

FINITE ELEMENT ANALYSIS (FEA) AND SIMULATION-BASED ENGINEERING

This competency focuses on advanced numerical simulations and finite element analysis (FEA) to solve complex engineering problems in mechanics, thermodynamics, and materials science. Using leading simulation platforms such as COMSOL Multiphysics, ANSYS, and MSC Marc, the team models and analyses structural integrity, stress distribution, heat transfer, and multiphysics interactions. The activity supports RDI by reducing prototyping costs, accelerating design validation, and optimising component performance. It helps partners develop reliable, efficient, and safe engineering solutions through precise virtual testing and model-based innovation.



ACHIEVEMENTS

- Applied FEA to study hardness behaviour and deformation zones in mechanical testing
- Modelling of novel auxetic honeycomb structures to analyse mechanical performance
- Investigation of hydrostatic and plastic zones in hardness measurement using FEA (Oláh, Horváth, Réger, Heliyon 2024)
- Analysis of mechanical properties of doubly re-entrant auxetic honeycomb structures (Széles, Horváth, Cveticanin, Polymers 2024)
- Study of negatively buoyant jet interaction with stable thermal layers in hot fluid storage tanks (Zachár, Journal of Energy Storage 2024)



INFRASTRUCTURE

- Software: COMSOL Multiphysics, ANSYS Mechanical and Fluent, MSC Marc
- High-performance computing (HPC) cluster for large-scale simulations
- Tools for structural, thermal, and coupled multiphysics modelling of components and assemblies
- Integration with CAD/CAM environments for design validation and optimisation workflows



REFERENCES

- Application of FEA in dual-training and cooperative projects with manufacturing partners such as Ferzol, TE Connectivity, and PEMÜ
- FEA-based investigation of aluminium bottle forming stability and forming limits in Bánki's research activities
- Finite element analysis of novel auxetic and metamaterial structures presented at ESB-related events