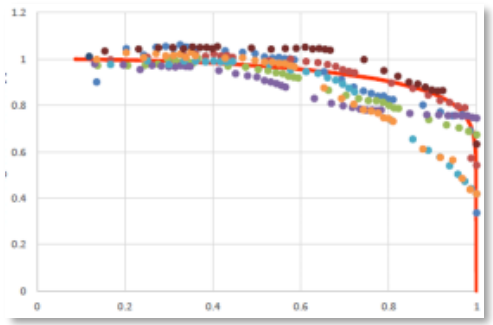
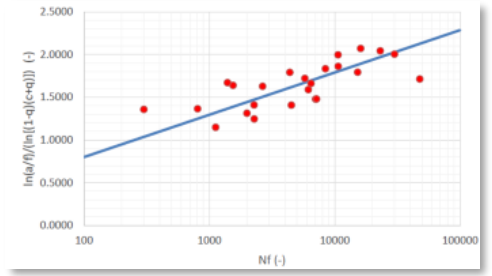
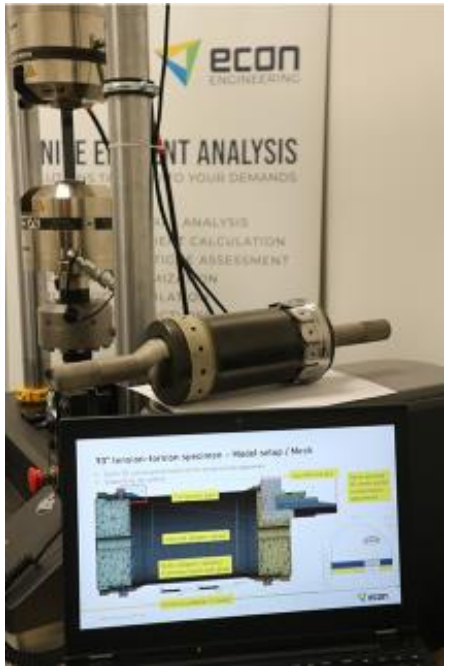
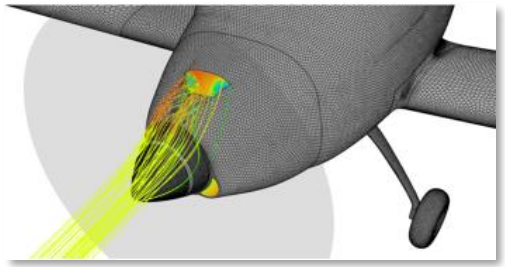
Econ Engineering Analysis Dept. R&D activities

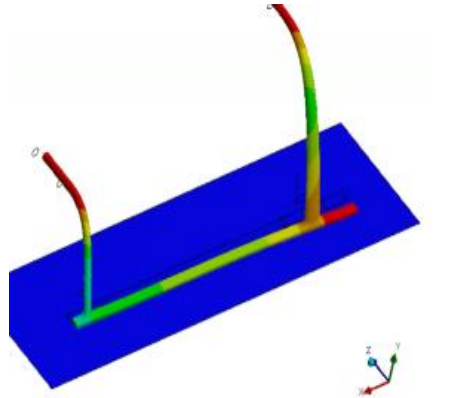
2024.05.29.



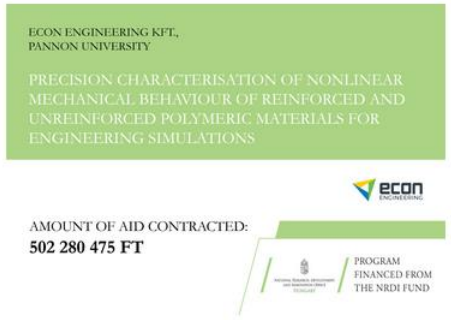








CORRESPONDING R&D TENDERS



KFI-2021

Precision characterisation of nonlinear mechanical behaviour of reinforced and unreinforced polymeric materials for engineering simulations

H2020 – GV-05-2017

eCon Engineering participates in a Horizon 2020 research and innovation action called QUIET, as a member of an international consortium.

NVKP 16

Manufacturing of polymer composite parts using automated short cycle time technology for automotive applications focussing on the complexity and recyclability

KFI-112

Development of Artificial Intelligence-supported simulation methods for propeller-airframe interaction optimization

2023-1.1.1-PIACI_FÓKUSZ-2024-00002	eCon Engineering Mérnöki, Szolgáltató Korlátolt Felelősségű Társaság	Kompozit forgólapátok automatizált előtervező rendszere légi- és szélerőművi alkalmazásokhoz	452 356 892	661 055 960

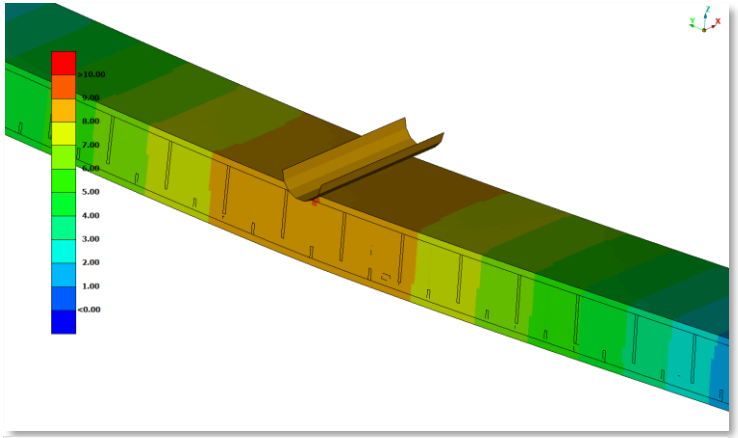
VISION – INTERNAL R&D ACTIVITIES

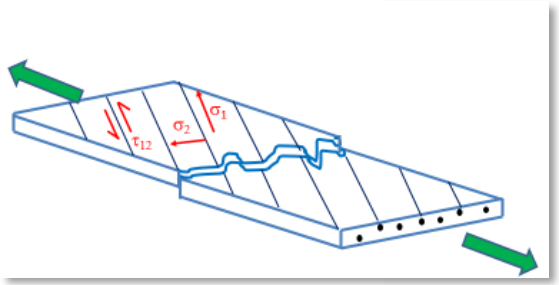
- Via extensive R&D the company's target to become leader in the region with regards to innovative engineering approaches:
  - New engineering disciplines
  - Keep up with newest trends
  - Integration innovation in everydays engineering work
  - Outcome: new, unique engineering services or eCon analysis software
  - Long-term target: Regional Competence Center
- Main research areas in the field of composites:
  - Data-driven solutions in material modelling
  - State-of-the-art optimizaton techniques
  - Intelligent (resilient materials)
  - Further self-weight reduction via more sophisticated analysis methods

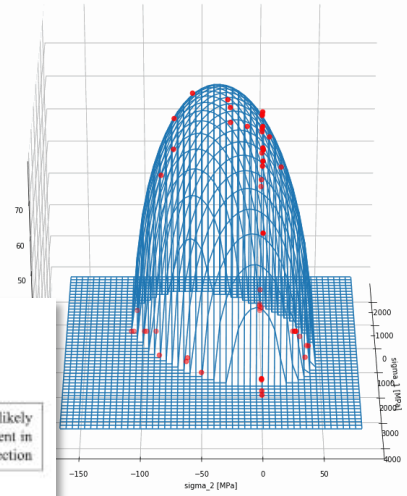
CLOSED

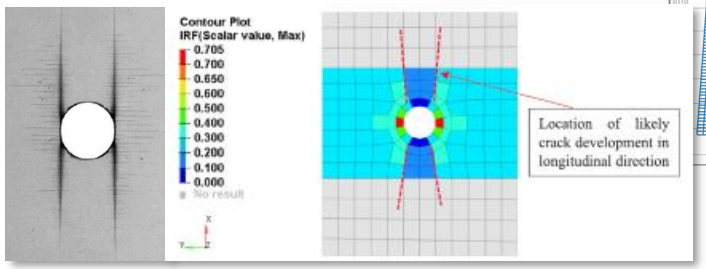
NVKP 16 – FE METHOD DEVELOPMENT

- High-precision simulation techniques for composite materials, sandwich structures and metallic inserts, as well as adhesive bonds
- More precise material constitutive models and parameter fitting methods
  - Stiffness
  - Static and cyclic failure

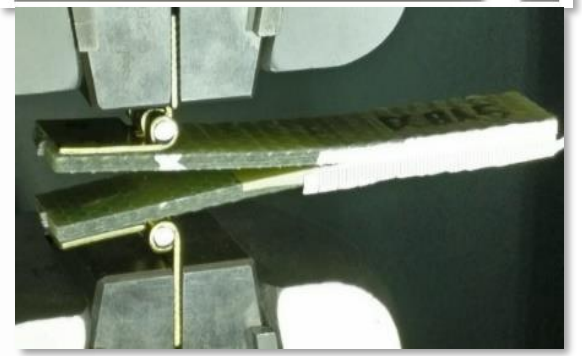


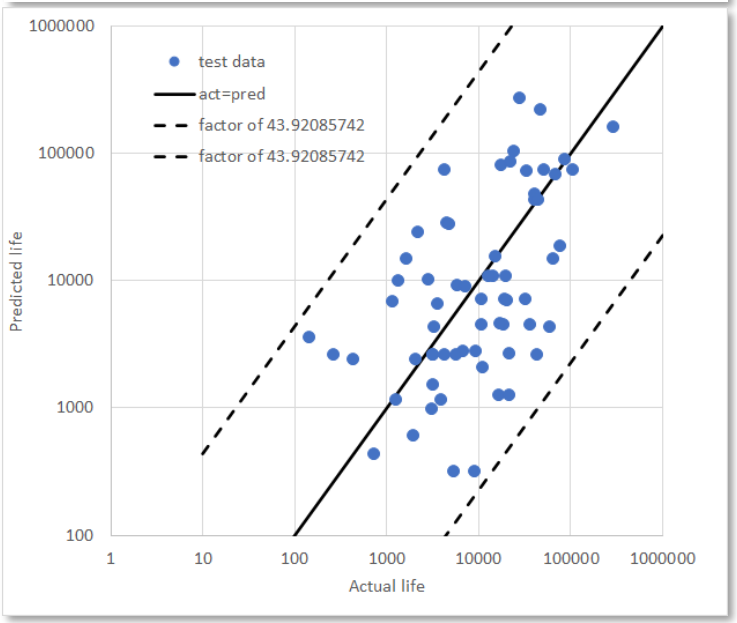






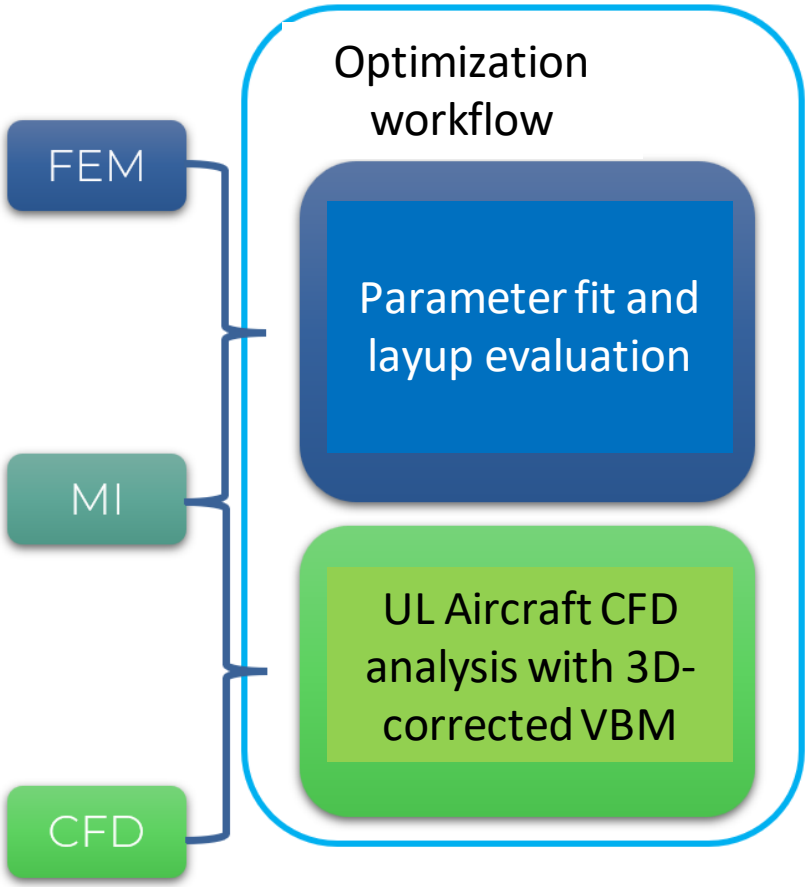
$$OF = \prod_{i=1}^{N} P_i \cdot \prod_{j=1}^{M} (1 - \Sigma P_j) = max$$

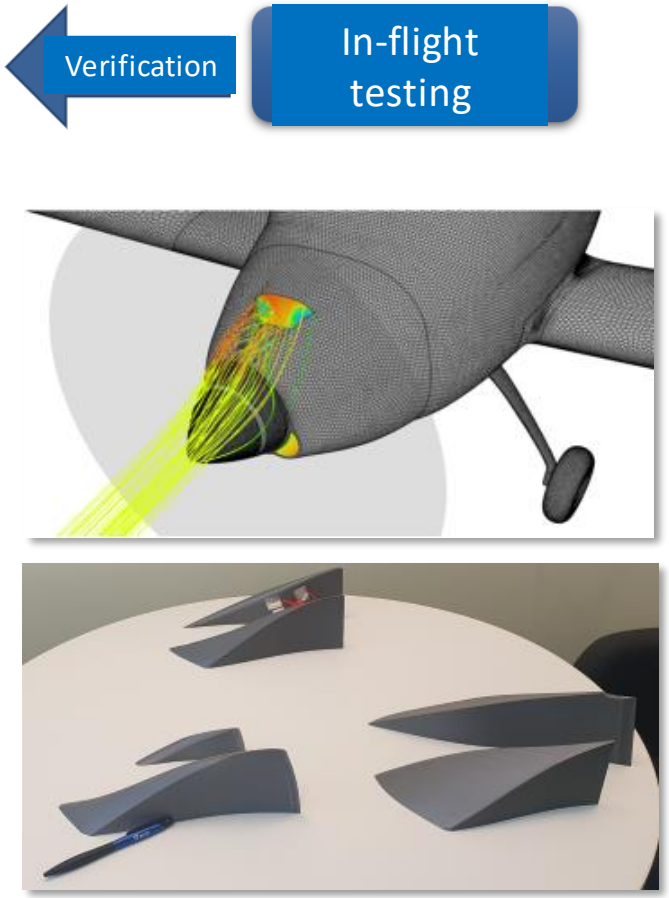




KFI 112/18 SUMMARY – EXPLOITONG AI AND OPTIMIZATION IN CFD AND FEM

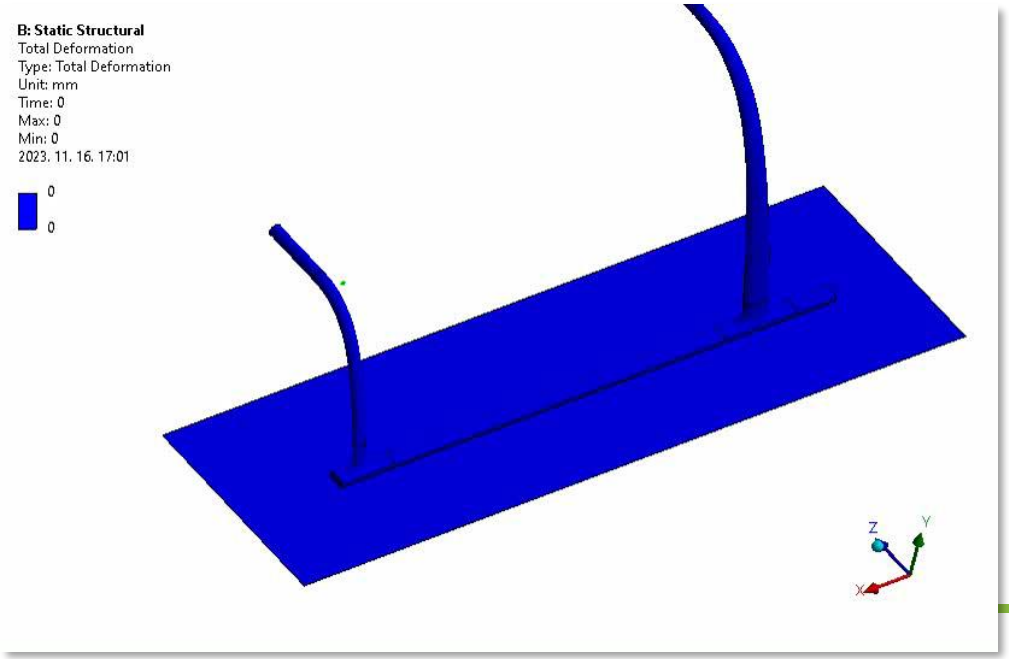
CLOSED

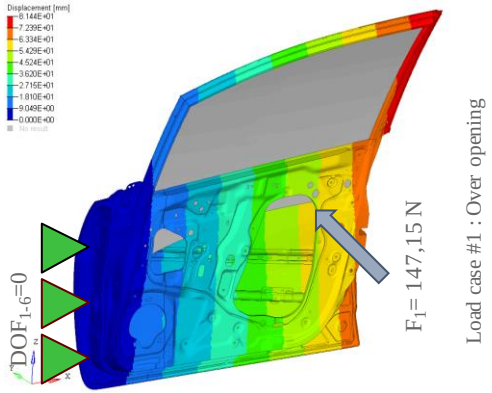


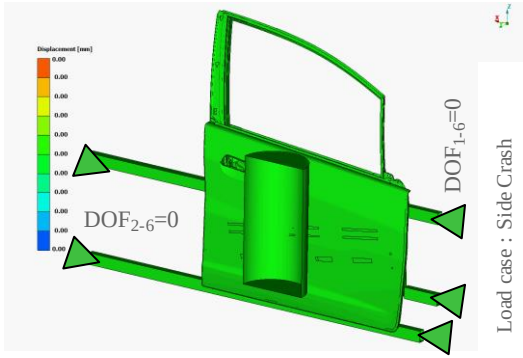


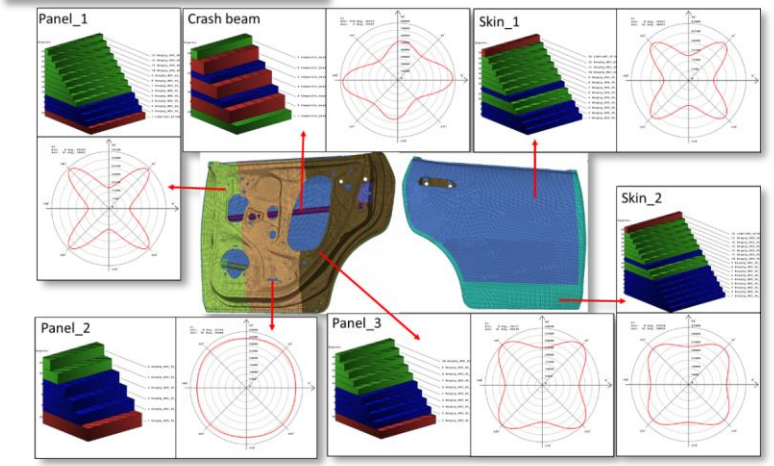
AMULET + QUIET PROGRAMMES (H2020)
REDUCTION OF CARBON FOOTPRINT WITH LIGHTWEIGHT SOLUTIONS

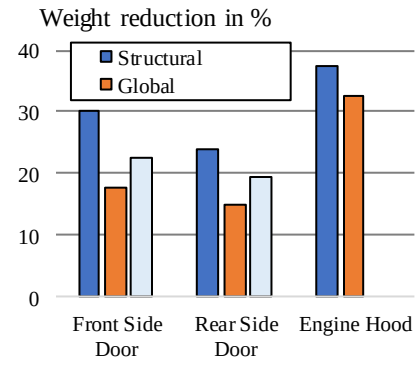
CLOSED







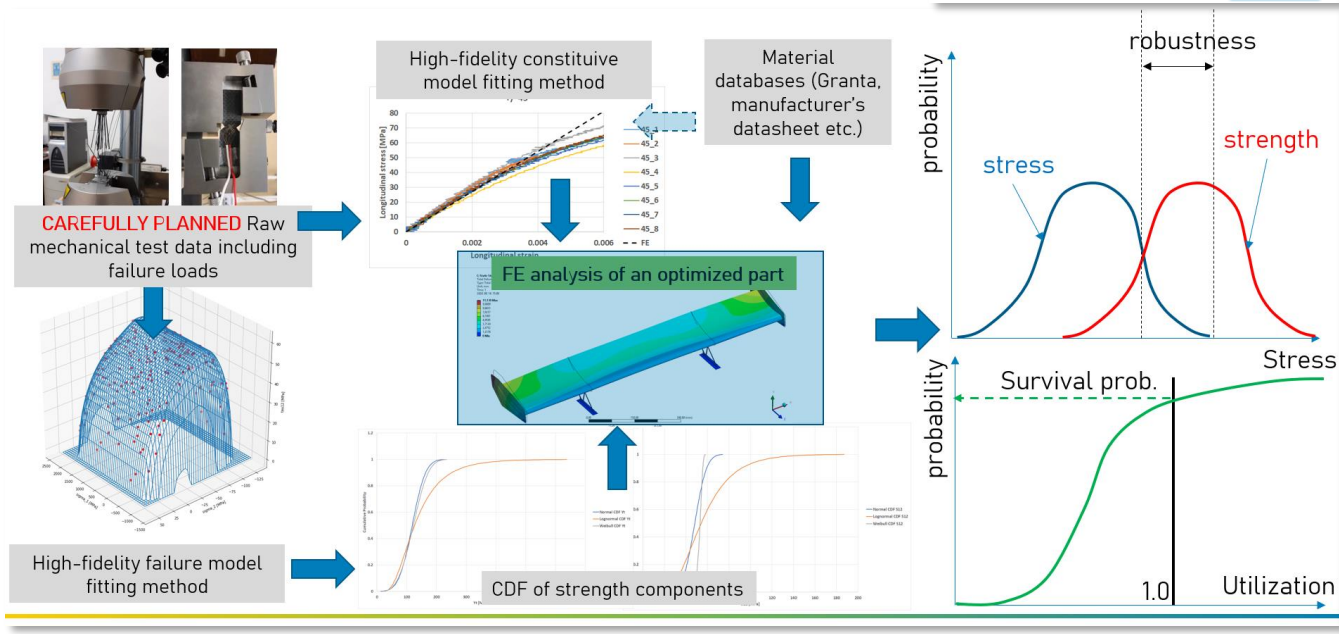


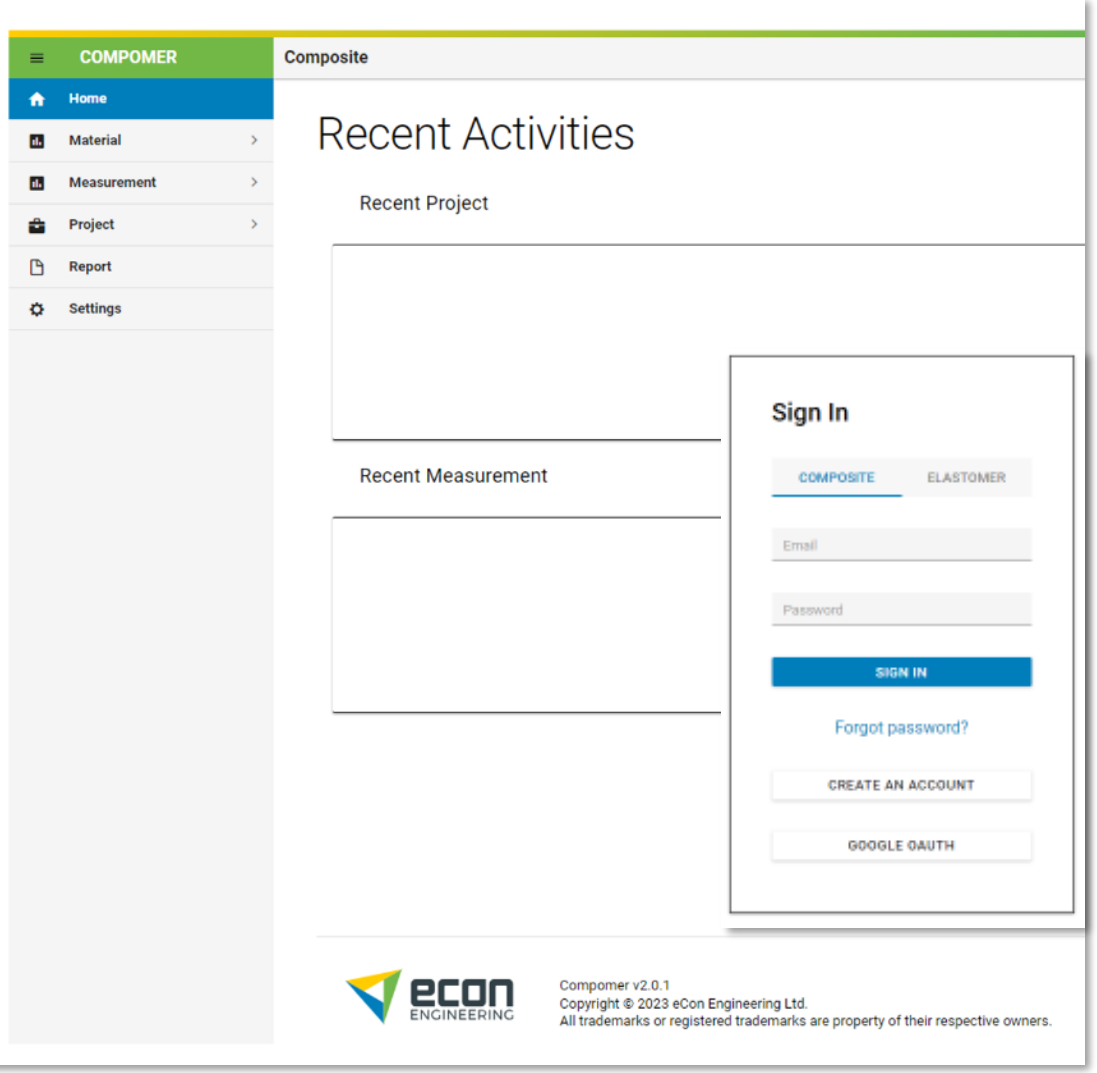


COMPOMER PROJECT – SOFTWARE DEVELOPMENT AUTOMATED COMPOSITE / RUBBER MAT. MODEL FITTER

ONGOING

- Material model fitter wizard (const. Model and failure)
- Reads in all available raw test data in one go
- Usable for standard and unique specimens with any layup
- We are currently looking for benchmark project!

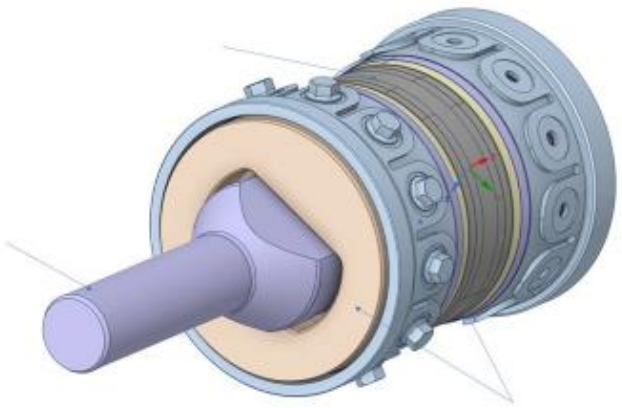


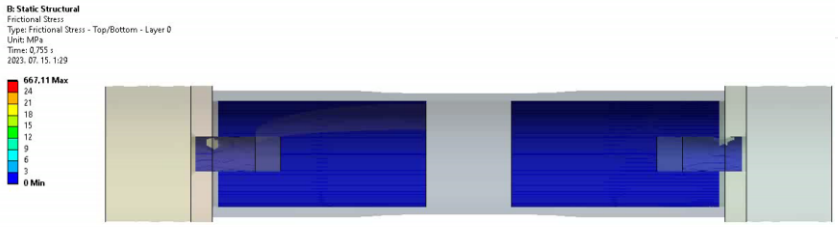


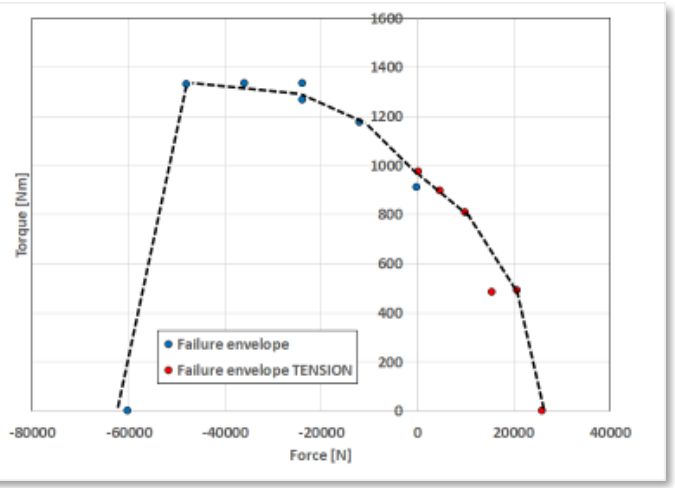
COMPOMER PROJECT
UNIQUE EXPERIMENTS FOR MULTIAXIAL FAILURE

ONGOING

Combined tension-torsion testing

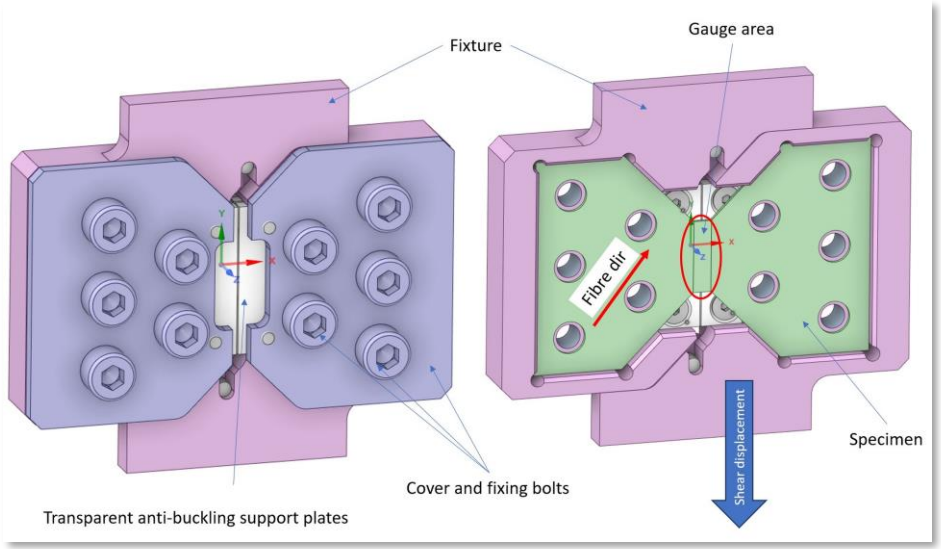


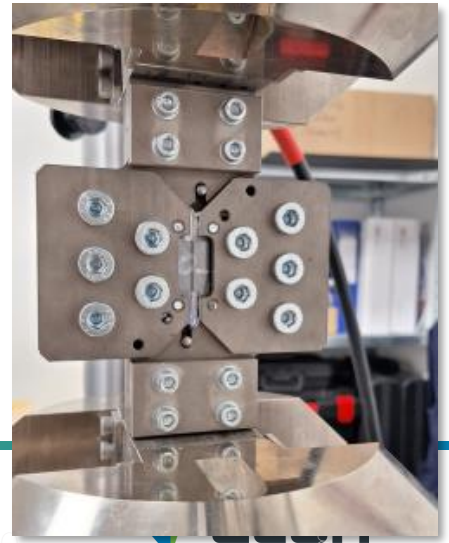




- Static composite strength analysis
- Contacts, CZM, adhesive failure
- Linear buckling and post-buckling
- Shell and 3D representations

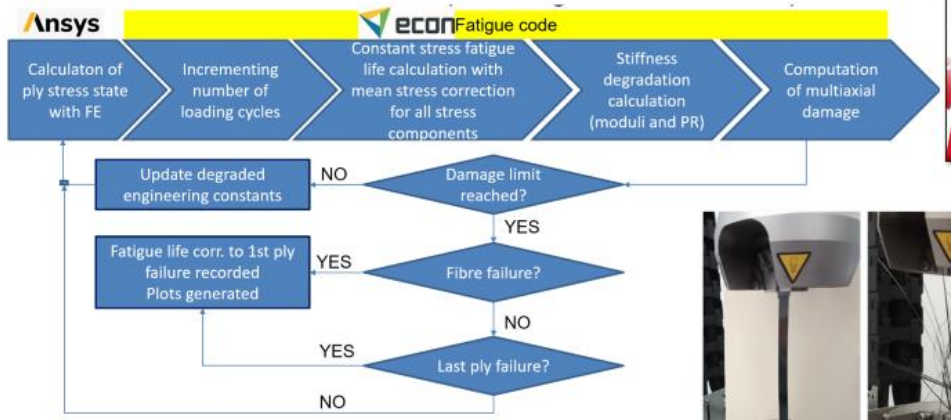
Off-axis UD shear

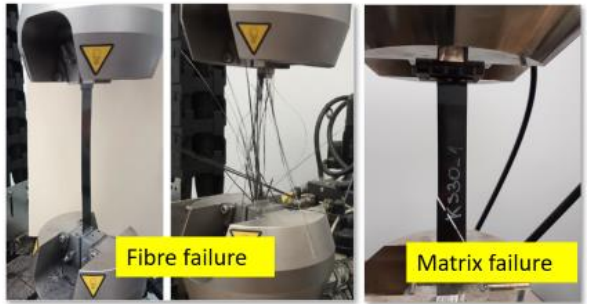


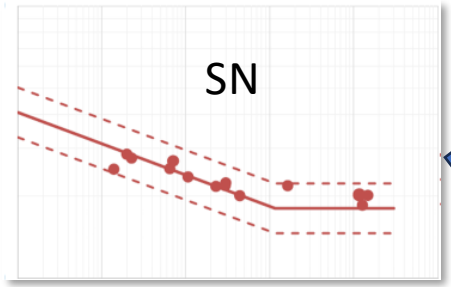


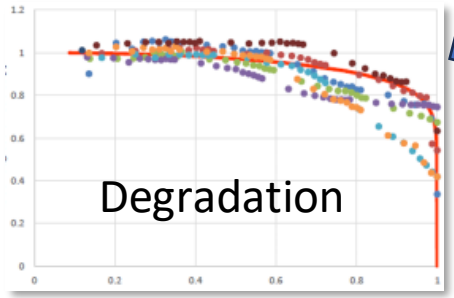
FATIGUE TOOL FOR CFRP MATERIALS SOFTWARE DEVELOPMENT

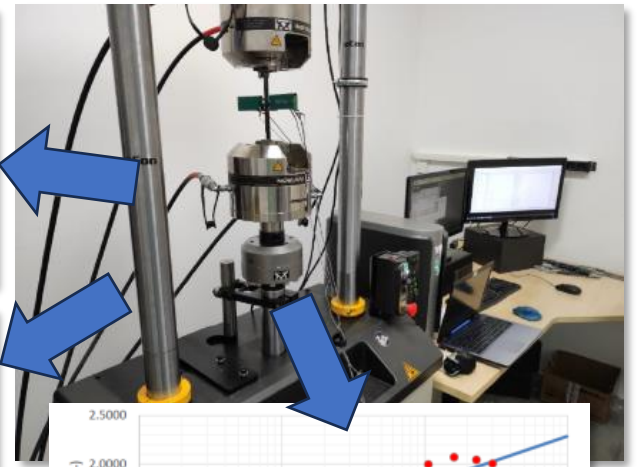
ONGOING

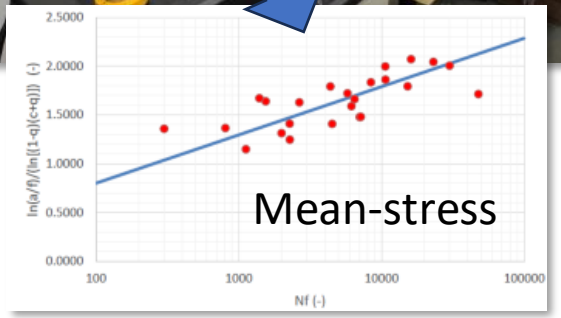


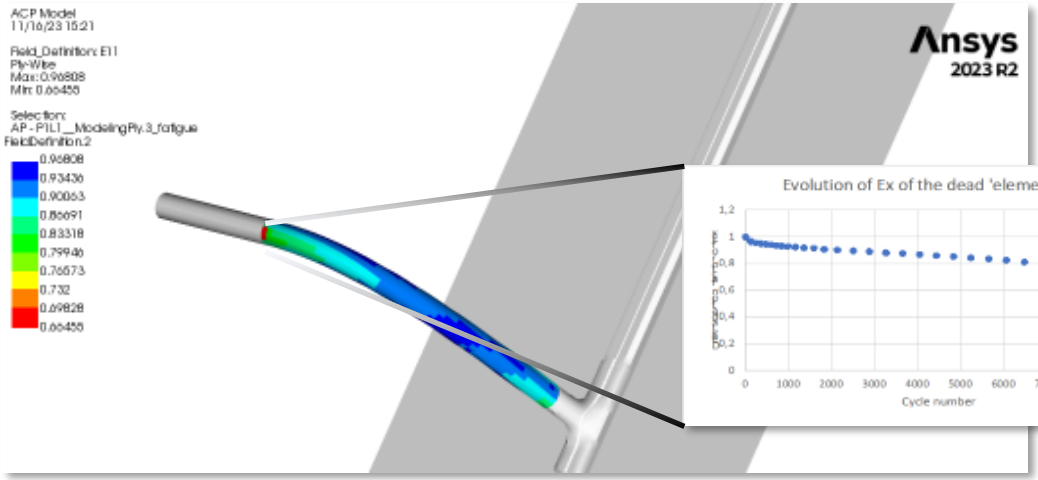


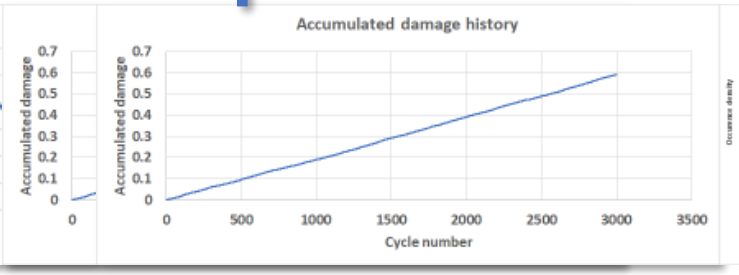


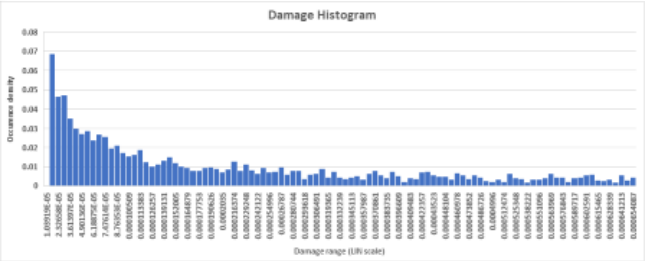












AUTOMATED PRE-DESIGN TOOL OF ROTATING BLADES FROM AERODYNAMICAL AND STRENGTH ASPECTS

About to start

AUTOMATED SIMULATION / OPTIMIZATION FRAMEWORK FOR ROTATING COMPOSITE BLADES

Blade CAD

Mechanical experiments

On-site diagnostics (telemetry)

3D-VBM + CL/CD/CM = eVBM

Simplifed CFD analysis
(virtual blade modeling)

CFD

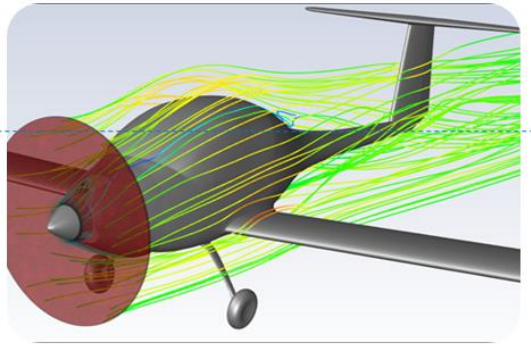
Automated fitting tool for fatigue
model parameters
Material Database

Optimization

FEM based ply-stress analysis

Automated fatigue assessment

FEM



FSI (Fluid-Structure Interaction)

Reduced Order
Model generator

Automated on-site
health monitoring

PARTICIPATION IN HUNOR PROGRAMME

COMFORT SIMULATION OF SPACE SUIT UNDERWEAR VIA DRAPING AND HEAT-MANAGEMENT ANALYSIS

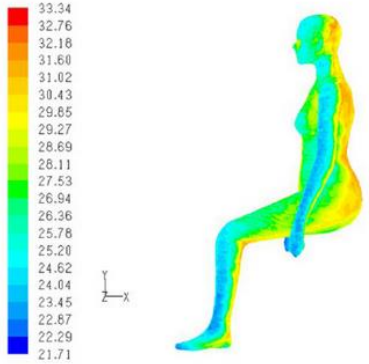
About to start

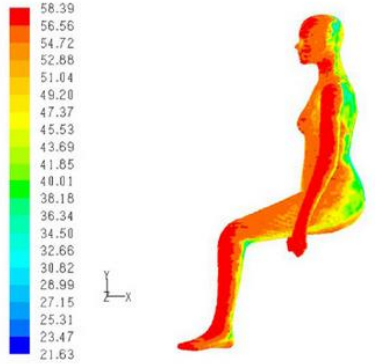
(A)

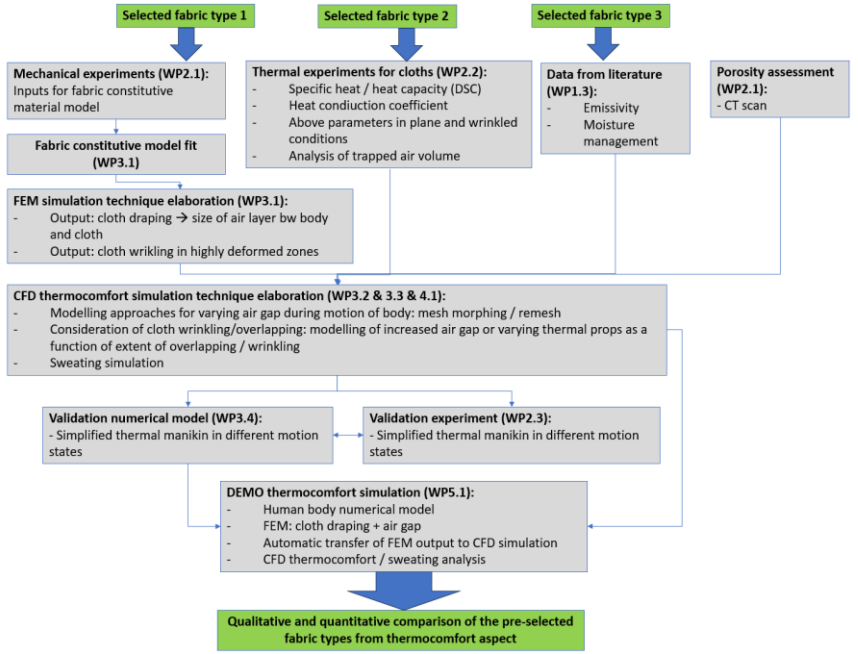
(B)

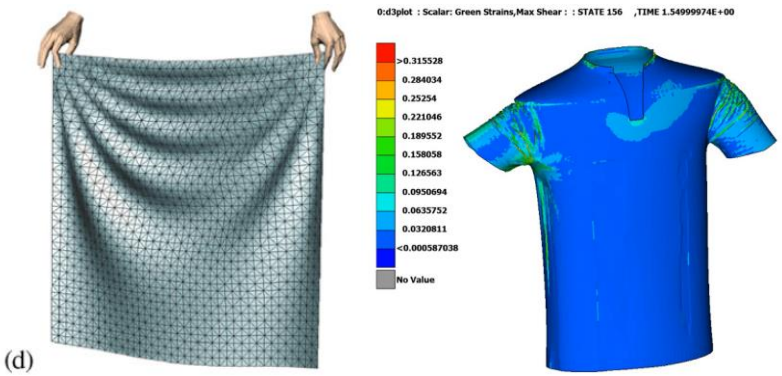
(C)

(D)









(d)

Dia:

FURTHER RELEVANT R&D INITIATIVES PENDING

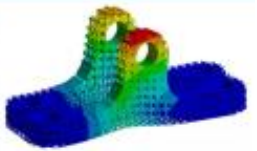
Numerical analysis based evaluation of the processing parameters of additive manufacturing

STATE-OF-THE-ART

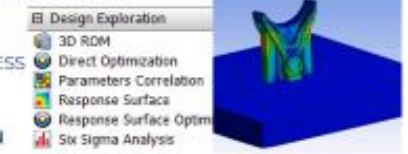
- AM TECHNIQUES ARE GETTING MORE WIDESPREAD THESE DAYS
- USED FOR FUNCTIONAL AND VISUAL PROTOTYPES, SMALL BATCHES OF REAL PARTS
- SLS AND MJF TECHNIQUES APPROACH INJECTION MOLDING IN PRODUCTIVITY
- DISTORTIONS AFTER PRINTING IS AN ISSUE LEADING TO SEVERAL TRIALS UNTIL SUCCESS
- STRONG NEED FOR OPTIMIZED PROCESSING PARAMETERS TO GET RIGHT-FIRST-TIME SUCCESS THAT RESULTS IN LOWER LEADTIMES AND CHEAPER MANUFACTURING
- AM SIMULATION FEATURES ON A LAYER-BY-LAYER BASIS AVAILABLE IN COMMERCIAL FE SOFTWARES (SUCH AS ANSYS)
- SETUP AND INPUT PARAMETERS FOR SUCH SIMULATIONS ARE KEY, BUT NO METHODS ARE AVAILABLE TO HELP USERS IDENTIFYING THESE PARAMETERS FROM PRACTICE
- RATHER PRAGMATIC VALUES USED THAT CAN ONLY BE SPECIFIC FOR A CERTAIN PROCESS / MACHINE AND NEED SEVERAL YEARS OF EXPERIENCE

R&D ACTIVITY AND INNOVATION

- **COUPLED EXPERIMENTAL-NUMERICAL** EVALUATION TECHNIQUES OF AM PROCESSING PARAMETERS
- **DATASET GENERATED**: DISTORTION AND STRENGTH VS. PROCESSING PARAMETERS
- ESTABLISHING **CORRELATION** BETWEEN RELEVANT INPUT PARAMETERS AND OUTPUT CHARACTERISTICS
- **BIG DATA** TECHNIQUES
- **DOE**, SENSITIVITY ANALYSIS, ROBUSTNESS
- **AI, ML** TECHNIQUES
- TOOL FOR **AUTOMATED CORRELATION**



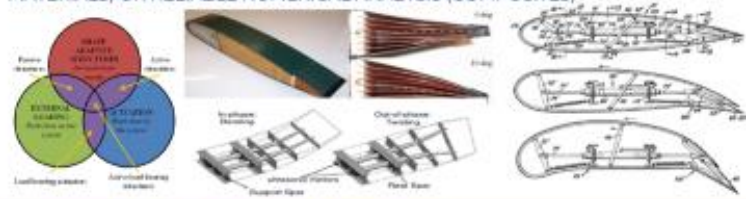
https://www.ansys.com/products/additive



R&D Idea
Design of morphing composite systems for resilient load-bearing structures

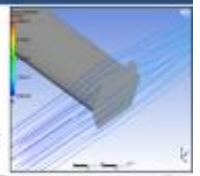
STATE-OF-THE-ART

- COMPONENTS DESIGNED FOR AN OPTIMUM OPERATION
- UNDER VARYING CONDITIONS THE ABILITY TO ADAPT LEADS TO RESILIENT PRODUCTS WITH MAXIMIZED EFFICIENCY IN A WIDE RANGE OF CONDITIONS
- RESILIENCE LEADS TO MORE ROBUST OPERATION
- ACTIVE ACTUATION IS A KNOWN BUT FAR COMPLEX SOLUTION
- PASSIVE ACTUATION NEEDS SPECIAL AND COSTLY MATERIALS (E.G. SMART MATERIALS) OR RELIABLE NUMERICAL ANALYSIS (COMPOSITES)



SUGGESTED R&D ACTIVITY AND INNOVATION

- PASSIVE ACTUATION VIA MORPHING COMPOSITE STRUCTURE
- DESIGN FOR A RANGE OF OPERATING CONDITIONS VIA:
  - FINDING **OPTIMUM SHAPE**
  - IDENTIFYING **COMPOSITE LAYUP** TO DELIVER THE DESIRED SHAPE
- DEVELOPMENT OF A HIGH-FIDELITY DESIGN OPTIMISATION FRAMEWORK INC. NUMERICAL FE AND CFD SIMULATIONS
- PILOT PROJECT: **SAILING BOAT WITH MORPHING WINGLET** FOR AUTONOMOUS CONTROL OF SINK



https://theislander.net/americas-cup-

THANK YOU FOR YOUR ATTENTION!

eCon Engineering Kft.

Mr. Gábor KIGLICS – CEO

H-1116 Budapest

3 Kondorosi St.

Tel.: +36-1-279-0320

www.econengineering.com