

Formula E: Driving smart software to victory

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REFERENCE-STORY

► The challenges

New race tracks, short development cycles, and a limited supply of energy add to the excitement

The all-electric Formula E racing series allows automobile manufacturers to convincingly demonstrate that motorsports does not always involve noisy engines and the smell of gasoline. The software integrated into a race car plays a decisive role in determining which electric car wins Formula E. Teams are namely permitted to make only very minor modifications to the hardware of a homologated vehicle. Conversely, they enjoy a wide range of opportunities for optimizing the car's software during the saison. Because only a certain amount of the available battery energy can be used during a race, teams need an intelligent energy-management strategy that ensures ideal distribution of energy and maximizes average vehicle speed. And it needs to ensure all of that in different situations: on unfamiliar race tracks, in adverse weather, during safety-car periods, or in a duel with a rival.

What is the biggest challenge of all? Time! On a race track, fractions of a second separate victory from defeat. Race car engineers must likewise race against the clock to meet extreme deadlines. Short gaps between races mean that teams must be able to very quickly and reliably develop new functions that sometimes cannot be put to the test until the weekend of the race.

► The solution

High-precision simulations lead to victory

As a technology partner of Audi Sport, ITK Engineering has supported the Audi Sport ABT Schaeffler team since 2016. More specifically, ITK helps develop the software for the vehicles driven by Formula E champion Lucas di Grassi and his fellow driver Daniel Abt. ITK handles everything from requirements analysis, development, and the combination of verification and validation all the way to integration into the vehicle. In this way, ITK Engineering helps Audi Sport ABT Schaeffler implement new functions and optimize its energy strategy.

Algorithms designed under strict adherence to processes of model-based software development allow calculated strategies and energy-distribution solutions to be stored on the vehicle control unit in real time. What's more, the team can continuously adapt these strategies and solutions during a race as conditions change.

In this context, temporally deterministic development processes play an essential role in making sure that the team can implement outstanding race track solutions just in time for race day.

Despite a lack of empirical data from the race track, virtualization and simulation enable requirements to be met extremely quickly while maintaining the highest standards of quality, traceability, test coverage, and documentation.

► The outcome

Lucas di Grassi wins the world championship in the Formula E

A driver as well as their vehicle and the entire racing team must cooperate flawlessly if they are to triumph in motorsports. By following an uncompromising approach to model-based development, the team succeeded in developing new functionalities in the shortest of time spans, as well as ensuring virtual preparation for race events, driver training in a simulator, and a winning energy strategy. All of this certainly helped Lucas di Grassi to maximize the potential of his vehicle at all times – propelling him to the 2017 Formula E championship title.



ITK assists Audi Sport ABT Schaeffler with:

- Requirements engineering
- Energy strategy and energy management
- Drivetrain control
- Development of functions and software
- Virtual verification and validation

Challenges:

- Short development cycles
- Limited energy budget
- Unfamiliar race tracks

The outcome:

- Lucas di Grassi is the 2017 Formula E world champion



”In Formula E, the software and the powertrain must operate in total harmony, so that our driver can rely one hundred percent on everything – that’s the key to success in this racing championship. With ITK Engineering, we have the perfect partner alongside us – not just for developing the software, but also for continuous tweaking and ongoing development, as well as trackside support. In motorsports, reliability, precision and the spirit of innovation are required – values that ITK and ABT both share.“

– Hans-Juergen Abt, managing director of ABT Sportsline