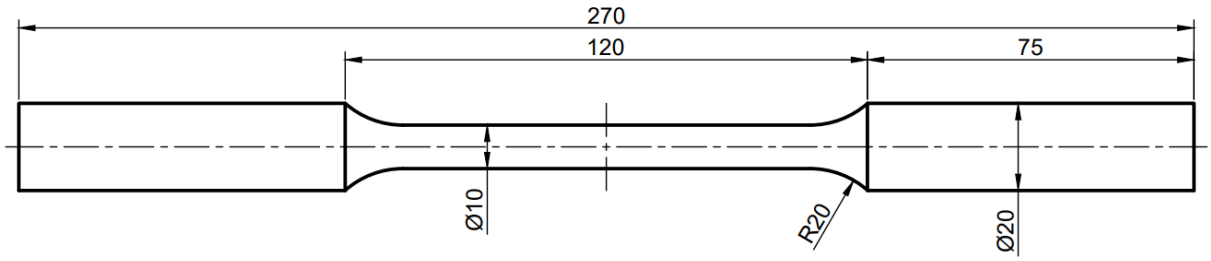
List 10

Task 1

According to the dimensions shown in the drawing below, prepare a geometric model of the material sample to be used in a uniaxial tension test. Assume that the element is made of structural steel (Young's modulus E = 200 GPa; Poisson's ratio υ = 0,3; tensile yield strength R_e = 250 MPa; tensile ultimate strength R_m = 460 MPa), and the tensile force applied to the surface of the grips with a diameter of ∅20 mm is: F_1 = 35 kN. For the analyzed element, determine the total displacements and reduced stresses according to the Huber-von Mises hypothesis.



Perform numerical simulations first ignoring, and then including the geometric nonlinearity and the material nonlinearity. Compare the results.

Please verify:

a) How will the strength of the tested sample change when the force F_1 becomes a bending force instead of a tensile force?

b) How will the strength of the tested sample, now loaded with a new bending force of F_1 = 350 N, change when a material with anisotropic properties is used instead of structural steel?