"Driving the Future: Unveiling Breakthroughs in Electric Vehicle Technologies - Insights from European Research and Innovation"

Funded by the European Union

Toolchain for Vehicle-Level Simulation

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Main Facts

About the project	
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Your contribution is in topic area (x):	
	Powertrain design and assessment
	Energy efficiency of vehicle sub-systems
	Electric/electronic/sensing architectures enabling autonomy and security of electric vehicles
	Passive and active safety of electric vehicles
x	Simulation tools for the rapid assessment and development of electric vehicles
	Product life cycle assessment, materials combination, eco-design, and other recyclability aspects

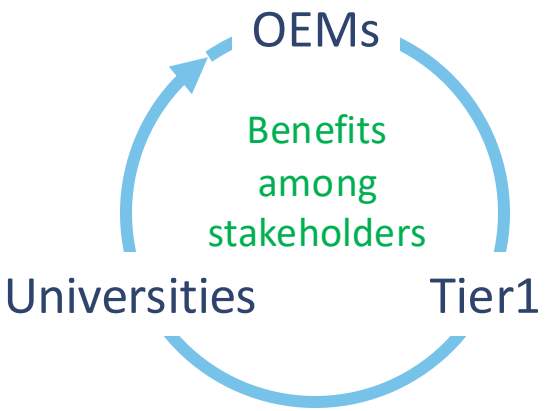
Toolchain for vehicle level simulation

Vehicle-Level Simulation

- Rapid and comprehensive simulations to evaluate improvements in vehicle performance resulting from innovations in powertrain components, active chassis actuators, drivetrain layouts, advanced control methods, etc.

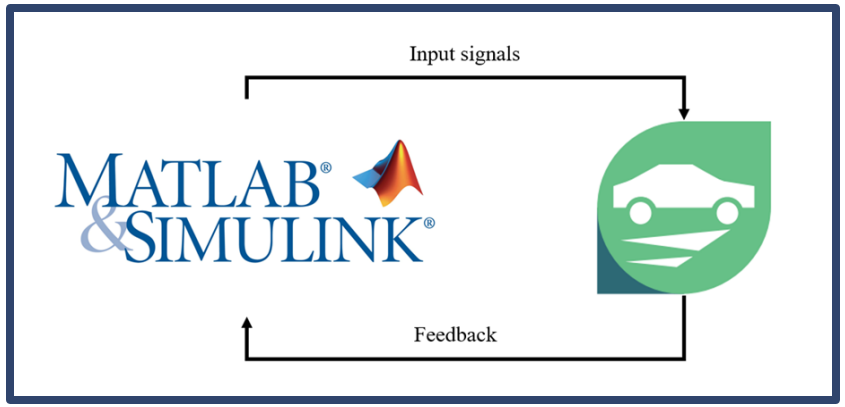
Innovation Database

- Individual stakeholder can focus on developing innovations of interest while relying on the database to set up the full vehicle simulation
- Stakeholders contribute to the database (with IP protected) to enhance the visibility and exposure of their innovations



MATLAB Simulink & AVL VSM Co-Simulation Platform

- Rapid control design & implementation in Simulink
- High-fidelity vehicle dynamics in VSM
- Flexibility in implementing component models and functions in VSM or Simulink

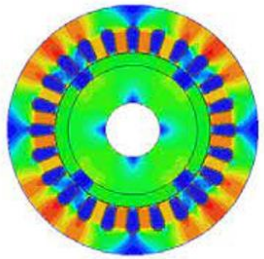


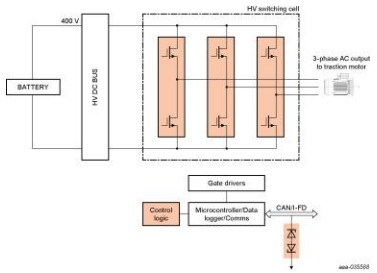
Models of components

- Computation-efficient surrogate models to ensure rapid simulation

Example for powertrain components

Detailed design





Validation on test rig

Surrogate models of traction motor and inverter

- Efficiency maps
- Torque actuation time constant
- Torque ripples
- PWM frequency of PE
- Thermal aspects
- Local control strategies
- …

The model allows the evaluation of vehicle performance in terms of, e.g., vehicle efficiency, longitudinal dynamics etc.

Example Use Cases

UC1: OEMs consider installing different components on their vehicles to evaluate vehicle efficiency improvements, resulting from:

- High-efficient powertrain components;
- Reduced mass of components with high specific power for the same power ratings;
- Reduced battery's capacity and mass due to increased powertrain efficiency while aiming for the same mileage.

UC2: Component providers showcase their technology and understand the range of vehicle segments the technology could be beneficial for

- Applications of e-axle/e-corner powertrains consisting of innovative on-board/in-wheel motors and high-voltage WBG-based PE drives, for a wide range of vehicle segments, with FWD/RWD/AWD drivetrain layouts and single-/multiple-speed gearbox or electric gears.

UC3: Research institutes develop control strategies and assess them on reliable vehicle and component simulation models, e.g.:

- Integrated control of WBG-driven electromechanical (semi-)active chassis actuators and IWMs considering the increase of the unsprung mass.
- Predictive health management of traction motors and PE devices through accurate thermal modelling and the vehicle controls to alleviate the thermal stress.