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Multiphysics Simulation Conference

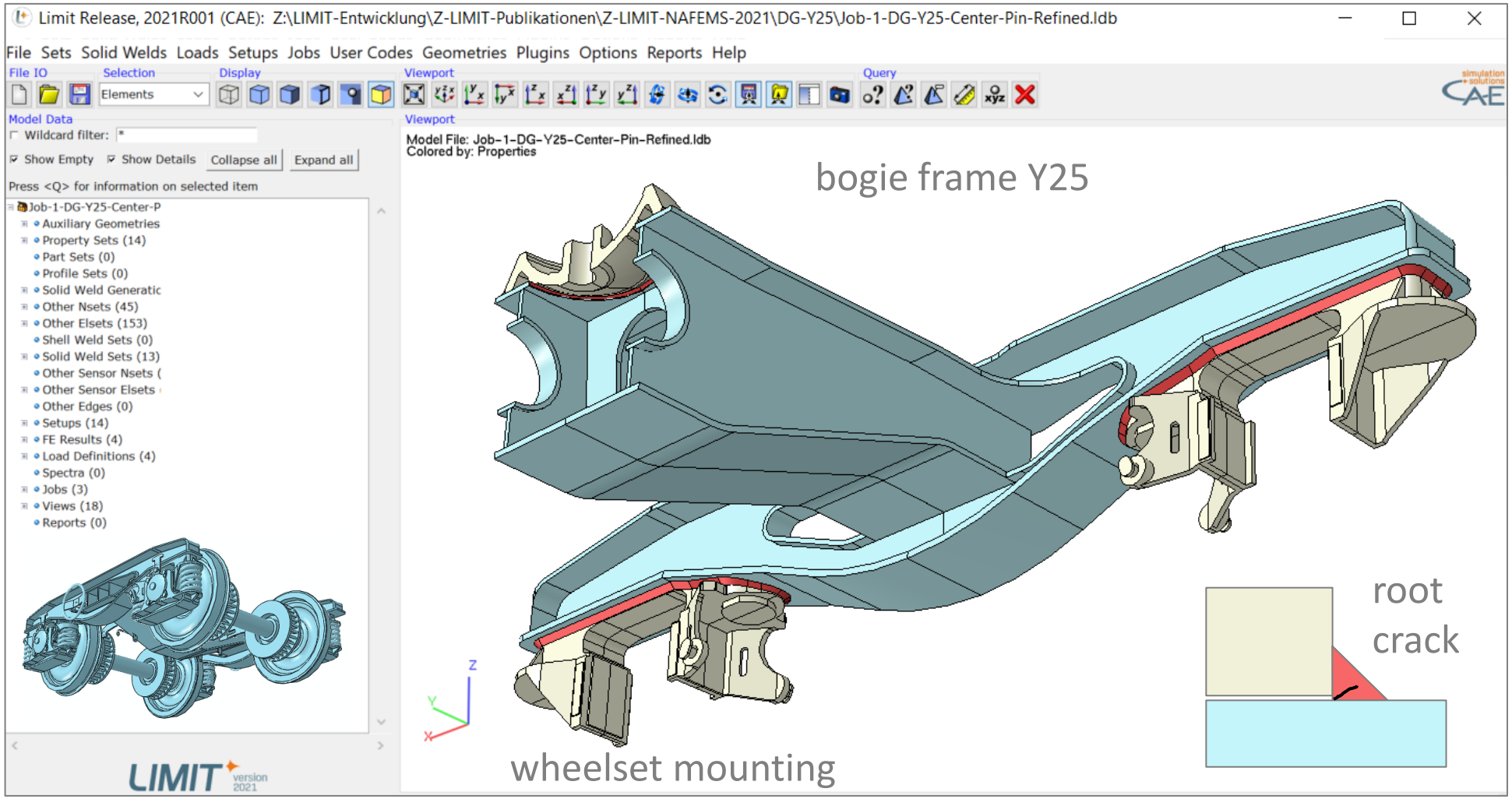
LIMIT stress evaluation

Efficient stress linearization in FEA continuum models for weld fatigue assessment

N. Friedl, T. Daxner, W. Vonach
CAE Simulation & Solutions GmbH
Vienna, Austria

Fillet Weld / Root Failure

LIMIT
stress evaluation



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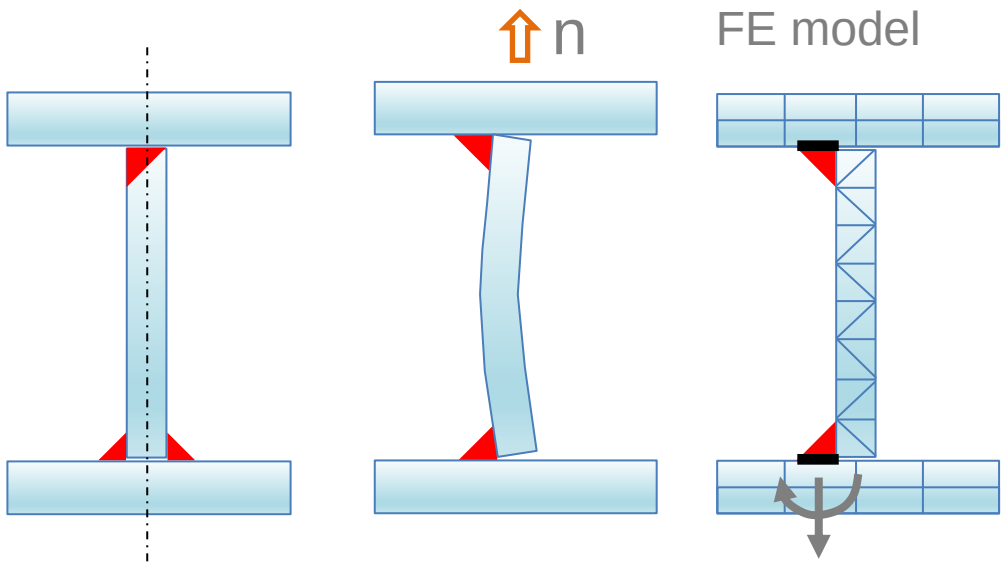
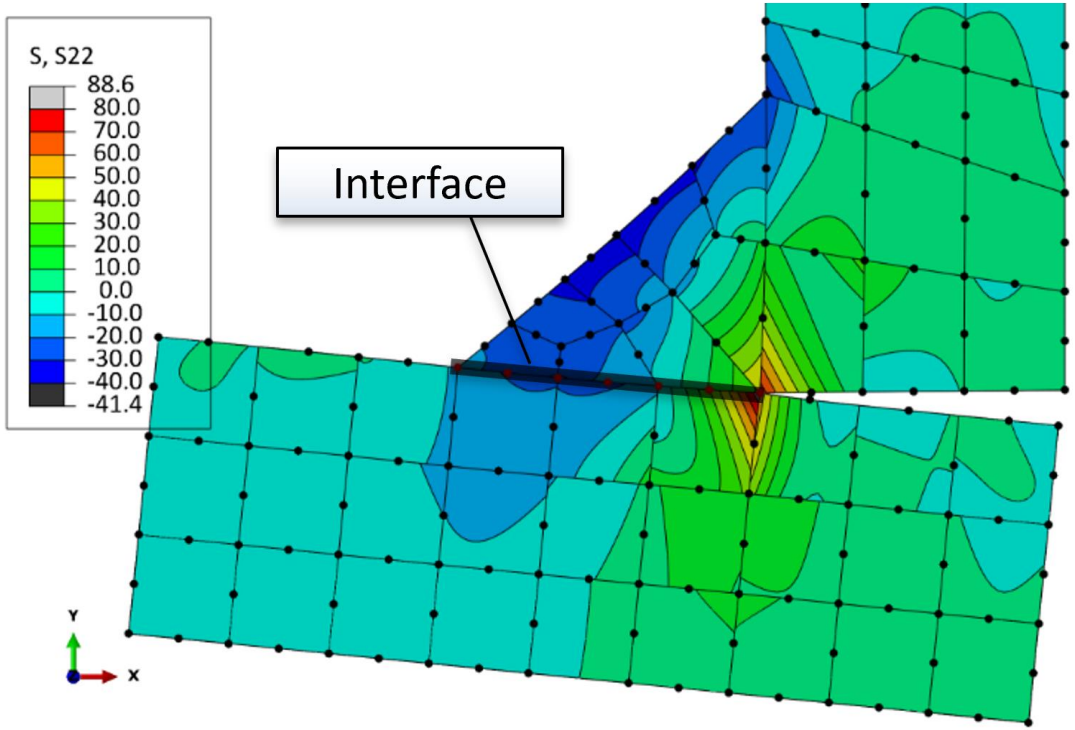
Meshing Considerations

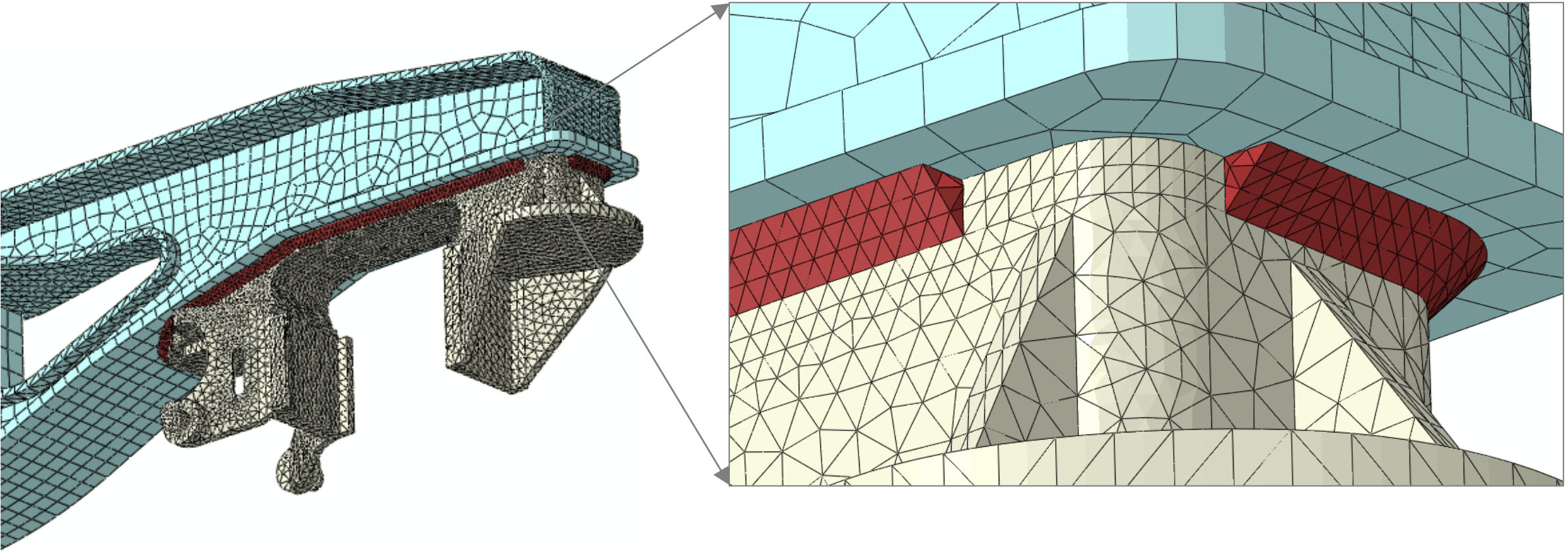
- Full penetration and fillet welds



n = ?
m = ?
=> linearized stresses



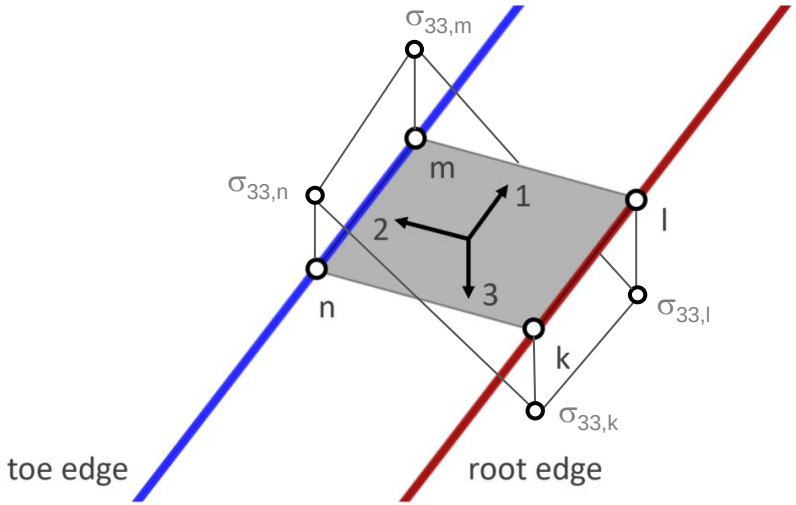
Mesh

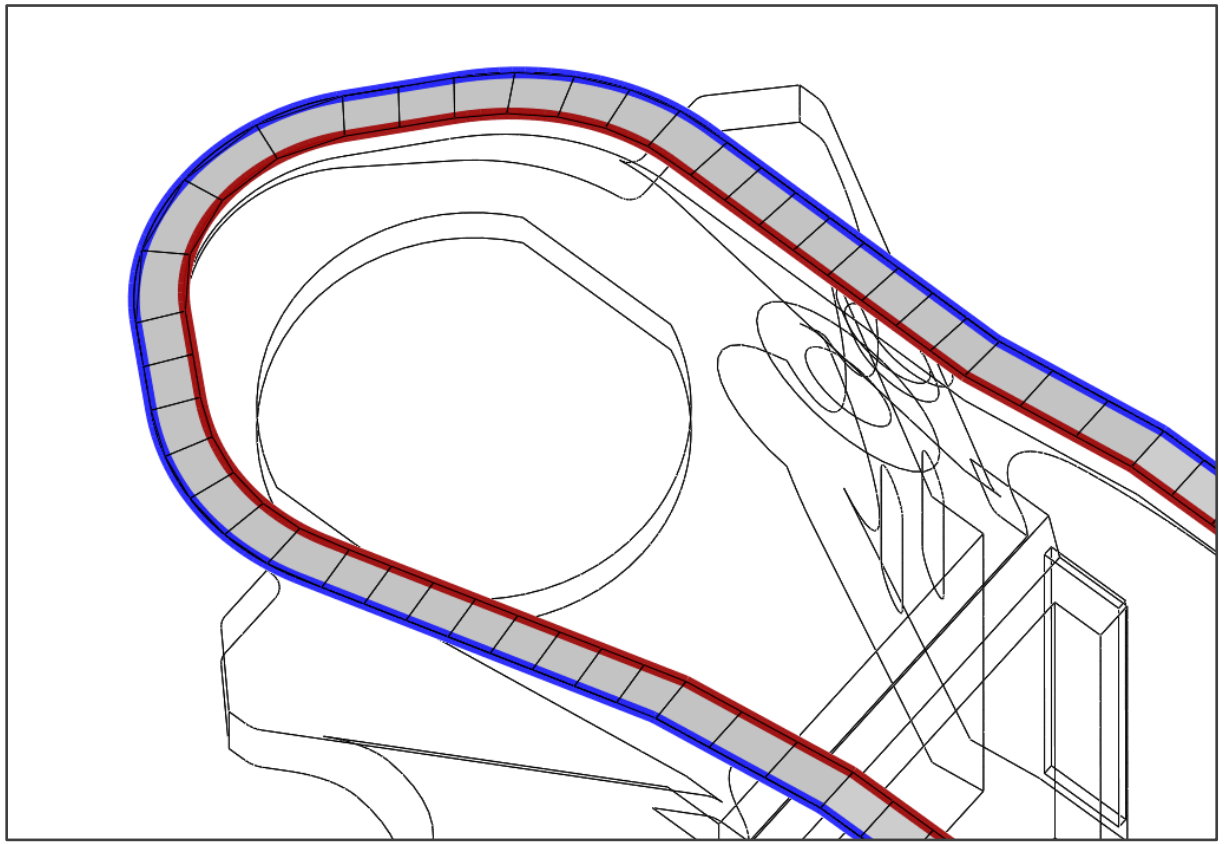


Linearization Mesh

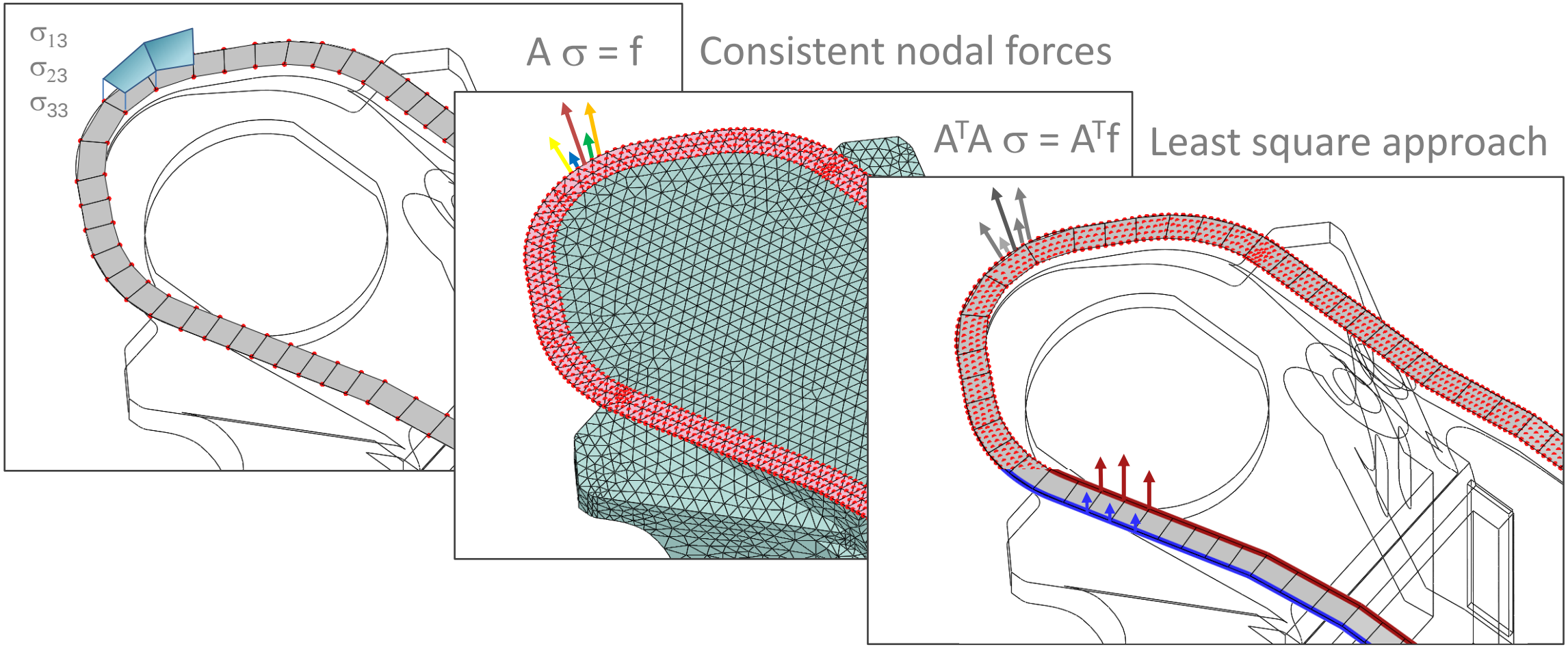
- Quadrilaterals
- Three unknown traction stresses at each node:

  σ_{13}, σ_{23}, σ_{33}





Solving the System

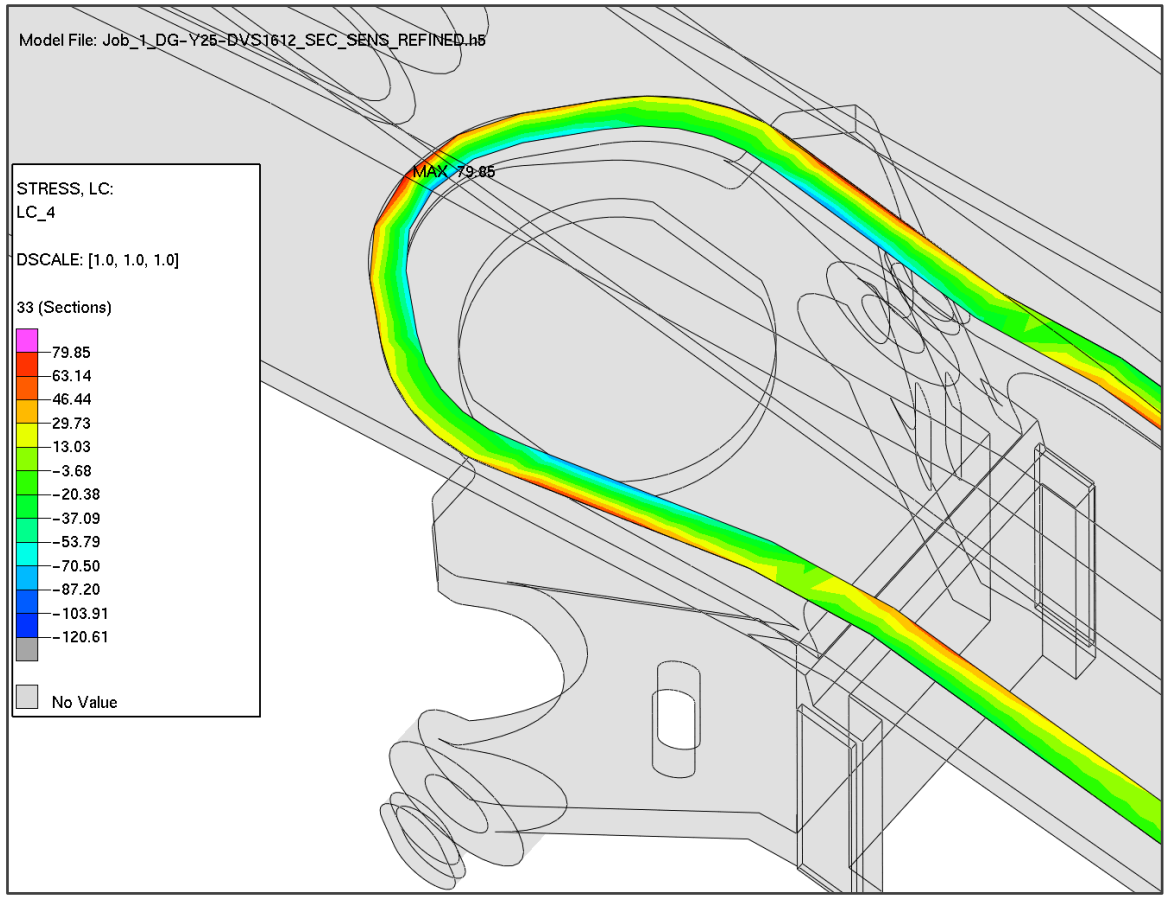


Iterative correction for root and toe edges

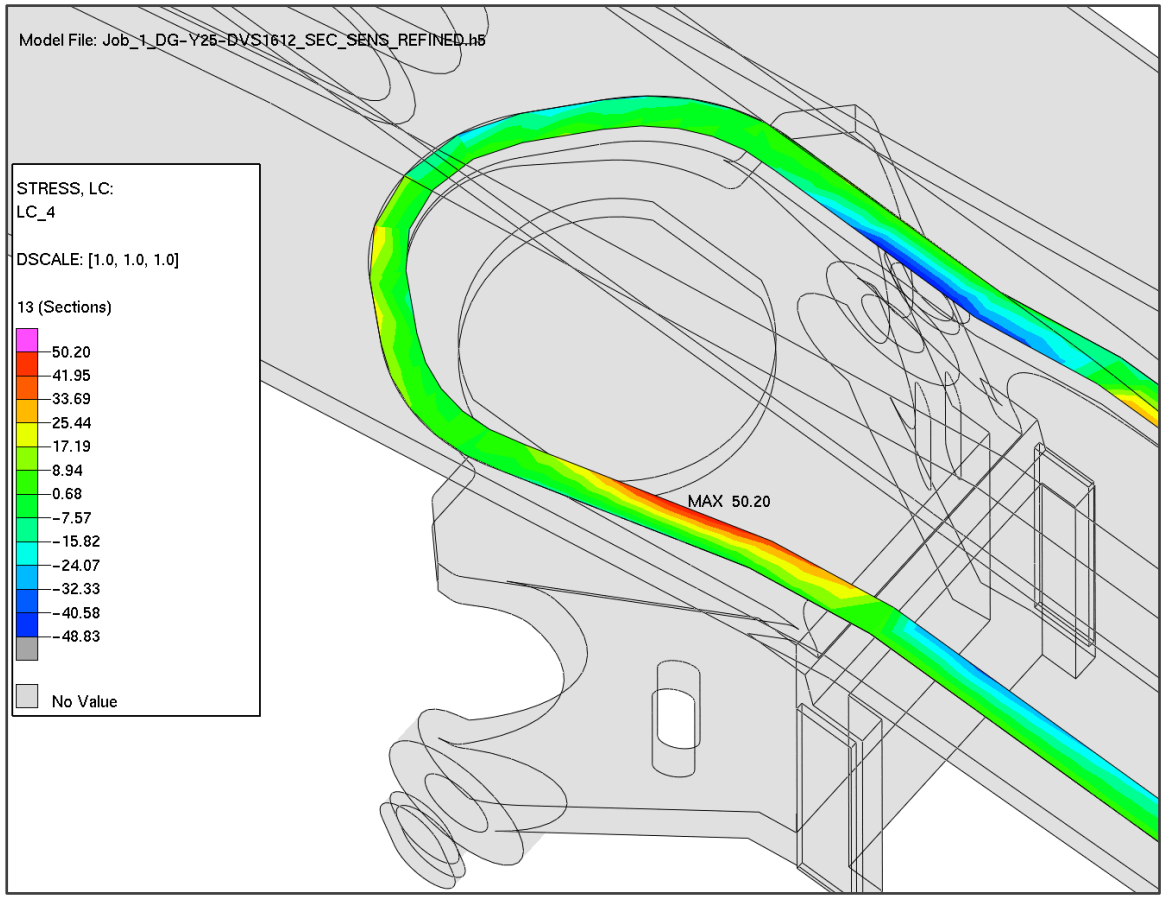
Linearized Stress Result

LIMIT stress evaluation

σ_{33} (stress normal to interface)



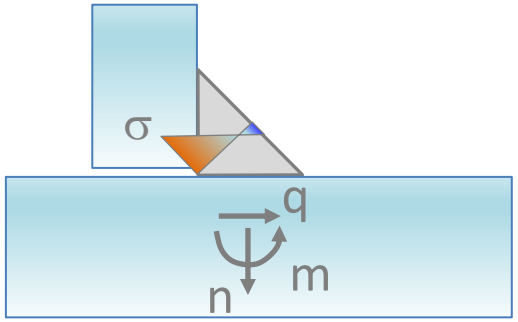
σ_{13} (longitudinal shear)



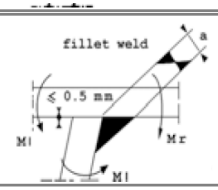
Error < 1% ÷ 3%

Fatigue Assessment

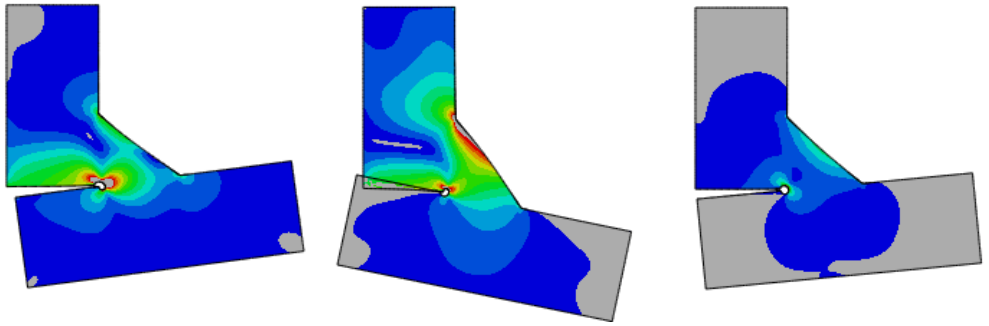
- Highly flexible
- Works with all fatigue codes!



Nominal or structural stress assessment, e.g. IIW or FKM guideline

			Steel	Alu
515		Trapezoidal stiffener to deck plate, fillet or partial penetration weld, out of plane bending Calculation based on maximum out-of-plane bending stress range in weld throat or stiffener	71	25

Notch stress approach i.e. R0.3, FAT340



q=1 [N/mm] n=1 [N/mm] m=1 [Nmm/mm]

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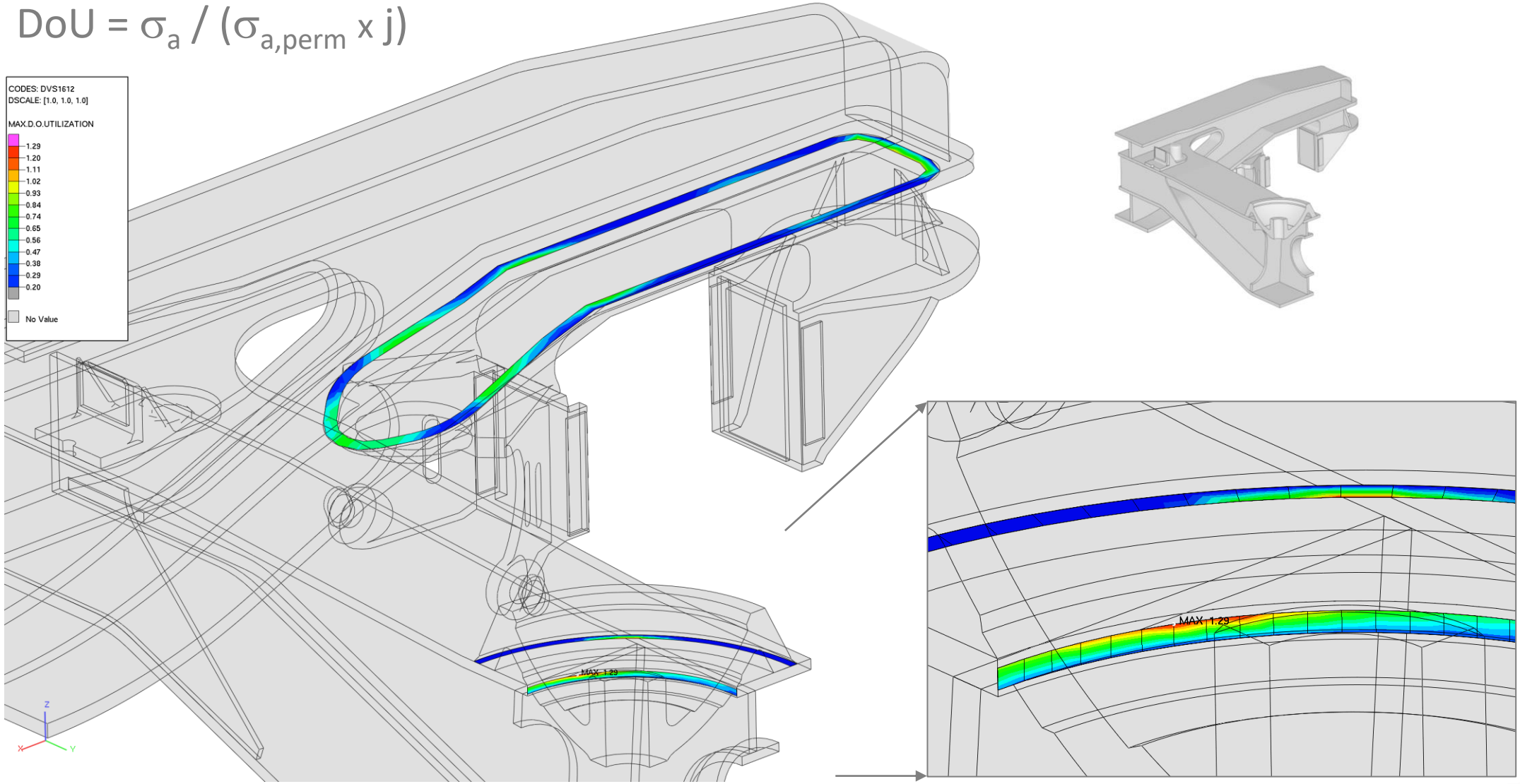
Final Result

$DoU = \sigma_a / (\sigma_{a,perm} \times j)$



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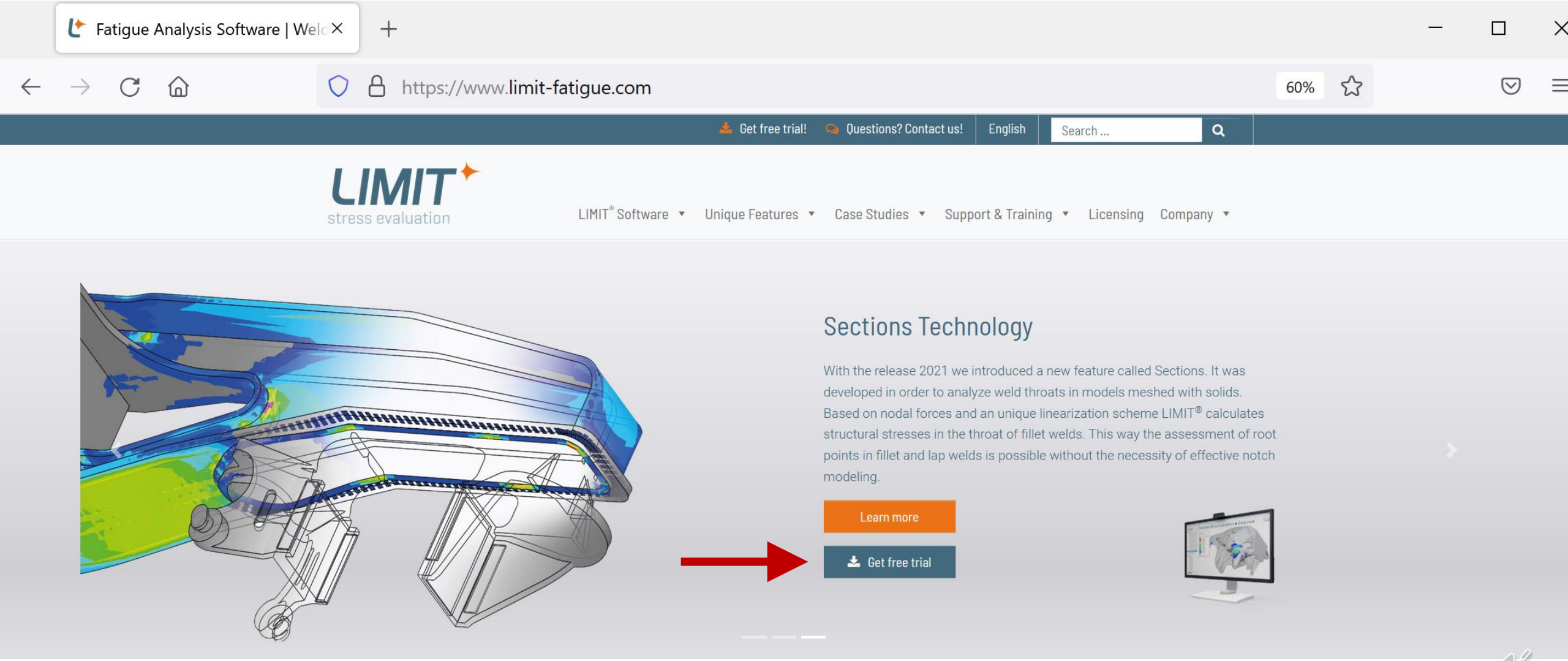
Thanks for your attention!

LIMIT stress evaluation



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