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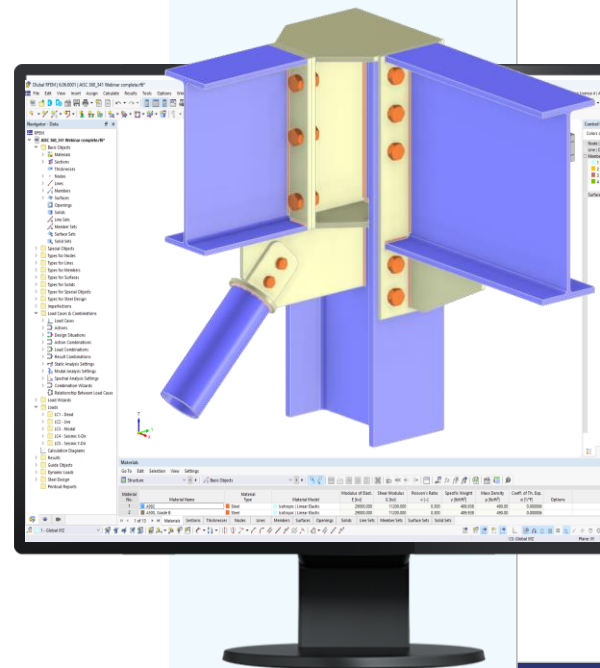
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Webinar

AISC 360-22 Steel Connection Design in RFEM 6



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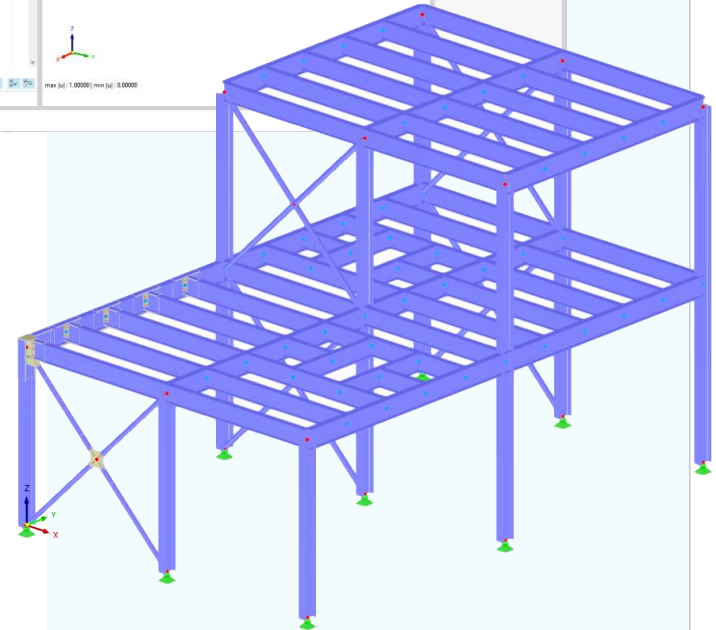
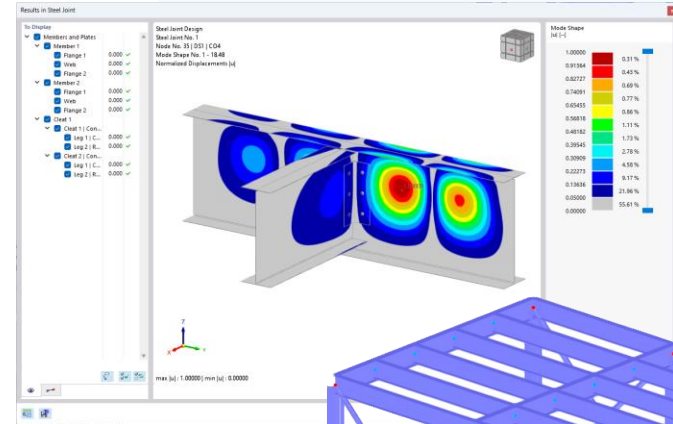
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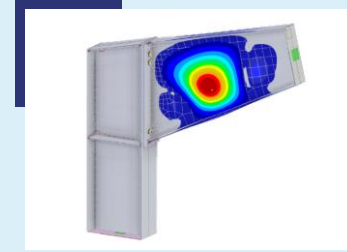
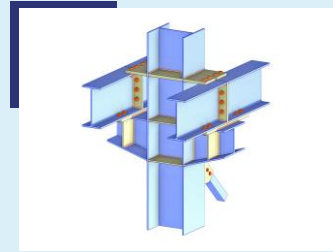
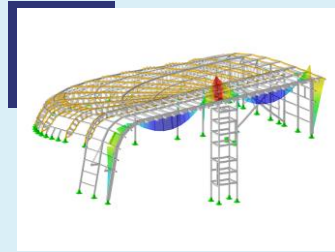
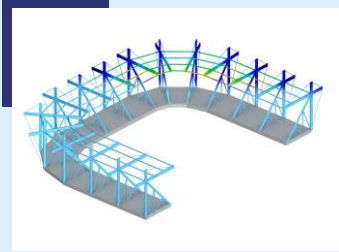
Content

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- 02 Applicable AISC 360-22 standard updates
- 03 New components and features available
- 04 Example model input data and workflow
- 05 Detailed design results review





Steel Design in RFEM 6



RFEM 6

**Steel Design
Add-on**

**Steel Joints
Add-on**

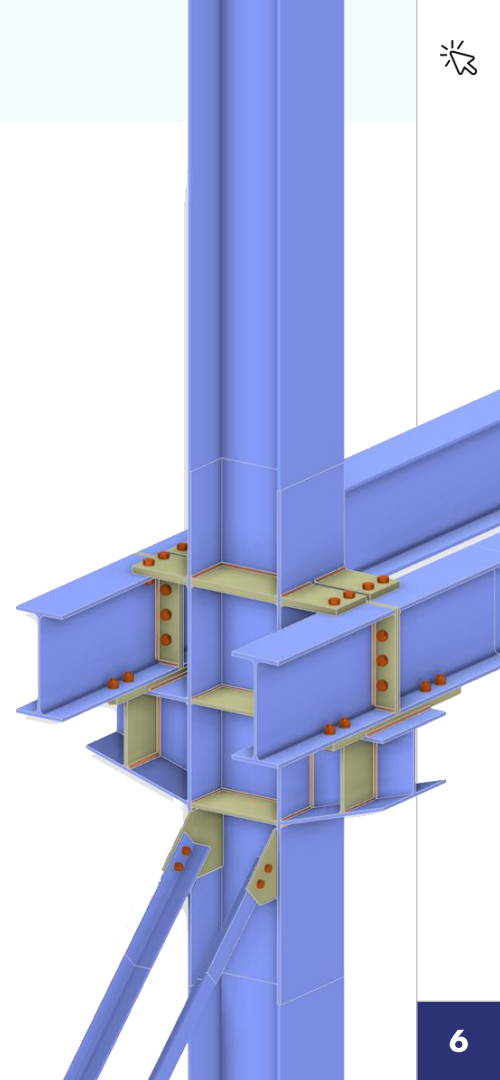
**Structure Stability
Add-on**





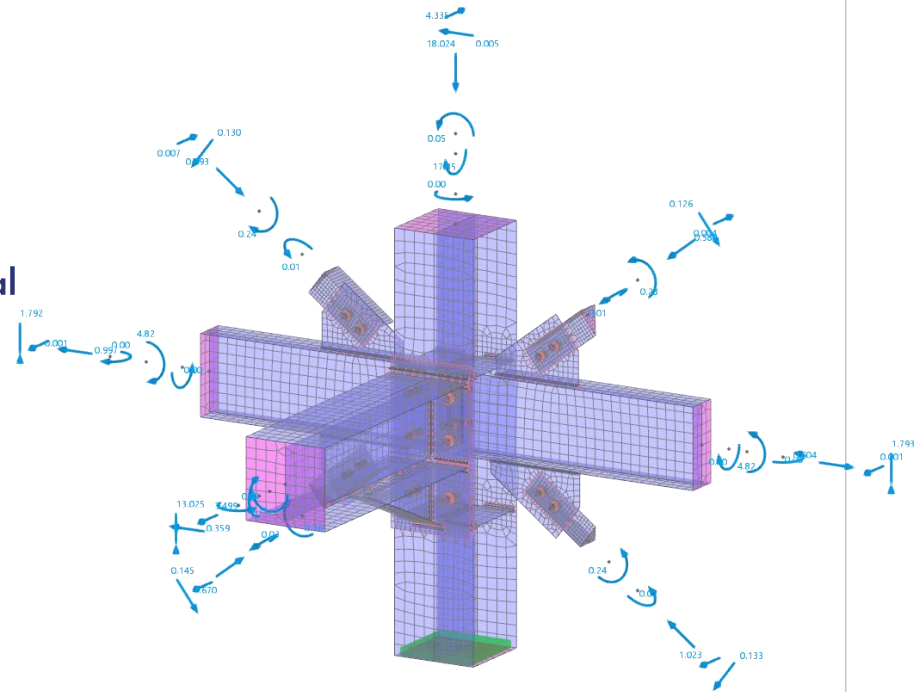
Why FEA for Steel Connection Design?

- Design of non-standard connections
- Components/members both in-plane and out-of-plane
- Consideration of complex loading
- Automatic submodel generation requiring minimal expertise level
- Additional buckling analysis submodel
- Calculate and classify connection stiffness
- More precise results with less assumptions
- Validation tool for non-standard connections



RFEM Steel Connection Design Concept

- Automatic FEA submodel generation
- 1D member elements → 2D elements
- Bolts and welds → 1D and 2D elements
- Linear elastic material → Nonlinear plastic material
- Geometric nonlinearities
- Automatic member end force transfer
- AISC plate, bolt, and weld design
- Buckling submodel with failure modes and critical load factors
- Integrated member design in RFEM 6





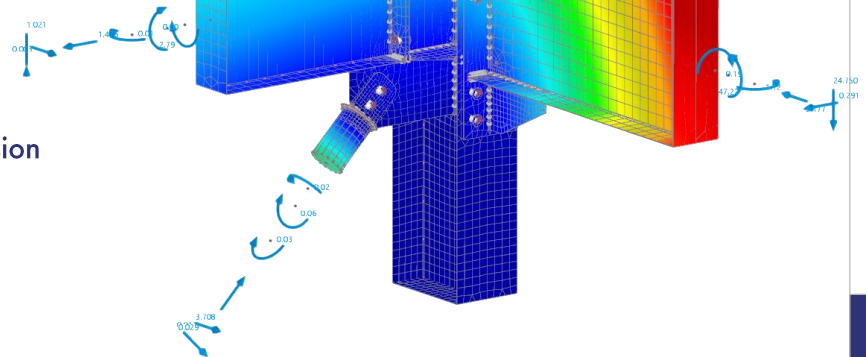
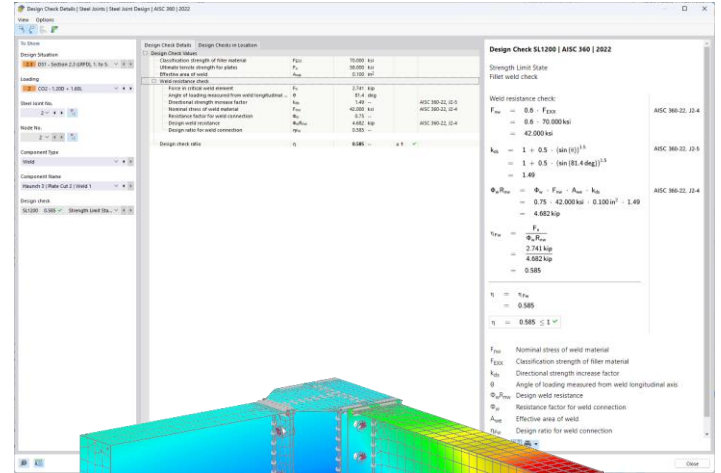
AISC 360-22 Updates

Sect. J2.4(a) – Welds and Welded Joints | Fillet Welds - Strength

- Clarifications and revisions to Sect. J2.4(a) and (b)
- Eqn. J2-4 - Fillet weld design strength, R_n

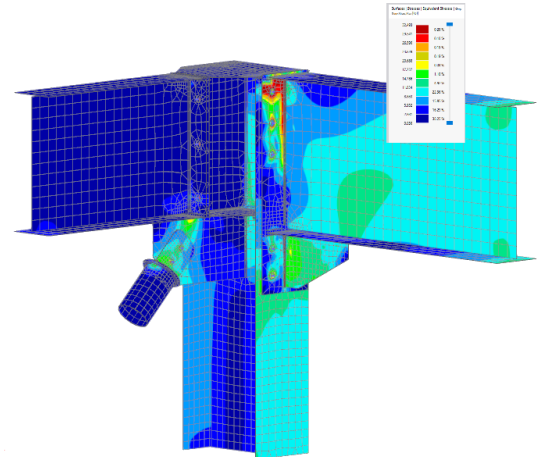
$$R_n = F_{nw} A_{we} k_{ds}$$

- New, directional strength increase factor, k_{ds}
 - $k_{ds} = (1.0 + 0.5 \sin^{1.5} \Theta)$ [Eqn. J2-5]
 - $k_{ds} = 1.0$ for rectangular HSS ends loaded in tension



Steel Joints Add-on Updates

- **Preloaded bolt input options**
 - Submodel includes applied bolt prestress force and increased surface friction coefficient for plates in contact
 - Load prestress from AISC 360-22 Table J3.1 – Minimum Bolt Pretension (0.7 x bolt tensile strength)
 - Advantages include increased joint rigidity and tightness, increased contact stress in plates, control of loosening with high vibrations, etc.
- **Connection stiffness and classification**
 - Calculation of rotational and axial stiffness available
 - Two values provided for unsymmetric connections (e.g., S_{My+} and S_{My-})
 - Classification from AISC 360-22 Fig. C-B3.2, B3.3: Rigid, Pinned, Semi-Rigid
 - Automatic export to global RFEM model (planned for future)



Steel Joints Add-on Updates (cont'd)

- **Round HSS Connections**
 - Sections and welds are analyzed using segmentation method
- **New Components/Capabilities**
 - "Inserted Member" – inserted section for stubs, fly bracing, intermediate connection piece, etc.
 - "Auxiliary Solid" – complex geometry modification to plates/members with box, cylinder, or section solid
 - "Cap Plate" – automatically positioned plate with correct dimensions and weld definitions
 - "Rib" – quick stiffener element between two existing plates reducing previous component input settings
 - "Connecting Plate – Notched Member" – automatically weld connected members to gusset plate through member notch
 - Measure Tools – right click in Joints view to activate measurement tools
 - Nonlinear Release in Submodel – contact edges w/o weld include nonlinear line/nodal releases (i.e., tension – release is activated; compression – contact between elements)

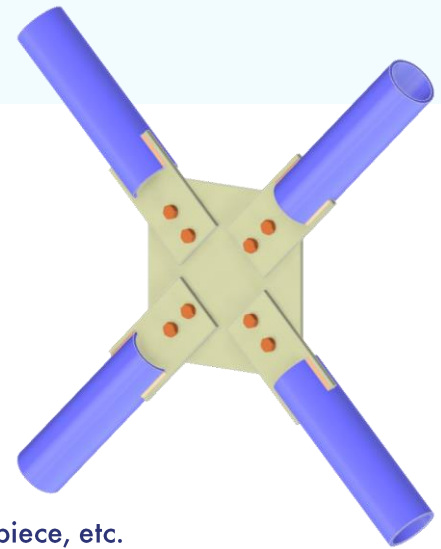
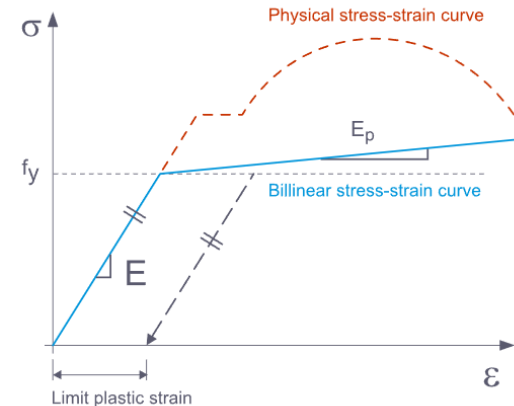
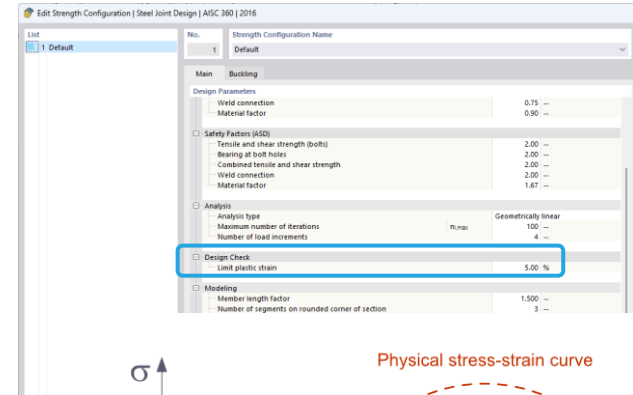


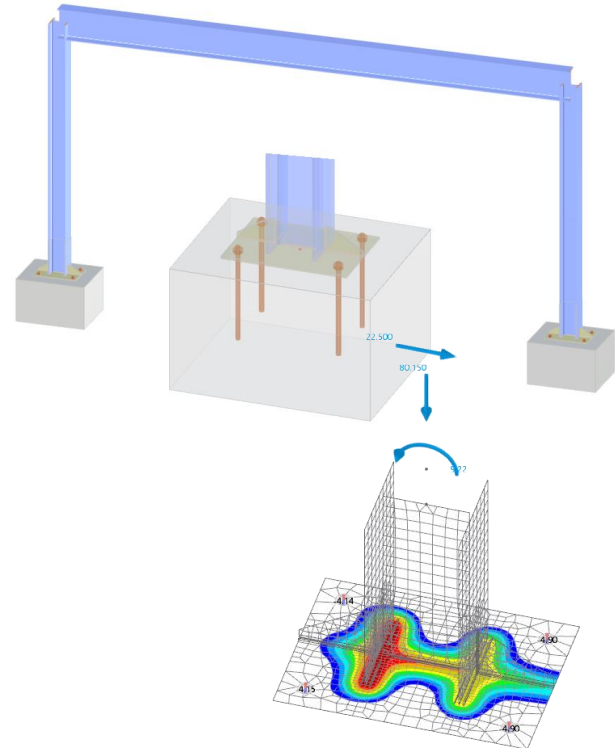
Plate Design Check – Plastic Strain Limit

- Plastic strain limit is the strength limit state criteria
- Flanges, webs, plates, etc. converted to 2D surfaces
- Nonlinear plastic material model assigned
- Von Mises yield criterion stress failure hypothesis
- $E_p = E/1000$ of steel material
- Utilize plastic behavior of steel with internal force redistribution after slight yielding
- Default value $\epsilon_{p\text{-limit}} = 5\%$ (EN 1993-1-5 Annex C.8 Note 1)
- Relevant correlation to actual steel plate behavior



Steel Joints Add-on Future Developments

- Automatic export of connection stiffness to global RFEM model
- HSS through-bolt connections
- Base plate design (in prerelease mode for EC)
- Graphic display of dimensions
- Modeling improvements (easier insertion of members/plates)
- Calculation optimization (mesh, details, performance)
- Template library improvements (integration in Dlubal Center)



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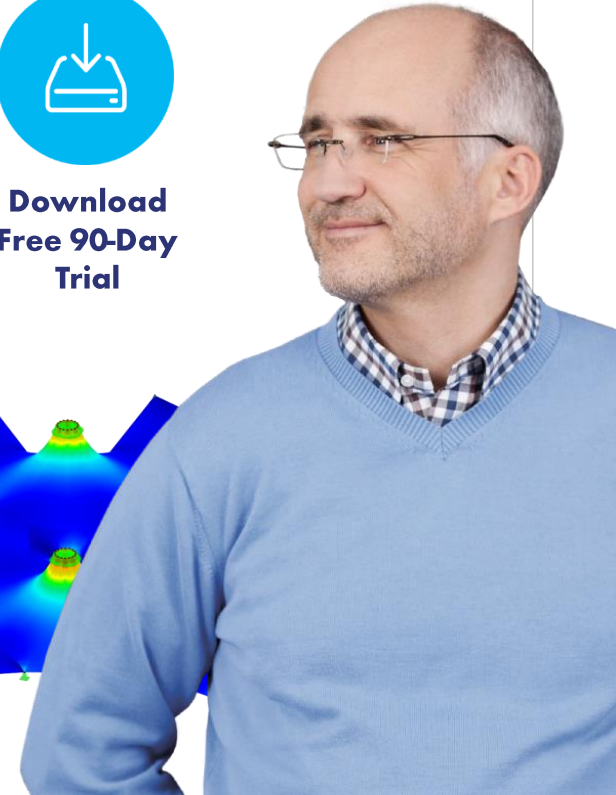
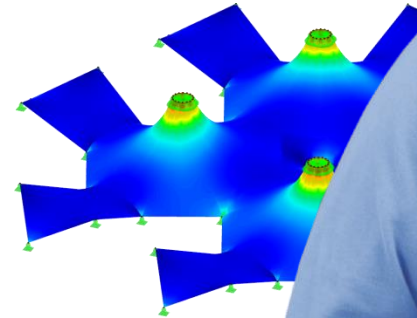
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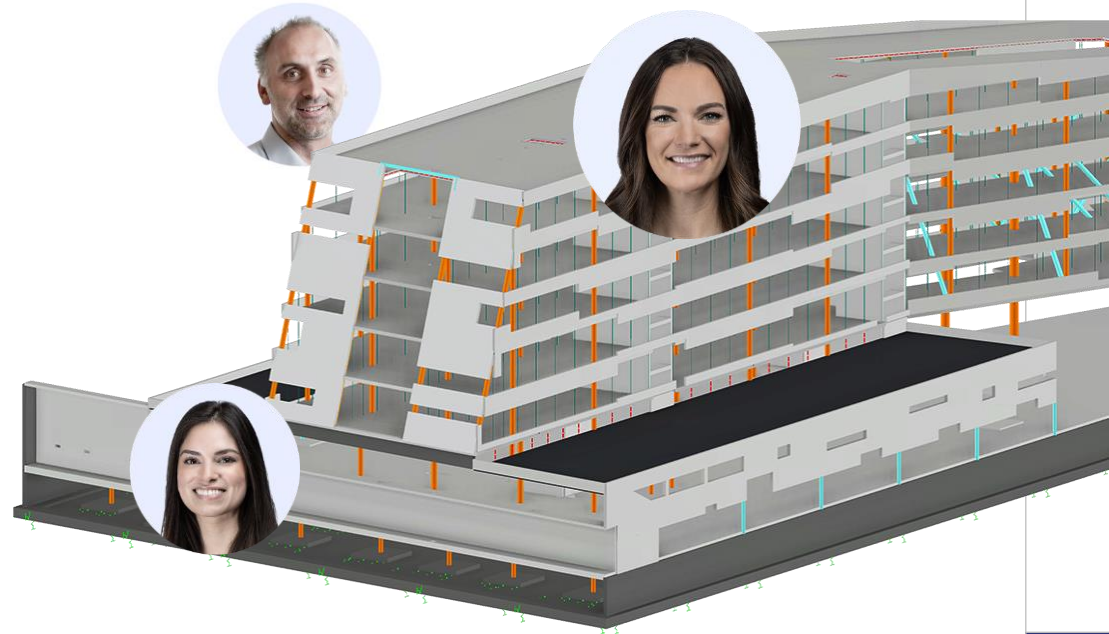
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