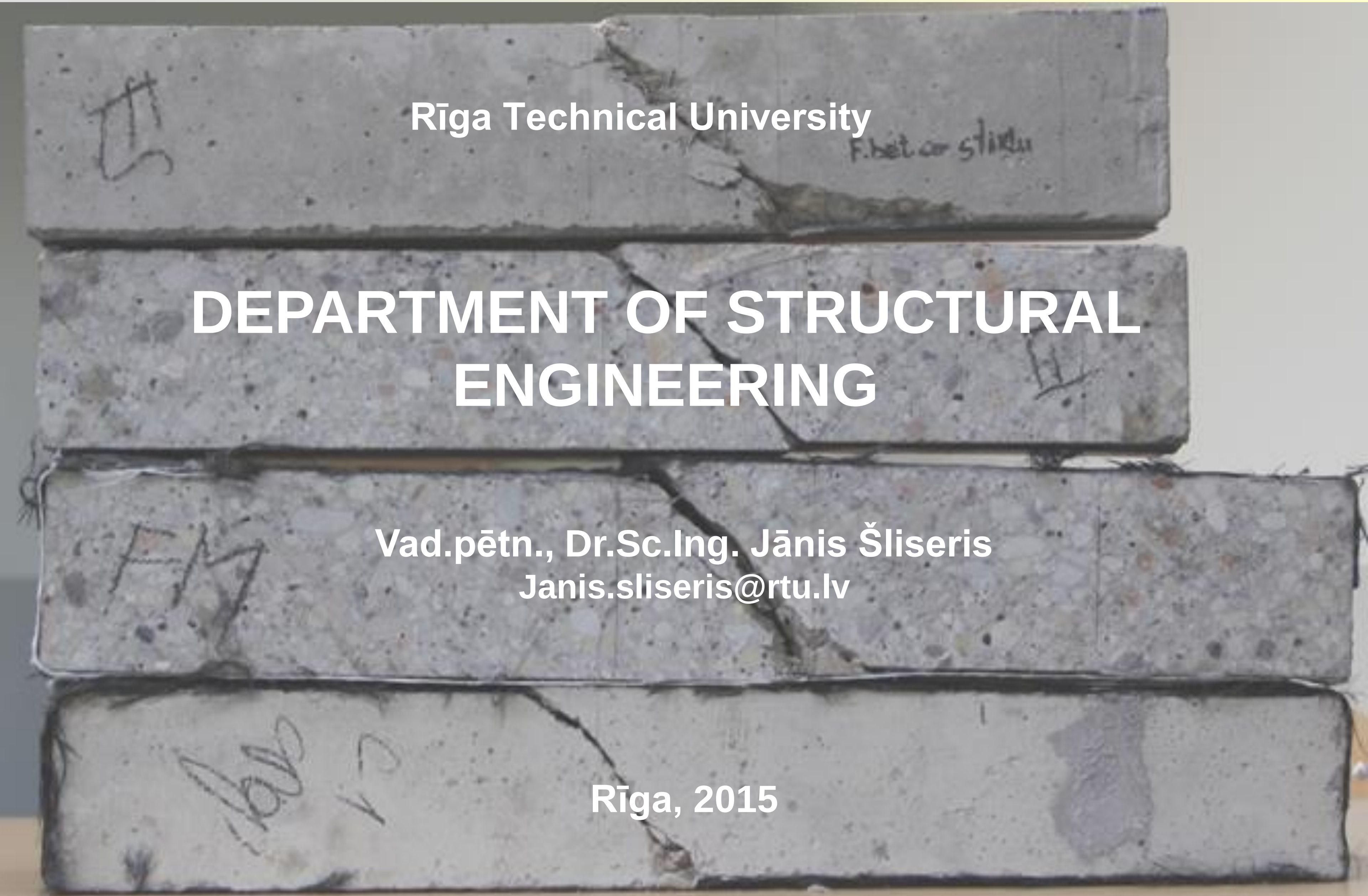

Rīga Technical University

# DEPARTMENT OF STRUCTURAL ENGINEERING

Vad.pētn., Dr.Sc.Ing. Jānis Šliseris
Janis.sliseris@rtu.lv

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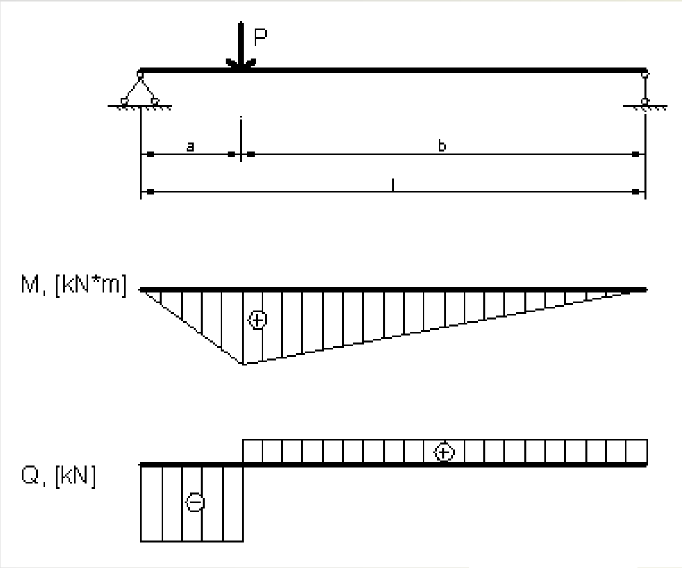
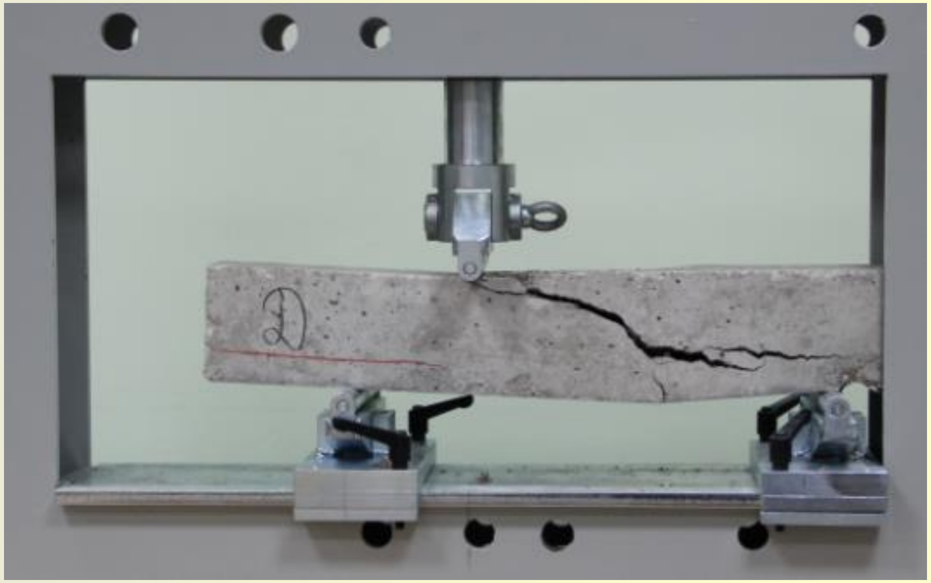
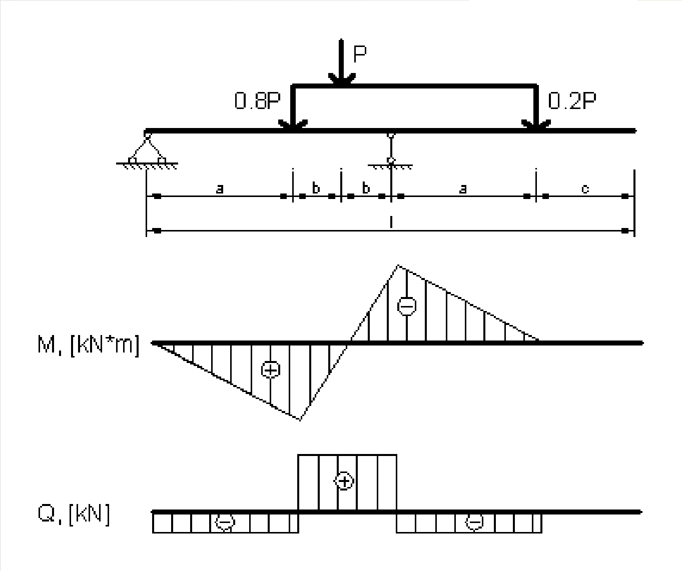
# DEPARTMENT OF STRUCTURAL ENGINEERING

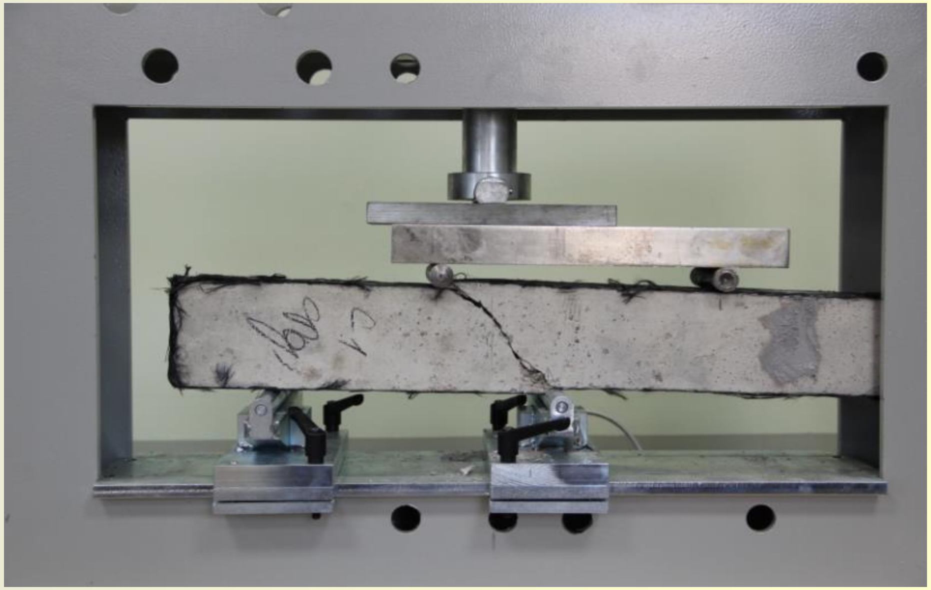
- Design, study and renovating structures made of different materials
- Survey and inspection of buildings, testing of concrete and timber materials and structures.
- Non-destructive testing
- Composite materials and structures
- Development of Combined structures
- Long Span Cable structures
- Finite element simulation and analysis
- Mathematical optimization (response surface method)
- Conformity assessment of construction products
- Development of Eurocode National Annexes

# Shear tests loadings scheme



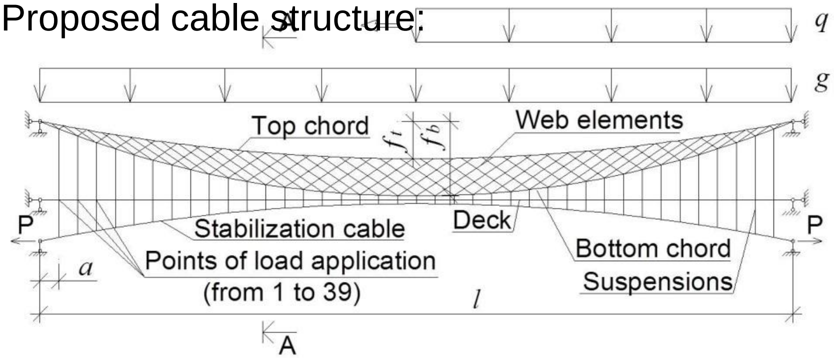


Vadims GOREMIKINS
(Scientific Supervisors: Dr. sc. ing., Profesor D.SERDJUKS, Dr. habil. sc. ing., Profesor K.ROCĒNS)

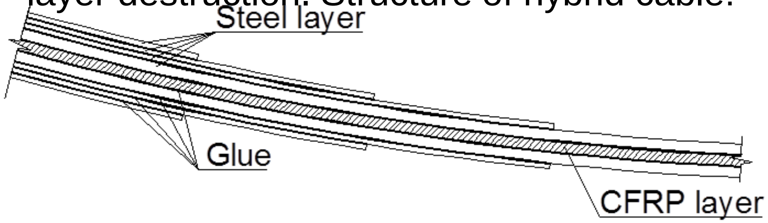
# RATIONAL LARGE SPAN PRESTRESSED CABLE STRUCTURE

• The displacements of the developed prestressed two-chord cable structure with the proposed cable truss are smaller by 26–30% than displacements of the structure with the single main cable with the same material consumption for span interval from 50 to 350 m. Proposed cable structure:




• Experimental testing of the physical models of the prestressed suspension cable structures confirms the accuracy of the numerical models with 10% precision. Physical model:

• Replacement of the steel single main cable of prestressed two-chord cable structure by the hybrid composite cable with CFRP middle layer and steel external layers with cross-section variable by the cable length three times decrease dead weight of the cable in the case of 200 m times and ensures functioning of the structure in case of the middle CFRP layer destruction. Structure of hybrid cable:




• The difference between results, which were calculated by the developed simplified determination method of natural vibration frequencies of prestressed suspension structures and experimentally achieved by the model testing, does not exceed 20%. Equations for determination of natural-vibration frequencies:

$$\omega_{v,i} = \sqrt{\alpha_1 + \frac{\alpha_2 + \alpha_4}{2} + \frac{\alpha_3 + \alpha_5}{2}}$$ – 1, 3, … mode shape

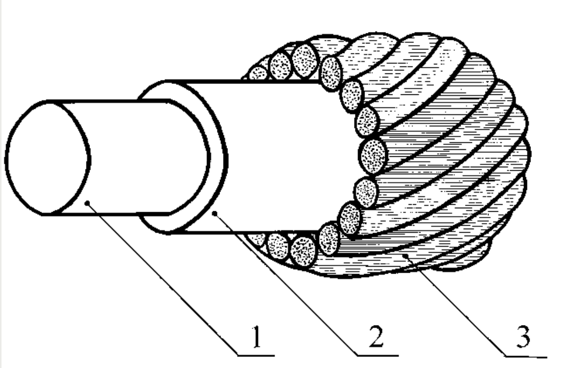
$$\omega_{v,i} = \sqrt{\alpha_1 + \frac{\alpha_2 + \alpha_4}{2}}$$ – 2, 4, … mode shape

$$\alpha_1 = i^4 \pi^4 EI \left(l^4 m\right)^{-1} \quad \alpha_2 = H i^2 \pi^2 \left(l^2 m\right)^{-1} \quad \alpha_3 = 2^9 \pi^{-2} E_c A_c f^2 \left(i^2 L_c l^3 m\right)^{-1}$$

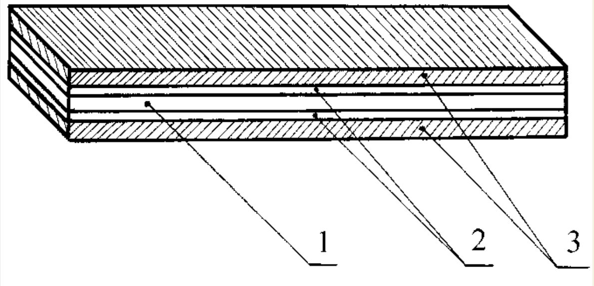
$$\alpha_4 = H_s i^2 \pi^2 \left(l^2 m\right)^{-1} \quad \alpha_5 = 2^9 \pi^{-2} E_{c,s} A_{c,s} f_s^2 \left(i^2 L_{c,s} l^3 m\right)^{-1}$$

## HIBRĪDA KOMPOZĪTVANTS
### (HYBRID COMPOSITE CABLE)

**a)**

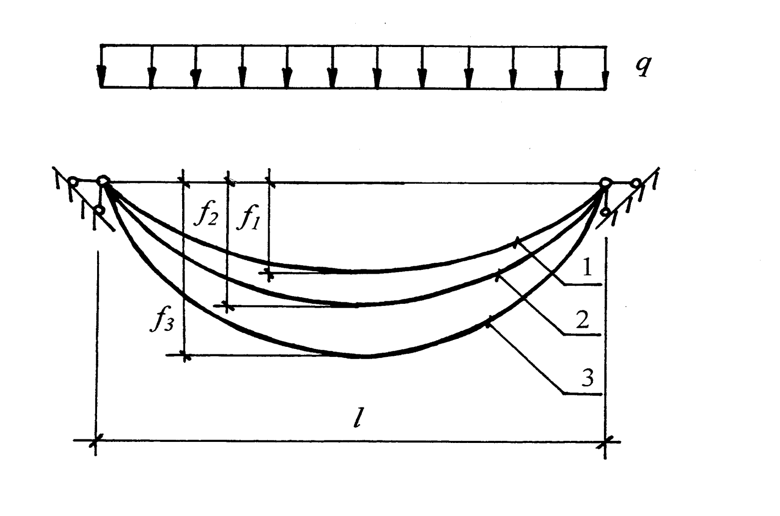



**b)**




*a*) – hybrid composite element on the base of joined together separate tapes; *b*) – hybrid composite element on the base of joined together separate strands;1 – FRP core; 2 – glue or FRP distributional layer; 3 – steel component.

## HIBRĪDA KOMPOZĪTVANTS DARBĪBAS SHĒMA
### (SCHEME OF HYBRID COMPOSITE CABLE WORK)

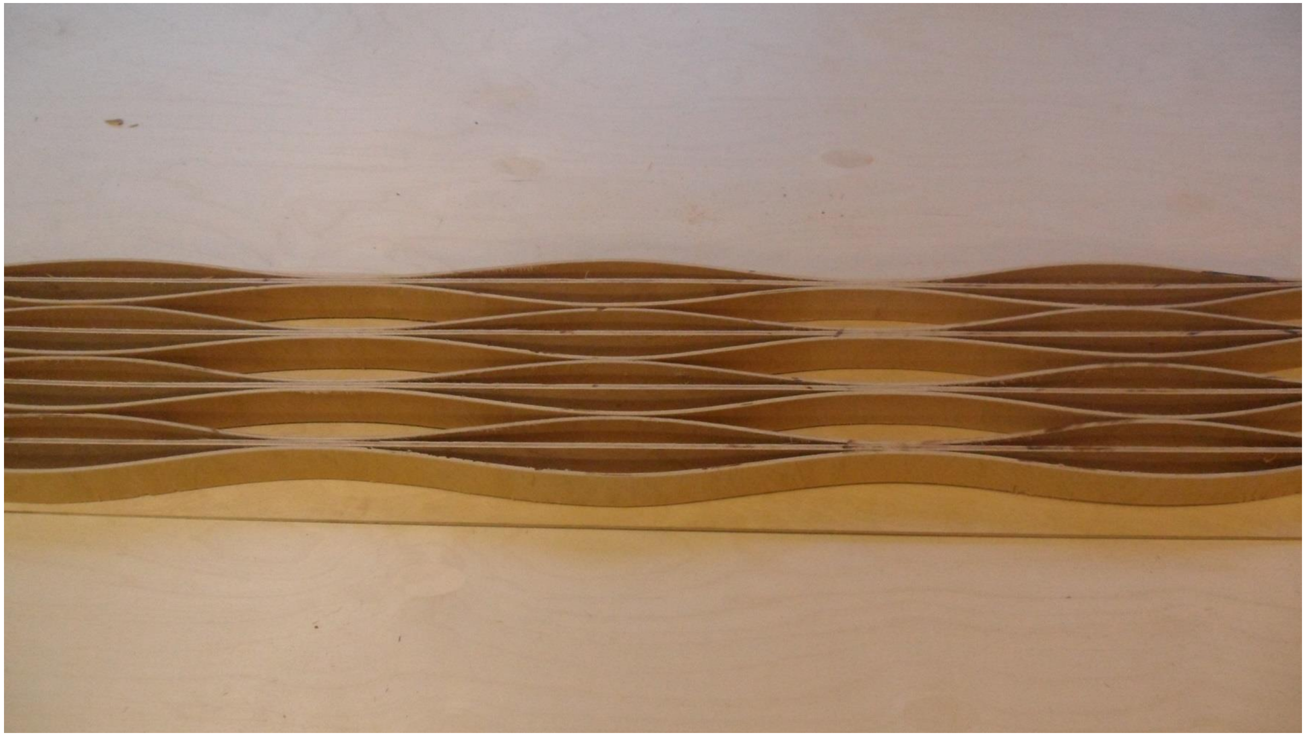



1 - steel wire, GFRP and CFRP work commonly; 2 - GFRP is excluded from the work; 3 - GFRP with CFRP are excluded from the work and steel wire works alone; *q* - design vertical load, acting at the cable; $f_1$ - deflection of the cable, which corresponds to the stage, when steel wire, GFRP and CFRP work commonly; $f_2$ - deflection, which corresponds to the stage, when GFRP is excluded from the work and steel wire works commonly with CFRP; $f_3$ -deflection, which is corresponds to the stage, when GFRP and CFRP are excluded from the work and steel wire works alone; l - span of the cable.

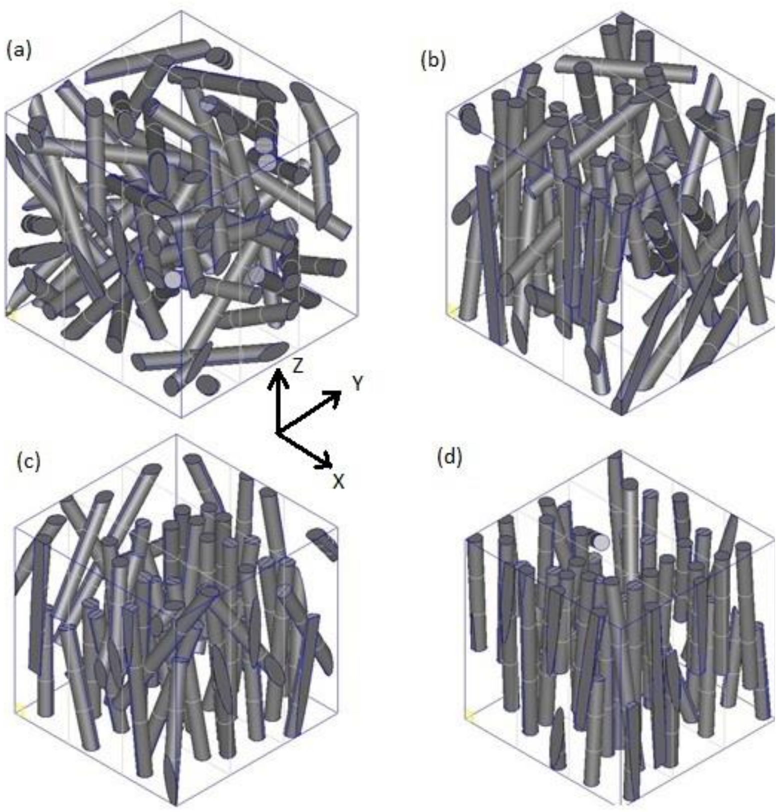
Riboti koka-saplākšņa paneļi

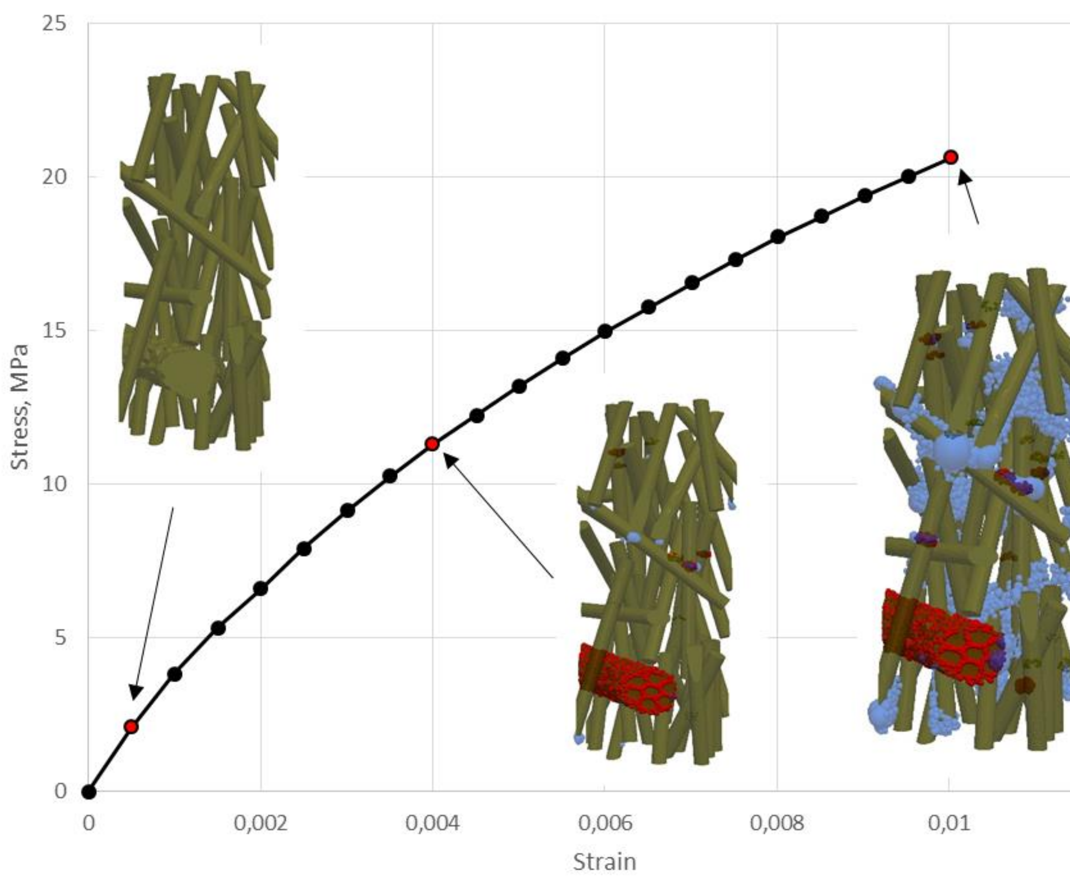
Ribu perpendikulārais virziens ir ļoti vājš!

Paneļi ar viļņveida ribojumu

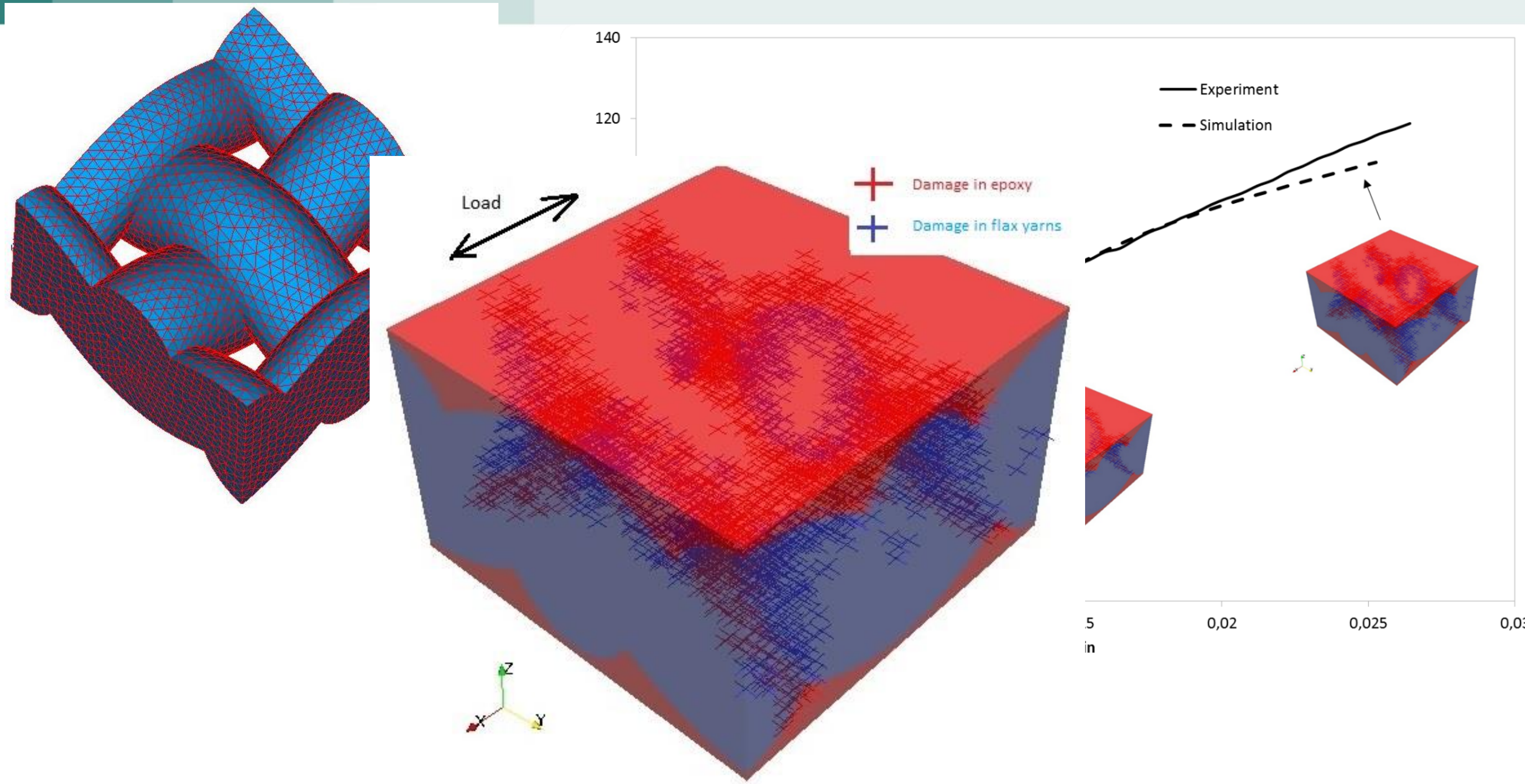


# Mikrostruktūru projektēšana un optimizēšana



# Mikrostruktūru projektēšana un optimizēšana



# Galvenie izaicinājumi

Kā optimālāk salīmēt atšķirīgus materiālus?
-Betons/CFRP
-Koks1/Koks2
-Koks/Tērauds
-Koks/Plastiki

Cikliskas mitruma-temperatūras izmaiņas ietekme?