

coa ~ cfd

COA-CFD

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Engineering Software Steyr

Canada

Biosimo AG

Mazlite

Germany

AUDI AG

IONOS

Poland

Scientific Solutions Systems

South Korea

Dohwa Engineering Co.

Institute for Advanced Engineering (IAE)

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Cloud-based Online Access to Computational Fluid Dynamic Simulation

COA-CFD makes Computational Fluid Dynamics available on demand, in the cloud, to engineers who are not CFD specialists. A consortium of twelve partners from seven countries developed hybridised solvers, a design-optimisation framework and a GAIA-X-aligned cloud infrastructure, and software packages for complex industrial and engineering problems, so that SMEs and industrial teams can simulate instead of prototype.

Main focus

CFD is one of the most powerful tools in industrial product and process development, yet it remains locked behind two barriers: scarce specialist expertise, at both human and software levels, and expensive high-performance hardware. The result is that an estimated 90% of the automotive supply market, overwhelmingly SMEs, cannot use simulation at all, and continues to rely on costly physical prototyping loops.

COA-CFD set out to remove both barriers at once. The project's central aim was to democratise CFD: to deliver accurate multi-physics simulation of real industrial processes through an interface that requires no prior CFD knowledge, running on cloud

resources rented by the hour rather than on a private cluster.

The expected outcome is a measurable shift in how Eureka Countries' manufacturing SMEs develop products, fewer physical prototypes, shorter time-to-market, better first-time-right quality, and lower material, energy and emissions cost across coating, chemical and renewable-energy applications.

Approach

The project advanced in four coordinated steps. First, solver hybridisation: complex industrial processes cannot be captured by any single numerical method, so ESS coupled four of its GPU-accelerated solvers, Lattice Boltzmann for the airflow, Finite Difference for the electrostatic field, a Lagrangian particle method for the droplets and a thin-film solver for the deposited layer into one framework.

Second, usability: the multi-physics stack was wrapped in a modular, task-oriented interface, so that setting up a simulation moved from months of expert work to a guided sequence of steps. Third, optimisation: we integrated a design-optimisation framework with reduced-order models and



optimisation interfaces embedded directly in the ESS suite, which can achieve design optimization in practical applications.

Fourth, the cloud: an on-demand alsimCloud platform is developed, which utilizes internal and commercial computing and storage resources and make the developed software packages available to everyone.

Achieved results

The project's headline result is a working, commercially available platform: ESS's alsim Cloud. Built on the hybridised solver stack and the particle-based method, it lets users run simulations without any local HPC hardware. alsim Cloud supports both centralised and decentralised usage, so it can serve a whole organisation as well as individual teams or sites. It is already in productive use by engineering teams without CFD expertise around the world.

The key technical milestone was the full top-coating simulation, demonstrating successful hybridisation of the four solvers into a single cohesive framework, executed with multi-GPU domain decomposition. Computation times were cut substantially with no loss of accuracy, and results were validated in repeated rounds against real-world data from automotive OEMs.

MYB used the platform to develop a novel coating applicator, with simulations indicating a reduction of overspray from 60% to 10% and energy savings of more than 270 kW per unit. Biosimo modelled

multiphase flows in trickle-bed chemical reactors. The Korean partners: Soda System, Dtonic, IAE, Dohwa Engineering and Unison, applied the solvers to wind-profile analysis for turbine siting and efficiency, and to water-resource management, as well as scour of bridge piers and offshore foundations. The water wash and dirt-management packages developed for Cargo Bicycle remain available and transferable to other vehicle applications.

Impact

The project's results are already exploited commercially: the on-demand platform has been widely used by internal users and customers, providing on-demand simulations internationally on many applications such as Top Coating and Sealing.

For further R&D, hybridisation has proven itself as a general strategy rather than a one-off: the same coupling approach is being carried across to powder coating, spray waxing, sealing and e-coating, and the design optimisation provides a basis for simulation-driven design loops rather than one-shot verification runs.

For industry and society, wider access to simulation means fewer physical prototypes and correspondingly lower consumption of material, energy and time. In coating alone, the overspray and energy reductions demonstrated in the project translate directly into lower emissions and waste for every line on which they are deployed.

About CELTIC-NEXT

CELTIC-NEXT is the EUREKA Cluster for next-generation communications enabling the digital society. CELTIC-NEXT stimulates and orchestrates international collaborative projects in the Information and Communications Technology (ICT) domain.

The CELTIC-NEXT programme includes a wide scope of ICT topics based on new high-performance communications networks supporting data-rich applications and advanced services, both in the ICT sector and across all vertical sectors.

CELTIC-NEXT is an industry-driven initiative, involving all the major ICT industry players as well as many SMEs, service providers, and research institutions. The CELTIC-NEXT activities are open to all organisations that share the CELTIC-NEXT vision

of an inclusive digital society and are willing to collaborate to their own benefit, aligned with their national priorities, to advance the development and uptake of advanced ICT solutions.

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