INTERNATIONAL CAE CONFERENCE

35th INTERNATIONAL CAE CONFERENCE AND EXHIBITION

THE ENGINEERING SIMULATION PATH TO DIGITAL TRANSFORMATION

Vicenza, ITALY | 2019, 28 - 29 OCTOBER

Vicenza Convention Centre @Fiera di Vicenza

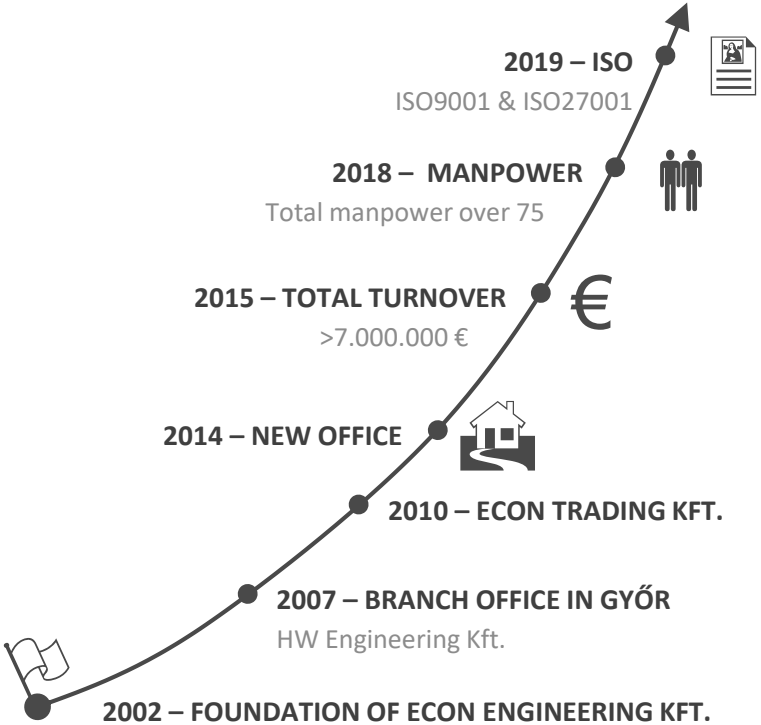
Innovation Driven Composite FEM Solutions at eCon Engineering

eCon Engineering Ltd, Hungary

eCon ENGINEERING

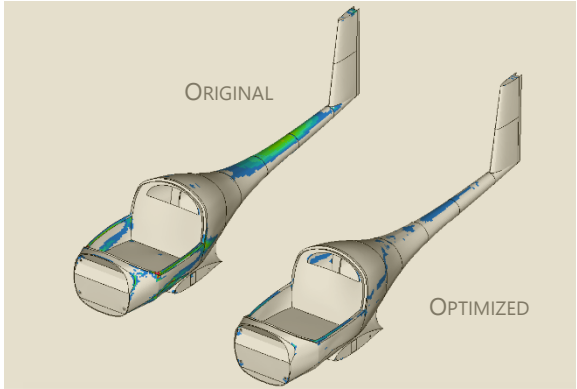
About eCon Engineering

- Location
  - Budapest, Hungary
- Manpower
  - ~100 eployee, 60+ engineer
- Depatments
  - CAE
    - FEM, CFD, MBS, 1D System Simulations
  - Software distribution and support
    - Ansys channel partner
    - Moldex3D
    - Cast-Designer
  - Automation solution
    - Production technology
    - Automatization, robotization
    - Single-purpose machines
    - Robot cells and testers



CAE R&D projects

- CAE solutions aided by AI
  - Effective preprocessing of large models
  - Probabilistic approach for inputs and failure criterion
- Improvement in fatigue life prediction
  - Based on thermodynamics
  - For metalic alloys, more materials to come
- Development of composite material simulation
  - Statistical based material cards
  - Manufacturing imperfections
  - Generic damage model
  - Automatic stiffness, strength and post critical evaluation
  - Composite fatigue in FEM
- Composite lay-up and topological optimization
  - Efficient multi-pourpose approach
  - Optimal stiffness-mass-manufacturing costs trade-offs



Composite FEM projects

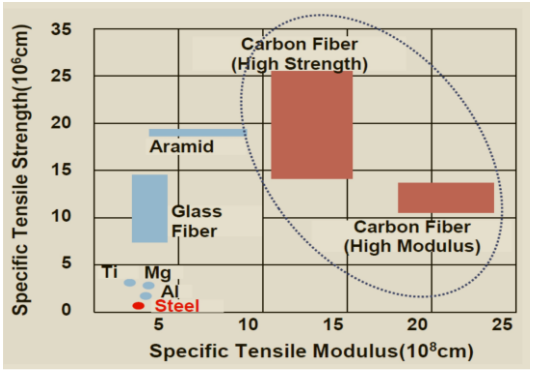
Fiber Reinforced Composite Materials

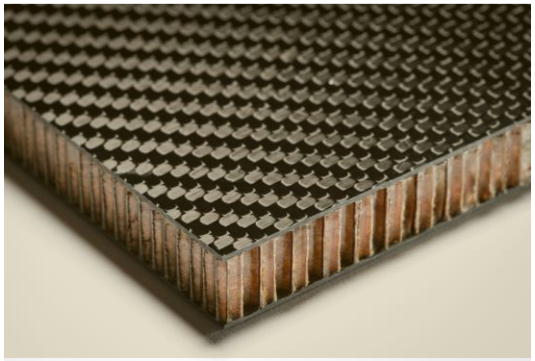
Advantages:

- Great specific strength
- Lightweight constructions
- Taylor-made mech. properties
- Fibre reinforcement placed in the loading directions

Main issues:

- Orthotropic behaviour (direction dependent)
- Complex failure mechanism
- Fatigue life prediction not solved
- FEM solutions are limited





Composite FEM projects

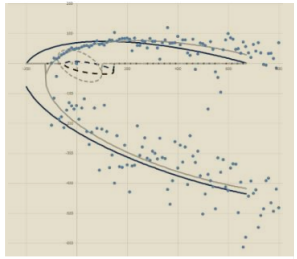
1st ply failure models

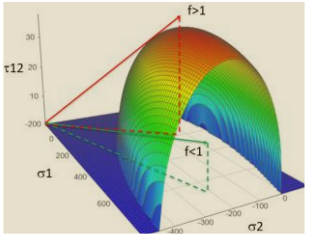
Realistic material laws to provide realistic stresses at failure

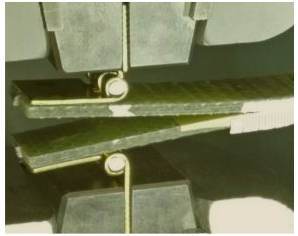
Advanced fitting methods on experimental failure stresses

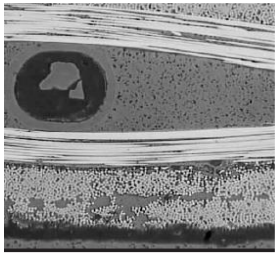
Material data card for failure

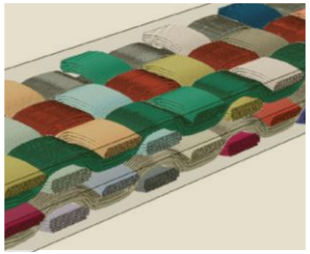
Realistic static failure predictions

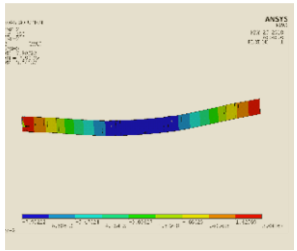










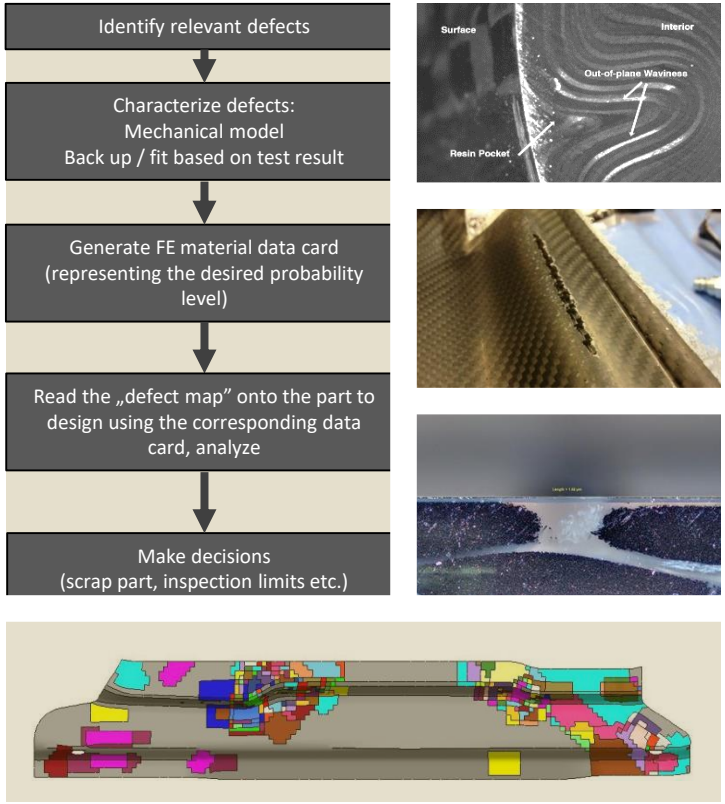


Composite Failure – New Method

- Different moduli in tension and compression
- Material nonlinearity around failure
- User defined material model in FE

- Failure model parameter fitting
  - Advanced optimization methods
  - Probabilistic based objective function definition
  - Assessment of fitting quality
  - AI to find the most suitable model for actual test data

Composite FEM projects



Characterization of Manufacturing Imperfection – New Method

- Defects do exist in composite parts
- Affect structural performance
- Material properties used to derived from laboratory tests and represent „flawless" material
- Generation and implementation of suitable mechanical models in FE environment Types of imperfections:
  - Waviness
  - Draping
  - Ply staggering
  - Resin Pocket
  - Dry fabric
  - Ply drops

Composite FEM projects

Horizon 2020 – QUIET – Composite lay-up optimization

Project Objectives:

Quiet

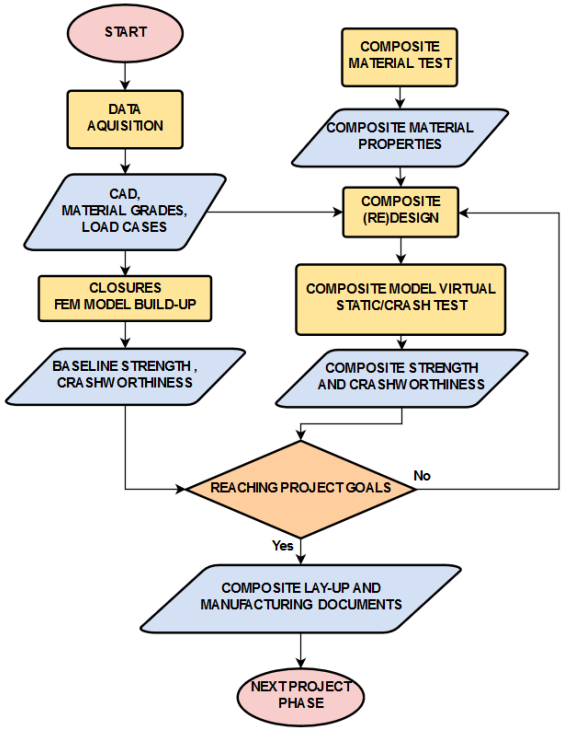
European Commission | Horizon 2020 European Union funding for Research & Innovation

WP3: New lightweight components with improved thermal performance [M1-M29] (**ECON**)

OBJECTIVES

- Developing suitable replacements of the earlier mentioned components which have enhanced thermal properties and lower mass compared to the original version
- Manufacturing **fully functional demonstration parts** (prototypes) that can be installed on the demonstration vehicle
- Measurement and simulation of the properties of the new parts
- Aimed results:
  - Weight reduction:
    - **Seats: -10 %** (from ~40 kg)
    - **Car glasses: -30 %** (from ~26 kg)
    - **Doors, trunk lid, engine hood: -20 %** (from ~80 kg)
  - Better **insulation: -20 % energy** needed to cool down or heat up the cabin
  - Lower **thermal inertia: -5 % energy** needed to cool down or heat up the cabin

25.10.2019 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 769826. The content of this publication is the sole responsibility of the Consortium partners listed herein and does not necessarily represent the view of the European Commission or its services.



Summary

Innovative projects in house

- Effective pre and post processing
- Fatigue life prediction
- Composite tools

Future plans

- Continuing R&D projects
- Increasing the cooperation in CAE solutions
- Entering new markets (Aerospace, Defence)

Acknowledgment

QUIET – QUalifying and Implementing a user-centric designed and EfficienT electric vehicle

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NVKP16 (NCEP16) – National Competitiveness and Excellence Programme

- The project is funded by the National Research, Development and Innovation (NKFIH) Fund, Project title: "Production of polymer products by a short cycle time, automatized production technology for automotive applications, with exceptional focus on the complexity and recyclability of the composite parts"; The application ID number: NVKP_16-1-2016-0046. The developers are grateful for the support.

Thank You For Your Attention!