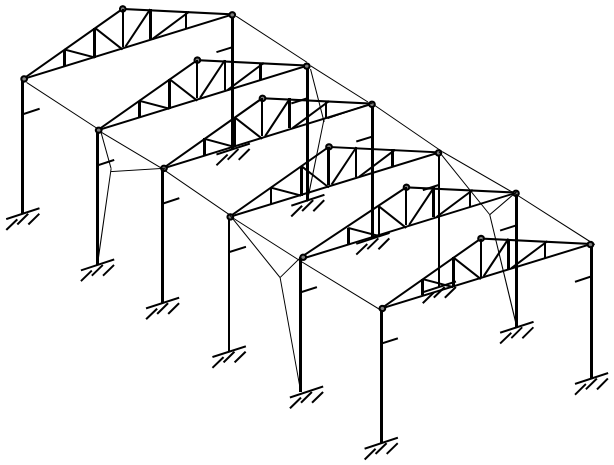
Finite Element Analysis

Exercise: warehouse structure (oversimplified, for teaching purposes only)

Identify the safety factor of the structure below, loaded by: self-weight, snow distributed loads, overhead travelling crane load. Effect of wind on the side walls may be neglected.



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Data:

L_1= 8 m

L_2=10 m

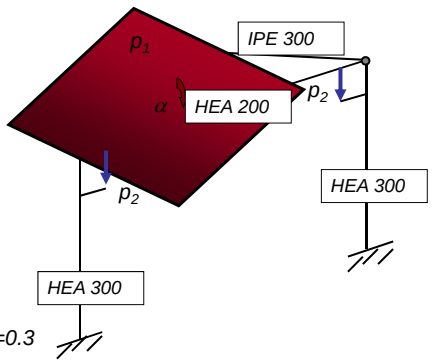
L_3= 1 m

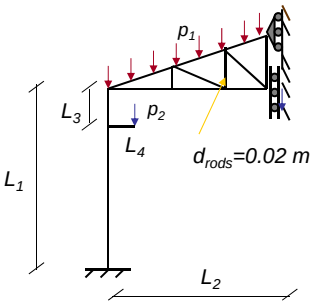
L_4= 0.4 m

α=15°

p_1= 7200 N/m

p_2= 100000 N





Equivalent model, exploiting symmetry: single half portal

Fe430:

E=200 GPa, ν=0.3

σ_y=275 MPa

ρ=7800 kg/m^3

N.B. portal dimensions are not of a real-world structure

p_1= *snow distributed load, per unit length (vertical, in N/m)*

p_2= *travelling crane load (vertical, in N)*

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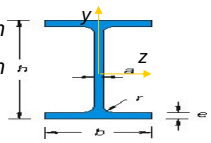
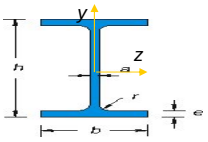
HEA 300 cross-section:

h=290 mm
b=300 mm
a=8.5 mm
e=14 mm
A= 106.27 cm²
J_z= 17300 cm⁴
J_y= 6300 cm⁴



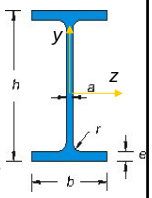
HEA 200 cross-section :

h=190 mm
b=200 mm
a=6.5 mm
e=10 mm
A= 51.05 cm²
J_z= 3510 cm⁴
J_y= 1330 cm⁴



IPE 300 cross-section :

h=300 mm
b=150 mm
A=7.1 mm
e=10.7 mm
A= 52.88 cm²
J_z= 8356 cm⁴
J_y= 603 cm⁴



Rods:

d= 20 mm
A= 3.14 cm²

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Outlines:

- Definition of cross-sectional data through real constants or section.
- 3D beam cross-section orientation.
- On screen visualization of beam cross-sections and elements reference system.
- Use of different element types.
- Use of beams of different cross-sections.
- Exploitation of problem symmetry.
- Handling of internal constraints (hinges, ball-joints, etc).
- Copy features of the solid modeler.
- Post-processing: quantitative visualization of significant problem quantities.