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HIGH-FIDELITY CFD IN THE CLOUD AS A KEY ENABLER FOR TRANSPORT AND RENEWABLE ENERGY CHALLENGES

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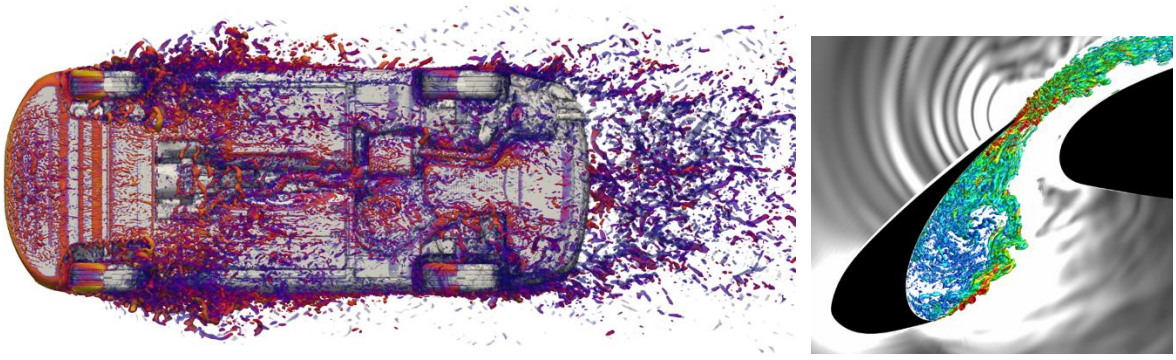
The term high-fidelity Computational Fluid Dynamics (CFD) refers to the class of methods designed to resolve important turbulent flow fluctuations directly, rather than representing their time-averaged effect through heuristic models. As the name implies, such methods give more reliable predictions than steady-state approaches. This benefit, however, comes at a cost of significantly increased computational effort.

The capability to accurately simulate turbulent fluid flow is an essential tool in the design of more energy-efficient, less noisy, and more competitive products in a wide range of fields such as transportation, renewable energy and many more. Furthermore, promising new approaches to design optimisation based on Machine Learning (ML) require large volumes of trustworthy training data. This requirement can be met by high-fidelity CFD combined with automated simulation workflows.

The presentation will summarise ongoing efforts to overcome barriers to the adoption of high-fidelity CFD for industrial design. These include improvements to turbulence models and numerical schemes, measures to automate and improve the energy efficiency of simulation workflows, and the harnessing of immense high-performance computing (HPC) resources available in the cloud. Using highlighted examples from the fields of aerodynamics and aeroacoustics, the case will be made that high-fidelity CFD methods combined with smart, adaptive workflows and cloud computing are a key enabling factor for future innovations, for large industrial OEMs and for innovative SMEs alike.



Visualisations from high-fidelity CFD simulations: Detached-Eddy Simulation of the generic DrivAer Notchback automotive validation case (left, Hetmann et al., 2021) and of broadband noise from the slat cove of a three-element high lift device (right, Knacke 2015)