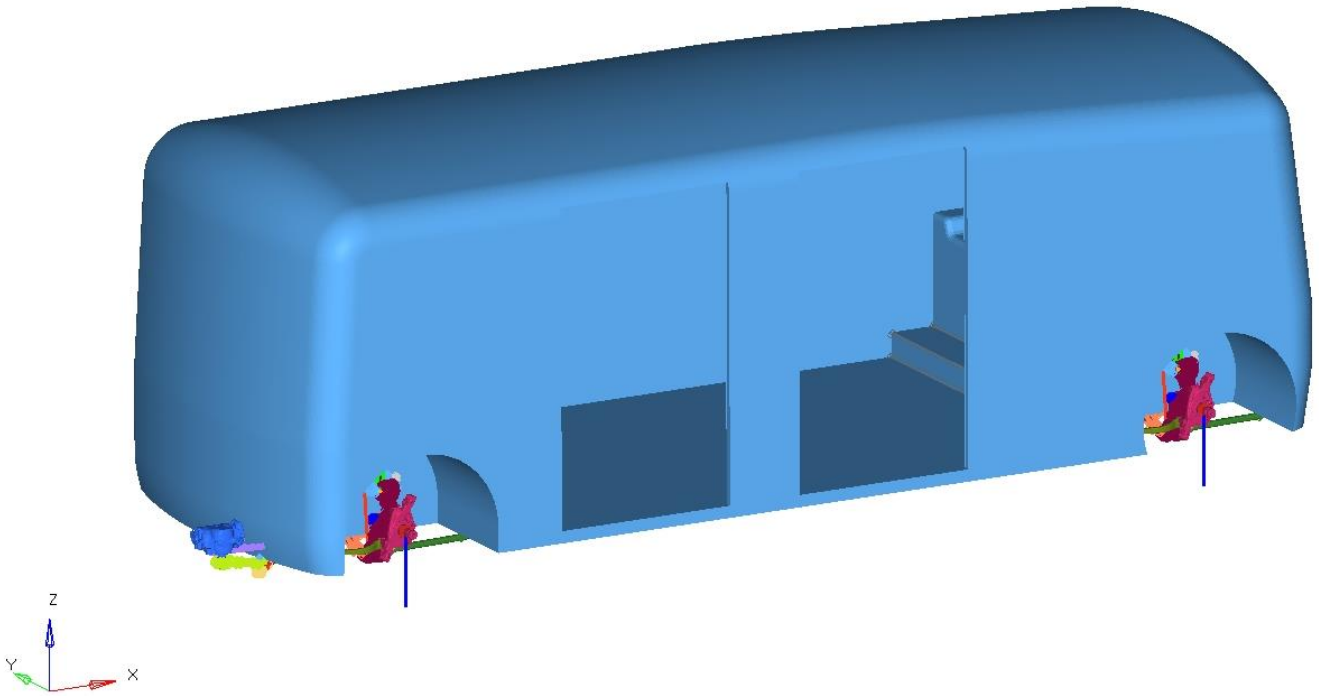


m = 540 g
-50 %

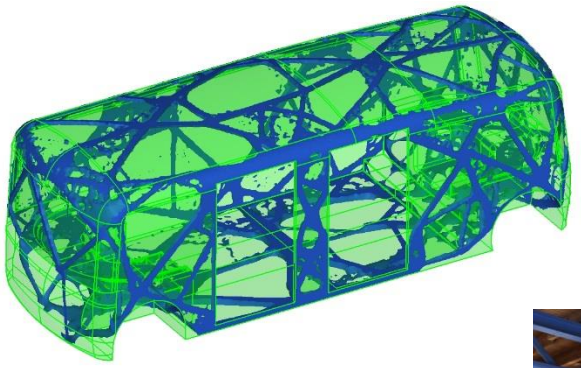
Explore the design domain with topology optimization

Topology Optimization of an Autonomous Bus





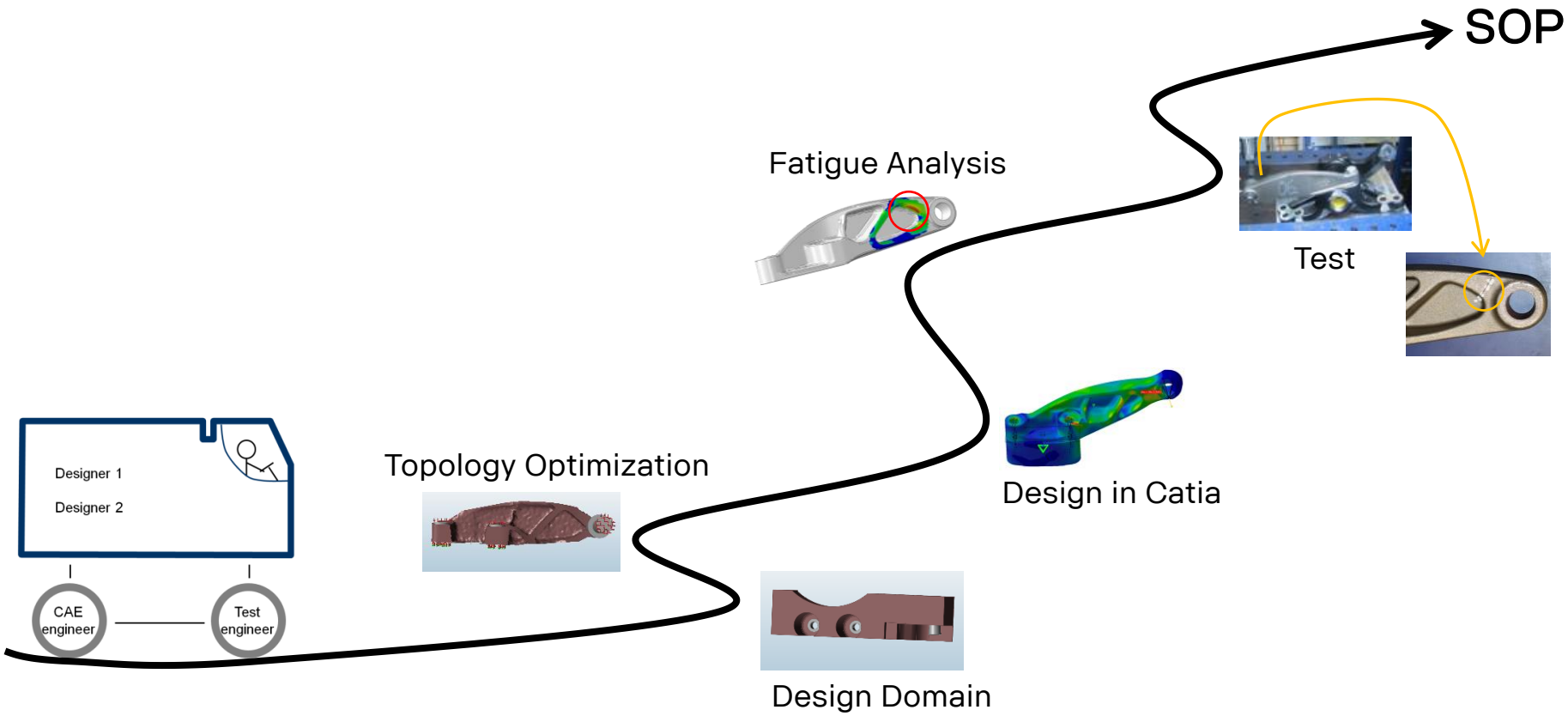
Topology Optimization of an Autonomous Bus



Carbon and Glass Fibre Body

Scania NXT

Simulation Based Product Development



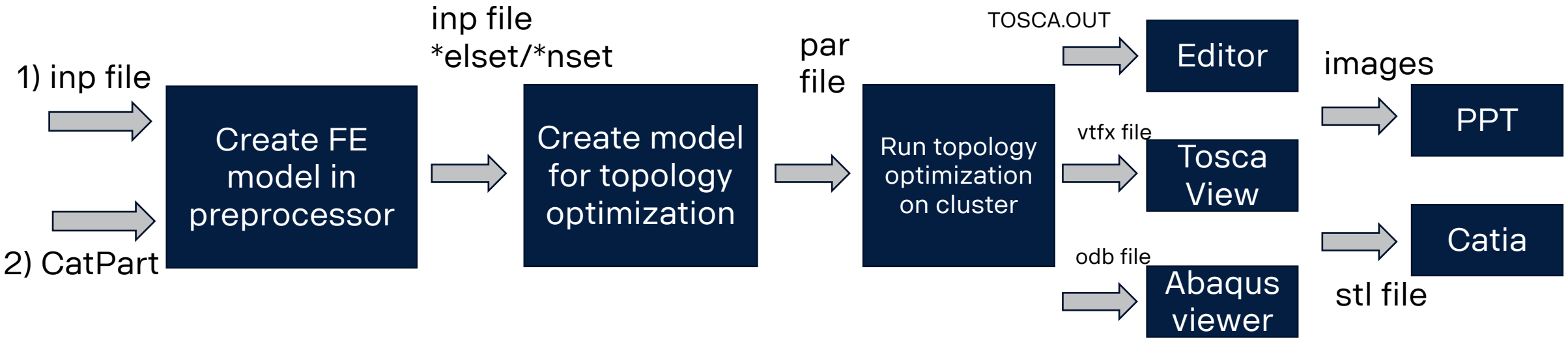
Summary

1. Better understanding of the design
2. Earlier understanding of the design

3. => Better designs in shorter time

CHALLENGES

Workflow Analyst -> Designer



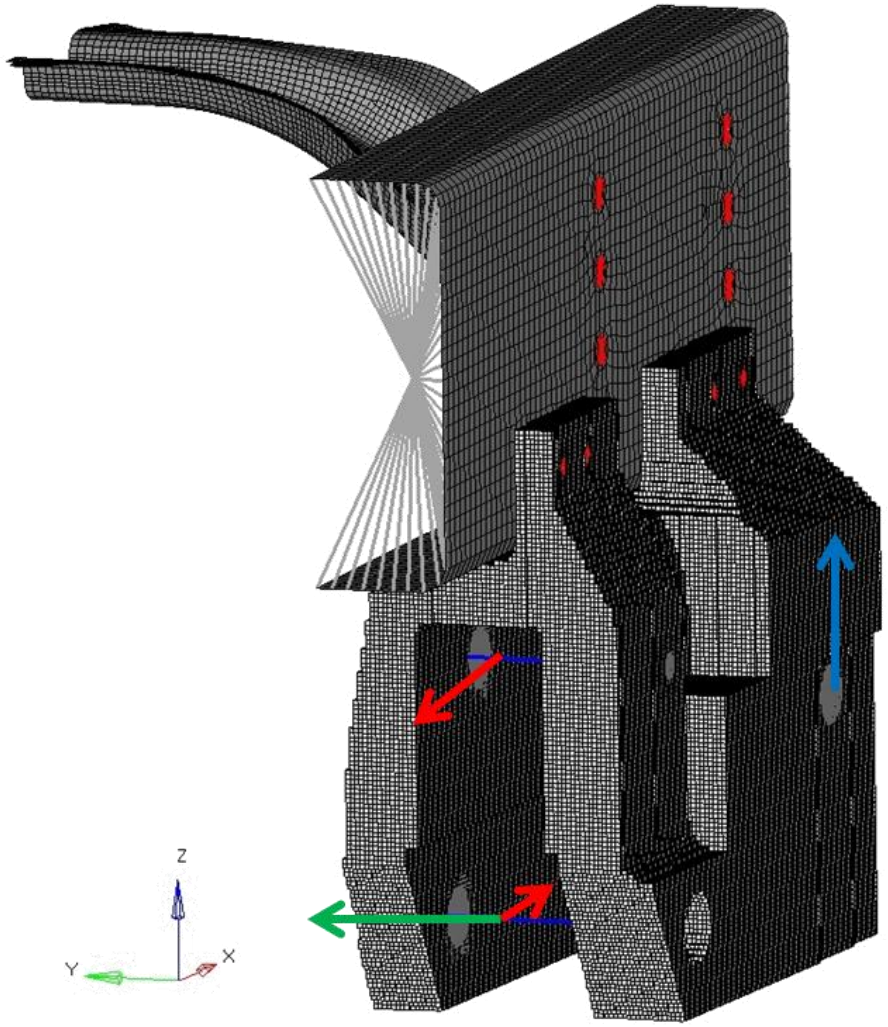
Tools:

FE solver: Abaqus Topology optimization: Tosca CAD: Catia

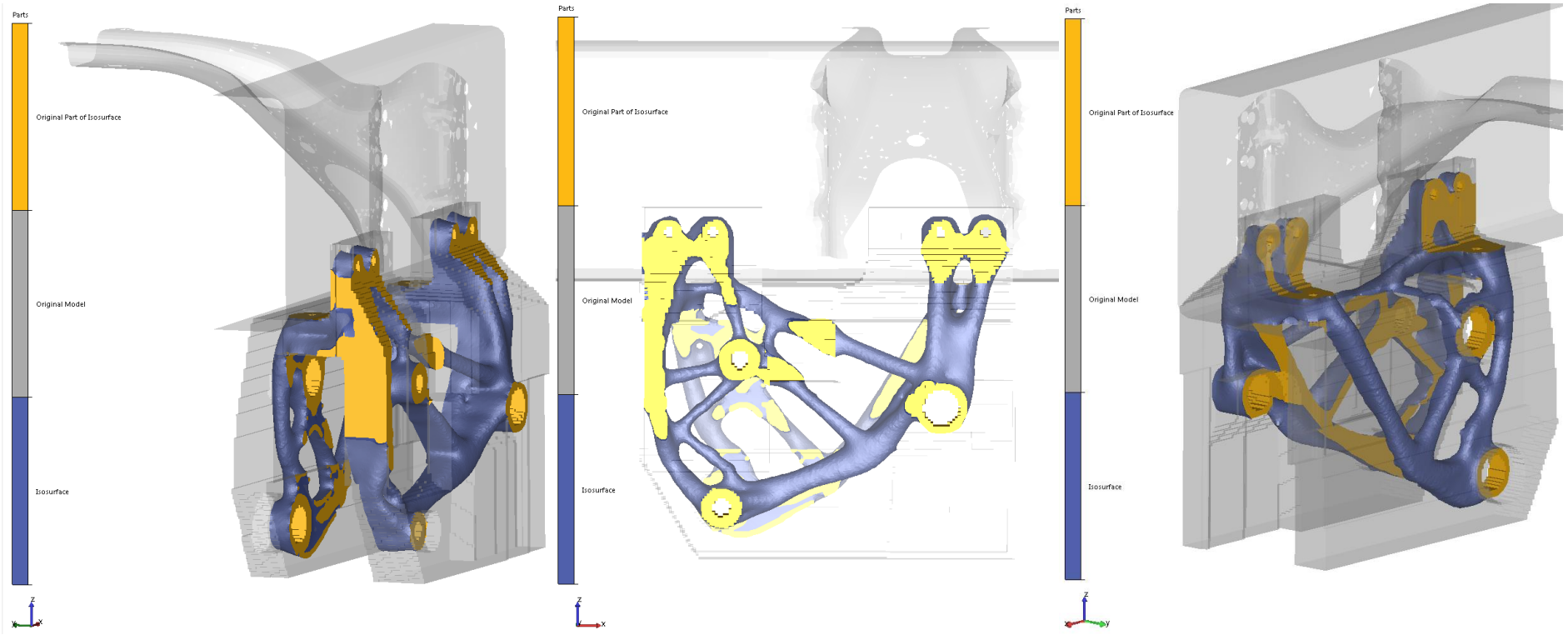
Topology Optimization – Result Transfer

Problem Definition

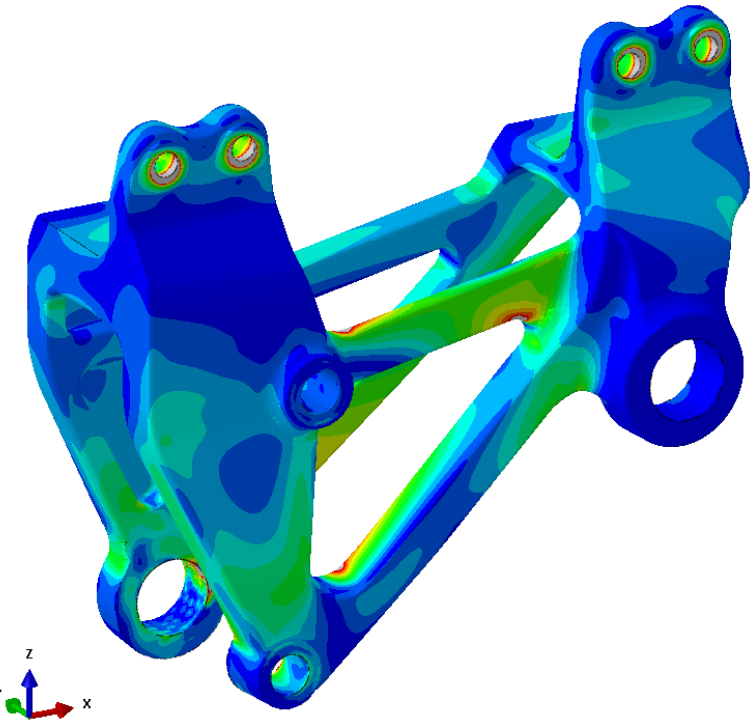
- Three load cases
- Limit on max stress
- Cast iron design

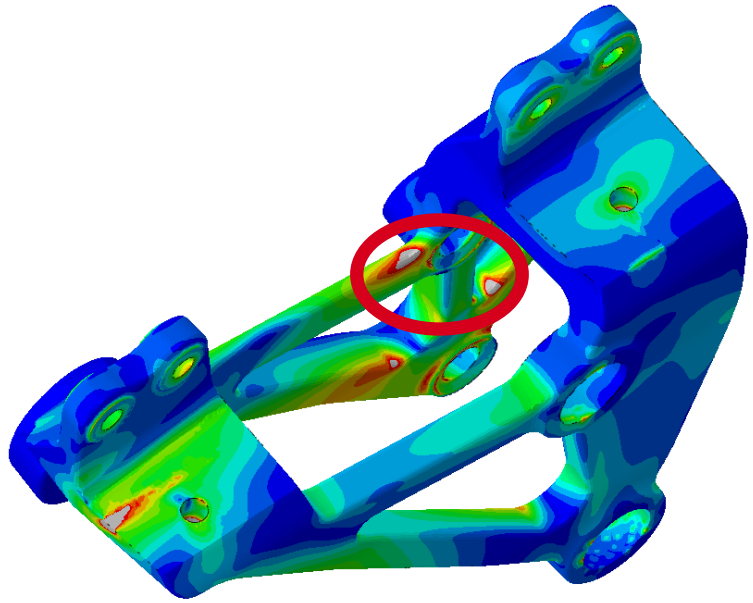


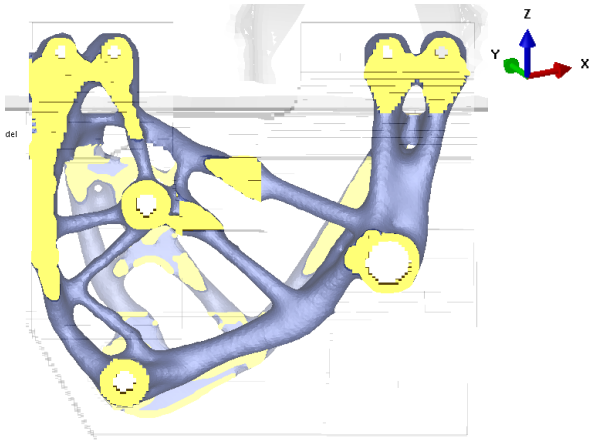
Result


Parts
Original Part of Isosurface
Original Model
Isosurface
Parts
Original Part of Isosurface
Original Model
Isosurface
Parts
Original Part of Isosurface
Original Model
Isosurface

Result Interpretation – First Design

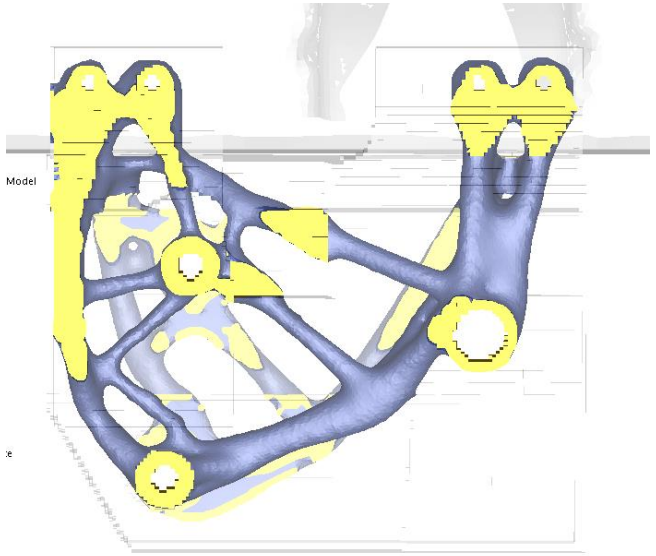


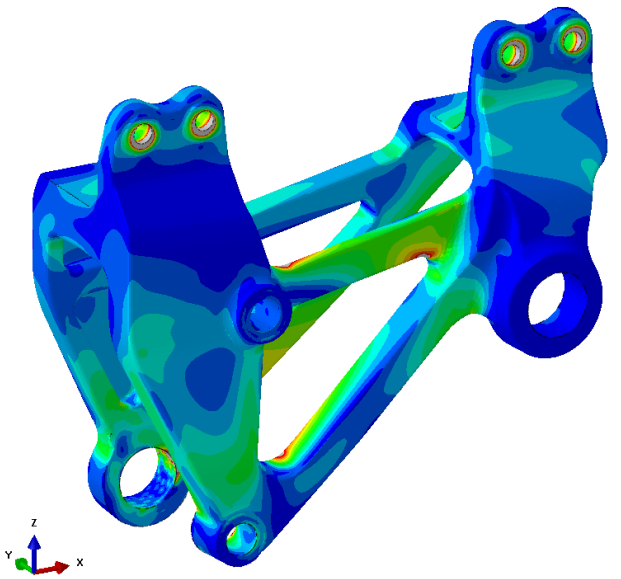




Areas with high stresses.

Summary





- Stress limit fullfilled
  - After shape optimization
- Mass decrease compared with current design 30%

- Deviation from topology optimization result => sub optimal solution.
- Result transfer is important.
- Highlight important structural members in topology optimization result.

Conclusions

- Correct used, it makes good designers great designers!
- But, how to transfer the geometry from topology optimization tool to CAD?
- But, how to transfer information/knowledge of the design to the new component?

Questions?

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