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Structural Analysis & Design Software

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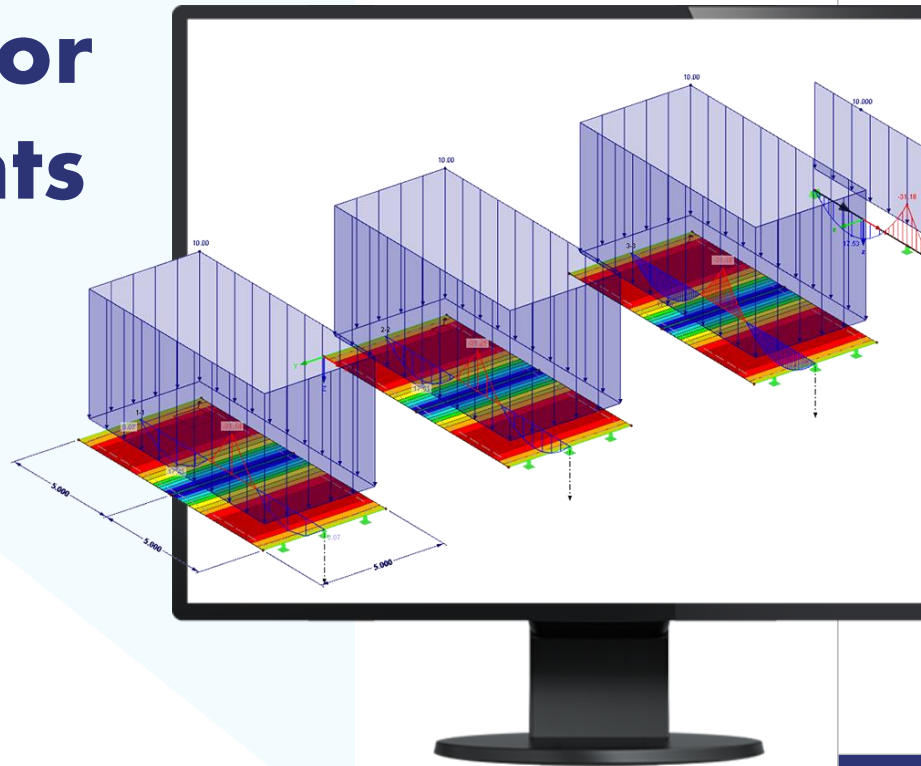CEO – USA Office

Technical Support & Sales Engineer
Dlubal Software, Inc.

Online Training

RFEM for Students

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Questions During the Presentation

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Show or hide control panel

Adjust audio settings

Ask questions

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Coffee Break

CONTENT

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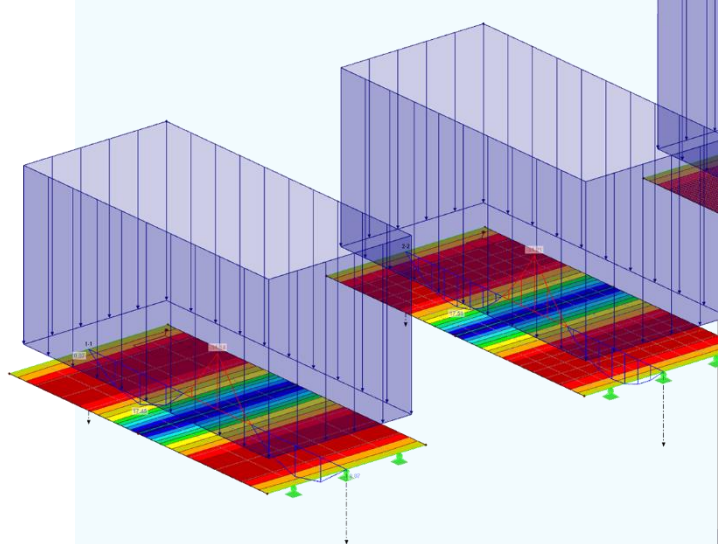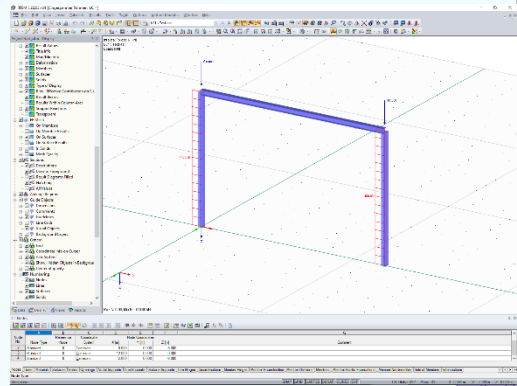
Basics of FEA

- Computer software based on the displacement method

- Analytical solution is difficult with large complicated structures

  - Structure model converted to finite interconnected element mesh

  - Material and cross-section properties given at each FE node

  - Mechanical behavior transferred between elements
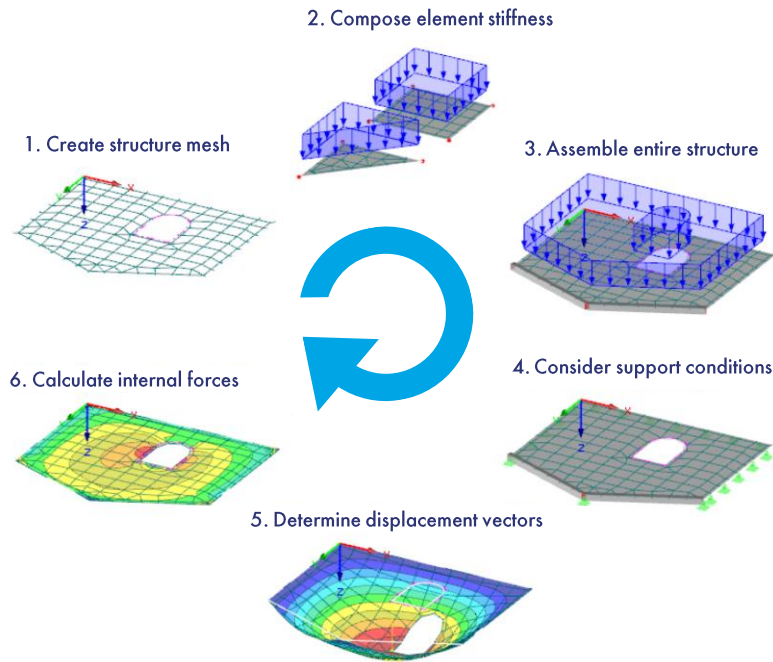
- Discretization: Structure submeshing into finite elements

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FEA Calculation Workflow

1. **Determine local element stiffness properties**

2. **Transfer stiffness properties to Global coordinate system**

3. **Assemble entire structure**

4. **Implement support conditions**

5. **Determine displacement vectors**

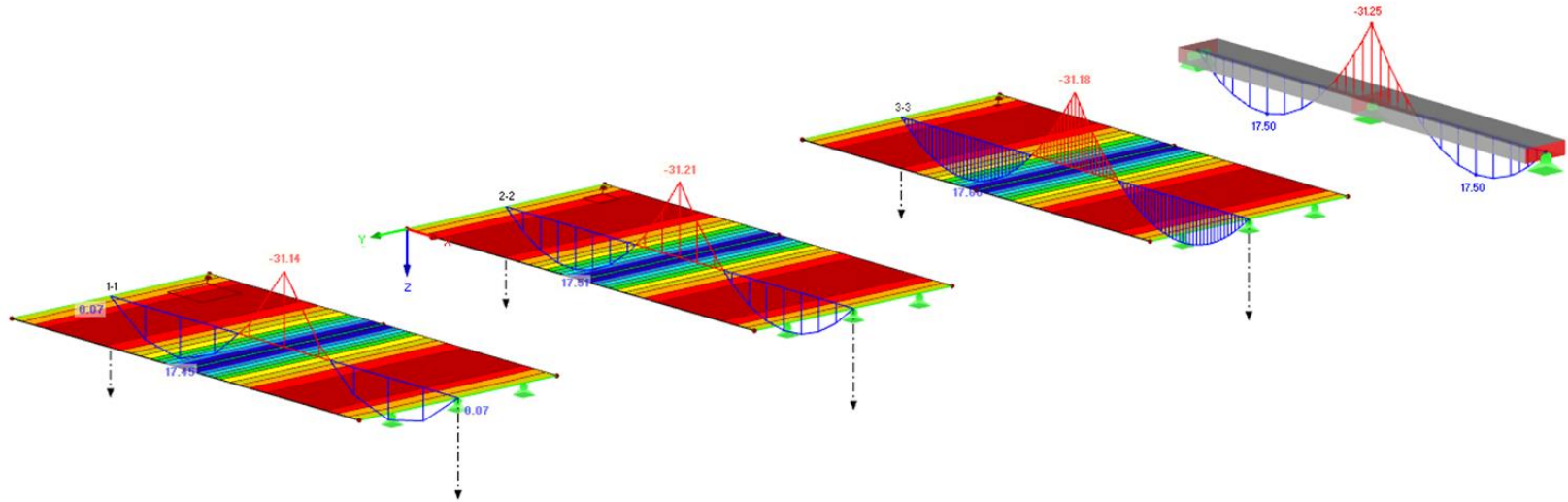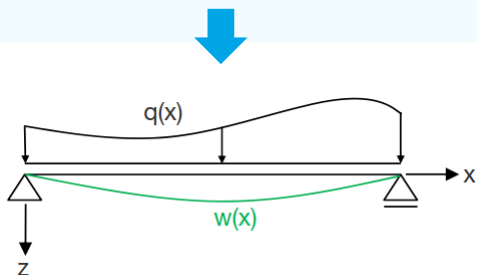6. **Determine support forces and internal forces**

2. Compose element stiffness

1. Create structure mesh

3. Assemble entire structure

6. Calculate internal forces

4. Consider support conditions

5. Determine displacement vectors

Continuous Plate

Plate Theory

Analogy for beam elements:

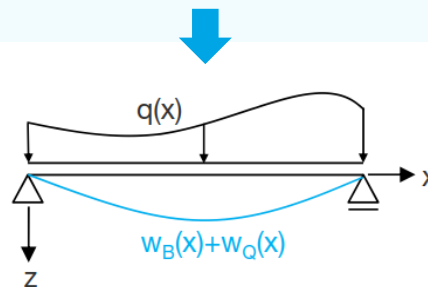| Bernoulli	Timoshenko
▪ Cross-sections remain in-plane and perpendicular to the member axis ▪ No consideration of shear deformations, completely rigid shear stiffness	▪ Cross-sections remain in-plane and perpendicular to the member axis ▪ Shear deformations are taken into consideration, shear stiffness is limited and isn't completely rigid

Plate Theory

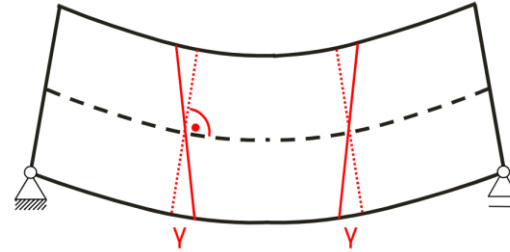Analogy for beam elements:
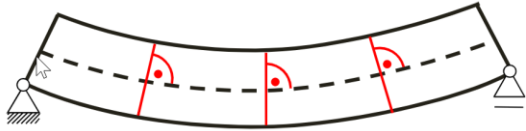
Bernoulli	Timoshenko

Plate Theory

Equivalent analogy for plate elements:

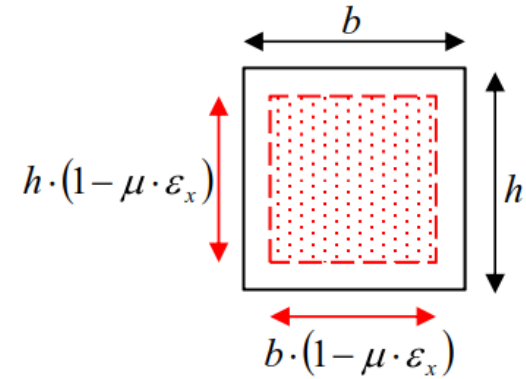| Kirchhoff	Reissner/Mindlin
▪ Geometrically linear: small deformations ▪ Linear elastic material: Hooke's law ▪ Cross-sections remain flat, no warping ▪ Constant thickness ▪ **No consideration of shear deformations**	▪ Geometrically linear: small deformations ▪ Linear elastic material: Hooke's law ▪ Cross-sections remain flat, no warping ▪ Constant thickness ▪ **Consideration of shear deformations** ▪ **Consideration of transverse/lateral strains**

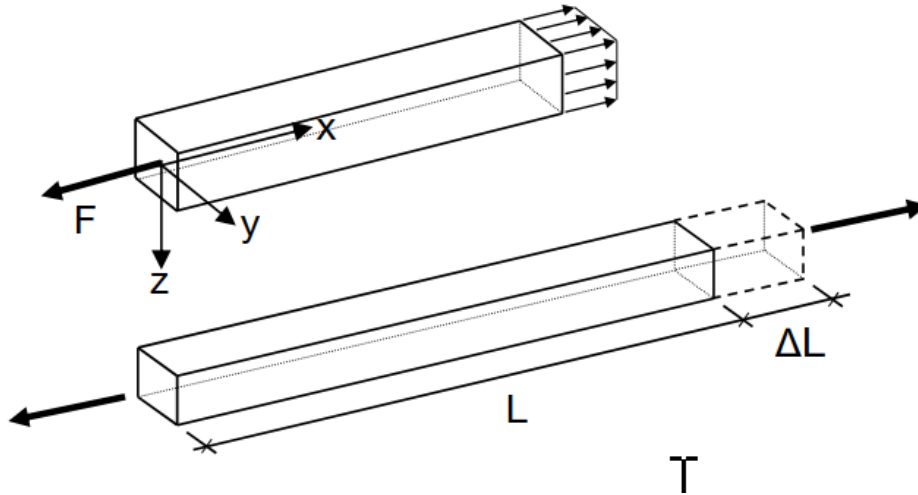Online Training

Transverse/Lateral Strain

$$h \cdot (1 - \mu \cdot \varepsilon_x)$$

$$b \cdot (1 - \mu \cdot \varepsilon_x)$$

Plate Theory

Transfer to plate elements:

Kirchhoff-Theorie	Reissner/Mindlin-Theorie
▪ **No consideration of shear deformations**	▪ **Consideration of shear deformations**
▪ Theory of thin plates	▪ Theory of thick plates
▪ Pure bending load bearing capacity	▪ Shear influence component is relatively high
▪ Simplified approach	▪ Significant error when neglecting shear force
	▪ Higher-value approach
	▪ More accurate shear forces

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Euler Case 1 and Stability Analysis of a frame
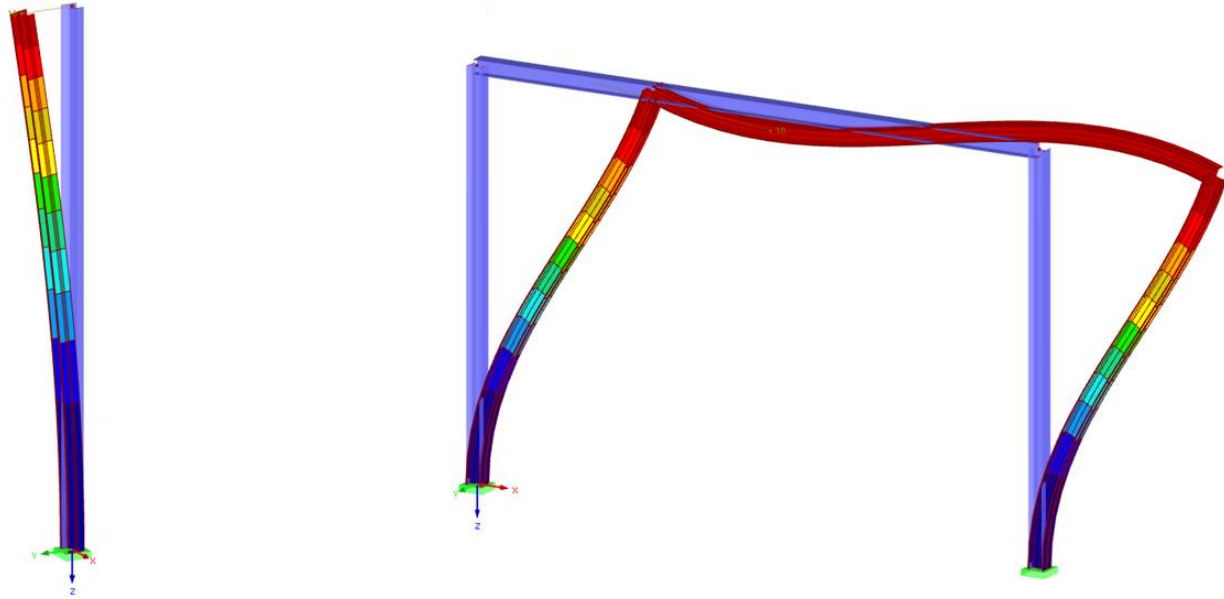
Concrete Model
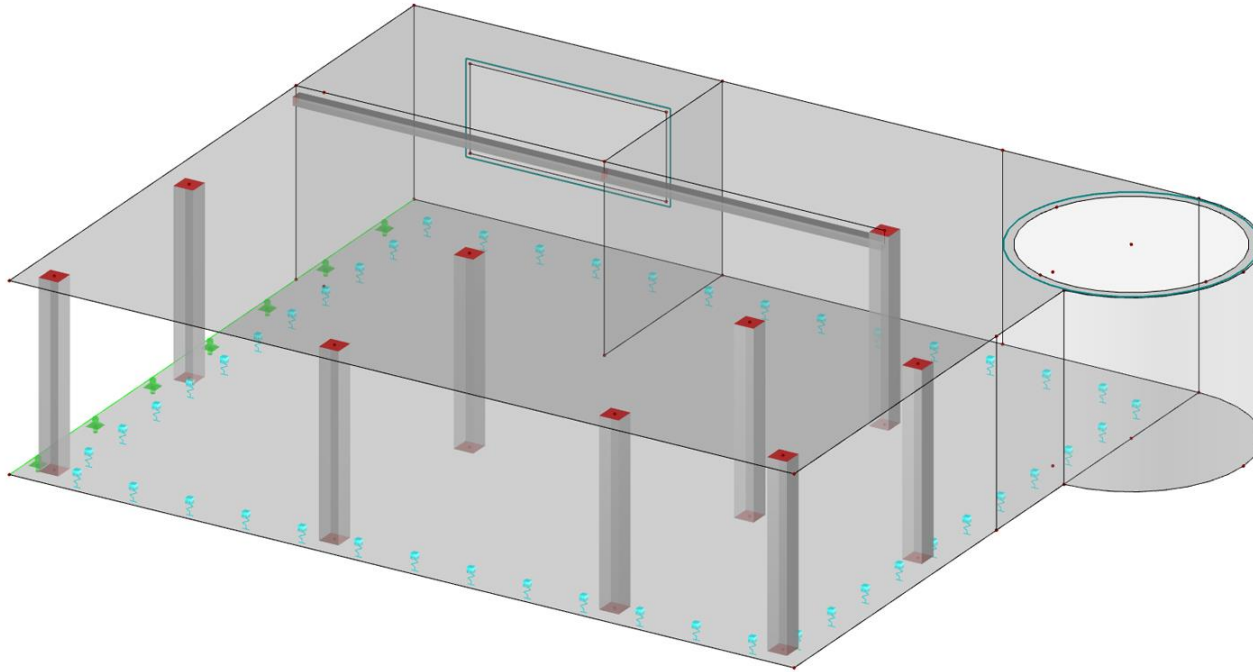
Open Discussion

Any Questions
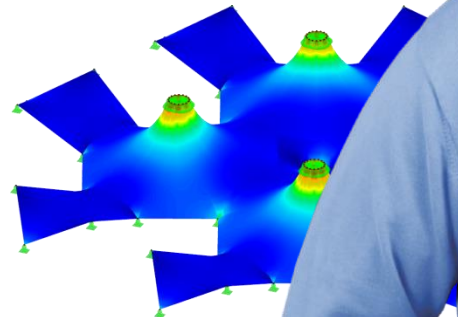
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