ITEA 4

Project Profile

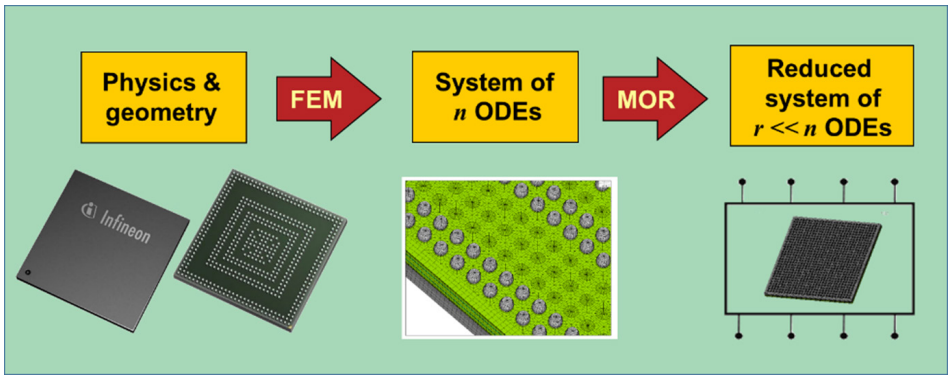
COMPAS

Compact modelling along the high-tech supply chain

The ITEA project COMPAS (Compact modelling of high-tech systems for health management and optimisation along the supply chain) will develop compact models for system-level simulations and ultra-compact digital twins for prognostic health management. This will result in innovations in model order reduction (MOR) to generate compact models and, artificial intelligence (AI) based health management of high-tech systems.

Addressing the challenge

Mechanical robustness and failure awareness are crucial to reliability and safety requirements in high-tech systems, which integrate numerous complex components. System-level simulations are only effective if details of these components are incorporated. However, suppliers are typically reluctant to share such proprietary information. A lack of data exchange formats and the sheer size of simulation data also prevents direct exchange along the supply chain. Reliability tests are therefore performed multiple times, wasting time and money and resulting in replicated components within the system to ensure reliable operation of high-tech systems.



Model order reduction allows an automatic transition from a large-scale finite element model consisting of millions of ordinary differential equations (ODE) into lower order highly accurate surrogate.

Proposed solutions

Due to their simplified nature and protection of proprietary data (MOR prevents reverse engineering), compact models offer a solution for faster system-level simulations with comprehensive, reliability assessments. COMPAS will therefore develop MOR-based compact models, including a clear exchange format, for non-linear, dynamic and coupled thermomechanical systems. A platform for compact modelling tools will allow designers to optimise their high-tech systems through simulation while ultra-compact digital twins will enable remaining useful life predictions to be made in real time. In high-tech systems (such as autonomous vehicles), factors beyond those considered by the thermomechanical compact model will influence their behaviour; COMPAS will thus enhance these digital twins with data-driven AI algorithms to minimise the risk of errors.

Projected results and impact

As the first project to address standardised compact models for thermomechanical applications, COMPAS intends to increase the TRL of non-linear compact models from 3-4 to 6-7. This will enable unprecedented design optimisation (thereby reducing experimental development cycles) and provide advanced health management for fail-safe high-tech systems with less hardware redundancy. As less computational resources are required, the compact models and digital twins can be implemented locally and sold by OEMs with their products. Additional business benefits include a reduction of time-to-market by at least six months and the growth of markets such as nonlinear finite element method software. Ultimately, COMPAS expects massive reductions of global data traffic, security risks and energy consumption while achieving higher performance.

Project partners

COMPAS
19037

Project start
January 2021

Project end
December 2023

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https://itea4.org/project/compas.html

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