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CAELESTIS: Hyperconnected simulation ecosystem supporting probabilistic design and predictive manufacturing of next

Description

CAELESTIS will develop an end-to-end Interoperable Simulation Ecosystem (ISE) that will perform multidirectional dataflow across the aircraftvalue chain linking product design and distributed engineering teams´ CAD-CAE tools, to accelerate the design and engineering optimization of disruptive aircraft and engine configurations, ensuring their manufacturability from the design conceptualization.

CAELESTIS ecosystem will be developed to integrate, interoperate, and autonomously execute simulation workflows involving a variety of state-of-the-art simulation tools tosupport the multi-disciplinary design, optimisation as well as uncertainty quantification and propagation across the design and manufacturing chain. The ecosystem will be boosted by HPC infrastructures to massively execute predictions and deliver optimized design and engineeringoutputs at realistic-time scales. In this regard, high-fidelity model-based digital twins with unprecedented level of detail and covering several production stages and manufacturing deviations will be developed and interconnected. Those will be linked to machine learning tools adapted to HPC simulation outputs to improve detection of manufacturing flaws based on a probabilistic approach to quantify uncertainties and theirpropagation and influence on structural integrity, as well as identify design for manufacturing interdependencies to provide optimized product topologies. From manufacturing point of view, HPC simulations will be made available at manufacturing shopfloor as reduced order models inonline monitoring edge computing devices, to support

- product performance prediction based on detected defects on real time and
- informed corrective actions to minimize and compensate their effect.

Overall, CAELESTIS ISE will contribute to generate optimized and reliable aircraft design configurations, widen the design space and optimize the manufacturing process window and improve production efficiency and inline quality assurance.

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