

ECOMOBIL VEHICLE COMPOSITE STRUCTURE INSERTS BEHAVIOR AND MODELLING

COMPARISON OF MEASUREMENTS DATA WITH SIMULATIONAL RESULTS

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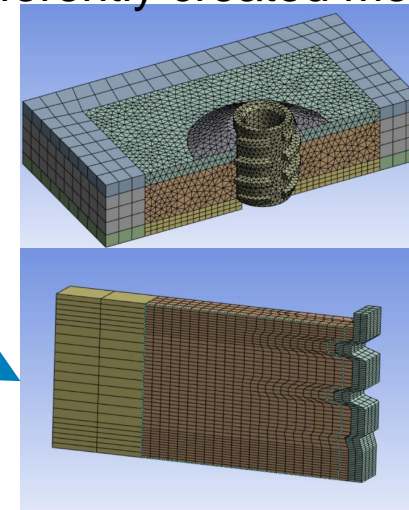


AIM OF MY WORK

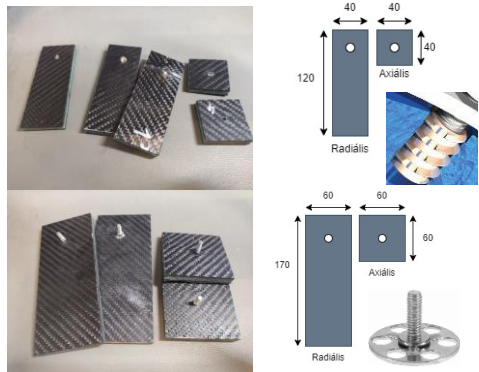
- ▶ Shell Eco-Marathon vehicle composite sandwich structure modelling and examination of inserts used in it.
- ▶ The following process were created for the examination
 - ▶ Laminate material properties measurements
 - ▶ Material model creation by three ways
 - ▶ Comparison of different models
 - ▶ Axial and radial load bearing measurements of different inserts
 - ▶ Finite element method simulation of the measurements



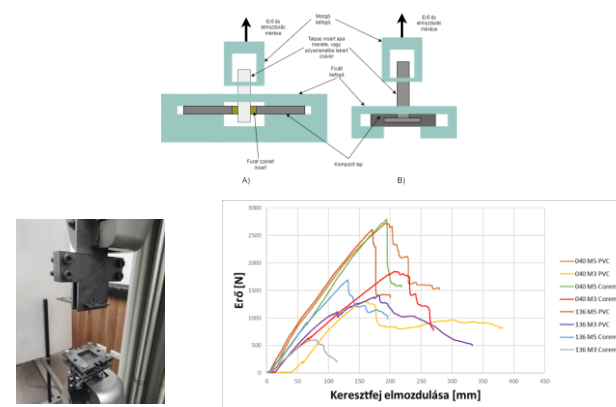
FEM simulation with differently created models



Specimen for self-tapping and plate inserts

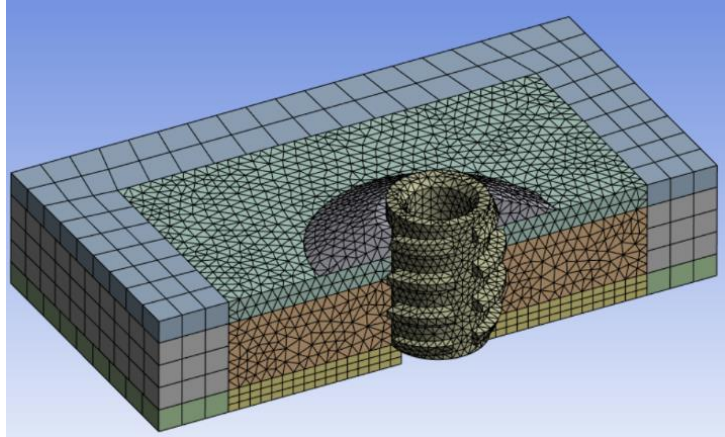


Measurements

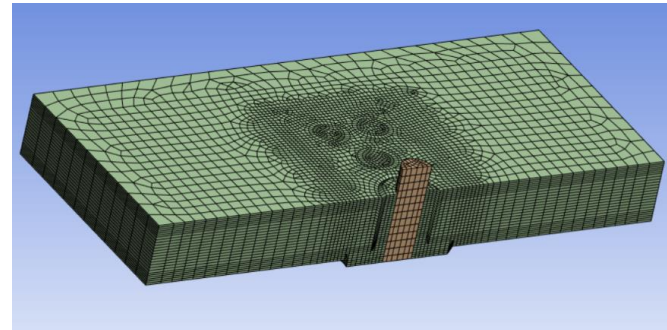
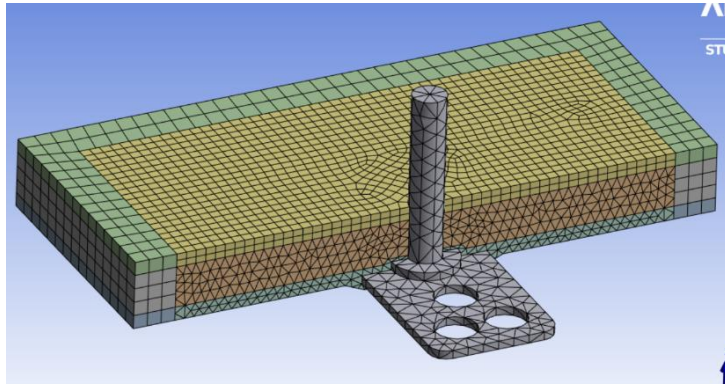
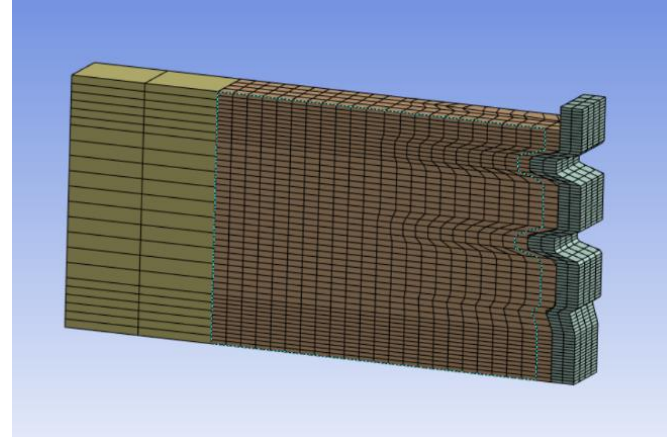


SIMULATION GEOMETRY, MESHING AND BOUNDARY CONDITIONS

Created with Static Structural

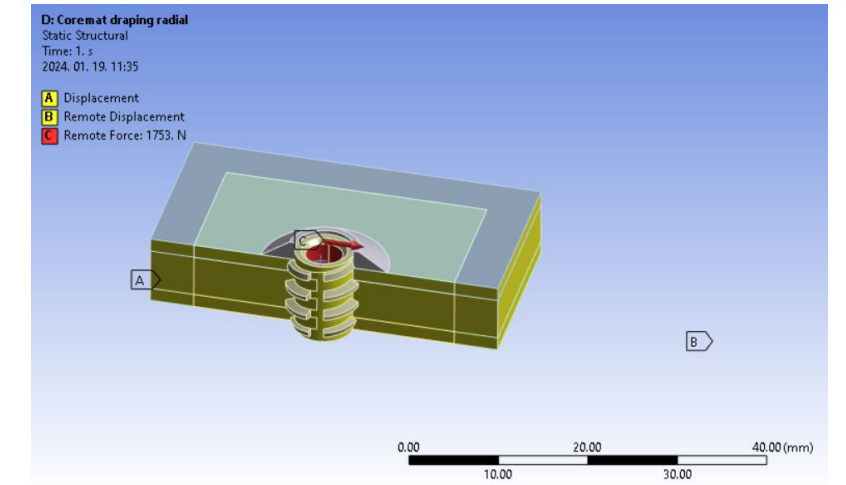
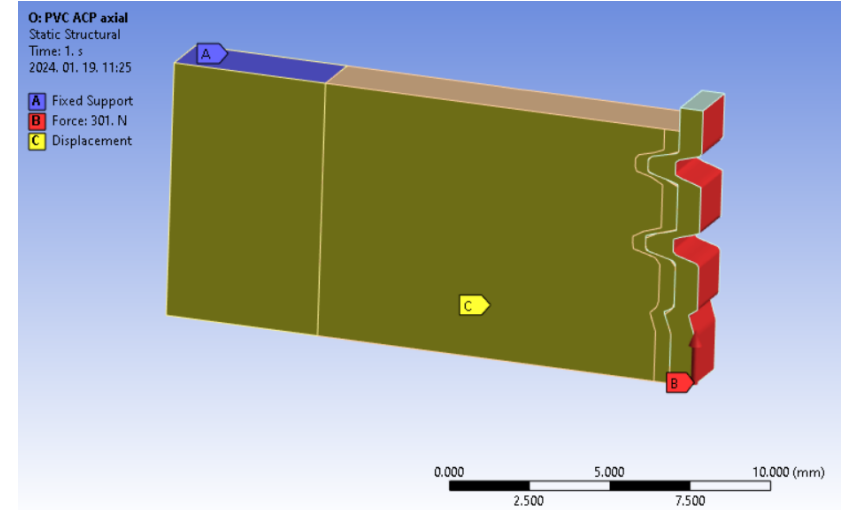


Created with ACP

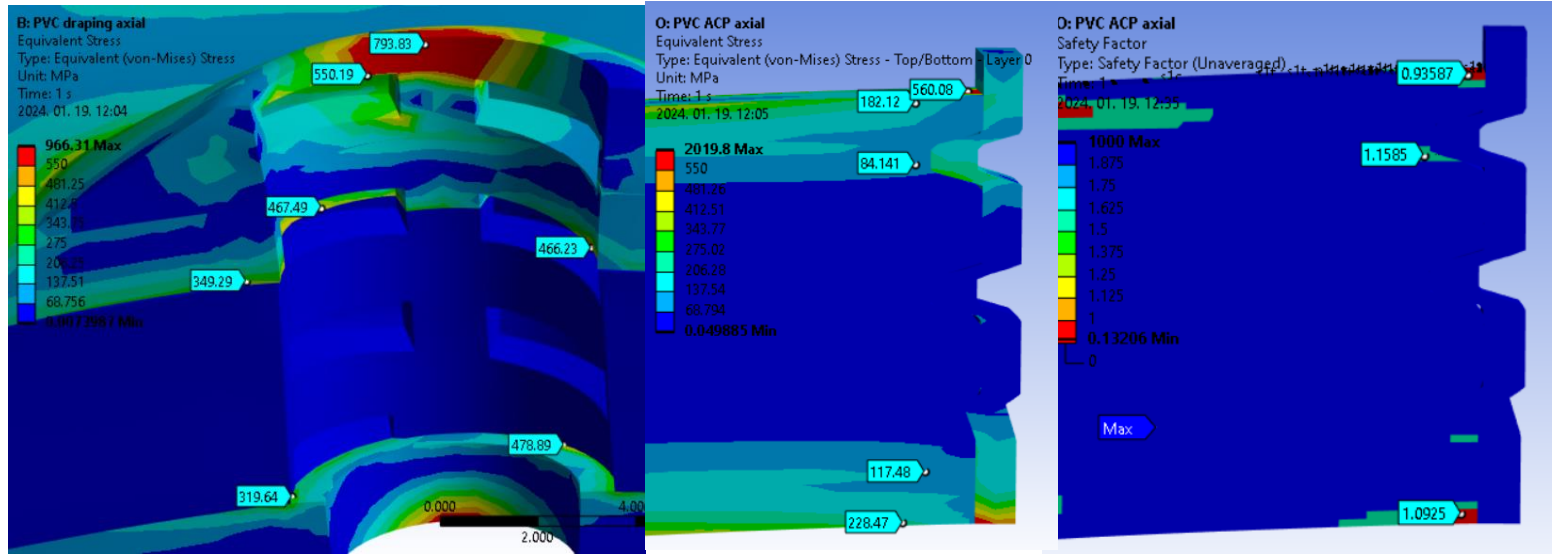


The axial and radial simulation boundary conditions was created similarly for each cases.

Axial and Radial setup for different models



RESULT OF AXIAL LOADING



Self-tapping insert results

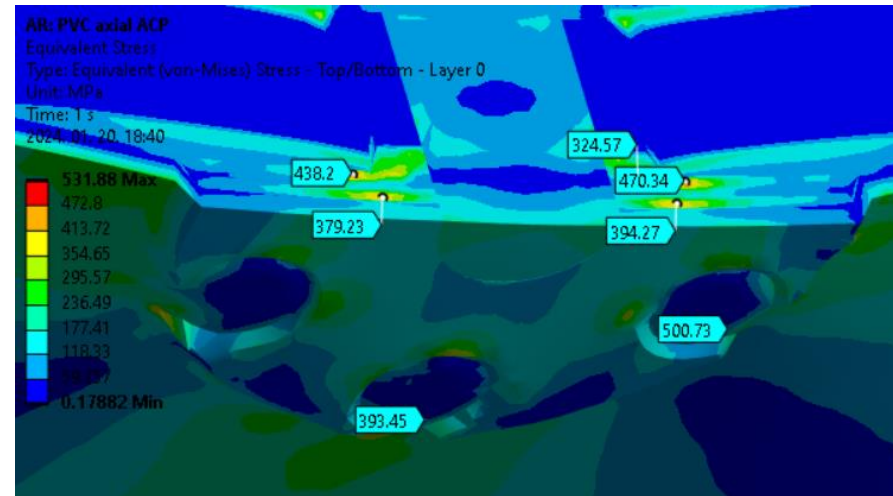
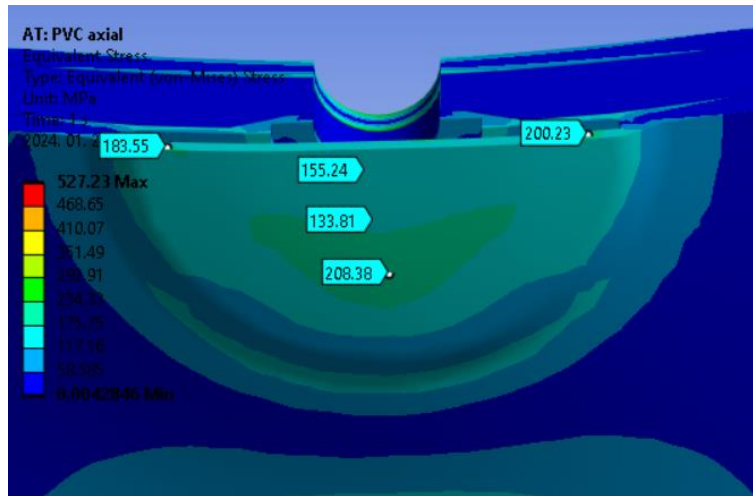
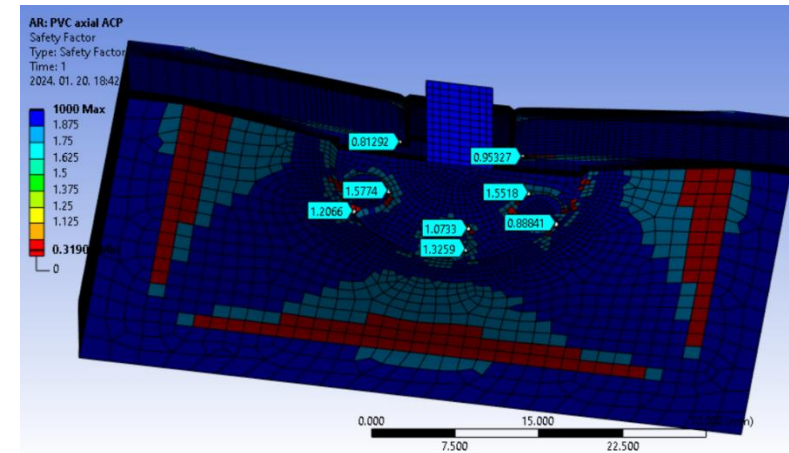
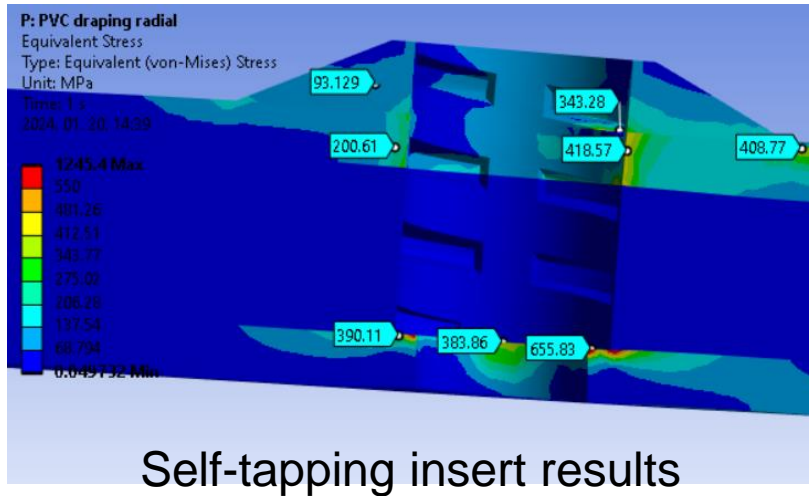


Plate insert results

- The von-Mises stress results of the different models was compared.
- The safety factor of the maximum stress and strain was examined in each cases



RESULT OF RADIAL LOADING



- The von-Mises stress results of the different models was compared.
- The safety factor of the maximum stress and strain was examined in each cases
- By self-tapping inserts there were no precise method to radially examine the ACP model

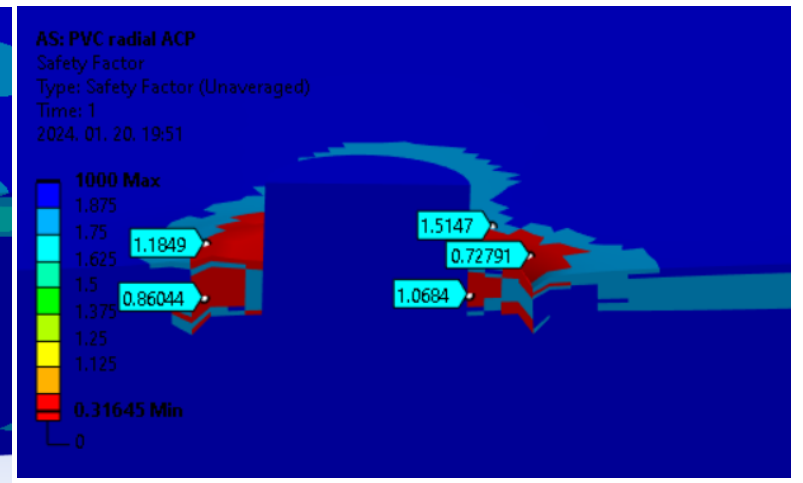
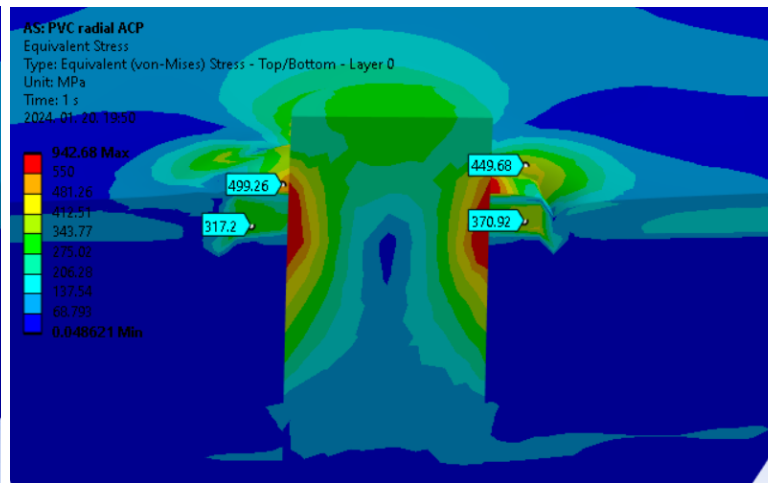
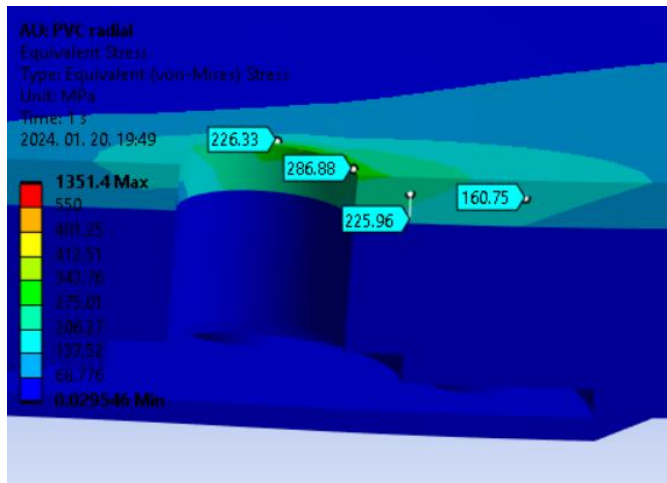


Plate insert results

ANIMATION OF RESULTS

Self-tapping insert static structural axial simulation

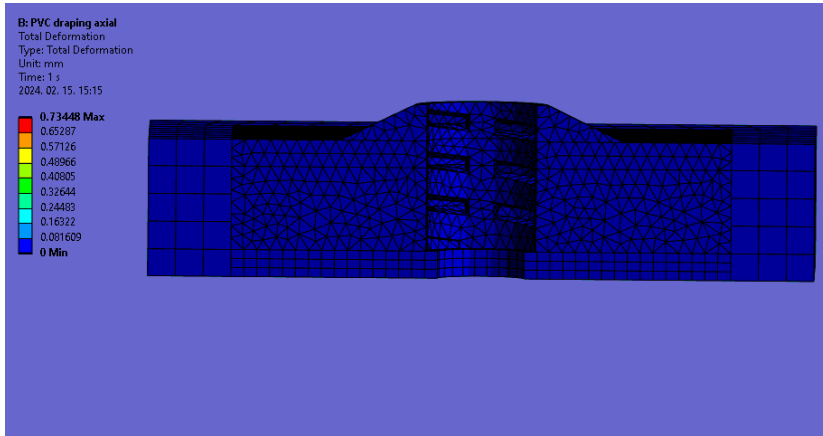
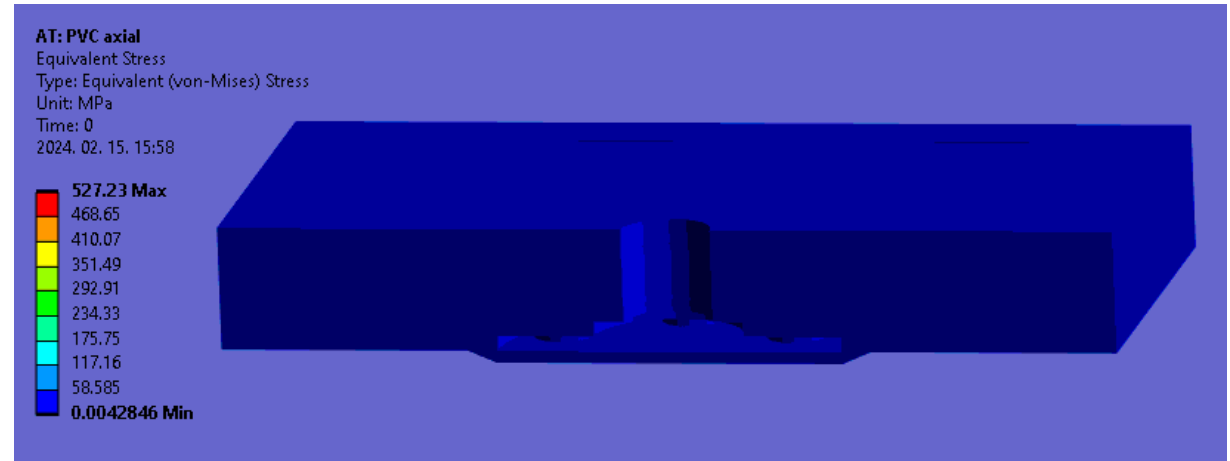
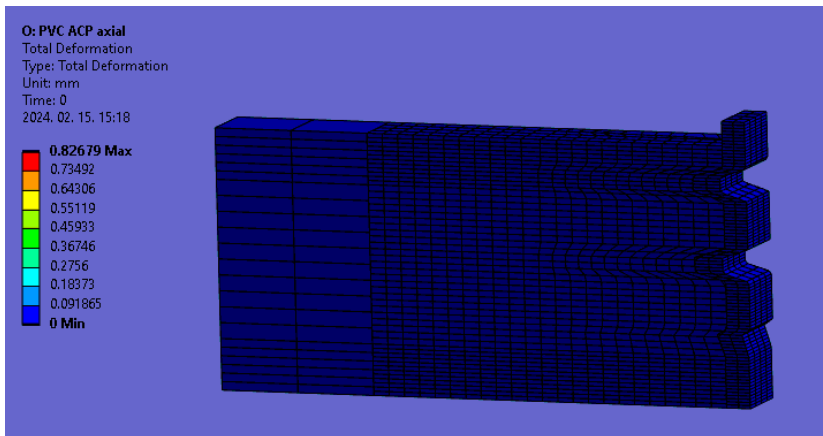


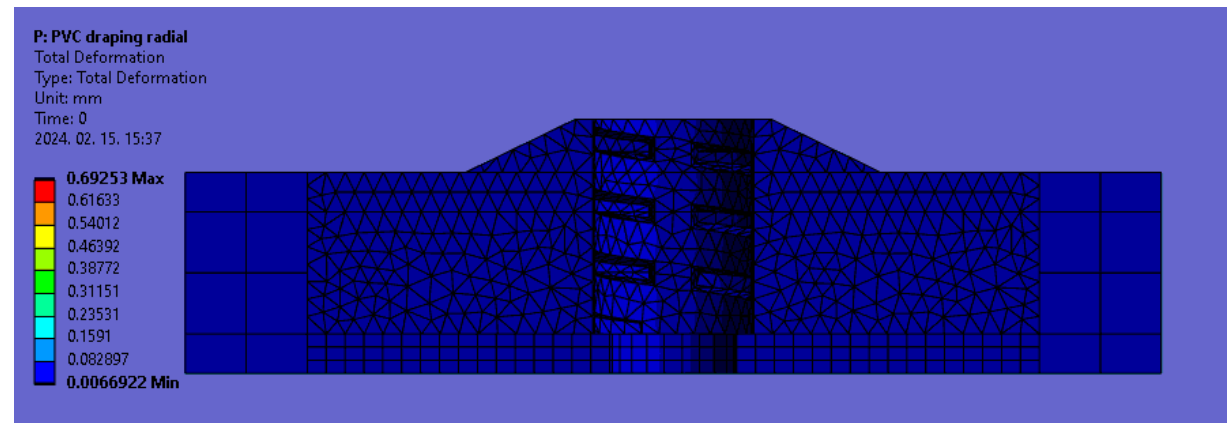
Plate insert static structural axial simulation



Self-tapping insert ACP axial simulation



Self-tapping insert static structural radial simulation



CONCLUSION, EVALUATION OF RESULTS

- ▶ In my research I went through a detailed examination of the problem
- ▶ As first step I have determined material models in different ways and compared them by reproducing results of standard measurement methods with each of them. This way I have got a good picture of the mechanics of the models I have. This process is not included in this presentation, but I have attached a simulation project for it called „Material Design”
- ▶ For the examination of inserts I have made two differently built simulational models. The first one was created in Static structural and used that the orthotropic directions are the same as the geometry directions. The second one is created with ACP, consist some geometrical neglections but the layers are modelled more precisely
- ▶ Through comparing the behavior of the two models loaded with the measured breaking forces I got detailed information about the failure of the material.
- ▶ The equivalent stress failure was one of the two main evaluation methods and the safety factor was the second one.
- ▶ At the end of my study I reached a good method to predict the failure of different composite inserts in sandwich structures
- ▶ For this competition I only introduced my results partially, because the full study is much longer than it could be presented.
- ▶ Also I have created only a shorter version of simulation files because the original files are huge and has many components