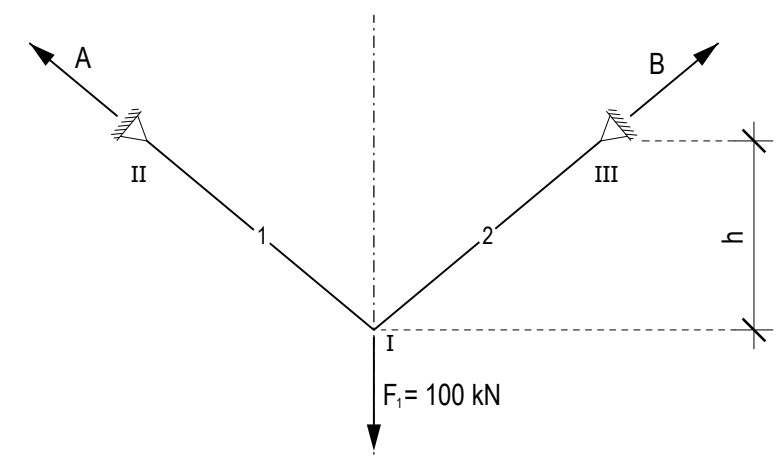
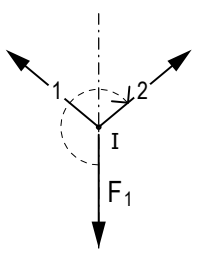
Task 1 Analysing cables with a given geometry

Draw the corresponding force diagrams for the cases a) and b). Indicate tension forces with red, compression forces with blue and external forces with green.

a)



form diagram 1:50

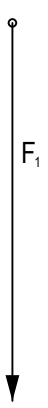


node I

node II

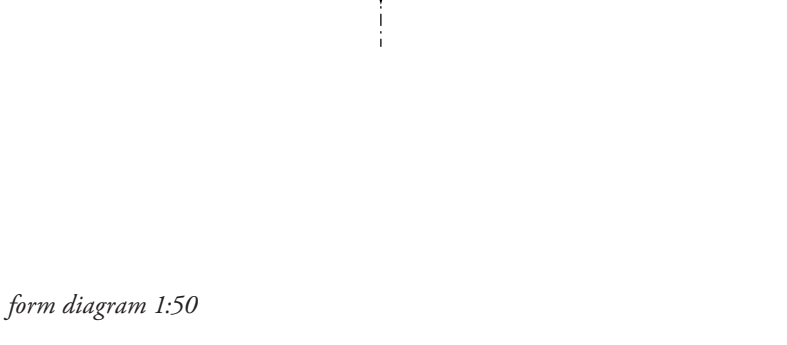
node III

subsystems



force diagram 1cm ≙ 20kN

b)



form diagram 1:50

node I

node II

node III

subsystems

force diagram 1cm ≙ 20kN

c) Describe the relationship between the force and form diagram by comparing at a) and b).

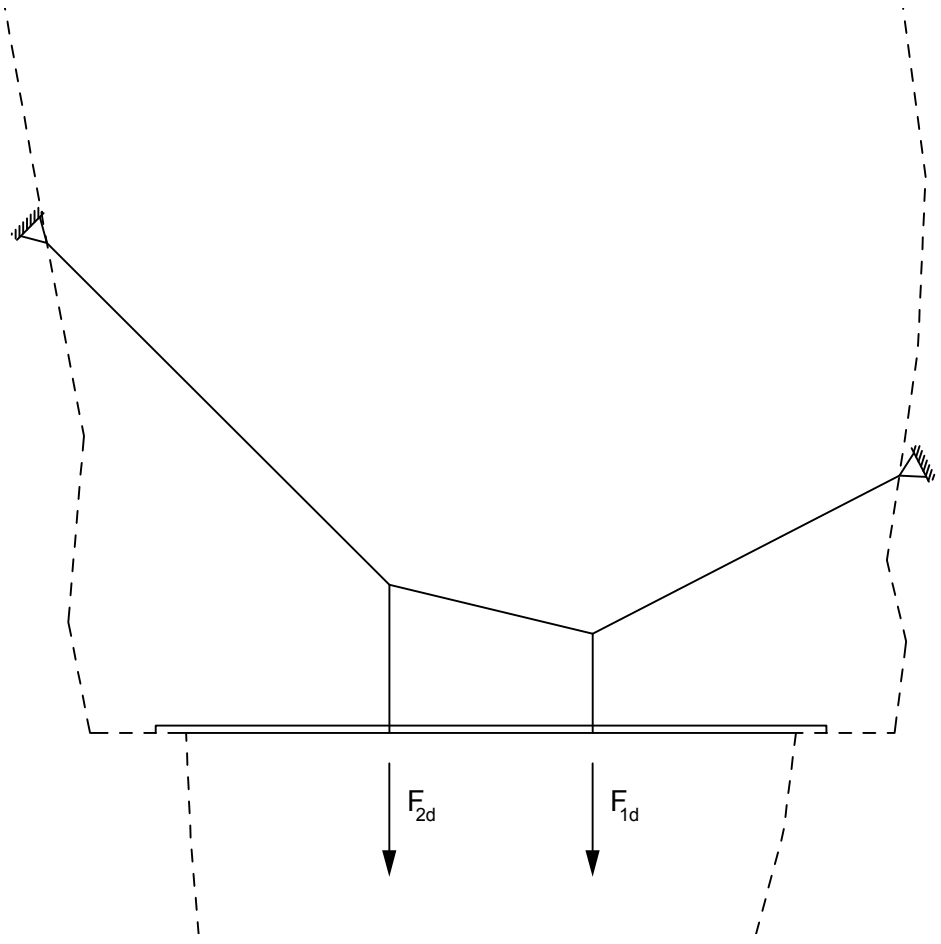
Task 2 Dimensioning of a suspension bridge

a) Draw the force diagram for the given cable bridge and find the relevant force $N_{d\,max}$ in the structure for $F_{1d} = F_{2d} = 40$ kN. Indicate tension forces with red, compression forces with blue and external forces with green.

b) Calculate the required cable diameter based on the stress within the relevant segment made out of steel S235. The material values can be found on the formulary.

c) Does the load-bearing safety remain guaranteed if the cable is made out of steel S355 with a diameter of 18 mm? Apply the method of axial force proofing to the relevant segment.

a)



form diagram 1:500

node I

node II

node III

node IV

node V

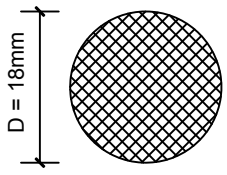
node VI

subsystems

force diagram 1cm ≙ 10kN

b)

c)



cross-section 1:10

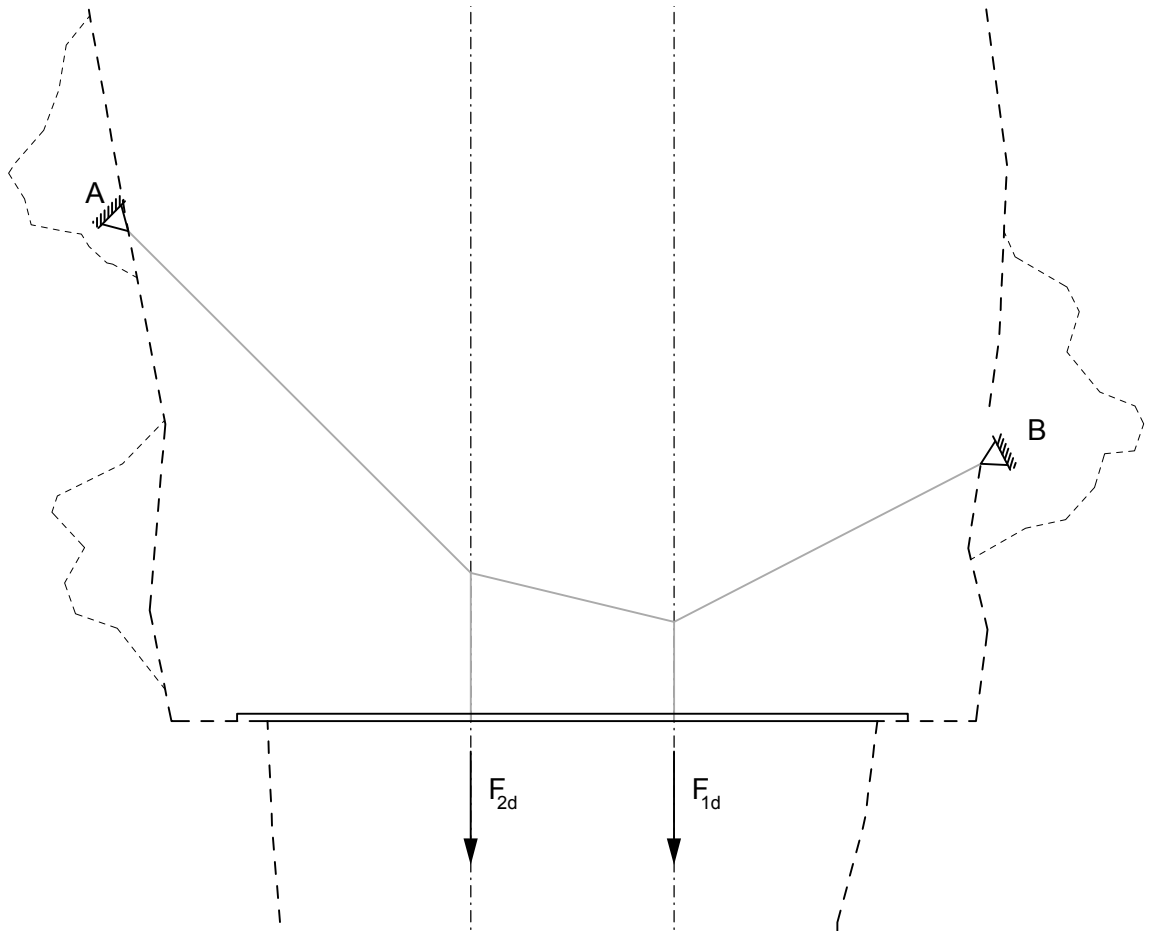
Creative Task A new suspension bridge

The given pedestrian bridge from task 2 is supported on fractured rocks and needs fixing.

a) Chose two new fixing points A and B for the cable. First find the resultant and then determine the direction of the reaction forces with help of the global equilibrium. Starting from the supports, solve node per node with help of the corresponding force diagram. Indicate tension forces with red, compression forces with blue and external forces with green.

b) Make a suggestion of a material and its diameter for the cables of your bridge. Calculate the values for the relevant member.

a)



form diagram 1:500

node I

node II

node III

node IV

node V

node VI

subsystems

force diagram 1cm ≙ 10kN

b)