Model.CONNECT: Case Studies of Virtual Testing for RDE, Electrification and ADAS

Connect simulation and test

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The challenge

Speeding-up development process by re-using simulation models from different tools from the office concept phase to the hardware testing and validation.

- Mastering new applications: ADAS, RDE, VTMS, calibration etc.
- Connecting existing co-simulation models in an optimal way.
- Using simulation models in HiL and testbed environments.
Integrated & Open Development Platform

Connect simulation & test

Connect existing elements within the vehicle development process for early, cost-saving decisions.
1. 30+ ready to use standard interfaces and tool wrappers
2. Maximum performance due to distributed computing
3. Error correction using patented coupling technique
4. Patented RT/non-RT synchronization technology
5. Solution stability in all simulation environments
Model.CONNECT: aligning model exchange and integration process within organization
ADAS/HAD
USE CASE: Adaptive Cruise Control w. Lane Keeping Assist
Project Reference: Platooning

Design objectives:
- Variable safety distance
- Fuel consumption reduction
- Interaction between various ADAS functions

Simulation toolchain:
- Road and traffic simulator (*SUMO/VTD/PreScan etc.*)
- Truck models (*AVL CRUISE*)
- Control functions (*Matlab or actual hardware*)
- Integration platform (*Model.CONNECT*)

3-10% fuel cost saving!

Road test cases performed in a virtual environment after 2 weeks!
Project Reference: Park Assist

Design objectives:
- Safe and fast autonomous parking
- Options for different vehicle types (also w. trailer)

Simulation toolchain:
- Road and traffic simulator (**VTD Vires, ADTF**)
- Sensor models (**different providers**)
- Vehicle models (**In-house tools**)
- Control functions (**C-code**)
- Integration platform (**Model.CONNECT**)

Easy integration of supplier models and open format scenarios.
"AVL, TÜV SÜD AND NVIDIA TEAM UP FOR ADAS/AD"

The most efficient validation will be done by those who use the smartest combination!
ELECTRIFICATION
Project Reference: Energy Efficiency Optimization for 800V BEV

Thermal model
Thermal management system

Powertrain model
Mechanical model
Electrical model

Vehicle dynamics model
(driver, maneuver, environment)

Traffic environment

Adding Highly Automated Driving functions results in a dramatic reduction of the peak and average thermal load for the critical electric components.
- Battery thermal load:
  - Peak: ~82%
  - Average: ~61%
- E-Machine thermal load:
  - Peak: ~70%
  - Average: ~37%

HEV/SW Environment:
- Sensors & Control Units
- RT HiL systems
- Distributed computing systems
- Testing Equipment
Energy Efficiency Optimization for 800V BEV
Thermal Management In The Loop

**HMI**
Change model parameters while simulation is running

**Thermal Management Controller**
Prototyping-Controller linked to (RT-capable) Co-Simulation via CAN interface

**Vehicle/Powertrain**
Mechanical and electrical model of vehicle

**Cooling System**
Passive or active battery cooling
RDE
AVL CRUISE M: The Factory of Premium Real-Time Models

Applications:
- Fuel Efficiency & Emissions
- Performance & Drivability
- EV/HEV
- Control function development
- Thermal Management
- Aftertreatment etc.

REAL-TIME CAPABLE
Project Reference: RDE test frontloading in the office
Customer Reference: Real Driving Emission Testing Environment on Engine Testbed
INTEGRATED AND OPEN DEVELOPMENT PLATFORM