Up and Running with Autodesk Nastran In-CAD

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Simulation Manager @ Symetri

AUTODESK. UNIVERSITY

Volunteers llogic 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

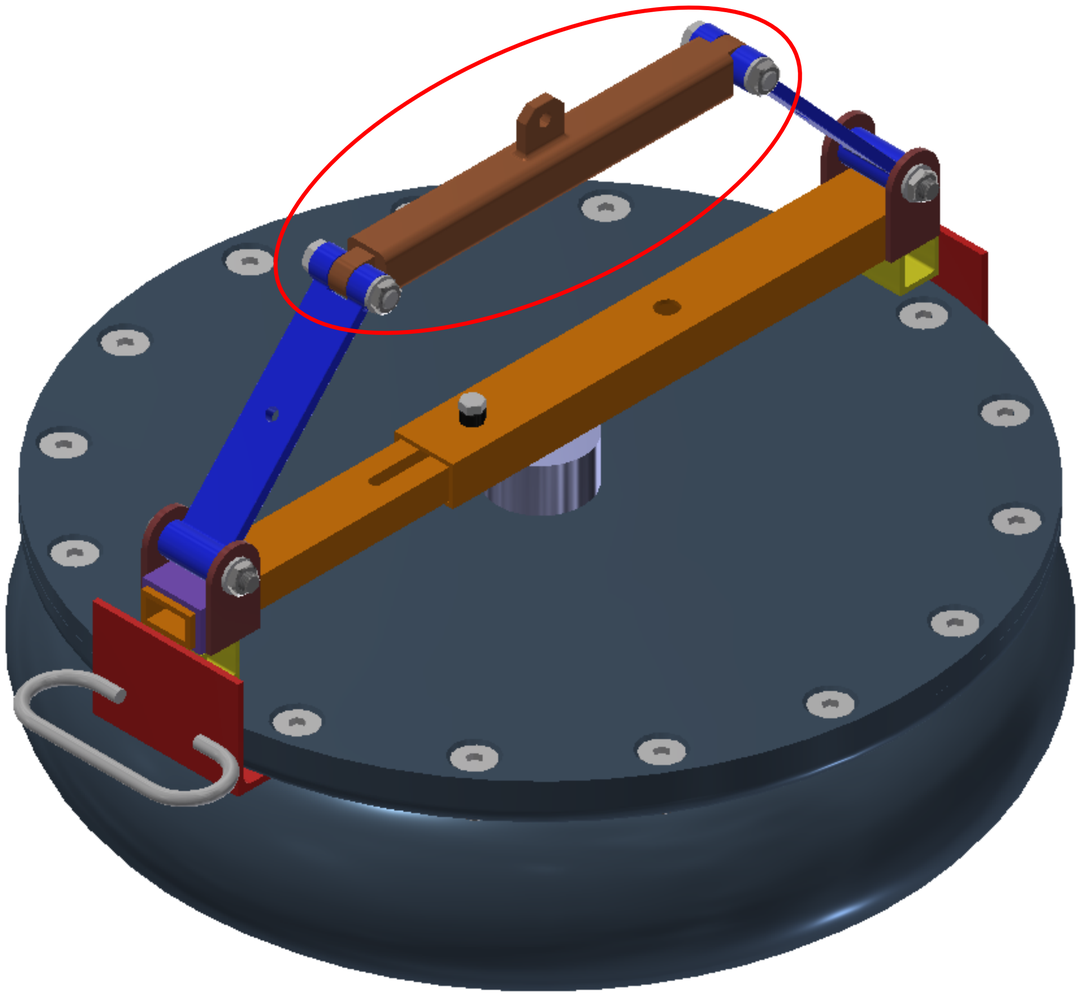
Why bother with simulation. I'll carry on using my intuition and hand calculations

To help you gain more confidence in simulation

Create great products

Avoid Over-engineering

Benefits of Upfront Simulation –



Benefits of Upfront Simulation –

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

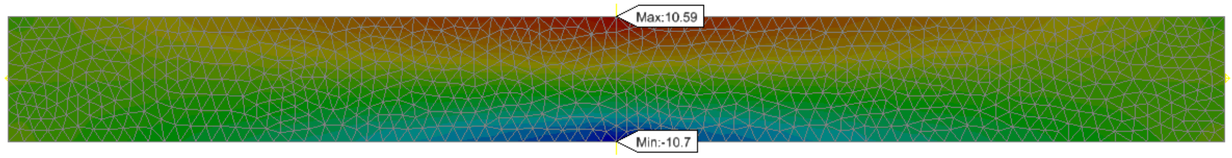
Load is applied centrally on the beam, therefore to find the maximum bending moment, we can use:

M = P x L / 4
= 780N * 390mm / 4
= 76050 Nmm

y = Distance to neutral axis
= Section height / 2
= 40mm / 2 = 20 mm

I = 2nd Moment of Area (for box section)
= Outer 2nd Moment of Area - Inner 2nd Moment of Area
= (BD^3 / 12) - (bd^3 / 12)
= (40 x 40^3 / 12) - (30 x 30^3 / 12)
= 2560000- 675000
= 145833 mm^4

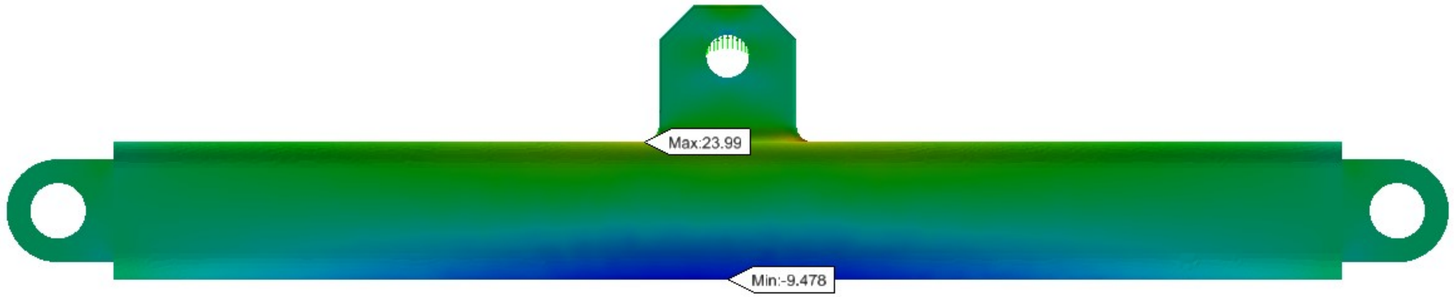
Therefore, Max Tensile or Compressive Stress due to bending is:
σ = 76050 x 20 / 145833
= 10.43N/mm^2 = 10.43 x 10^6 N/m^2 = **10.43 MPa**

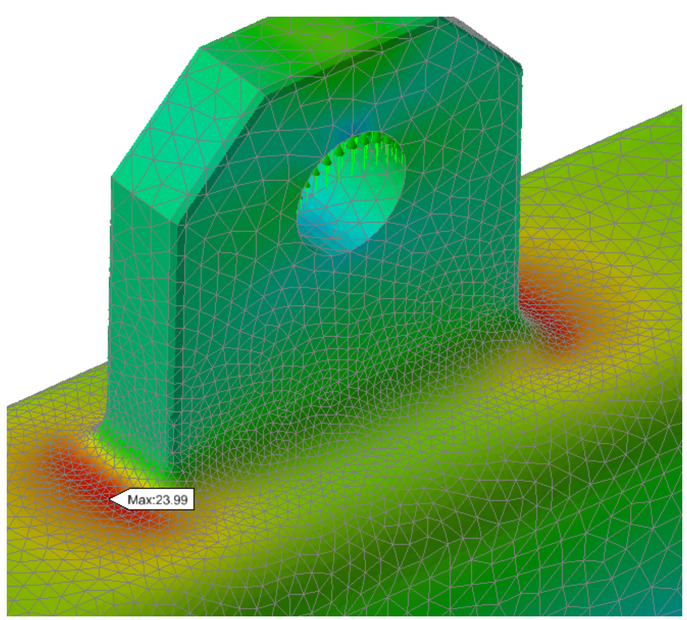


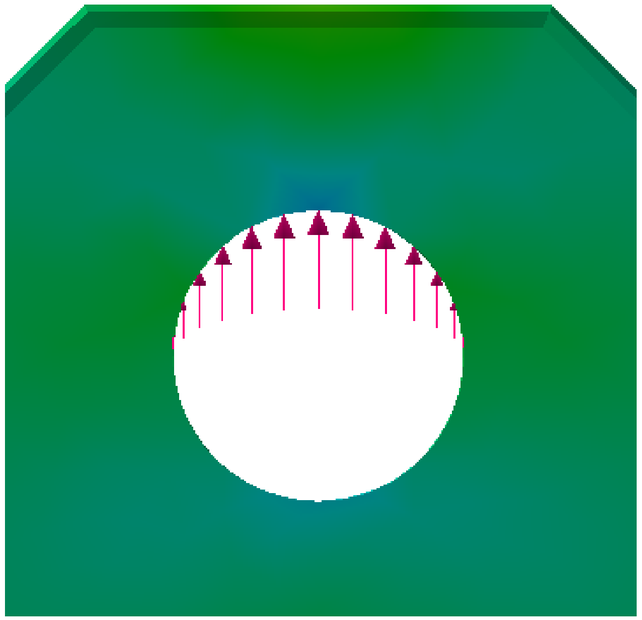
Tools Available

1. Hand Calculations

Benefits of Upfront Simulation –



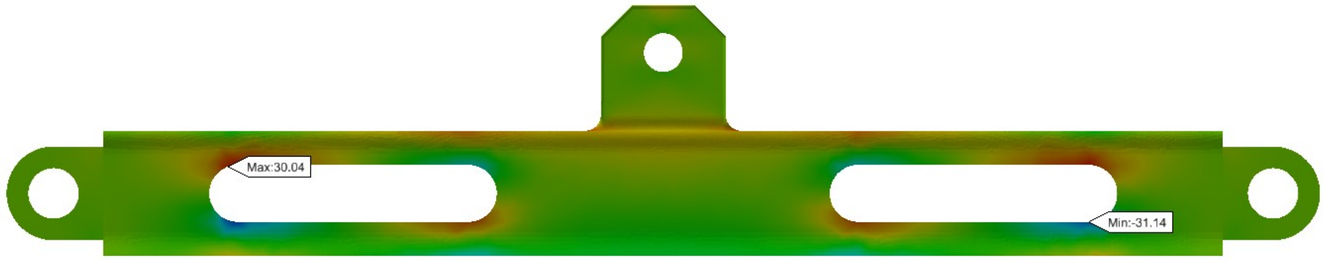


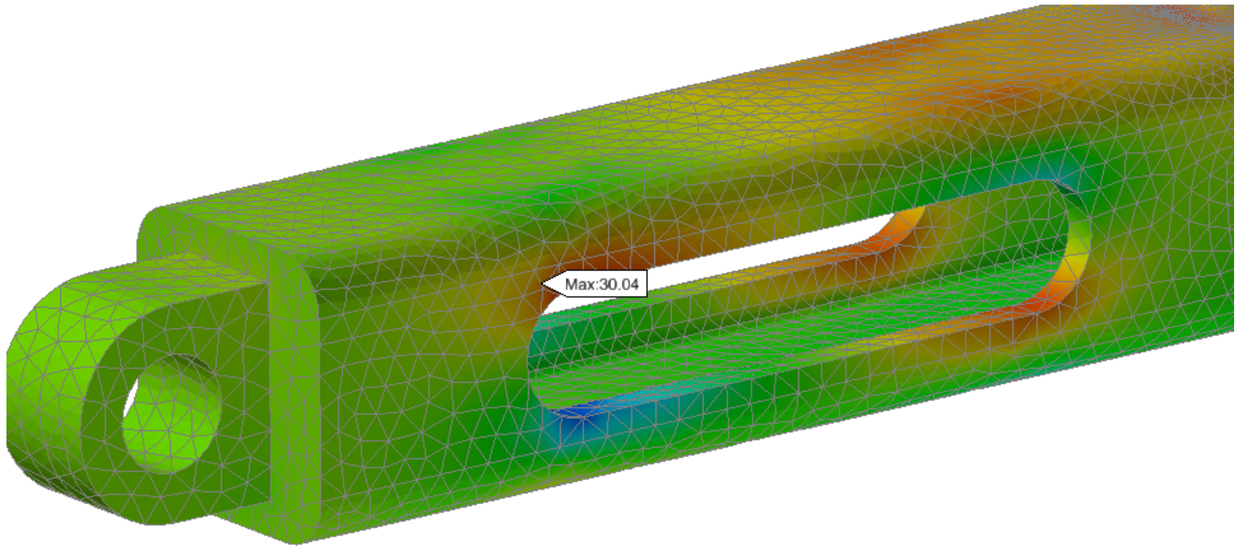


Tools Available

1. Hand Calculations
2. Upfront Simulation

Benefits of Upfront Simulation –

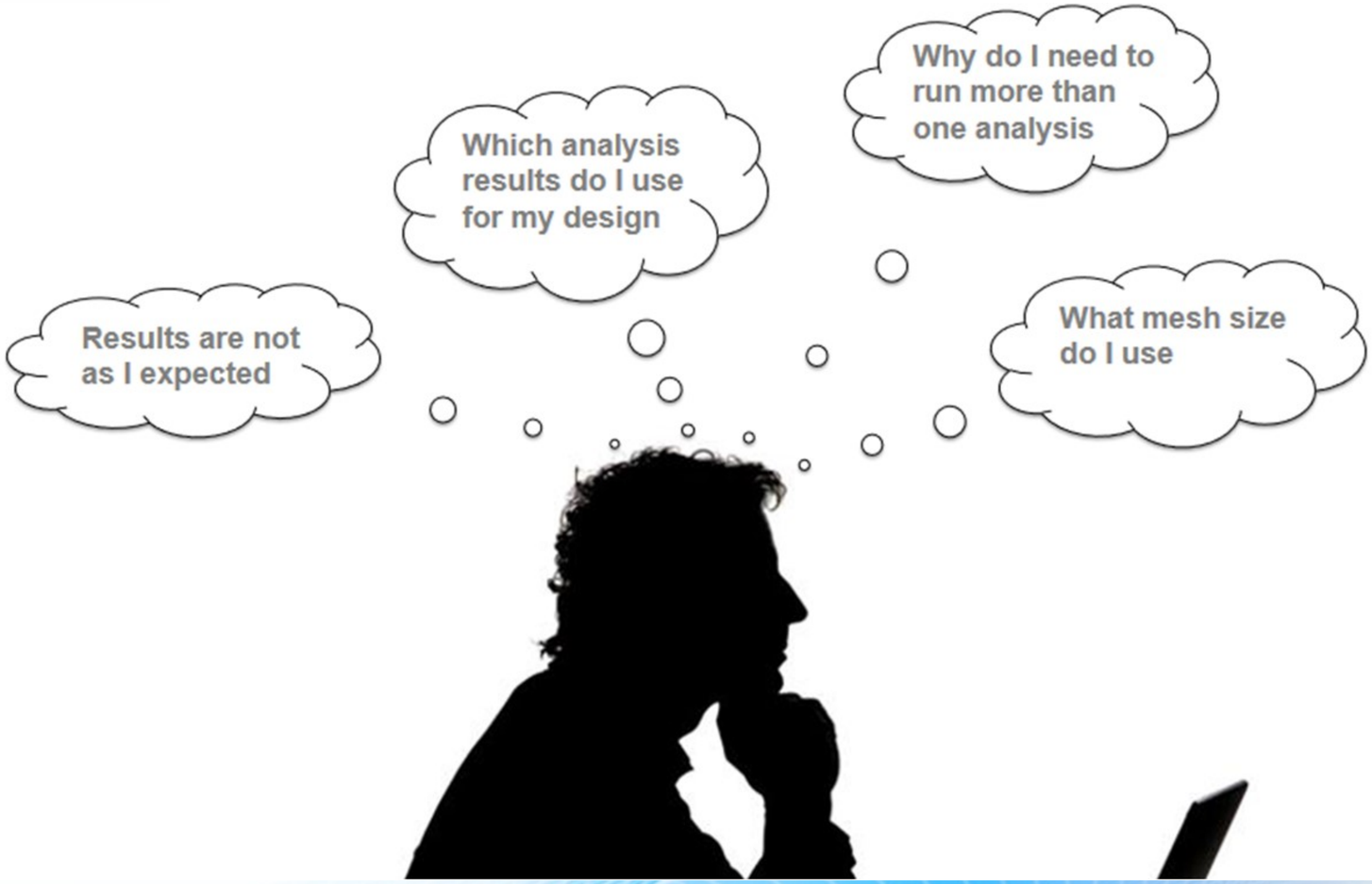




Tools Available

1. Hand Calculations
2. Upfront Simulation
3. Optimisation

The Big Myth



Question

…. How do I know my results are correct?

The Big Myth

<u>Answer</u>

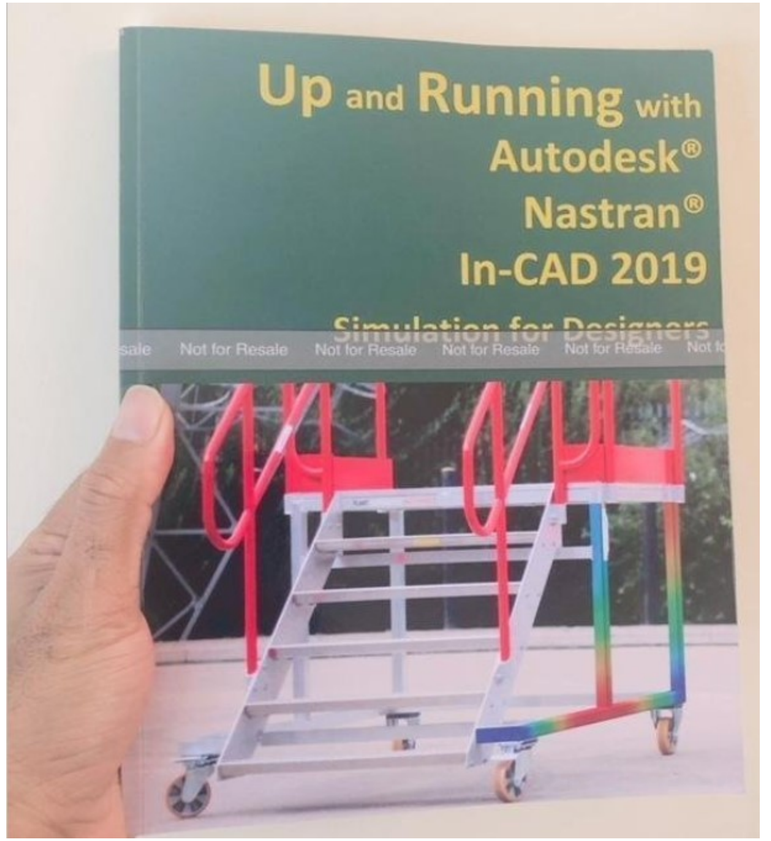
…. Well you do!

Really…….

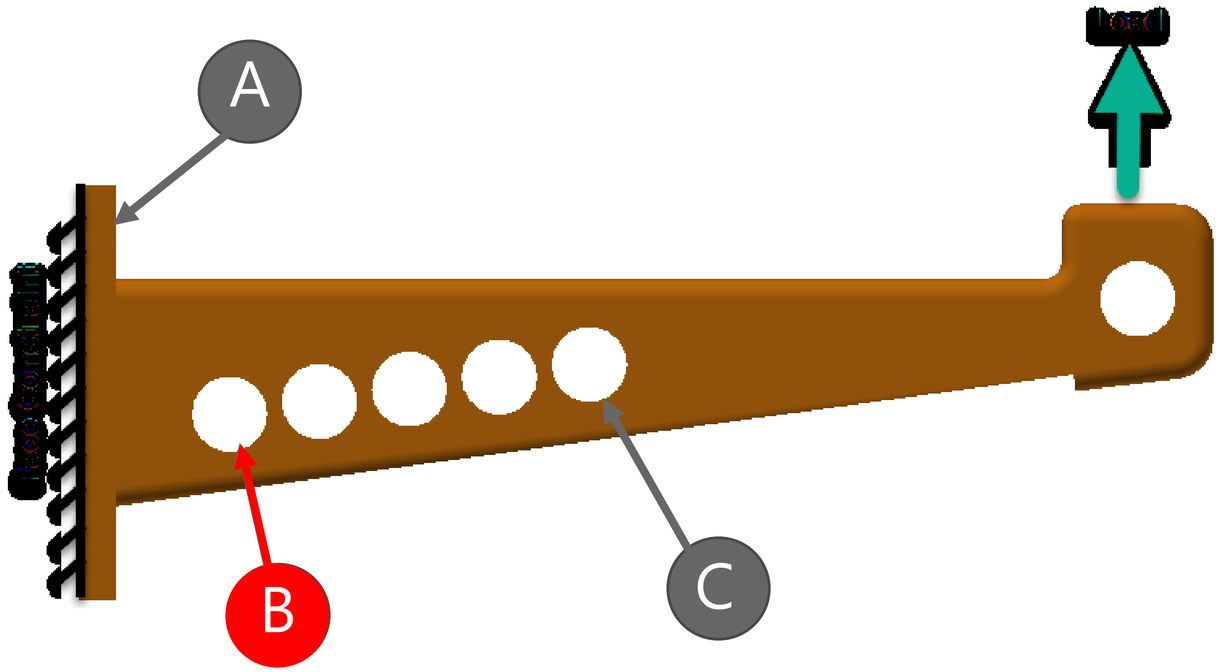
Short Test (Quiz!) –
To proof you know the answer (Well I hope!!)

Rules of Engagement

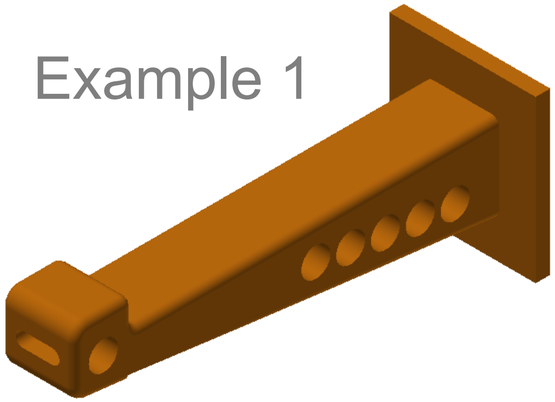
Just raise your hand.



The Big Myth – Are my results correct?



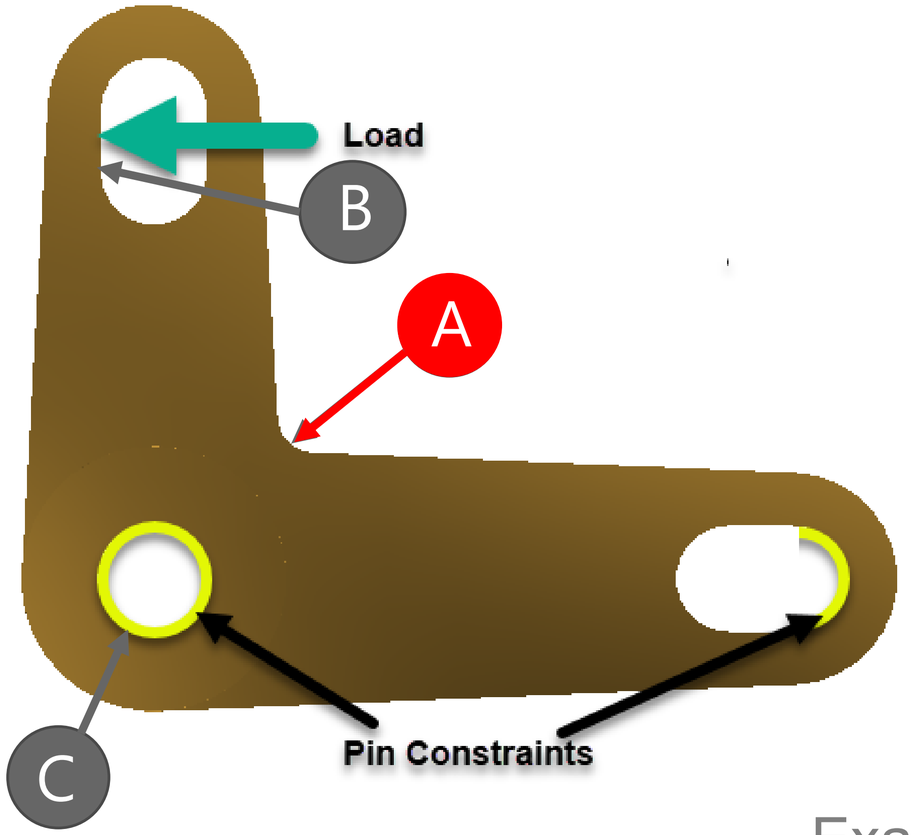
Example 1

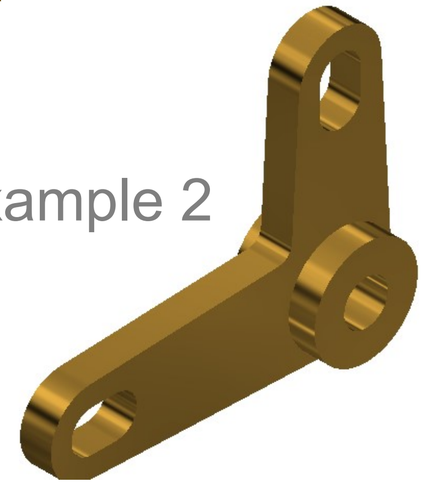


Tips and Tools to help you…

1. Max-Stress – You have an idea

The Big Myth – Are my results correct?





Example 2

Tips and Tools to help you…

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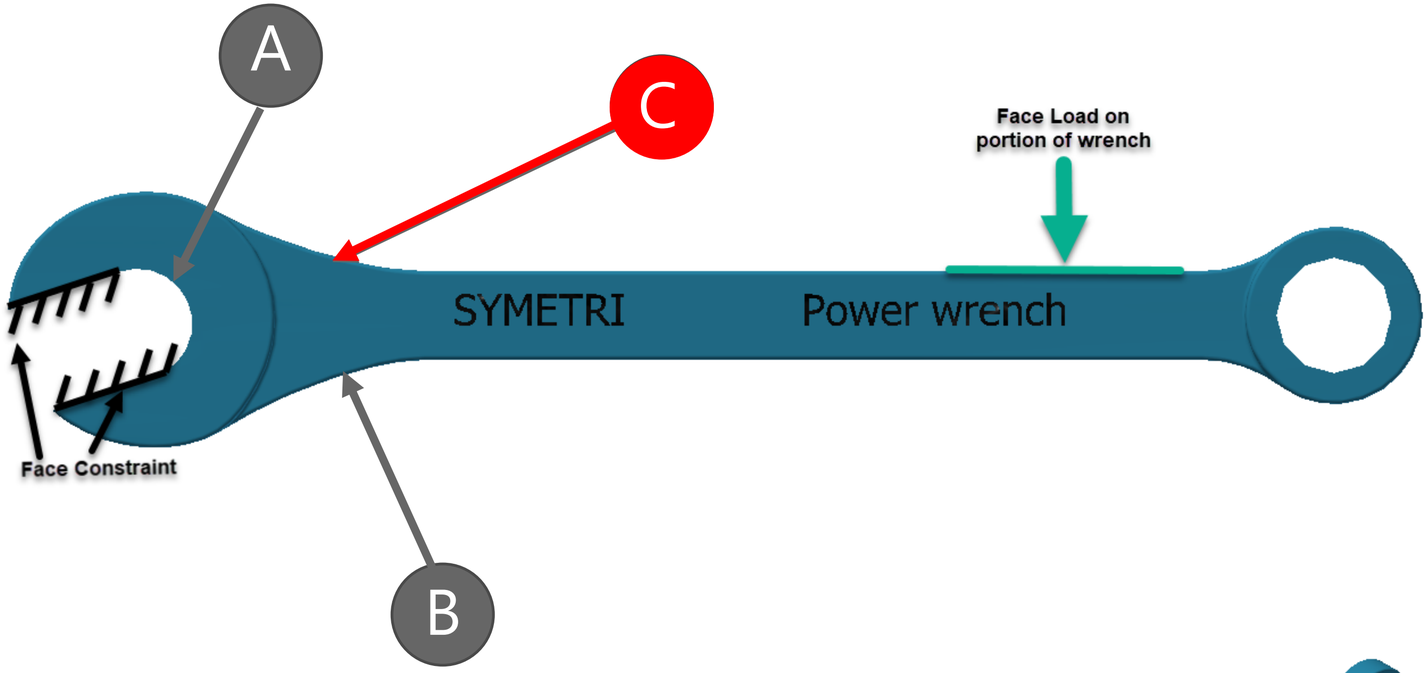
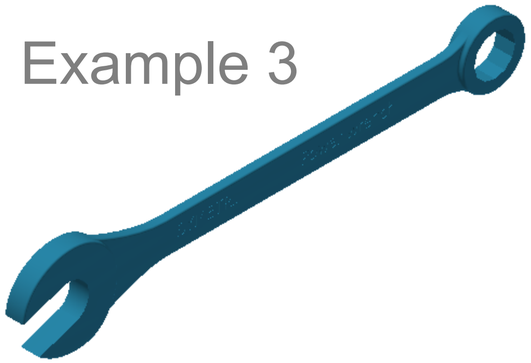


Example 3



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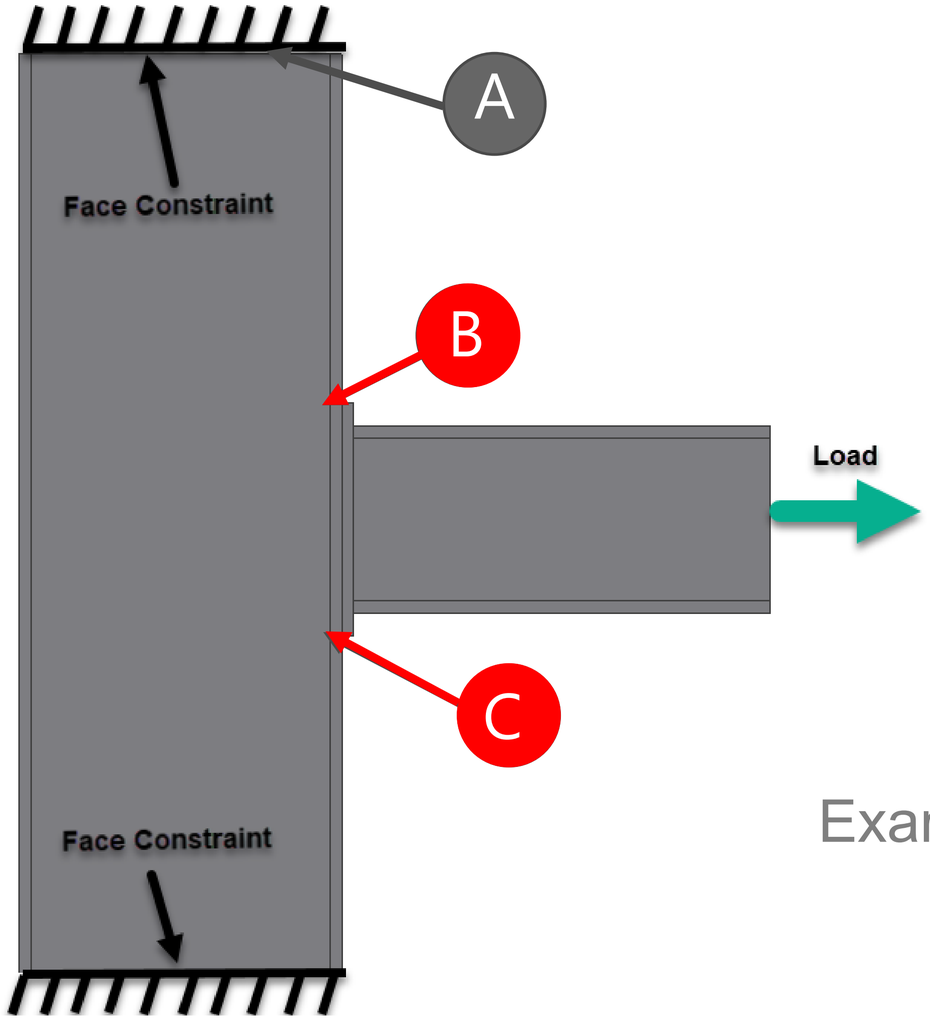
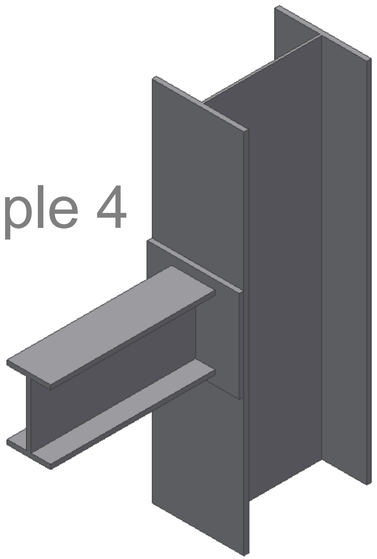


Example 4



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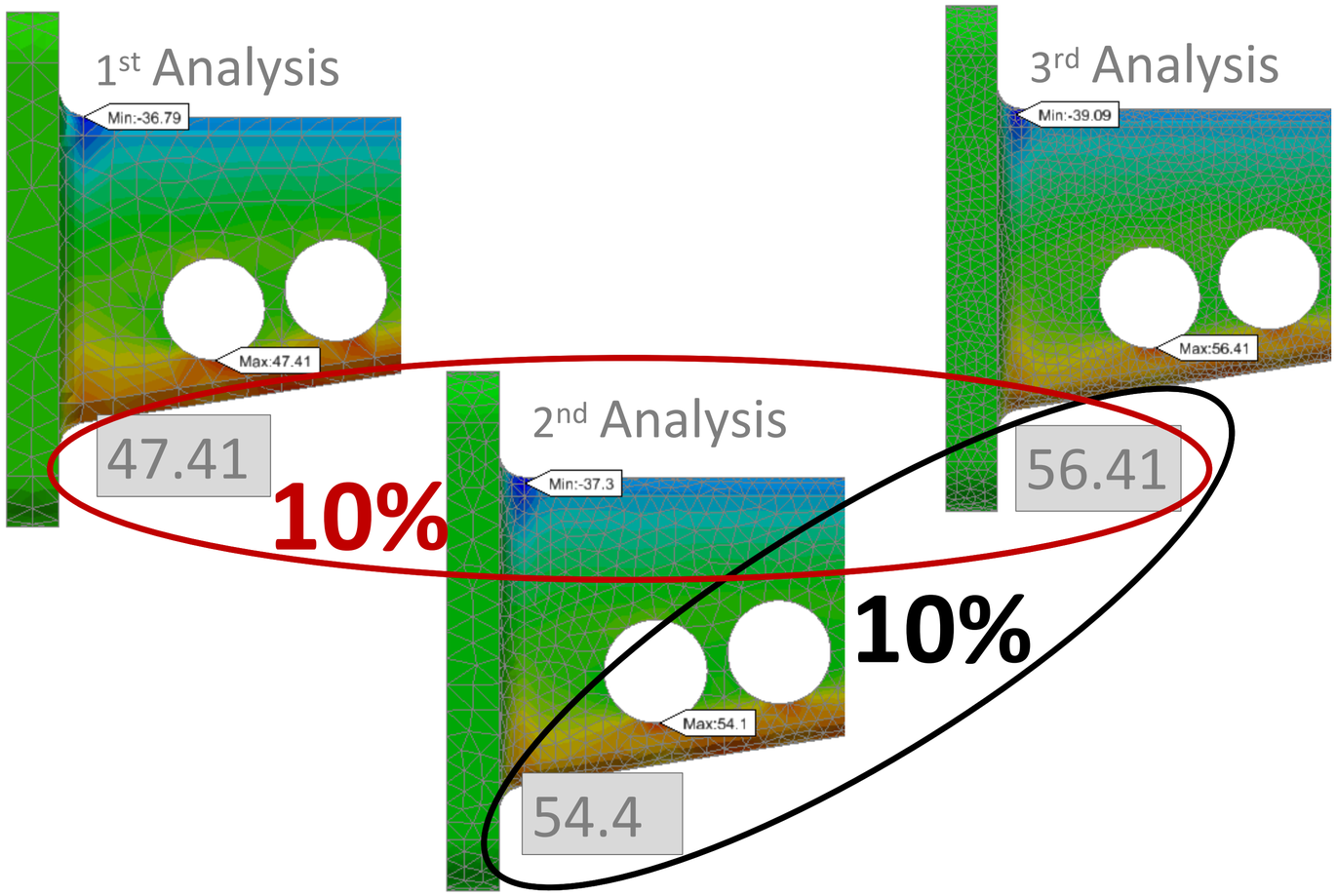
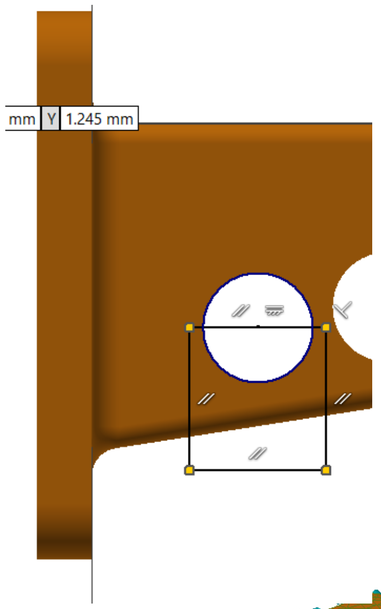
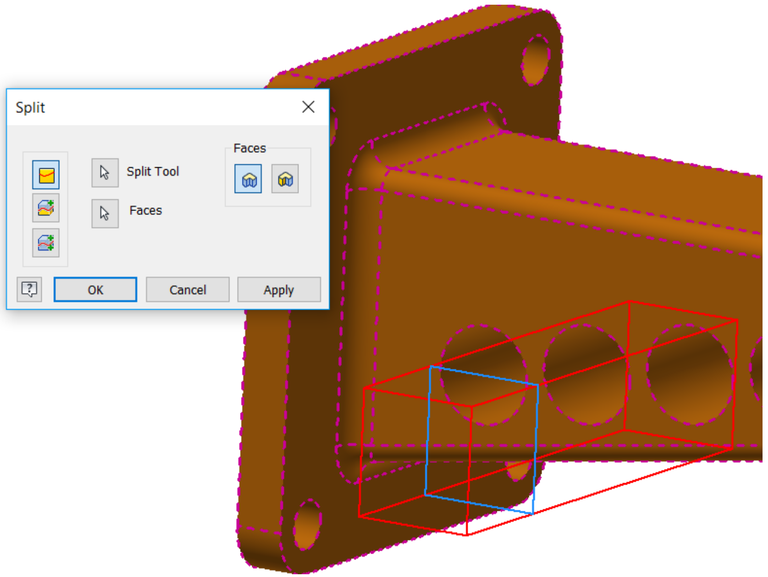


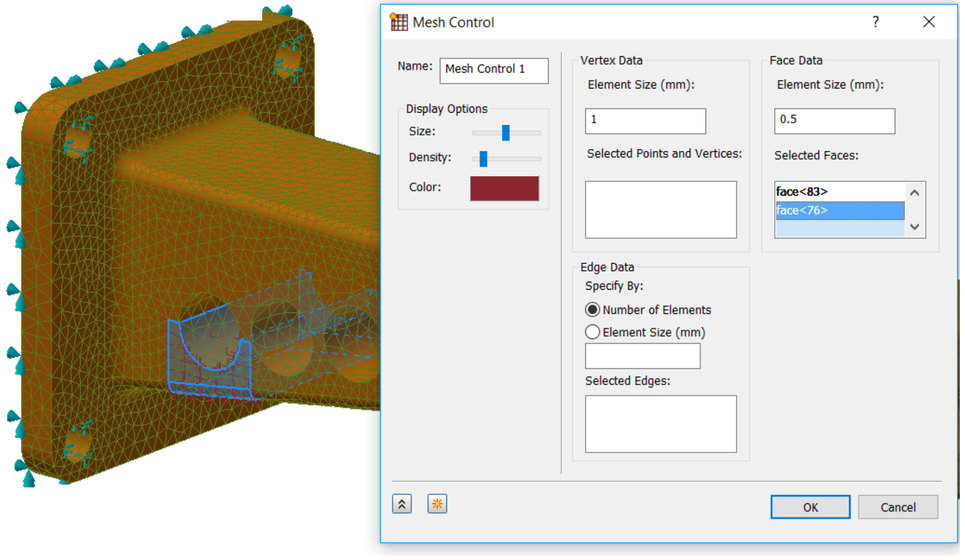
Tips and Tools to help you…

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

The Big Myth – Are my results correct?



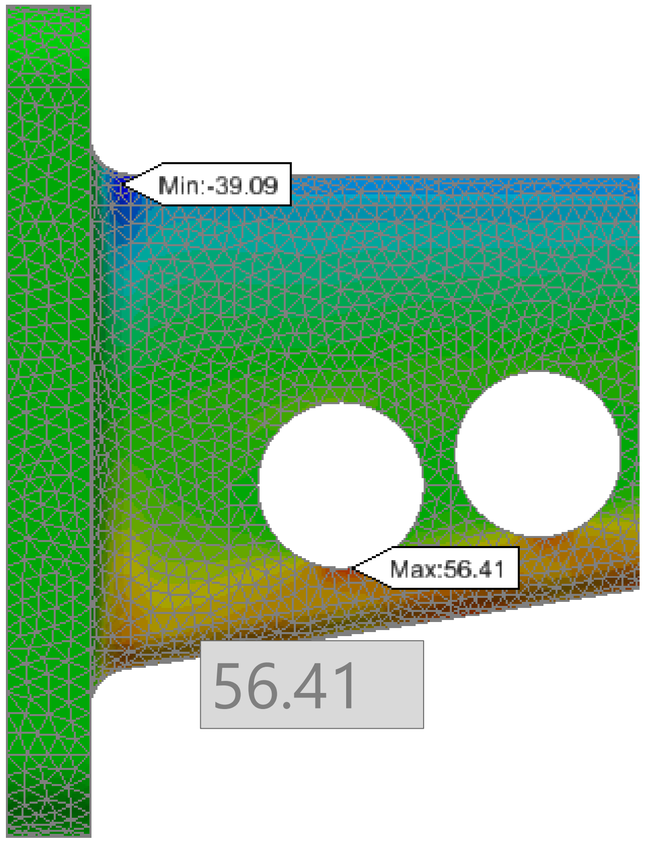




Tips and Tools to help you…

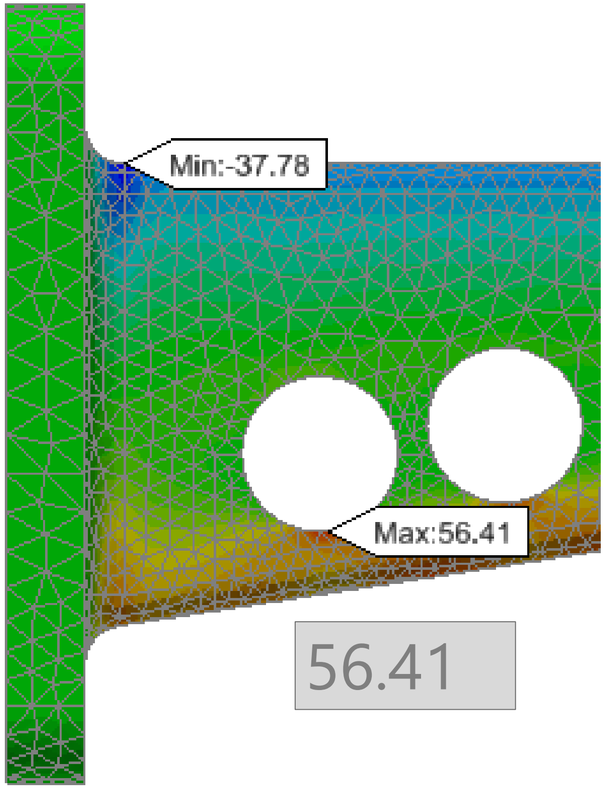
1. Max-Stress – You have an idea
2. Analyse with 3 mesh sizes
3. Split faces to define local mesh

The Big Myth – Are my results correct?



56.41

Global Mesh Control



56.41

Local Mesh Control

Tips and Tools to help you…

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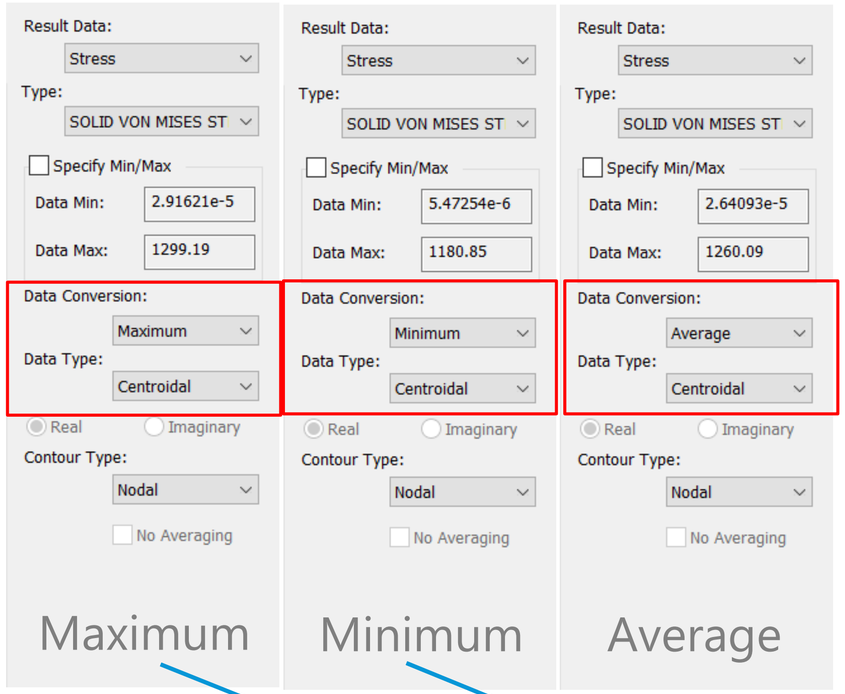
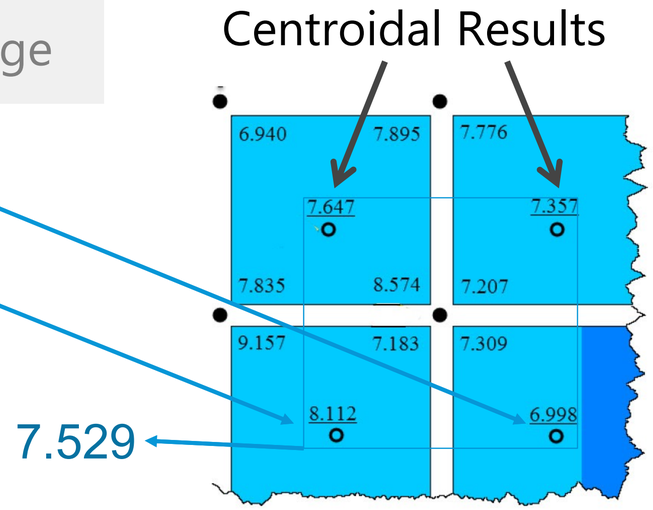
The Big Myth – Are my results correct?

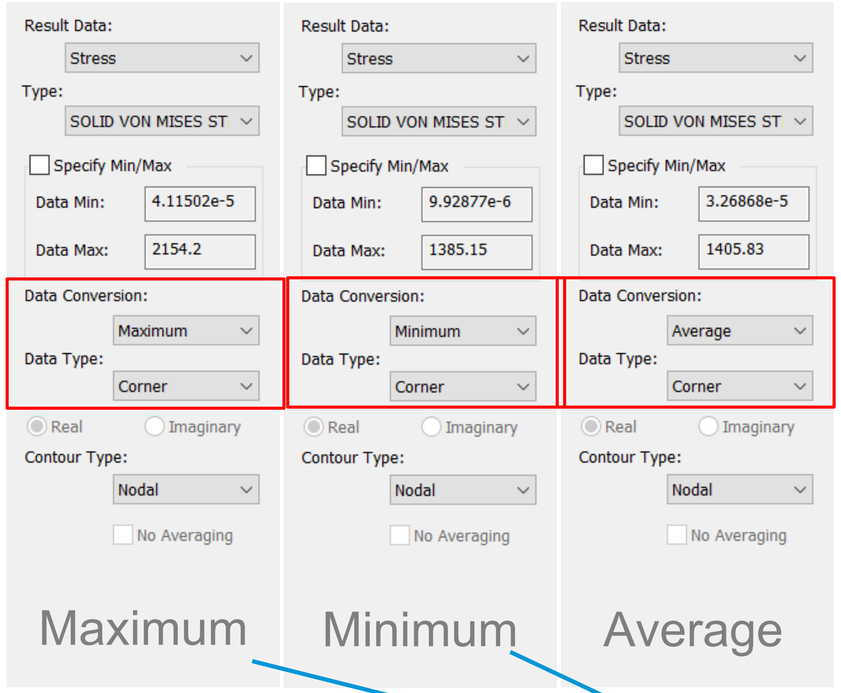


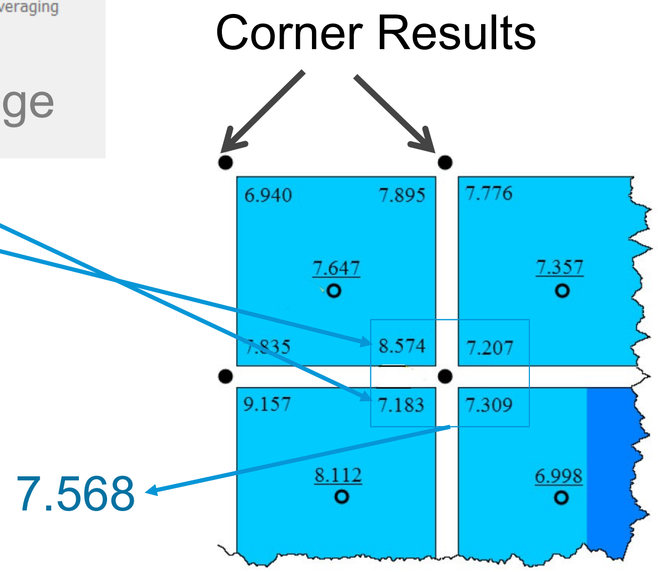


Tips and Tools to help you…

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

The Big Myth – Are my results correct?

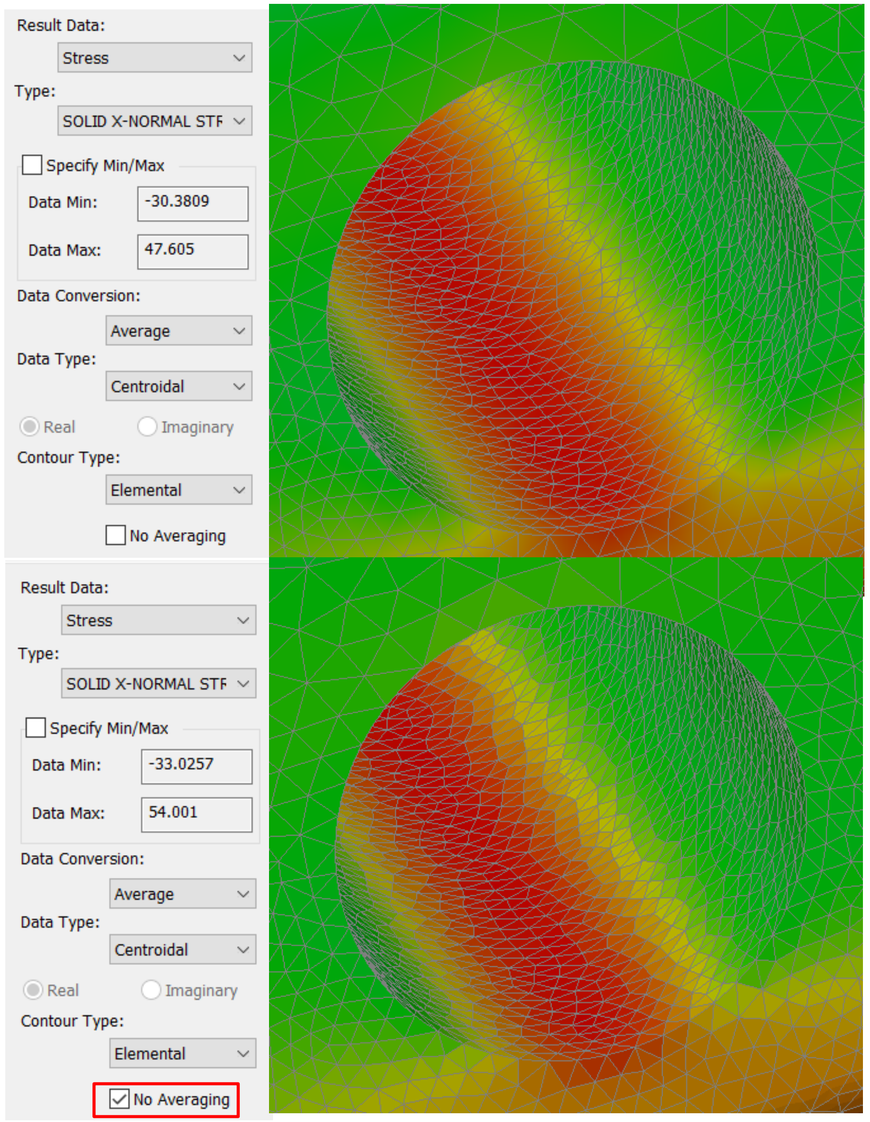




Tips and Tools to help you…

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

The Big Myth – Are my results correct?



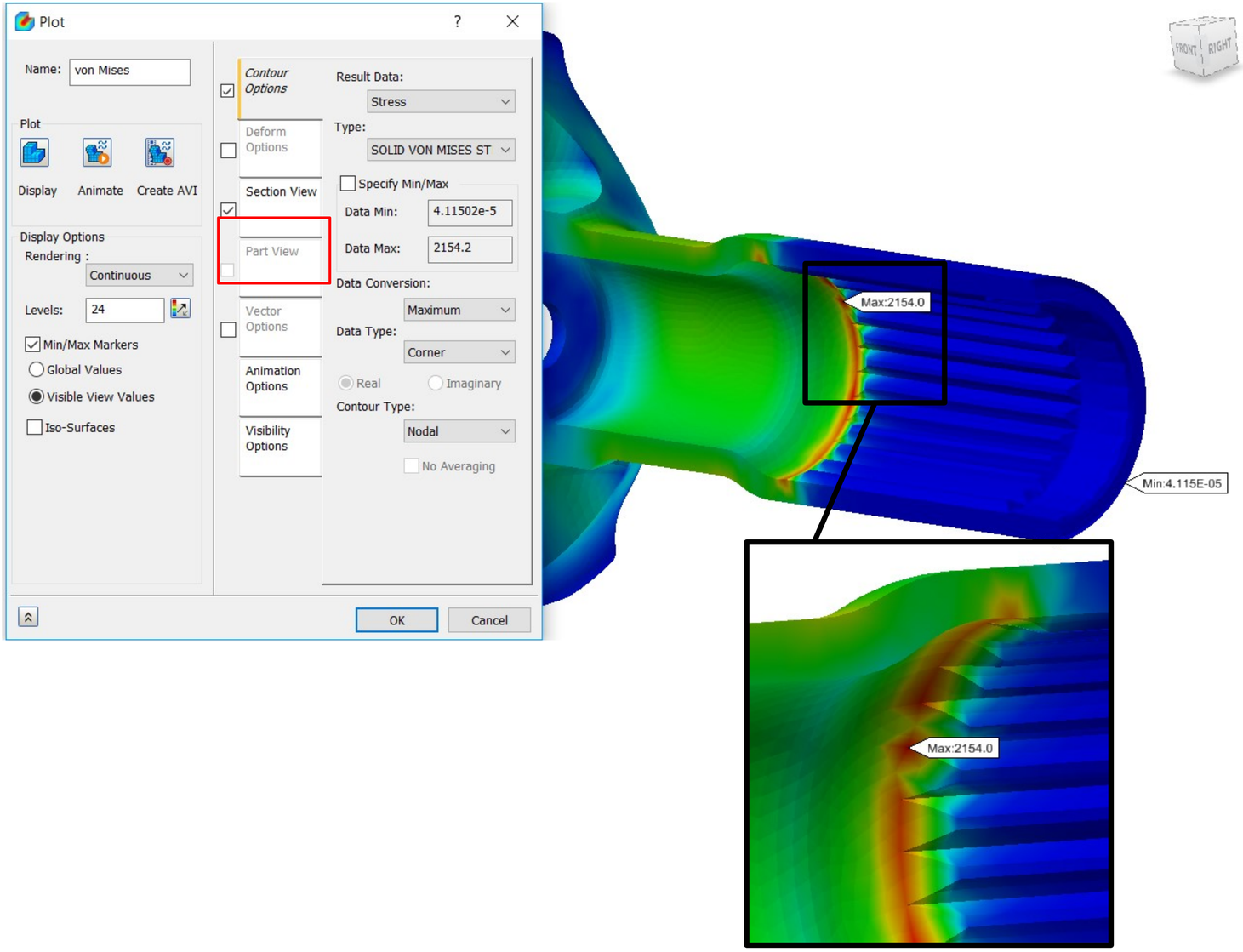
Tips and Tools to help you…

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

Stress Singularities

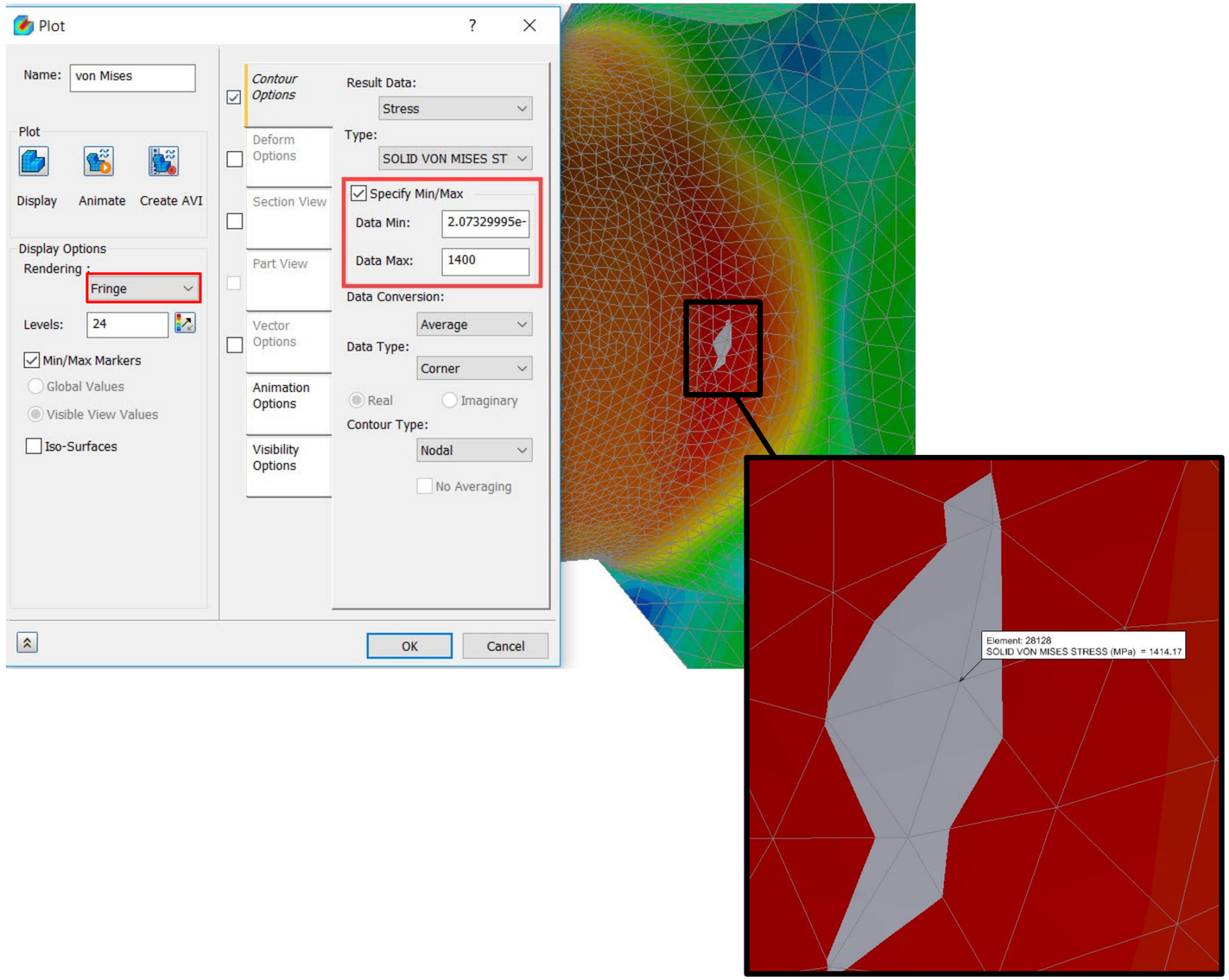
The Big Myth – Are my results correct?



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?



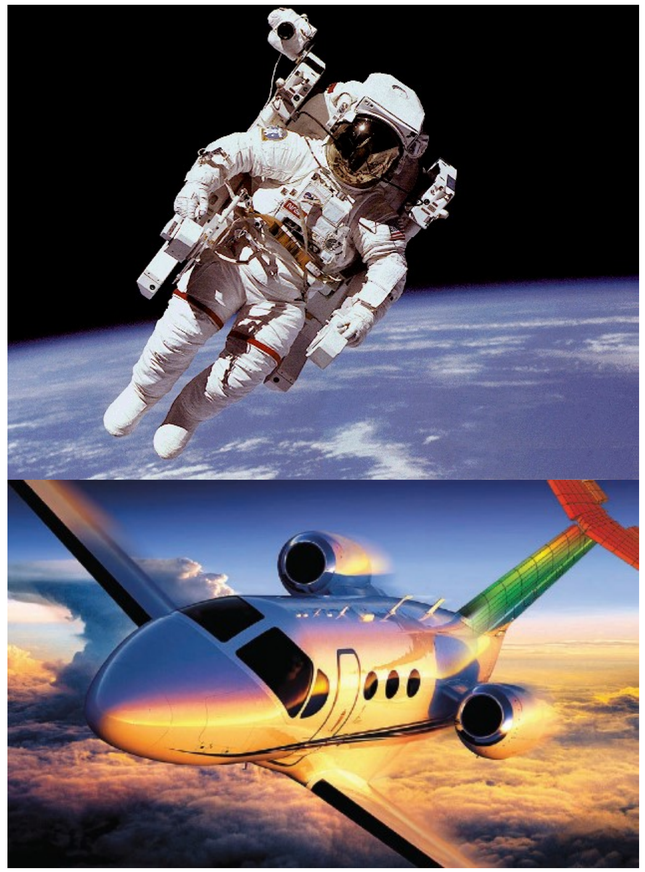
Tips and Tools to help you…

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

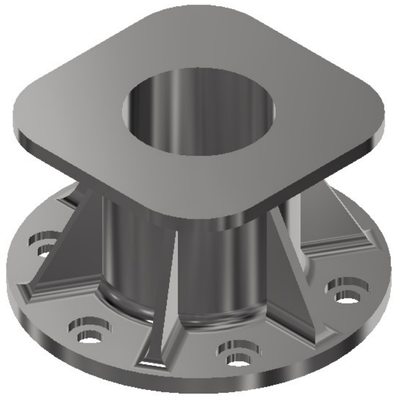


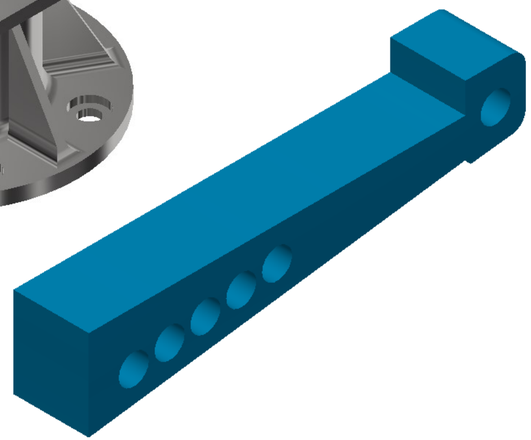
Absolutely

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 llogic 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?

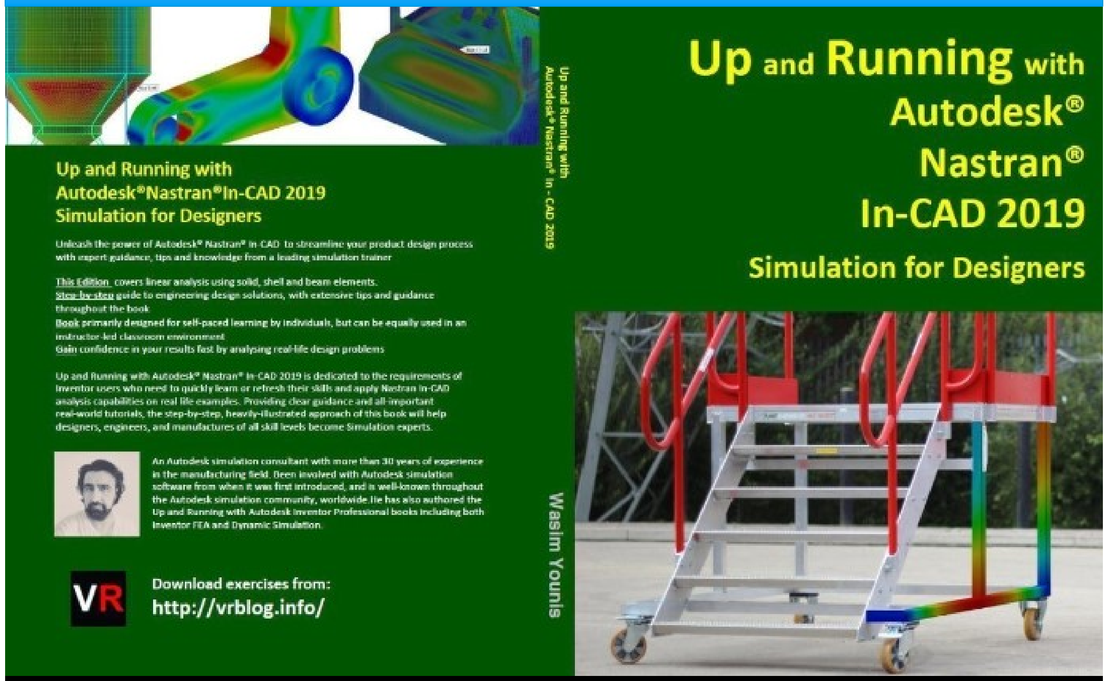
……. So fire away……

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

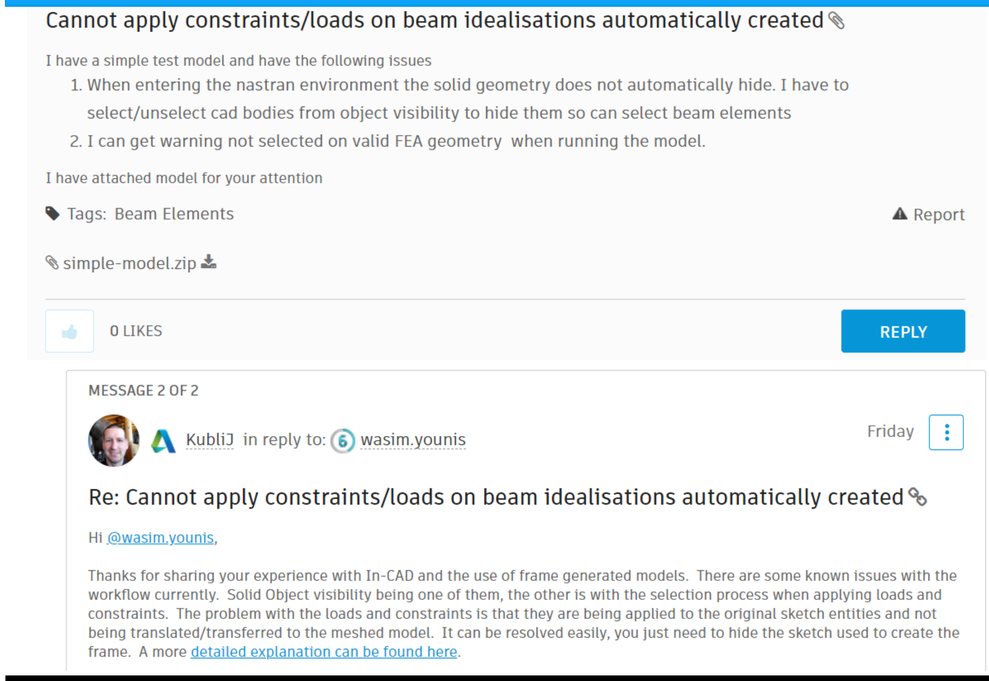
Resources to help you accelerate learning…

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



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

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