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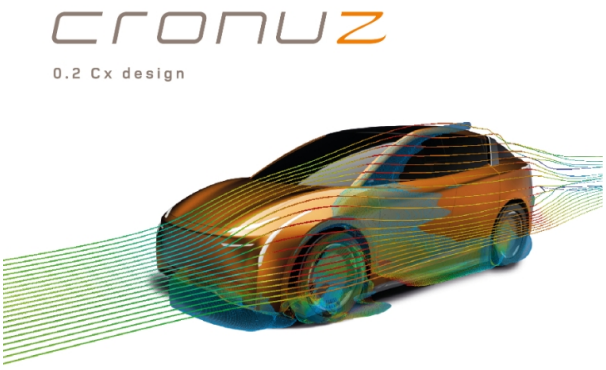
Aerodynamics and CFD

Aerodynamics is a key vehicle functionality to achieve the industry goals regarding emissions and vehicle efficiency. Aerodynamics rivals weight as energy consumer at low speed cycles (WLTP) and is the main energy consumer at highway cycles, thus the Cd targets are lowered year by year. To achieve best in class aerodynamic values (Cd and Cl), IDIADA provides deep knowledge of the contribution of all vehicle parts to the aerodynamic forces and an experienced CFD and wind tunnel testing team.



CFD Simulation:

The IDIADA CFD team has **more than 25 years** of experience in simulating **various automotive fluid dynamics problems**: aerodynamics, thermal and cooling, multi-phase, aero-acoustics, etc. We have **in-house hardware premises** and in order to be aligned with our customers, we are skilled in the most used software packages: STAR-CCM+, ANSYS, OpenFOAM, PowerFLOW, etc.

Road testing:

Aerodynamics testing in real driving conditions include steady and transient events.

- **Measurements on test track:** Coast down, air drag as per VECTO, and cross wind
- **Measurements on open road:** Steady flow driving scenarios, and transient driving scenarios: Gusts and Driving maneuvers

Applus IDIADA

Wind tunnel testing:

IDIADA provides turn-key wind tunnel testing support in third party wind-tunnels, such as GIE S2A. The IDIADA support includes: mock-up definition and construction, test scheduling and on-site support at the testing sessions.

The Cronuz Project:

Get more information regarding the Cronuz Project presented at the Geneva Motor Show 2018 at our news section.

Research Activities:

In order to provide optimal solutions for airflow modelling, IDIADA develops proprietary software based on Vortex methods and Artificial Intelligence. Two differentiate strategies for high fidelity turbulence modelling are developed by IDIADA:

- **VORCAT:** IDIADA co-develops together with VORCAT Inc. a **CFD tool based in vortex methods** that overcomes the main drawbacks of **RANS and LES turbulence models** and provides unprecedented flow accuracy. VORCAT simulates incompressible, turbulent flow in three-dimensions by a time-accurate and physically consistent numerical methodology.

- **Artificial intelligence:** IDIADA participates in the EU funded UPSCALE project that aims to develop **Artificial Intelligence** enhanced **CAE tools**. One of the IDIADA objectives in the UPSCALE project is developing a **Physics Informed Machine Learning** model for correcting RANS modeled Reynolds Stress Anisotropy, this trained algorithm aims at enhancing the accuracy of the an-isotropic component of Reynolds Stress tensor (R) modeled by Reynolds Averaged Navier Stokes (RANS) based turbulence models using machine learning techniques, these modified RANS

turbulence models will provide the accuracy of LES modelling while keeping the efficiency of steady state RANS simulations.

- **Aerodynamics of real-driving events investigation:** S2A and IDIADA are engaged in a collaborative research project to **investigate aerodynamic drag in real-driving conditions**, since the effect of traffic events and real wind is not taken into consideration in standard wind tunnel tests and Computational Field Dynamics (CFD) simulations.