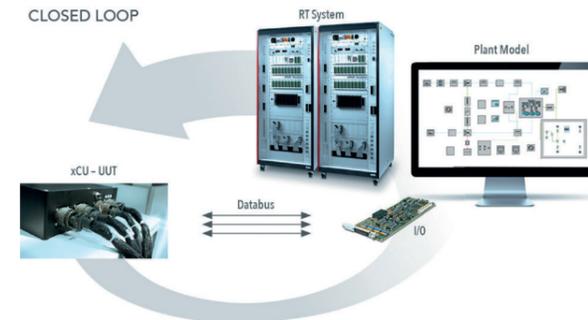


REAL TIME MODELLING FOR POWERTRAIN CALIBRATION

AVL CRUISE™ M offers automated engine calibration, using semi-physical modelling on the basis of an extensive test database and powertrain engineering know how.

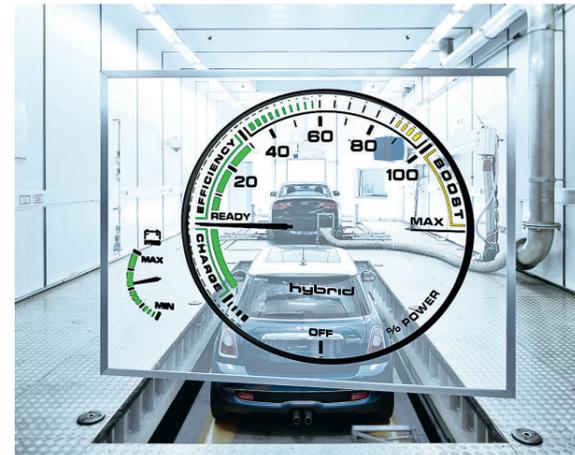
- Semi-physical combustion modelling
- Advanced heat transfer models applied
- Sensor and actuator models available
- Backed-up by comprehensive engine test data



VEHICLE ENERGY MANAGEMENT SYSTEM

One of the primary motivations for developing AVL CRUISE™ M was to offer a comprehensive simulation environment that perfectly meets all the development requirements in the increasing complexity of Vehicle Energy Management Systems (VEMS). The relevant features include:

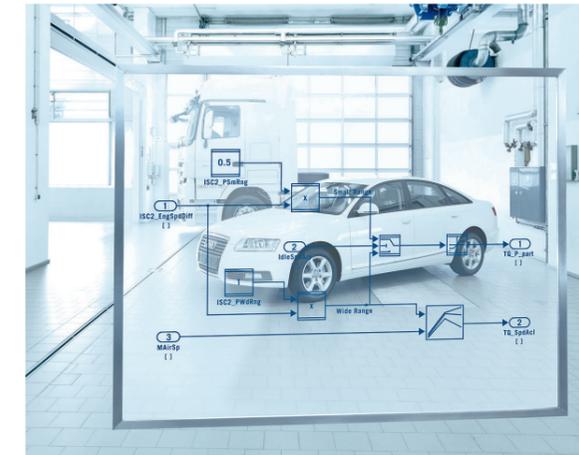
- A fully coupled system level simulation that considers transient interactions between all sub-systems
- An energy management concept design including system energy balance optimization
- Operation strategy and controls development for effective heating and cooling of critical components



CONTROL FUNCTION DEVELOPMENT

AVL CRUISE™ M introduces seamless control function development from MiL to SiL to HiL using crank-angle resolved engine models with scalable model fidelity and an open integration concept. This enables the re-use of highly mature, realtime-capable office models in the advanced test system with the following results:

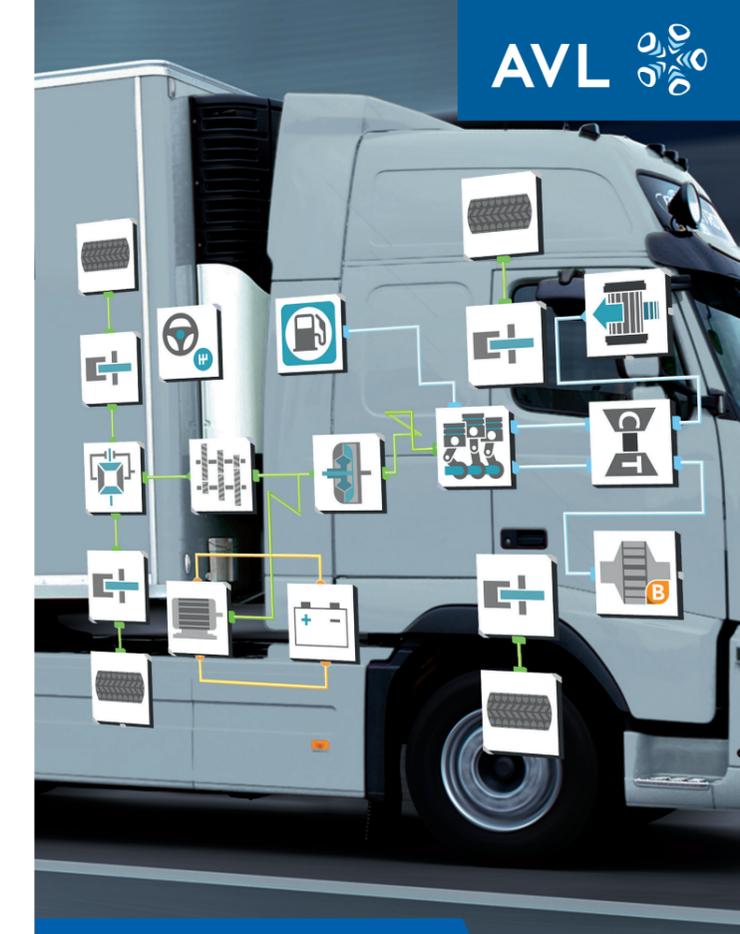
- Consistent, comparable and reproducible tests are possible even before the hardware is available
- A lower risk of missing critical operating conditions
- Real-world environment constraints without actual risk for the driver and equipment



MODEL BASED TESTING

AVL CRUISE™ M delivers the right system plant model fidelity for a wide range of testbed applications, such as engine, transmission, battery, e-machine etc. The re-use of the multi-physics model ensures consistency, result comparability and shortens the test preparation time. Some of the benefits are:

- Test and calibration of components in any vehicle powertrain concept, from the most conventional to the most innovative
- Re-use of system models prepared by simulation experts in the office reduces the testbed downtime
- High-quality system models enable frontloading of development tasks from the road to the testbed

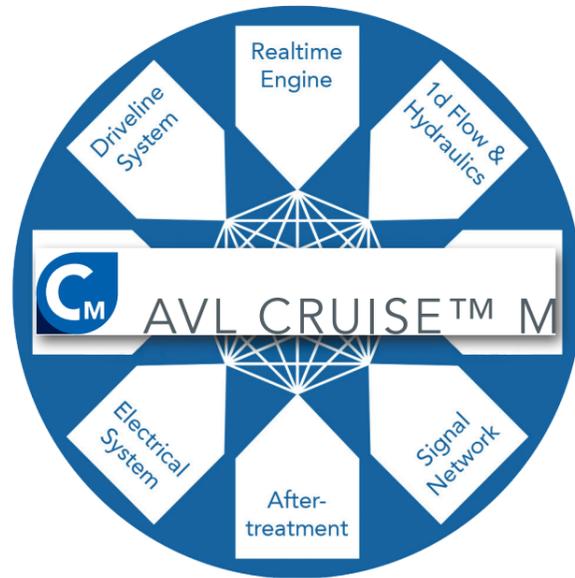


AVL CRUISE™ M

Multi-Disciplinary System Simulation

FOR FURTHER INFORMATION
PLEASE CONTACT:

AVL List GmbH, Hans-List-Platz 1, A-8020 Graz, Austria
T: +43 316 787 1222, Email: ASTMarketing@avl.com,
www.avl.com/simulation



AVL CRUISE™ M
Multi-Disciplinary System Simulation

The challenge of mastering the increasing speed and complexity of the vehicle development process requires simulation-based methods with a high level of integration with test systems.

Our goal is to support development with an integrative, open and consistent simulation approach, enabling the re-use of high quality models.

Our solution is AVL CRUISE™ M - a vehicle system simulation platform that is a highly convenient and versatile tool throughout the development process.

AVL CRUISE™ M brings the advantages of multi-disciplinary system simulation closer to you and makes your work easier.

AVL CRUISE™ M
for Engine Development

The engine domain is at the heart of the entire multi-disciplinary model based development solution. It focuses on system level real-time engine simulation which can be used over the entire vehicle development cycle and offers:

- Scalable engine modeling depth from surrogate to physical level
- Crank-angle resolved cylinder and gas path solution
- ECU calibration with the virtual engine at an early development stage

AVL CRUISE™ M
for Cooling and Lubrication

AVL CRUISE™ M, as multi-disciplinary solution, provides efficient thermal fluid cycle simulation as the thermal link between drivetrain sub-systems. Highlights include:

- Reduction of thermal losses and efficient (re-)use of available thermal energy
- Detection of critical thermal conditions to prevent vital engine and driveline parts damage
- Fully integrated user-extendable property database with numerous solids, oils and coolant media

AVL CRUISE™ M
for Aftertreatment Development

AVL CRUISE™ M Aftertreatment is a part of the leading thermochemical system simulation package. AVL's expertise helps development engineers to meet future emission regulation targets with key elements including:

- Prediction of drive and legislation cycle emission considering the complete vehicle and driver behavior
- Optimization of aftertreatment control strategy and its interaction with other control units
- Re-use of entire RT capable vehicle from concept phase for calibration and testing

AVL CRUISE™ M
for Driveline and Transmission

The flexibility of AVL CRUISE™ M helps to turn powertrain concept ideas into reality, extending application range to driveline control systems including hydraulic networks. It helps users with:

- Fast and accurate analysis of fuel efficiency, emission and performance trade-off
- Efficient gear shifting strategy development and virtual drivability assessment together with AVL VSM™ and AVL-DRIVE™
- Freely defined driveline architecture to simulate passenger cars, commercial, special purpose or off road vehicles and motorbike

AVL CRUISE™ M
for Electrified Powertrain

AVL CRUISE™ M supports modeling and simulation of core electric components and systems (e-turbocharger, e-drive, ...) within any electrified powertrain configuration (HEV, EV, FCEV,...) enabling:

- Quick and efficient concept potential assessment
- Support for HEV/EV control function strategies development
- Driveline energy flow, losses distribution and efficiency analysis for conventional drivetrains, EV and HEV

