

Up and Running with Autodesk Nastran In-CAD

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Simulation Manager @ Symetri



Volunteers Ilogic driven analysis...

1. ANDREW INTVELD
2. DARRIN LINDBLOM

This Class is for...



Users just starting out in Life (Simulation!)



I hope experts may pick up one or two tips.

Goal of this class is....

Which analysis results do I use for my design

Why do I need to run more than one analysis

Results are not as I expected

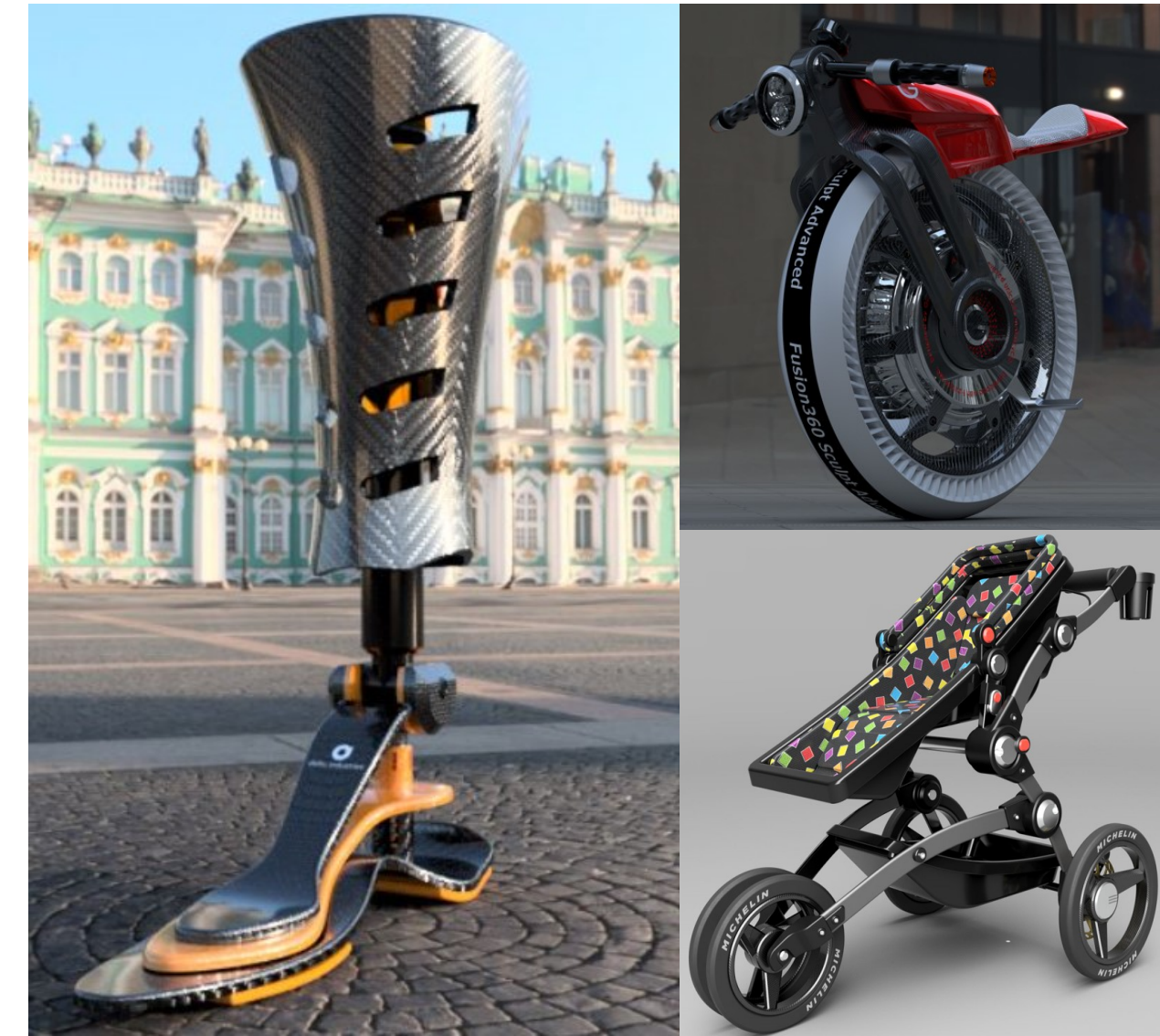
What mesh size do I use

Why bother with simulation. I'll carry on using my intuition and hand calculations

ME
Thinking !

To help you gain more confidence in simulation

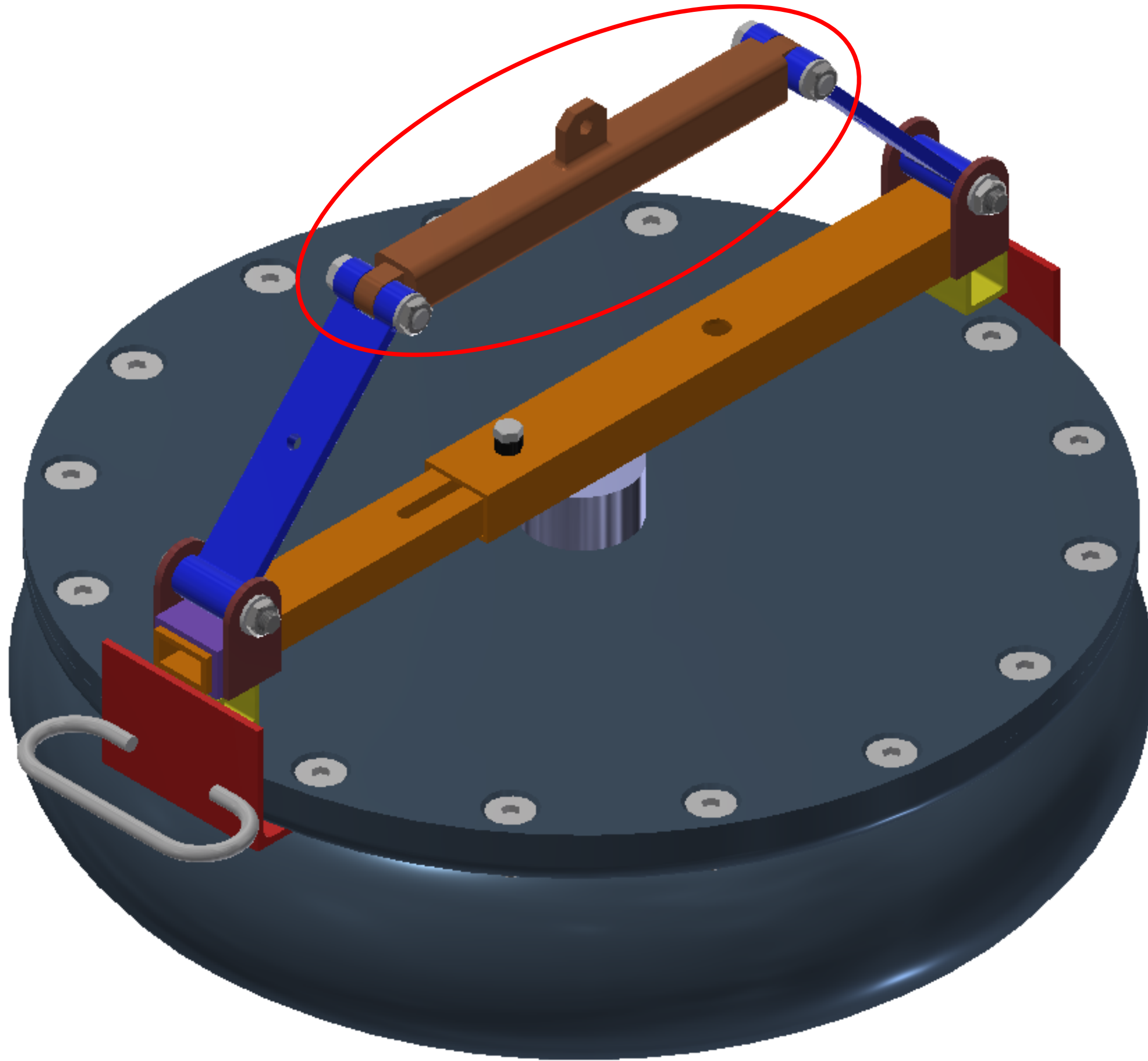
Create great products



Avoid Over-engineering



Benefits of Upfront Simulation –



Benefits of Upfront Simulation –

Tools Available

1. Hand Calculations

$$\sigma = Mx \frac{y}{I}$$

Load is applied centrally on the beam, therefore to find the maximum bending moment, we can use:

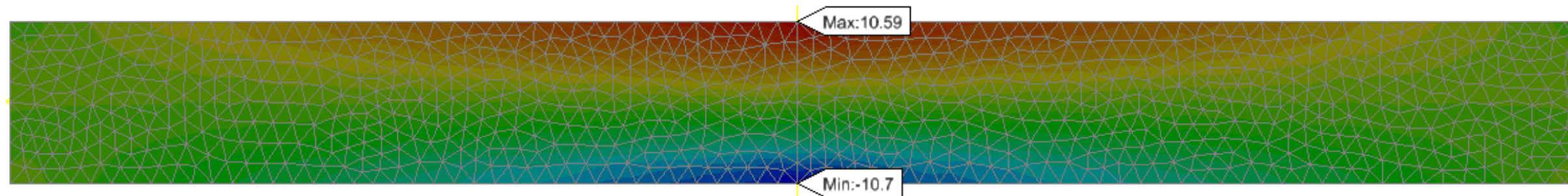
$$\begin{aligned} M &= P \times L / 4 \\ &= 780\text{N} \times 390\text{mm} / 4 \\ &= 76050 \text{ Nmm} \end{aligned}$$

$$\begin{aligned} y &= \text{Distance to neutral axis} \\ &= \text{Section height} / 2 \\ &= 40\text{mm} / 2 = 20 \text{ mm} \end{aligned}$$

$$\begin{aligned} I &= \text{2nd Moment of Area (for box section)} \\ &= \text{Outer 2nd Moment of Area} - \text{Inner 2nd Moment of Area} \\ &= (BD^3 / 12) - (bd^3 / 12) \\ &= (40 \times 40^3 / 12) - (30 \times 30^3 / 12) \\ &= 2560000 - 675000 \\ &= 145833 \text{ mm}^4 \end{aligned}$$

Therefore, Max Tensile or Compressive Stress due to bending is:

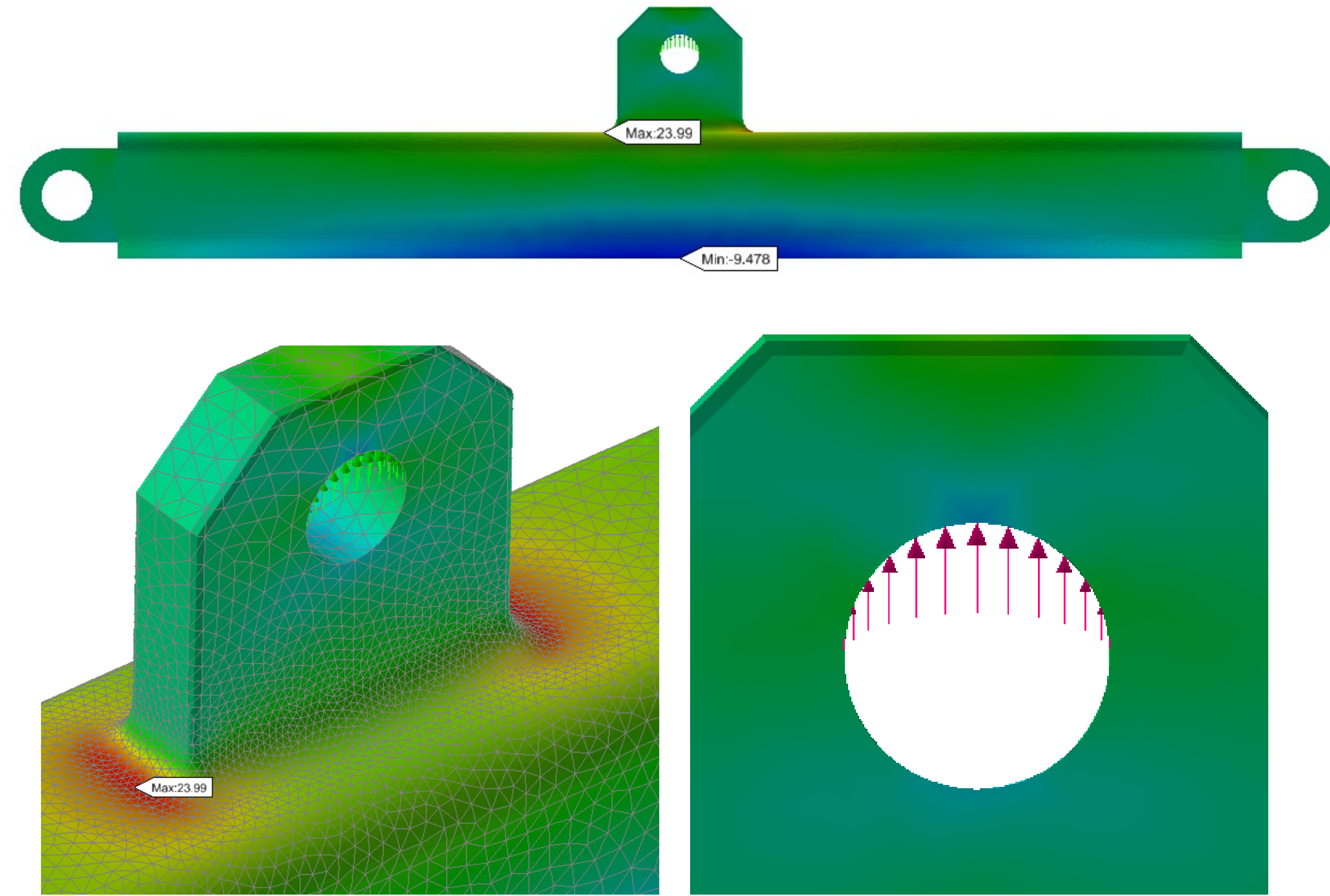
$$\begin{aligned} \sigma &= 76050 \times 20 / 145833 \\ &= 10.43\text{N/mm}^2 = 10.43 \times 10^6 \text{ N/m}^2 = \mathbf{10.43 \text{ MPa}} \end{aligned}$$



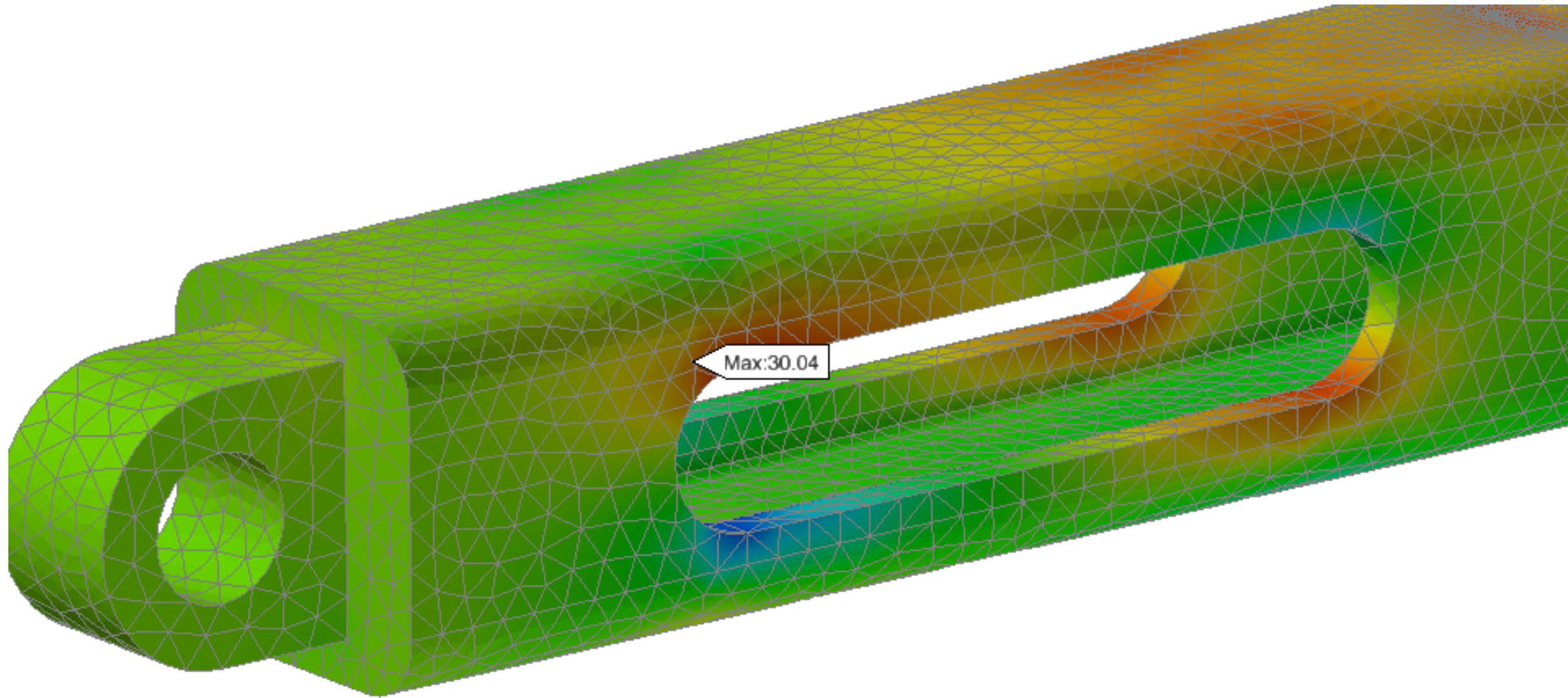
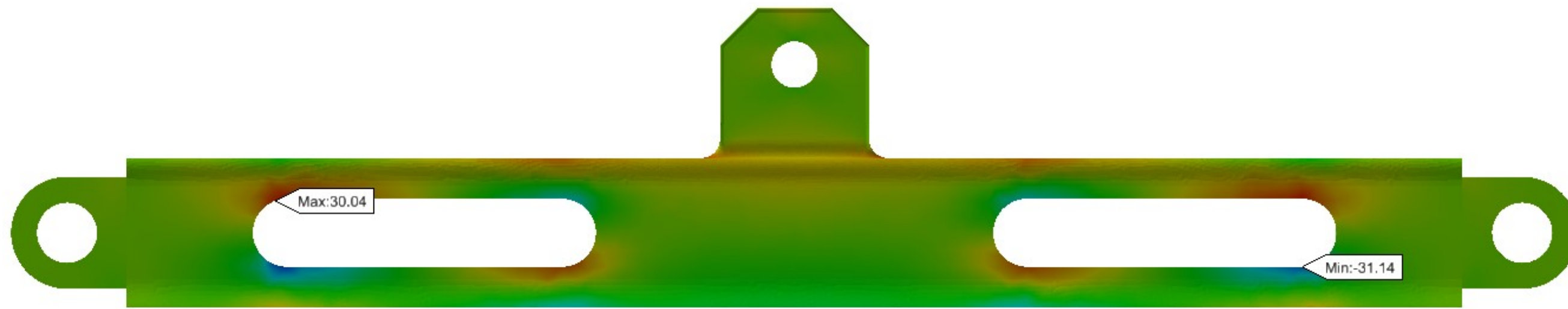
Benefits of Upfront Simulation –

Tools Available

1. Hand Calculations
2. Upfront Simulation



Benefits of Upfront Simulation –



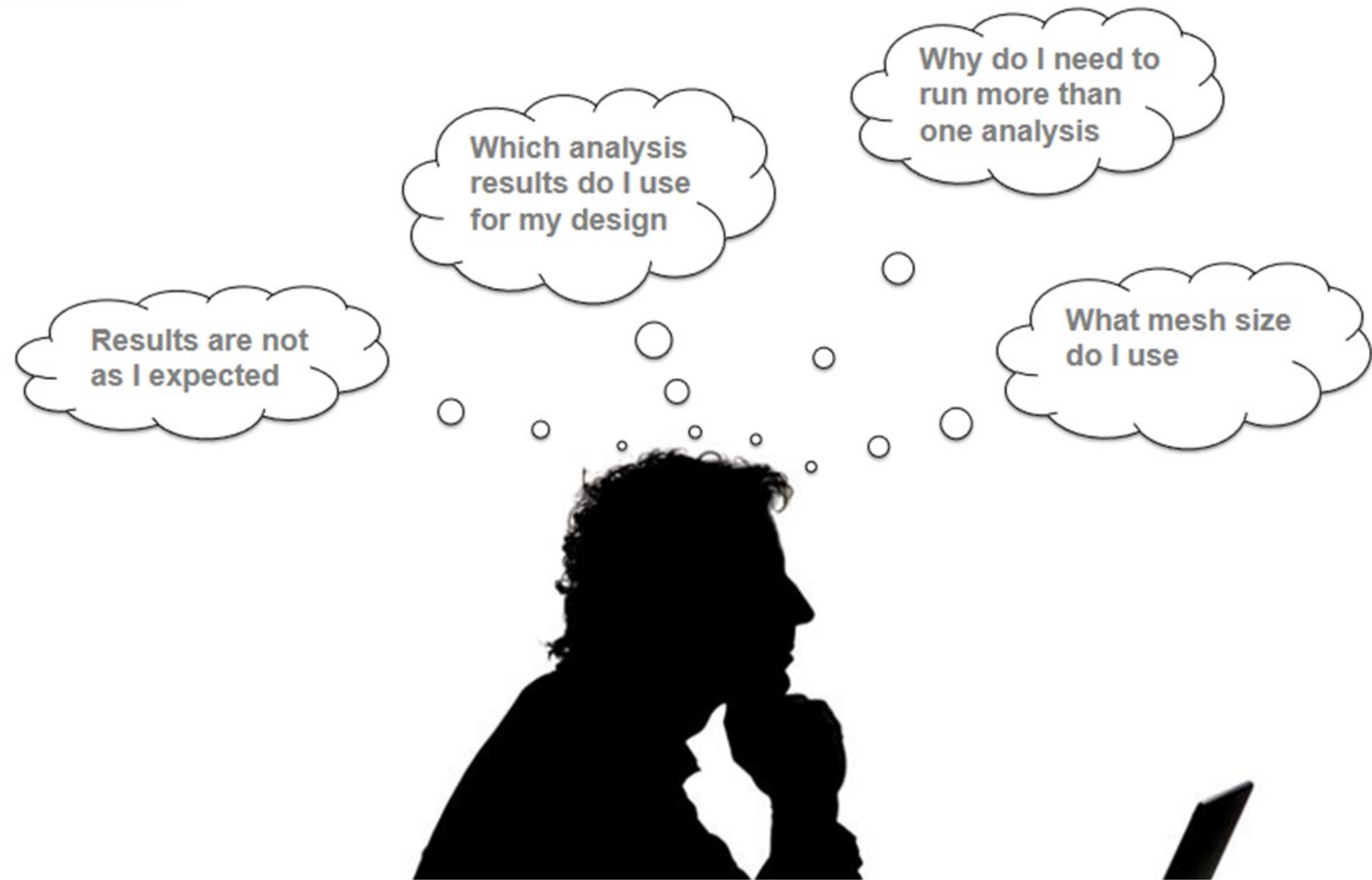
Tools Available

1. Hand Calculations
2. Upfront Simulation
3. Optimisation

The Big Myth

Question

.... How do I know my results are correct?



The Big Myth

Answer

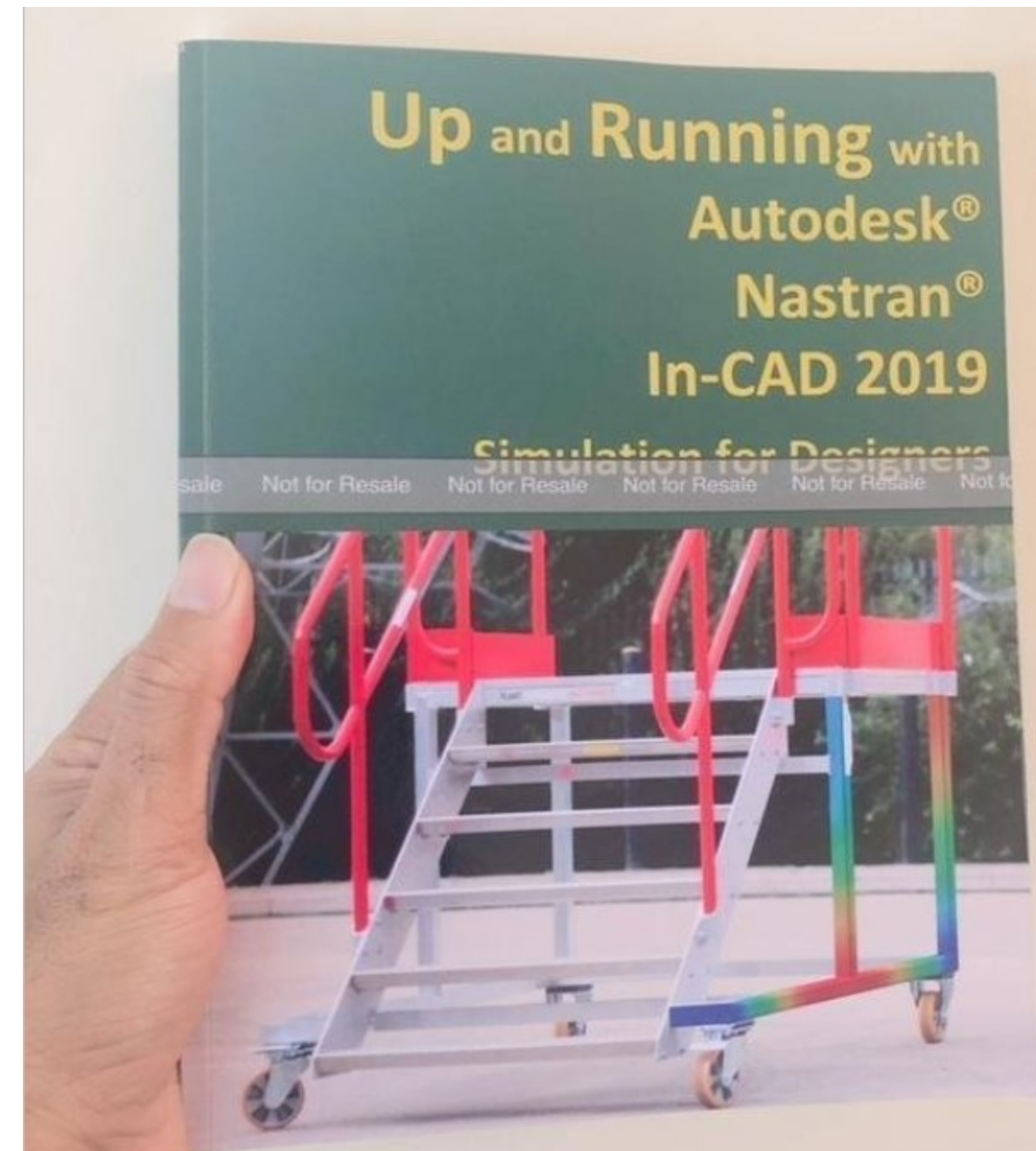
.... Well you do!
Really.....



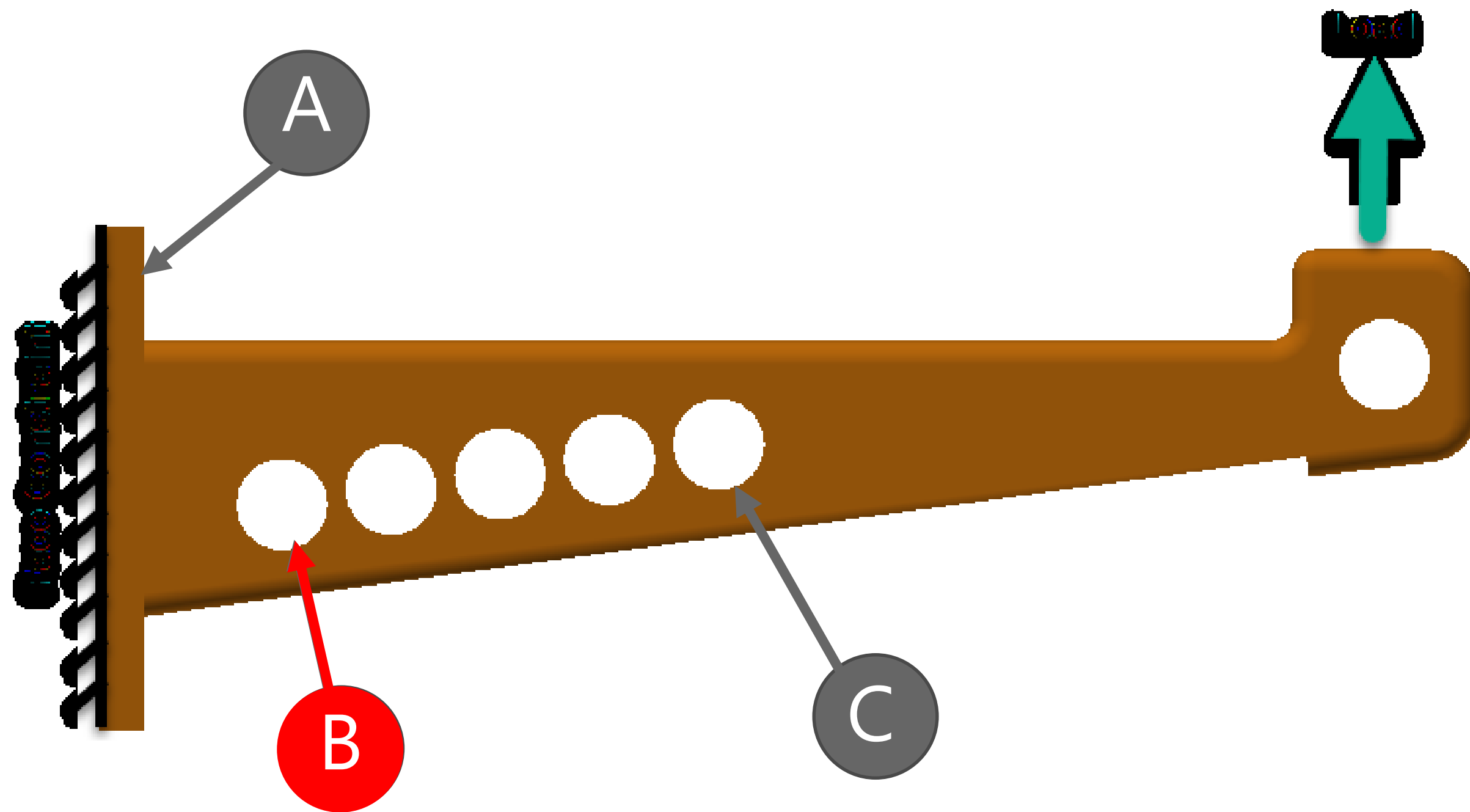
Short Test (Quiz!) – To proof you know the answer (Well I hope!!)

Rules of Engagement

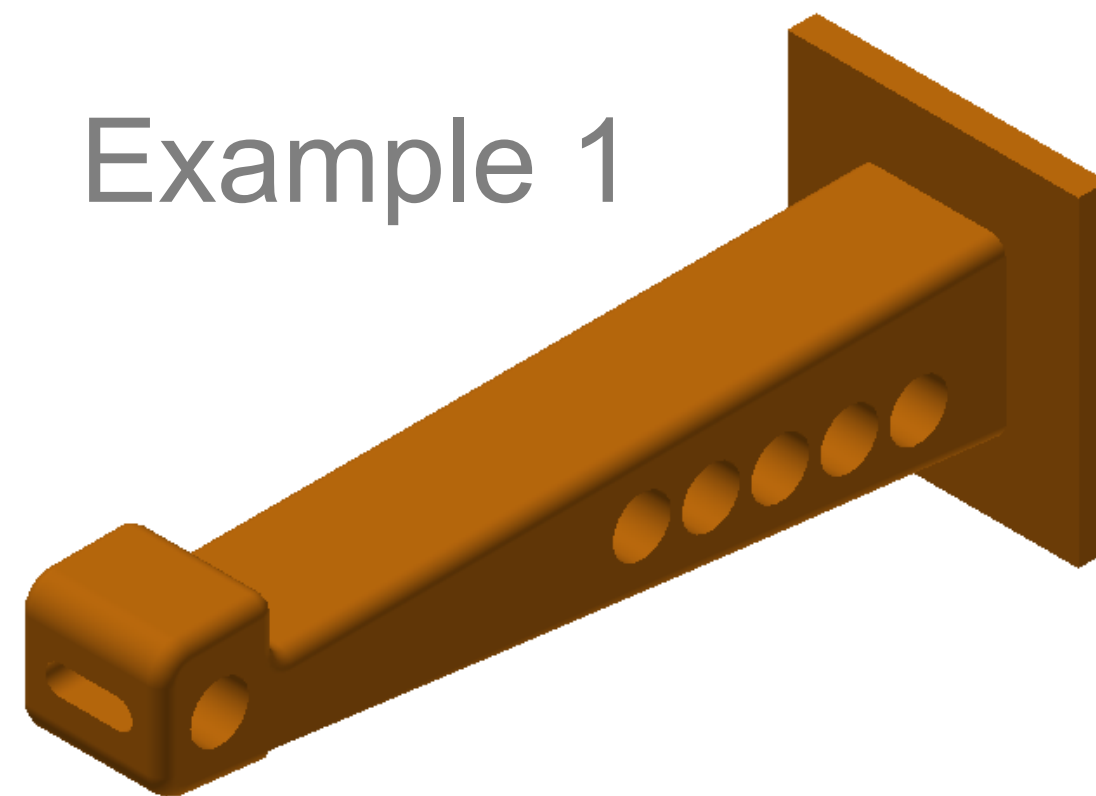
Just raise your hand.



The Big Myth – Are my results correct?



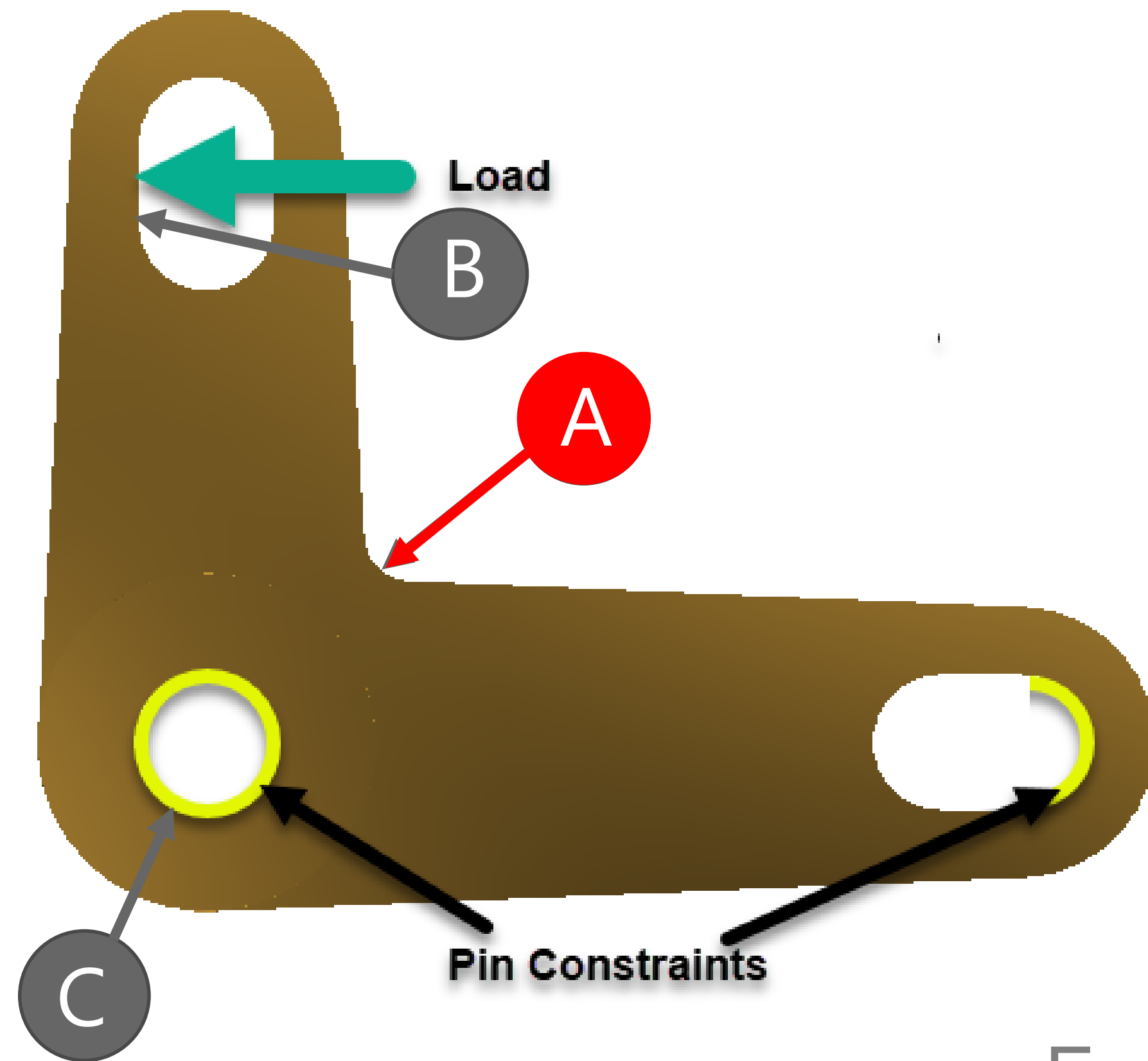
Example 1



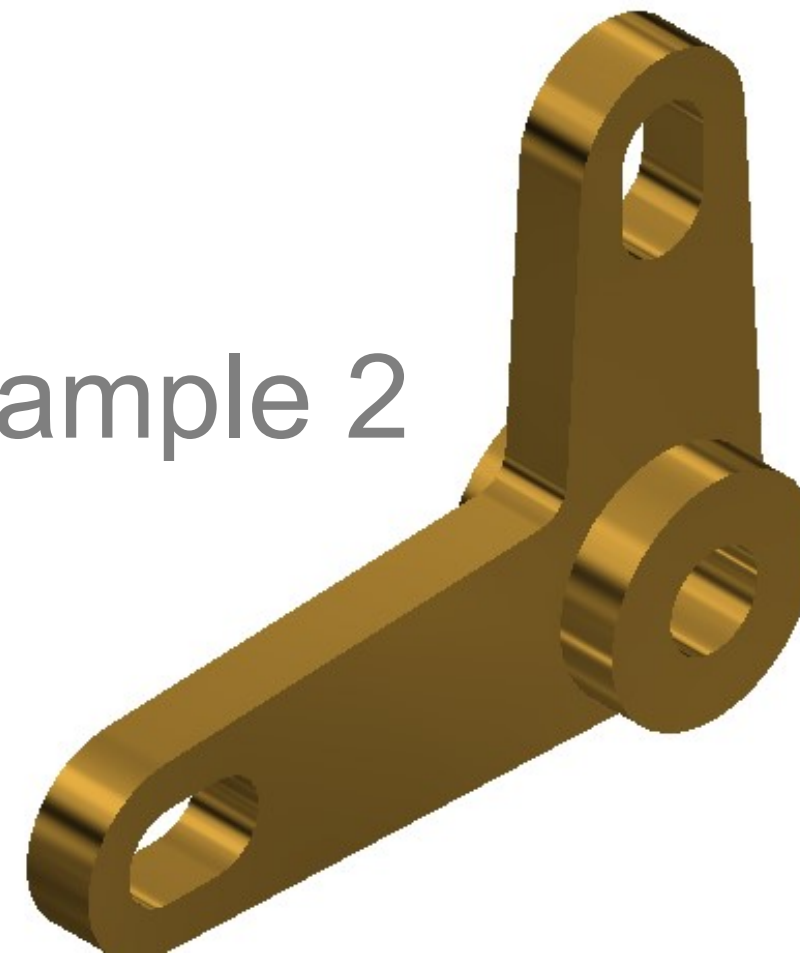
Tips and Tools to help you...

1. Max-Stress – You have an idea

The Big Myth – Are my results correct?



Example 2



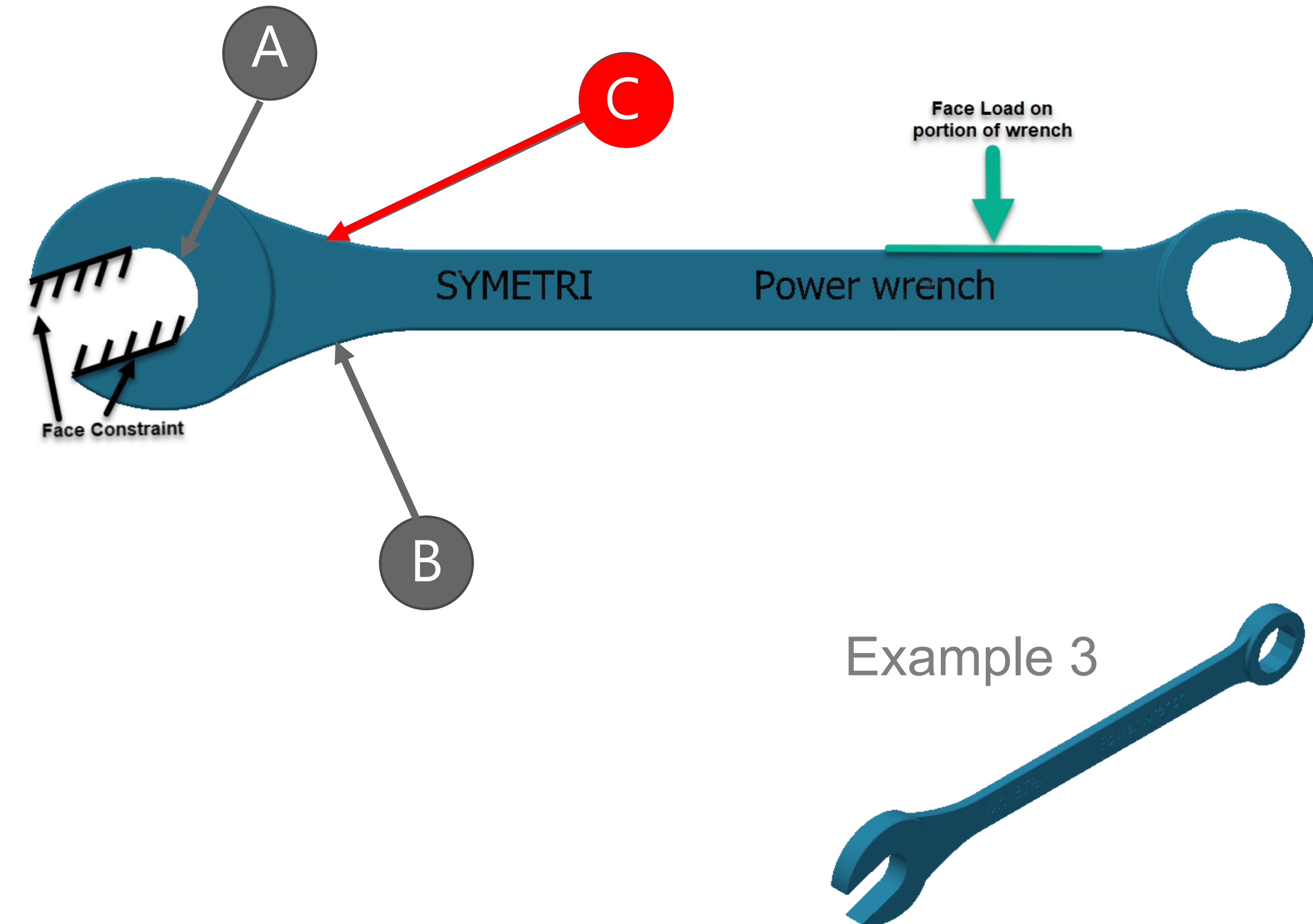
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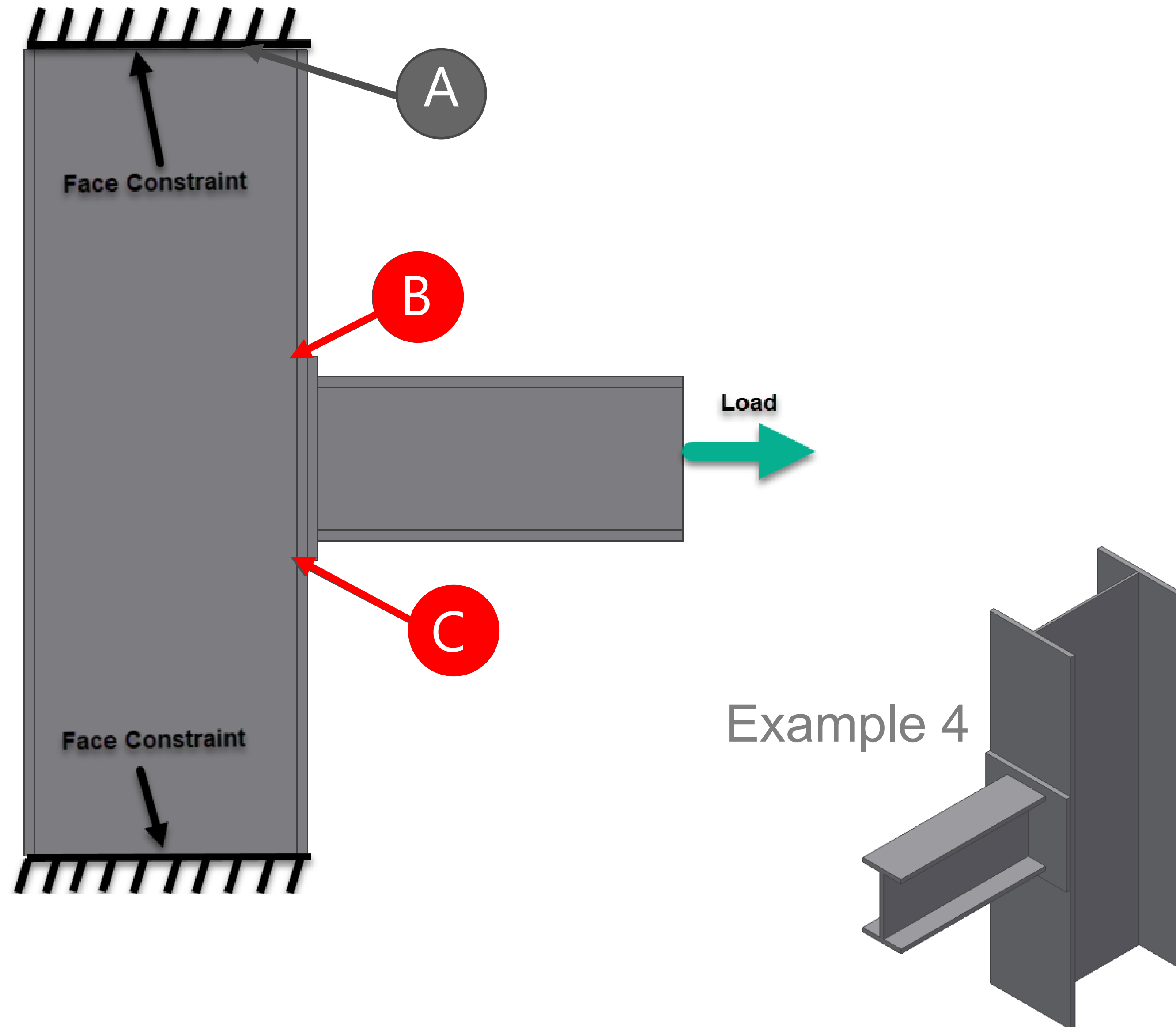
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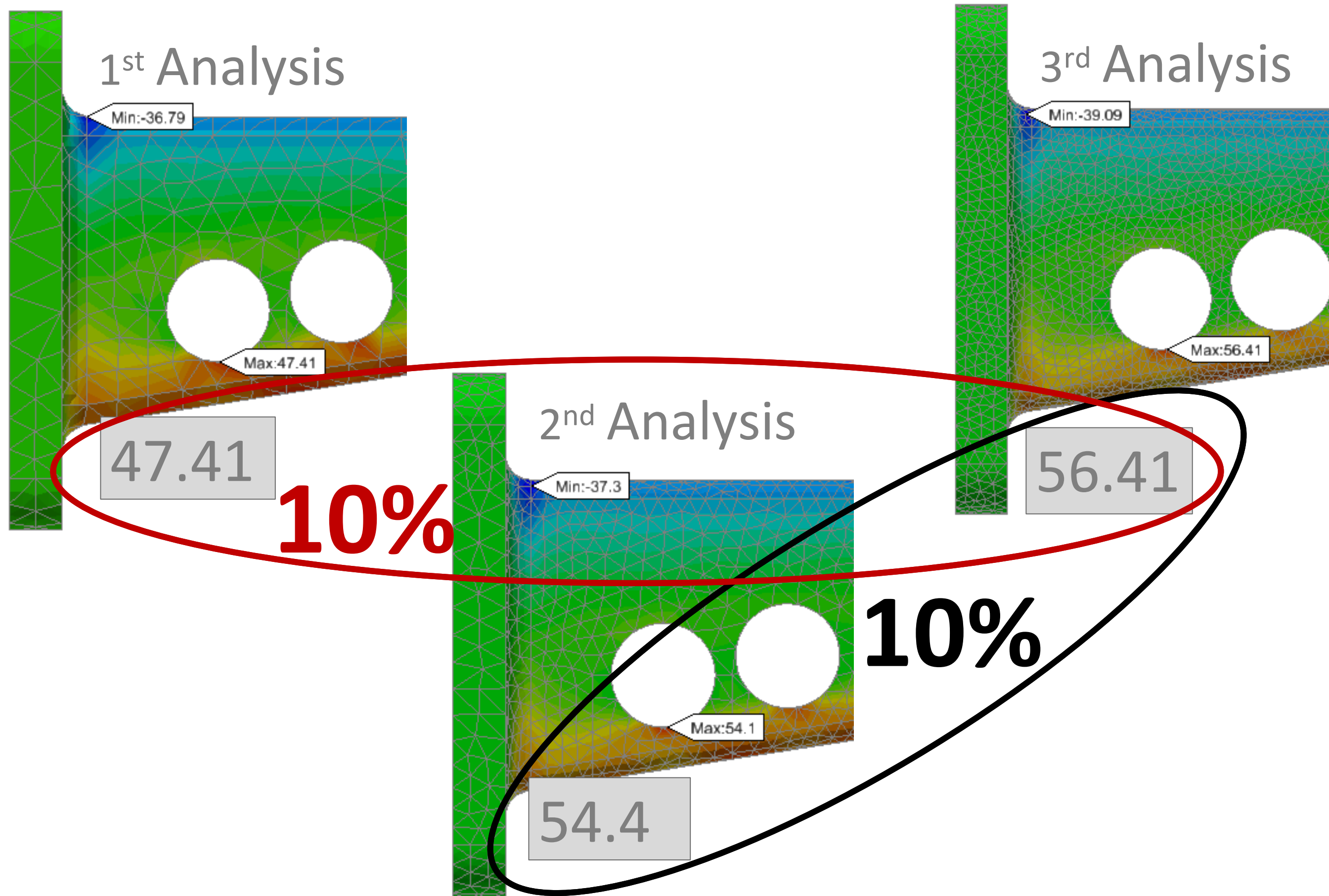
Tips and Tools to help you...



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Tips and Tools to help you...

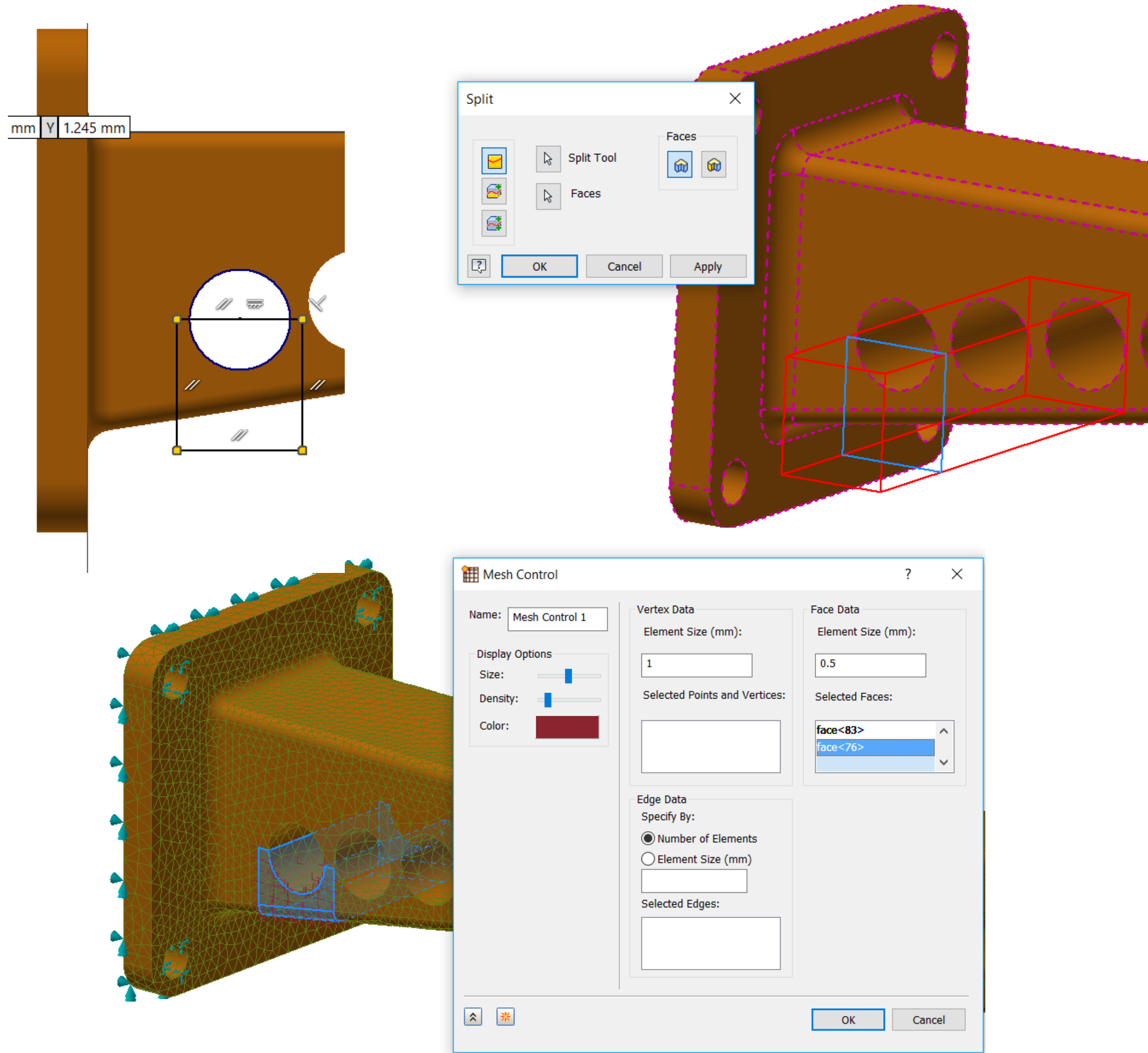


1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes

The Big Myth – Are my results correct?

Tips and Tools to help you...

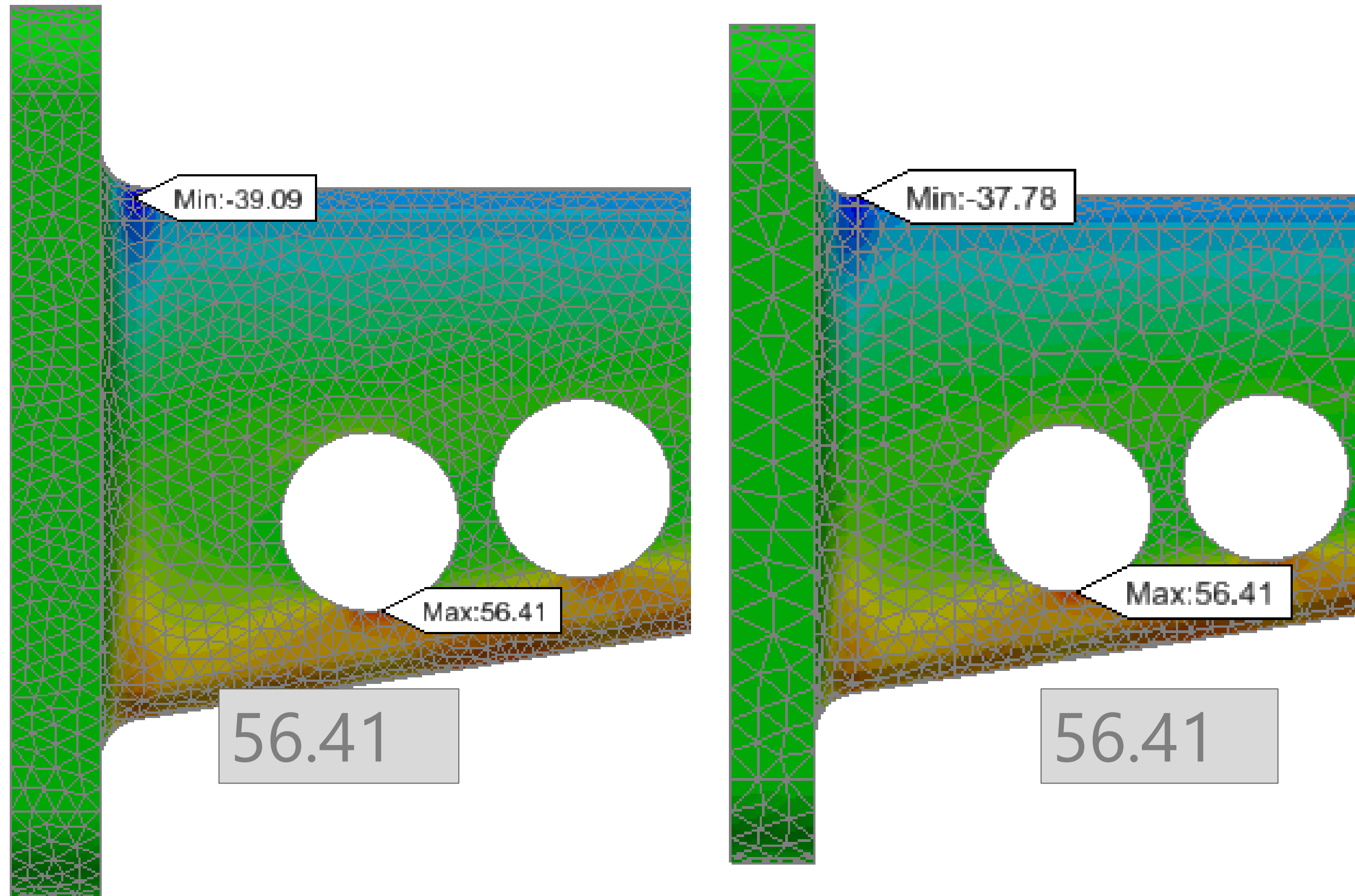
1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh



The Big Myth – Are my results correct?

Tips and Tools to help you...

1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh



Global Mesh Control

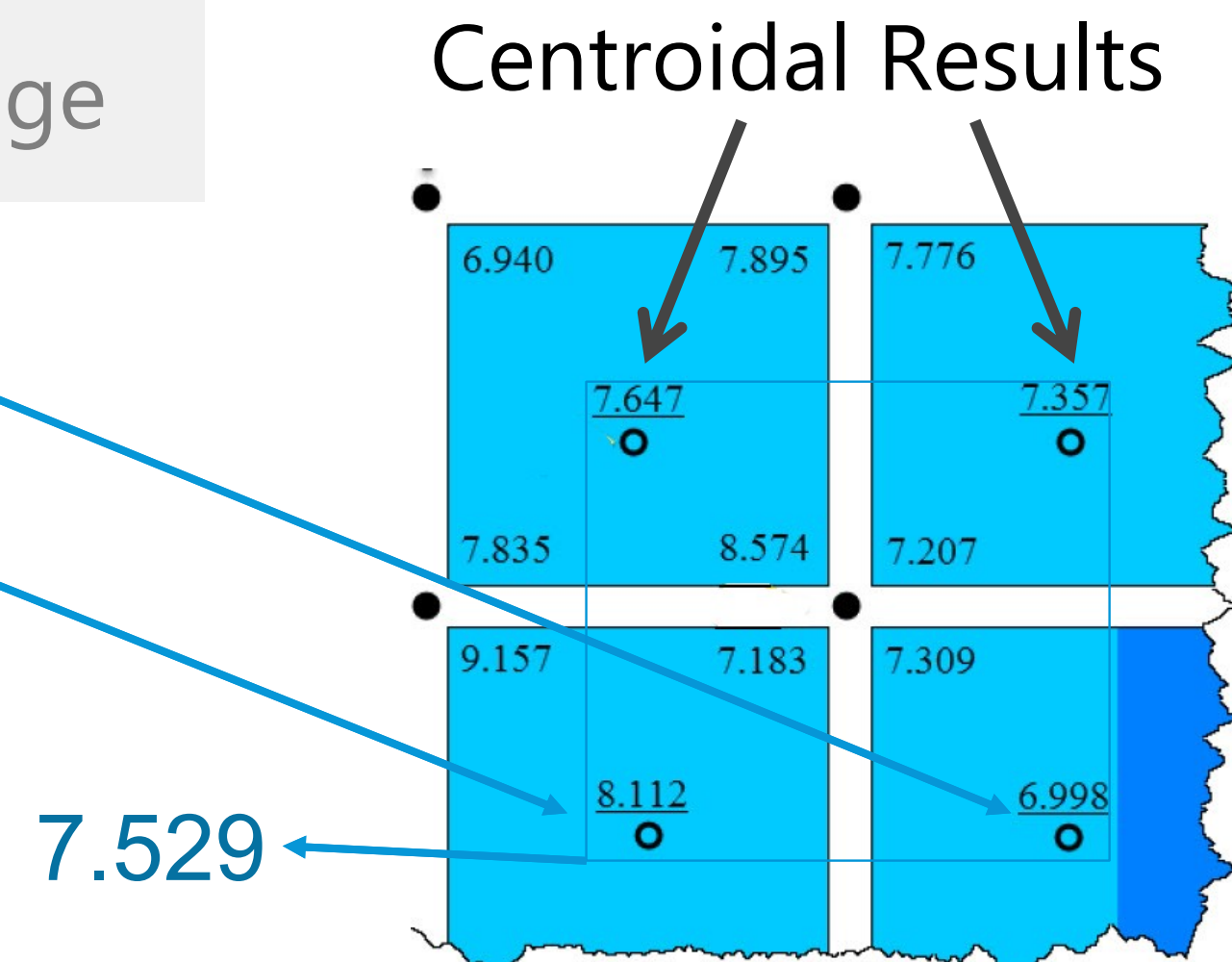
Local Mesh Control

The Big Myth – Are my results correct?

Tips and Tools to help you...

1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh
4. Centroidal Results

Maximum	Minimum	Average
Result Data: Stress	Result Data: Stress	Result Data: Stress
Type: SOLID VON MISES ST	Type: SOLID VON MISES ST	Type: SOLID VON MISES ST
<input type="checkbox"/> Specify Min/Max	<input type="checkbox"/> Specify Min/Max	<input type="checkbox"/> Specify Min/Max
Data Min: 2.91621e-5	Data Min: 5.47254e-6	Data Min: 2.64093e-5
Data Max: 1299.19	Data Max: 1180.85	Data Max: 1260.09
Data Conversion: Maximum	Data Conversion: Minimum	Data Conversion: Average
Data Type: Centroidal	Data Type: Centroidal	Data Type: Centroidal
<input checked="" type="radio"/> Real <input type="radio"/> Imaginary	<input checked="" type="radio"/> Real <input type="radio"/> Imaginary	<input checked="" type="radio"/> Real <input type="radio"/> Imaginary
Contour Type: Nodal	Contour Type: Nodal	Contour Type: Nodal
<input type="checkbox"/> No Averaging	<input type="checkbox"/> No Averaging	<input type="checkbox"/> No Averaging

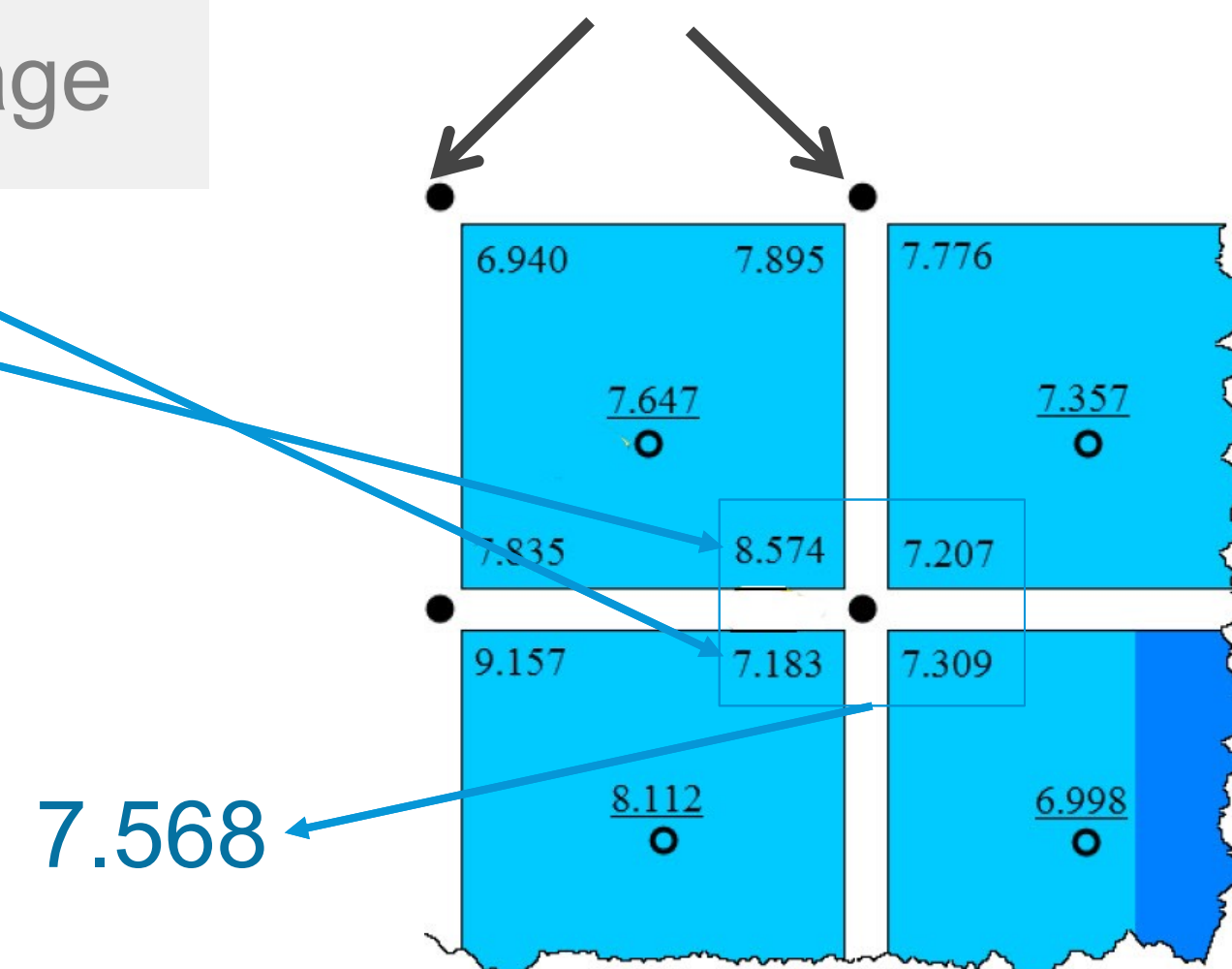


The Big Myth – Are my results correct?

Tips and Tools to help you...

Maximum	Minimum	Average
Result Data: Stress	Result Data: Stress	Result Data: Stress
Type: SOLID VON MISES ST	Type: SOLID VON MISES ST	Type: SOLID VON MISES ST
<input type="checkbox"/> Specify Min/Max	<input type="checkbox"/> Specify Min/Max	<input type="checkbox"/> Specify Min/Max
Data Min: 4.11502e-5	Data Min: 9.92877e-6	Data Min: 3.26868e-5
Data Max: 2154.2	Data Max: 1385.15	Data Max: 1405.83
Data Conversion: Maximum	Data Conversion: Minimum	Data Conversion: Average
Data Type: Corner	Data Type: Corner	Data Type: Corner
<input checked="" type="radio"/> Real <input type="radio"/> Imaginary	<input checked="" type="radio"/> Real <input type="radio"/> Imaginary	<input checked="" type="radio"/> Real <input type="radio"/> Imaginary
Contour Type: Nodal	Contour Type: Nodal	Contour Type: Nodal
<input type="checkbox"/> No Averaging	<input type="checkbox"/> No Averaging	<input type="checkbox"/> No Averaging

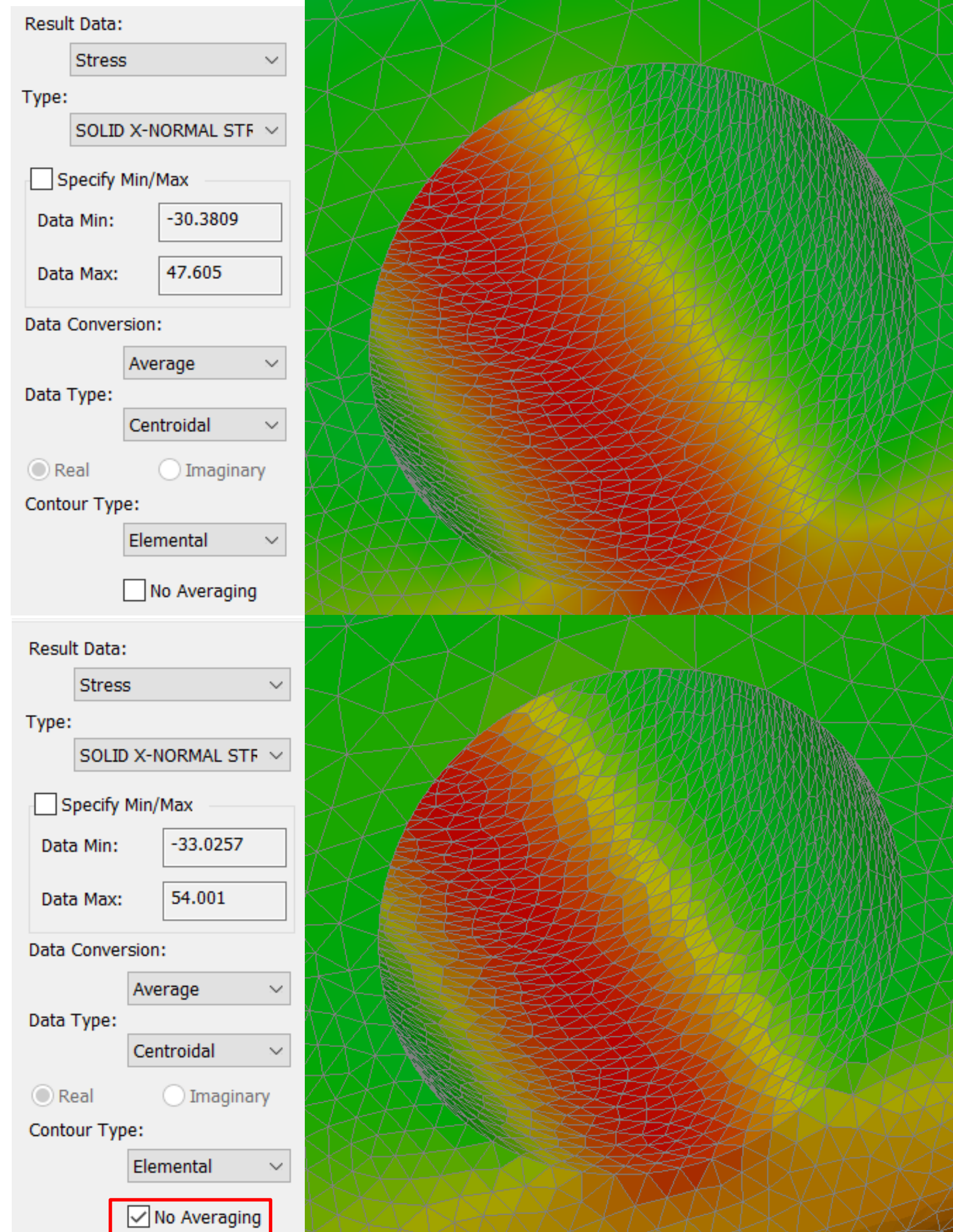
Corner Results



1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh
4. Centroidal Result
5. Corner Results

The Big Myth – Are my results correct?

Tips and Tools to help you...



1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh
4. Centroidal Results
5. Corner Results
6. Average and No Averaging Results

Stress Singularities



CRF01317 [RF] © www.visualphotos.com

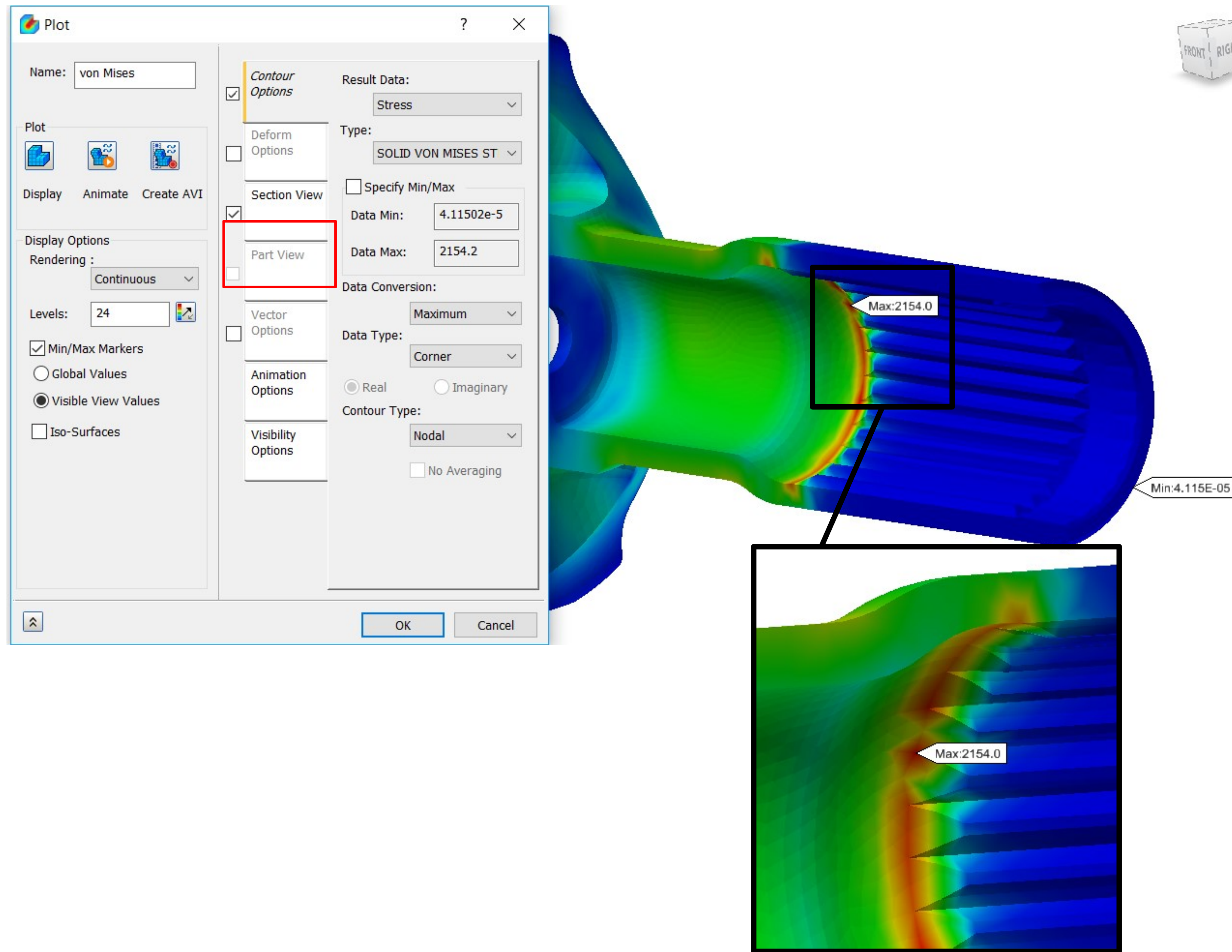
Stress Singularities



The Big Myth – Are my results correct?

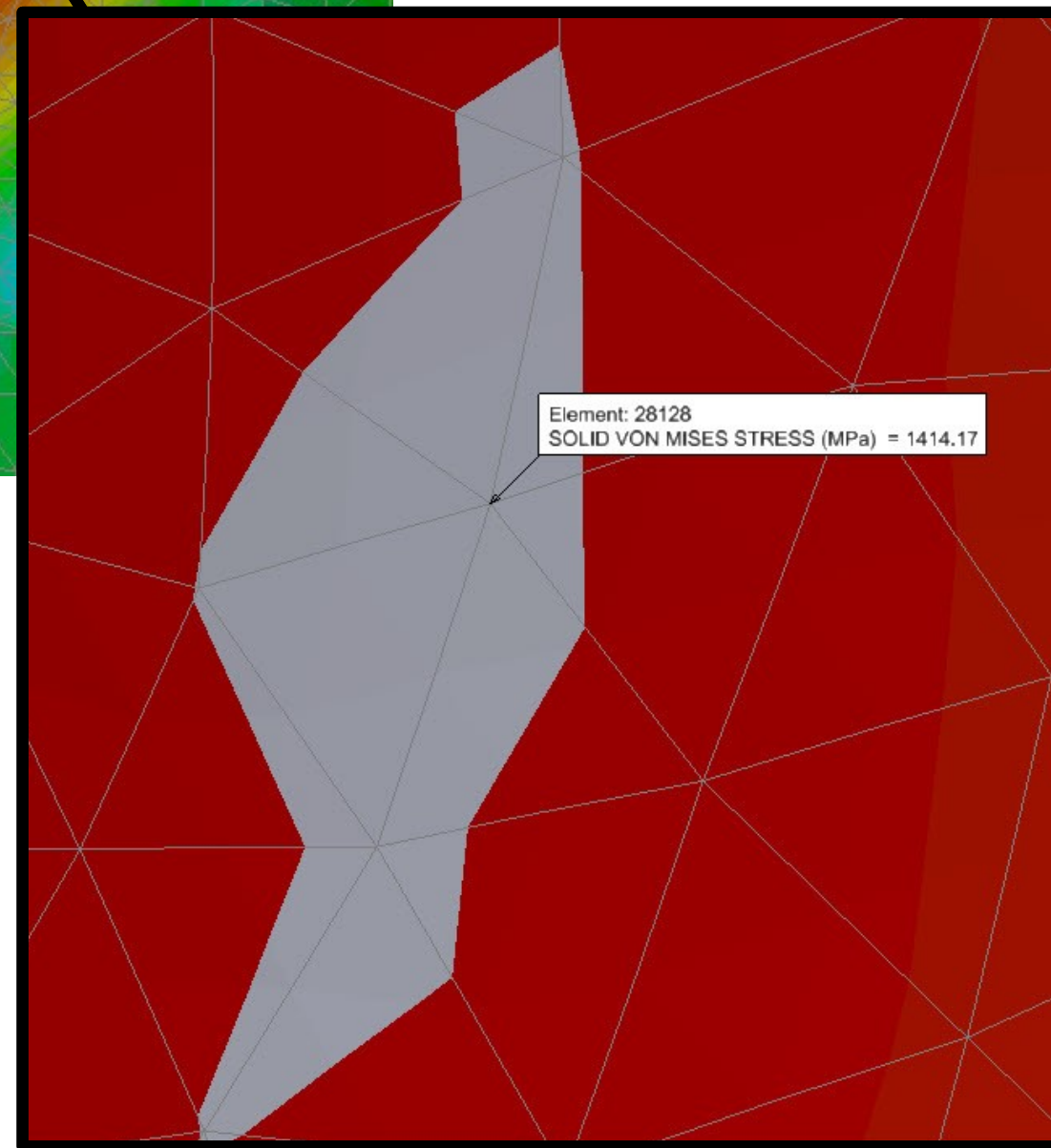
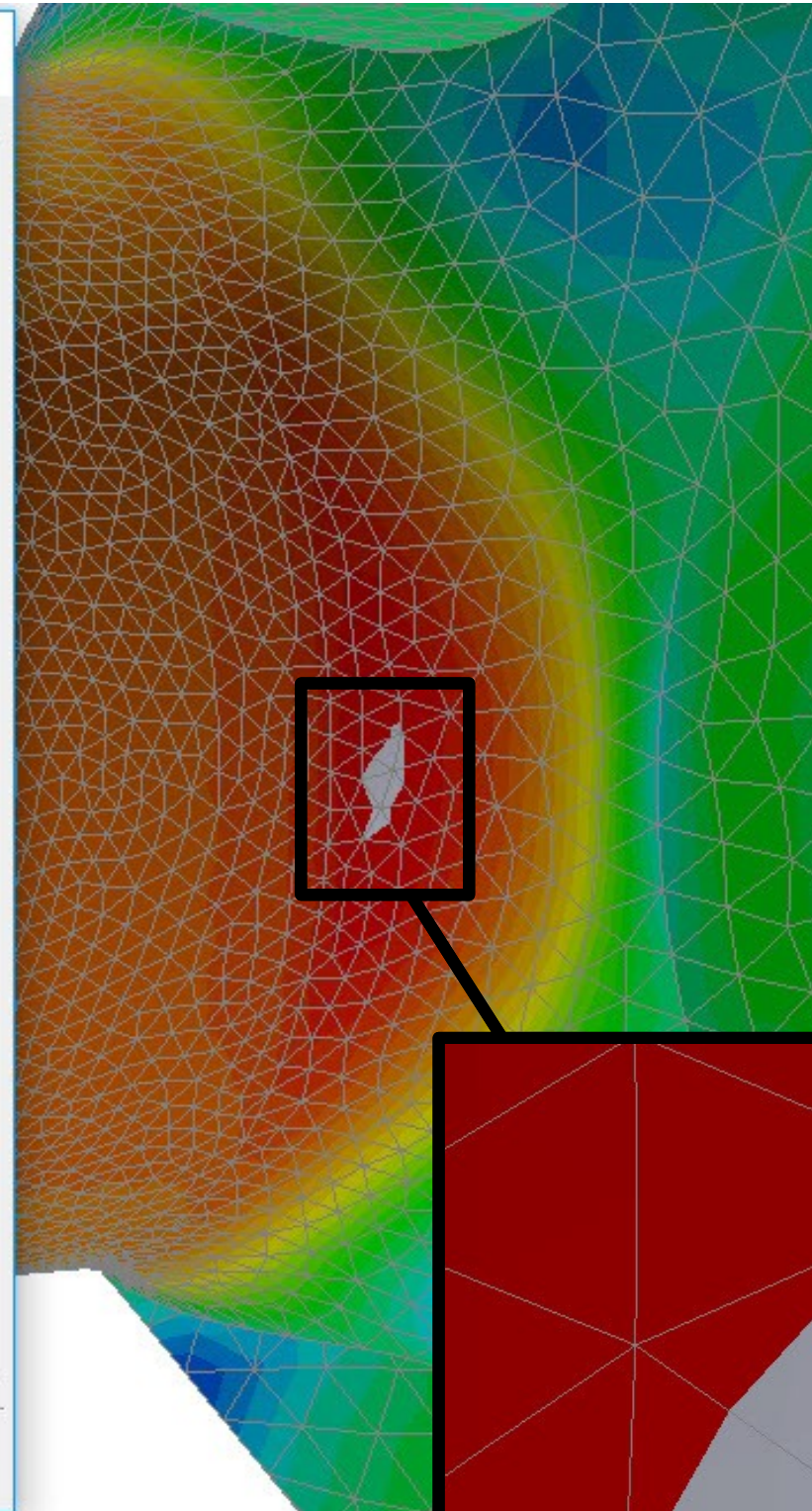
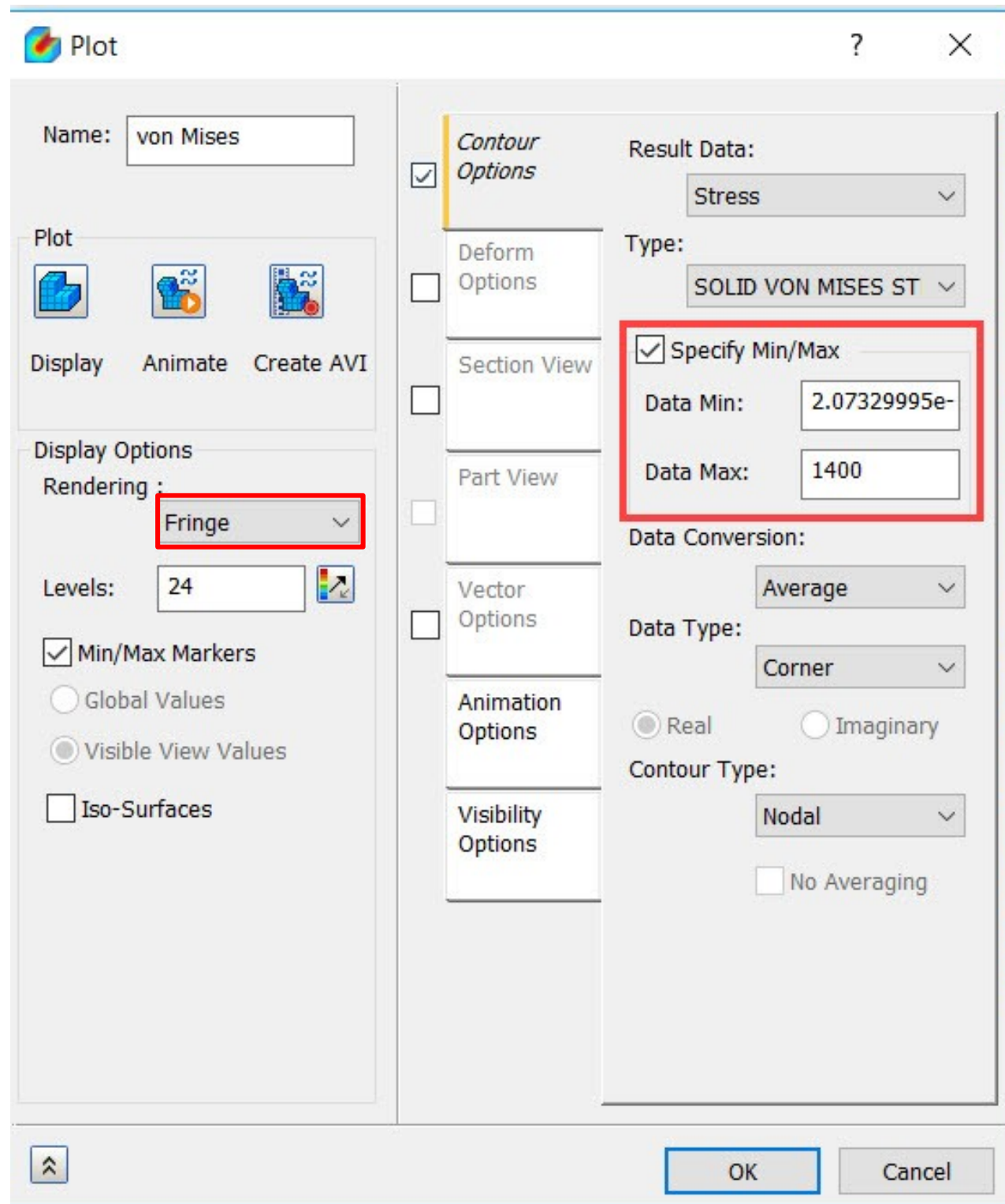
Tips and Tools to help you...

1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh
4. Centroidal Results
5. Corner Results
6. Average and No Averaging Results
7. Section Stress Plots



The Big Myth – Are my results correct?

Tips and Tools to help you...



1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh
4. Centroidal Results
5. Corner Results
6. Average and No Averaging Results
7. Section Stress Plots
8. Fringe Stress Plots

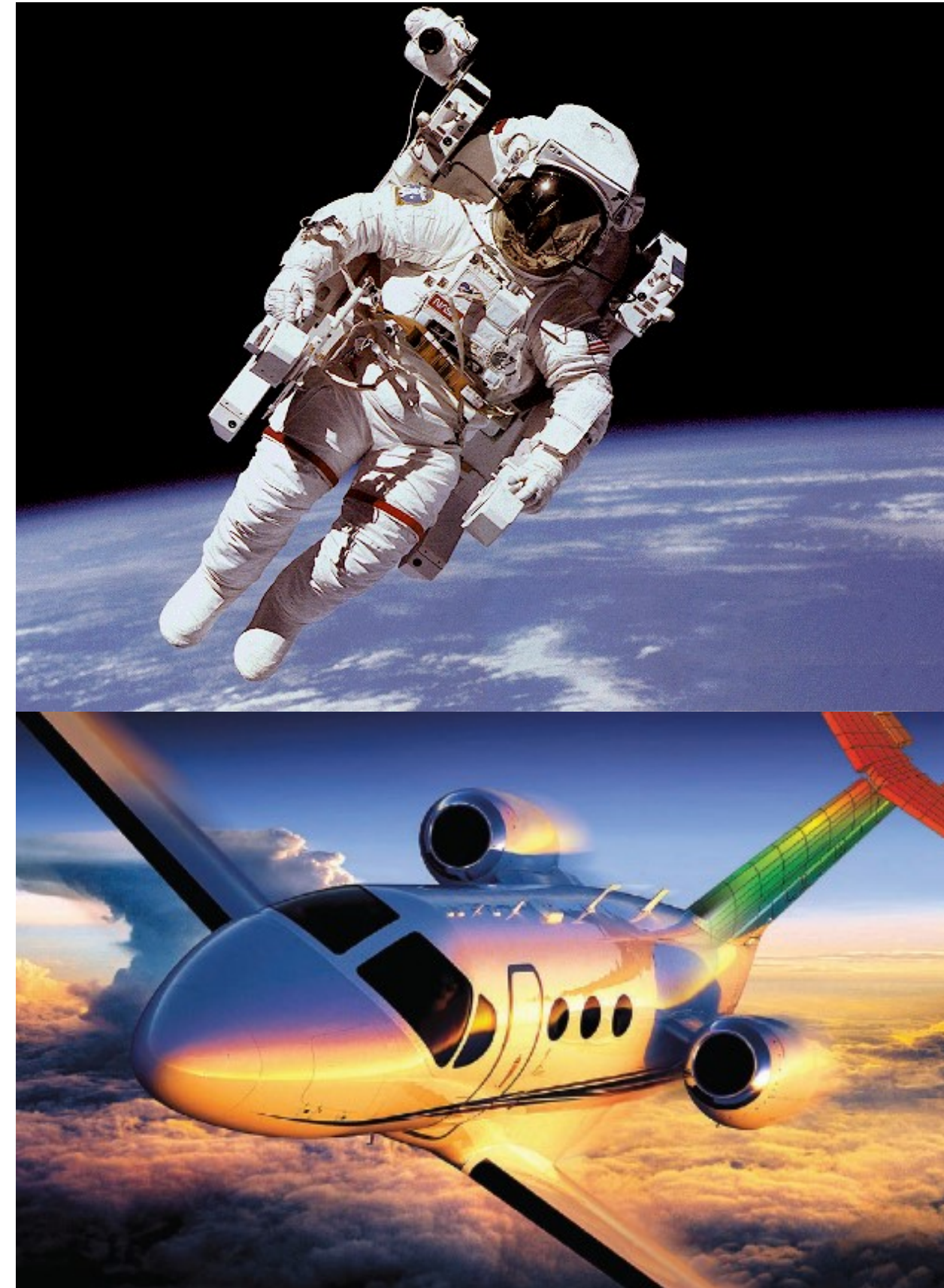
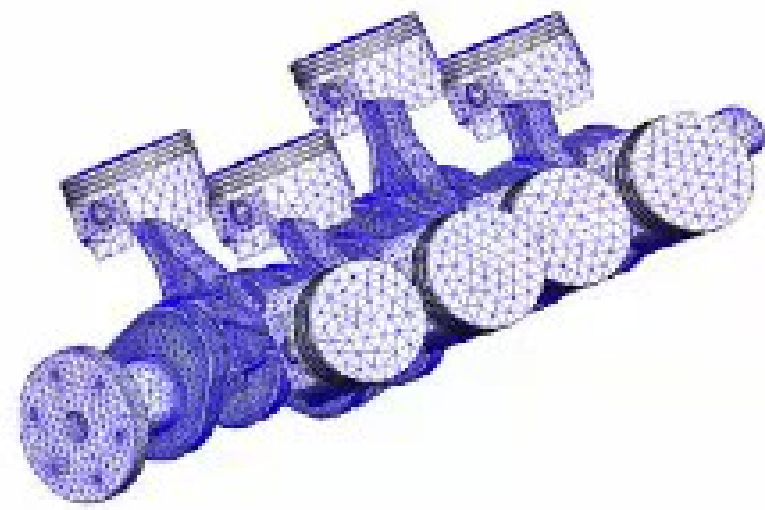
Finally can I trust Nastran results?

.... If you flew here to Las Vegas
You will need to if you want to fly back home
without STRESS.....

Can I trust Nastran results

Autodesk® Nastran® In-CAD 2019

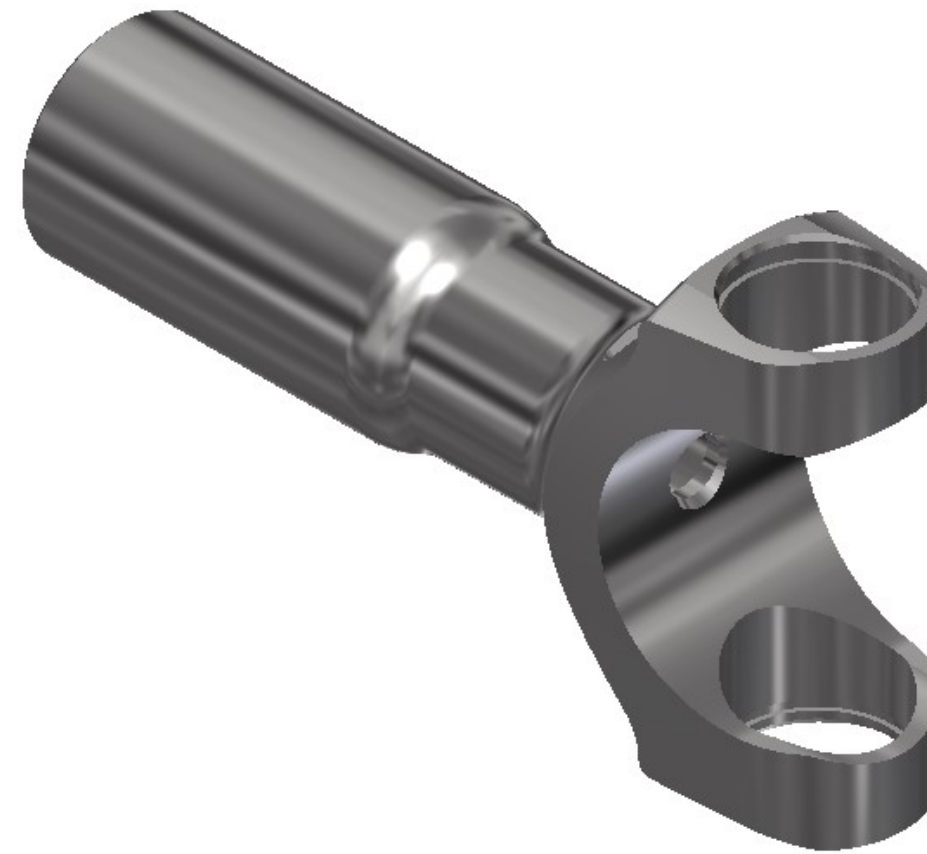
Verification Manual



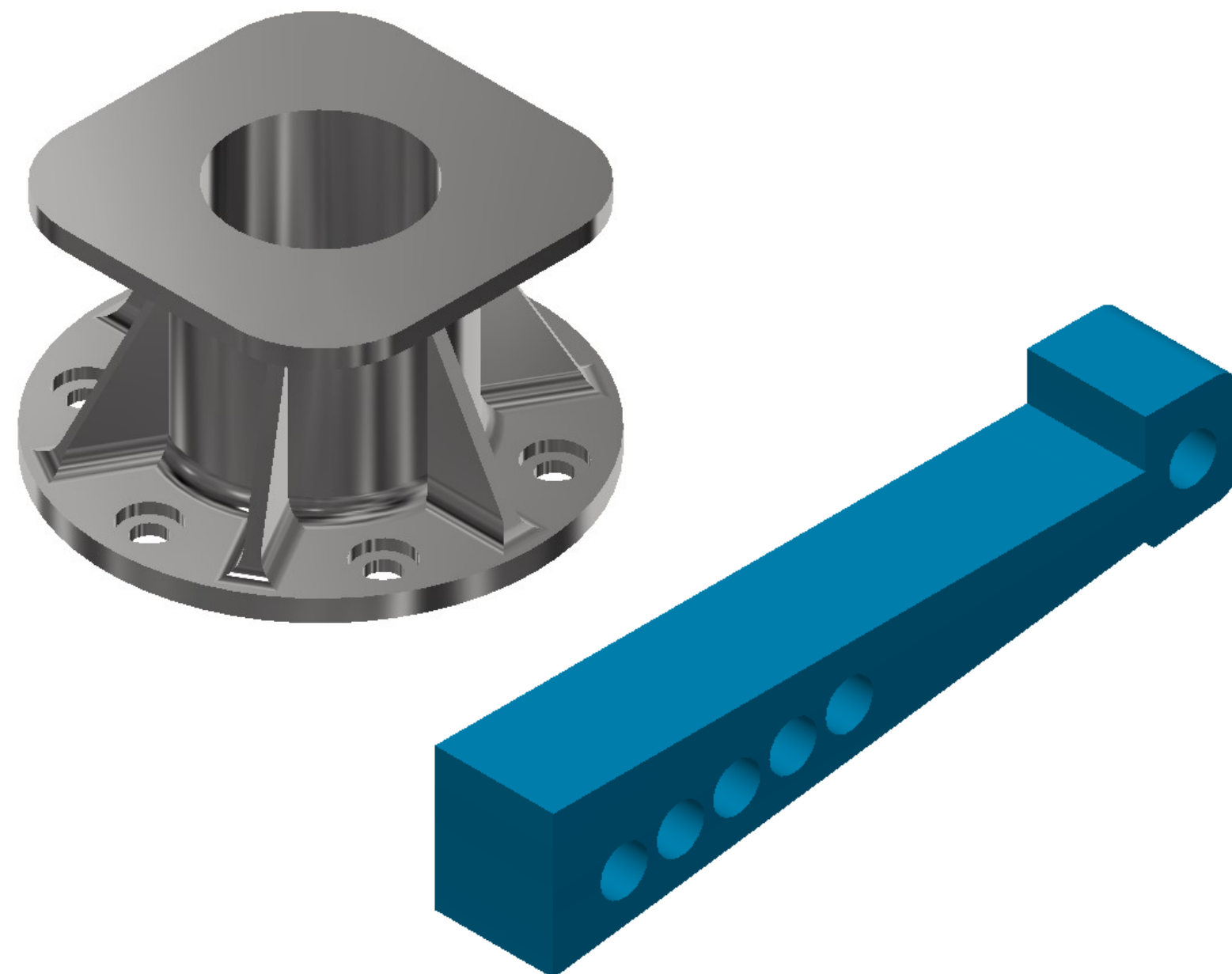
Absolutely

1. Verification Document
2. NASA
3. Most planes verified with Nastran if not all.
4. Industry Standard Solver

Nastran In-CAD in action



Live Demo 1 – Part Analysis including tips.



Live Demo 2 including by Attendees – Analysis workflow simplified using Ilogic automation

Typical Examples

Above and Beyond Inventor FEA

1. Bolted Connections
2. Thermal Analysis
3. Buckling
4. Vibration
5. Impact Analysis
6. Elastic/Plastic (Non-Linear)

.... Well are you more confident now?
..... Did you learn something new?.....



..... Or perhaps you have some questions?
..... So fire away.....



Want to learn more @ AU...

IM225112-L - Hands-on FEA: Test Your Simulation Intuition

Weds 14th 10.30 – 12.00

IM225102 - Autodesk Nastran In-CAD for Inventor: Unlocking Dynamics

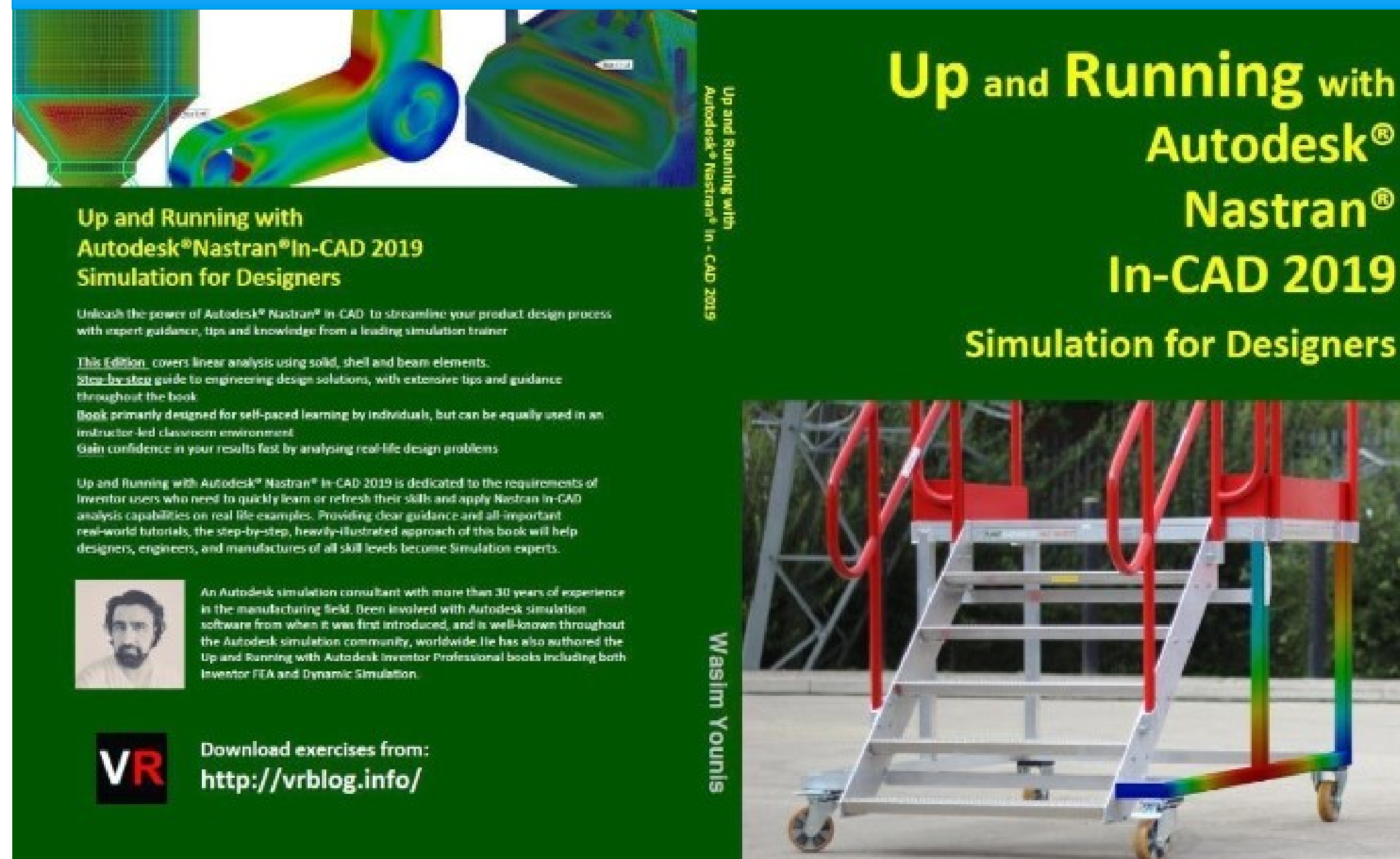
Thurs 15th 09.15 – 10.15

ENR226383 - Challenges of Simulating Advanced Materials in Nonlinear Applications

Thurs 15th 14.45 – 15.45

Resources to help you accelerate learning...

<https://goo.gl/AVmc26>



Self-paced learning with real world examples.
Available on Amazon worldwide

<https://forums.autodesk.com/t5/nastran-in-cad-forum/bd-p/75>

Cannot apply constraints/loads on beam idealisations automatically created

I have a simple test model and have the following issues

1. When entering the nastran environment the solid geometry does not automatically hide. I have to select/unselect cad bodies from object visibility to hide them so can select beam elements
2. I can get warning not selected on valid FEA geometry when running the model.

I have attached model for your attention

Tags: Beam Elements

Report

simple-model.zip

0 LIKES

REPLY

MESSAGE 2 OF 2



KubliJ in reply to: wasim.younis

Friday



Re: Cannot apply constraints/loads on beam idealisations automatically created

Hi @wasim.younis,

Thanks for sharing your experience with In-CAD and the use of frame generated models. There are some known issues with the workflow currently. Solid Object visibility being one of them, the other is with the selection process when applying loads and constraints. The problem with the loads and constraints is that they are being applied to the original sketch entities and not being translated/transferred to the meshed model. It can be resolved easily, you just need to hide the sketch used to create the frame. A more [detailed explanation can be found here](#).

Nastran In-CAD Forum - Excellent resource for
any questions you may have



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