

Propulsion Engineering



Function Development & Integration

- Function development
- E/E development
- Functional system integration
- Application software testing
- System validation



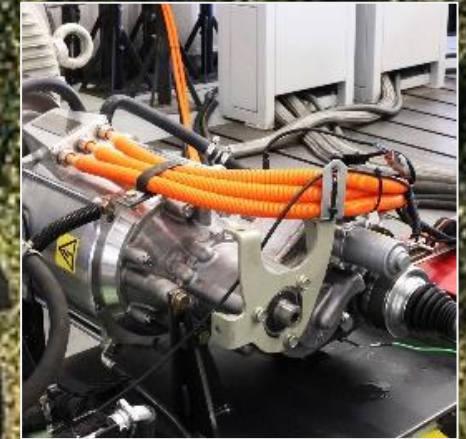
Software Engineering Services

- AI/ML services
- ADAS integration and algorithms
- 3D Modeling and Visualization
- Simulation and optimization tools



Thermal & Energy Management

- Concept & simulation
- Specification & integration
- HVAC & thermal comfort
- Vehicle thermal management
- Thermal system testing

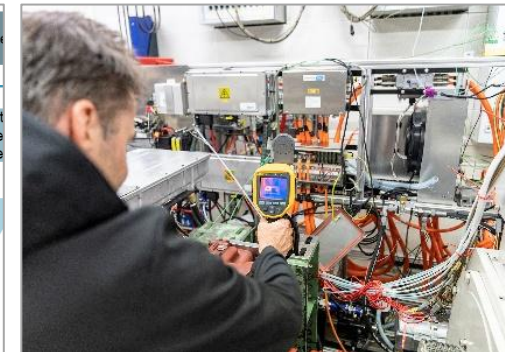
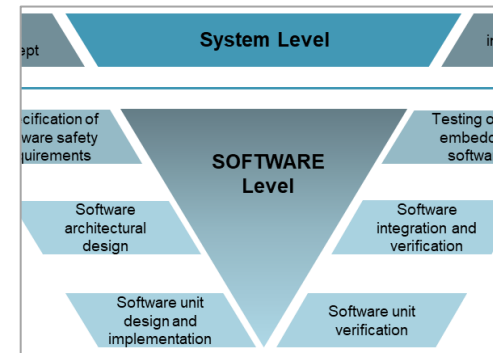
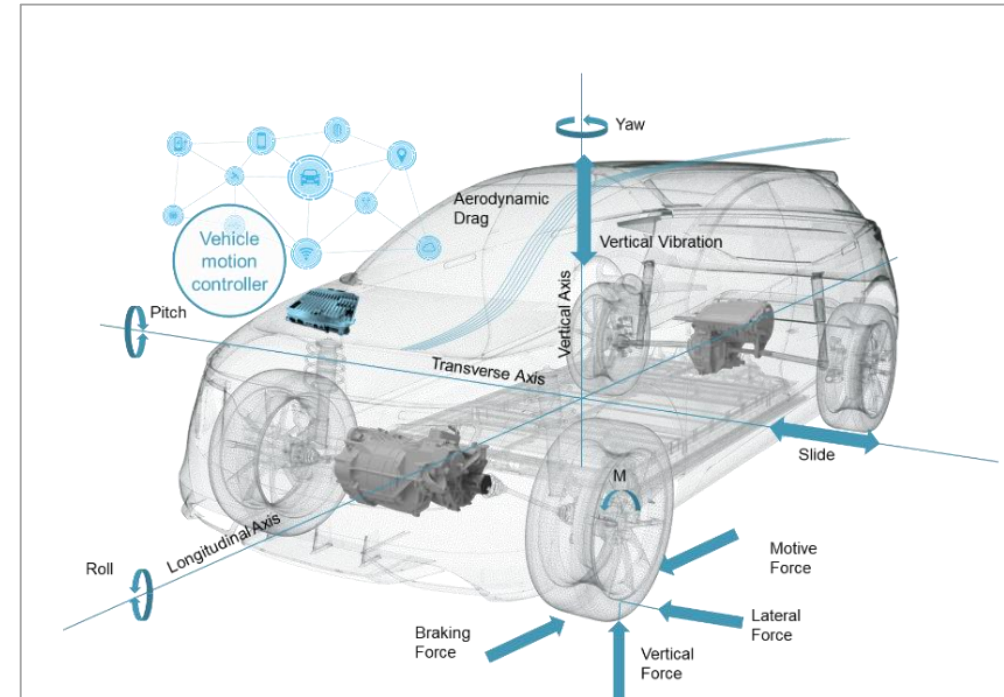


Propulsion Testing

- eDrive testing
- Engine testing
- Gearbox testing
- Environmental & EMC testing
- Battery cell testing
- H2 system verification

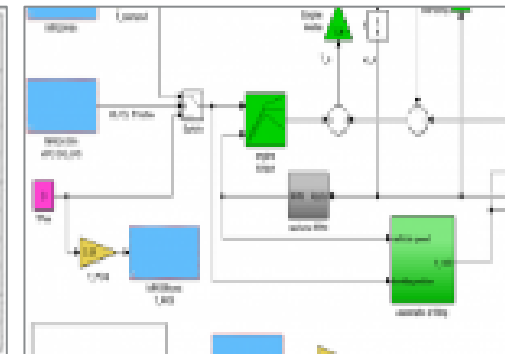
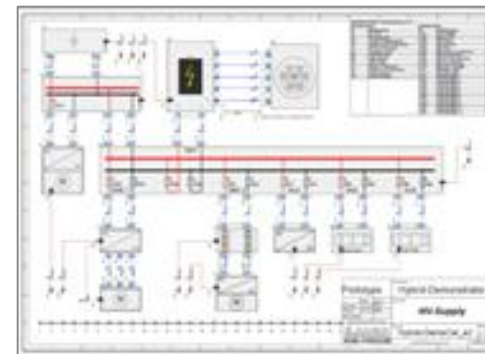
Function Development & Integration

- Functional system integration
 - eDrive / e-Axle
 - HV battery
 - Fuel cell
 - H2 storage system
 - Engine incl. auxiliaries and gearbox
 - Boardnet & communication
- Powertrain systems and drivability
 - ePropulsion calibration
 - Powertrain performance optimization
 - Engine calibration
 - H2 system functions
- HV system and energy storage
 - AC/DC charging
 - Safety functions
 - HV battery control
 - Hydrogen storage system functions
 - Electrical auxiliaries



Electrics / Electronics

- EE System development
 - Control unit Architectural concept
 - Residual bus
 - PDU layout and development
 - Fuse concept
- SW engineering
 - SW requirement engineering
 - SW architecture
 - Function development
 - SW development & testing
 - Gateway solutions
- HV & LV wiring
 - 3D CAD component packaging and harness routing
 - Harness fixation concept
 - Cable dimensioning & length definition
 - Connector & pinning alignment
 - Harness partitioning
- EE prototyping & validation
 - LV & HV prototype harness build up
 - LV & HV PDU prototype build up
 - LV & HV wiring validation
 - System HiL Set-ups

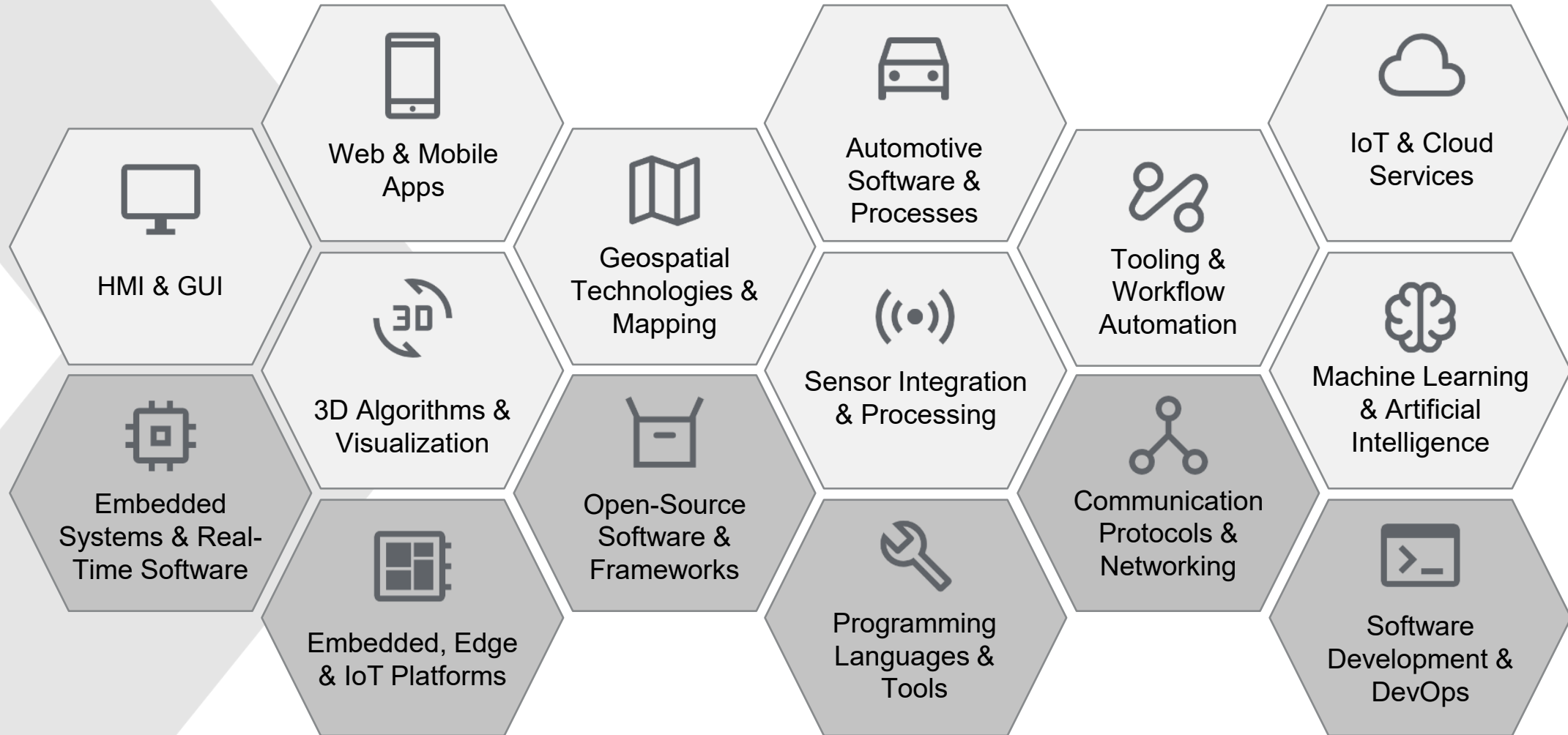


Software Engineering Services

Competences

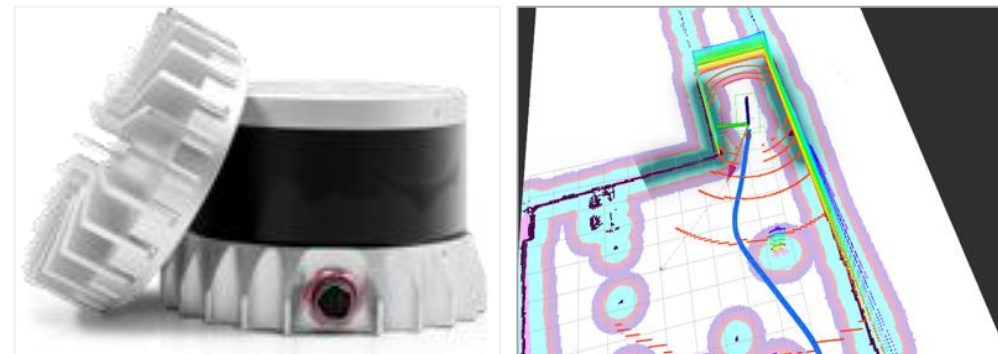
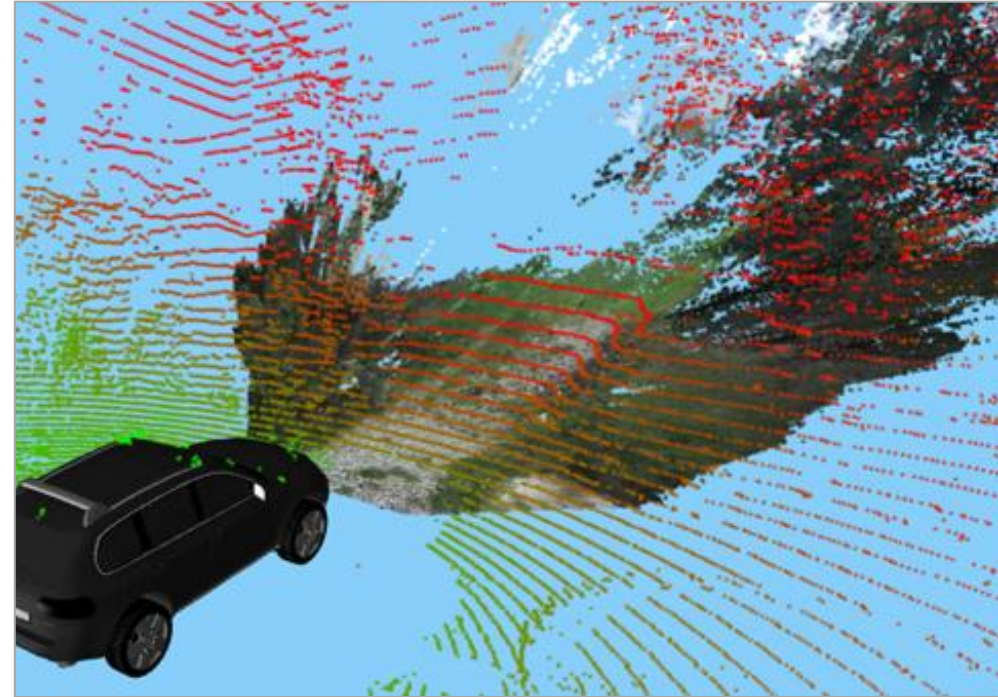
Services

Foundation



ADAS and Automated Driving

- **Hardware integration**
 - **Sensor integration:** integrate advanced sensors like cameras, lidars, and AHRS/GPS for precise data acquisition.
 - **Actuators:** implement high-performance actuators for precise control and responsiveness.
 - **Vehicle components:** ensure optimal performance and compatibility by integrating essential vehicle components, enhancing overall system efficiency.
- **Software integration**
 - **Sensor drivers:** develop robust drivers for seamless sensor communication and data acquisition.
 - **Actuator drivers:** develop reliable actuator drivers to ensure precise control and coordination of vehicle movements.
 - **Communication protocols:** utilize CAN, DDS or other protocols for reliable communication.
 - **Data handling:** implement advanced techniques for effective sensor data management and real-time decision-making.
- **Functional software**
 - **Functional modules:** develop modules that enhance vehicle capabilities, ensuring safety and efficiency.
 - **GPU accelerated algorithms:** use GPU acceleration for high-performance, real-time ADAS algorithms.
 - **GUI/HMI:** design intuitive GUIs and HMIs with technologies like React and OpenGL for a seamless user experience.



Thermal & Energy Management

- **Concept development & simulation**
 - Requirement & DVP development
 - 1D & 3D simulation
 - Concept optimization based on cost, performance & complexity
 - Thermal system architecture development & benefit statement on vehicle level
- **HVAC system & cabin thermal comfort development**
 - 3D CFD simulation (e.g. air duct & cabin air flow, defrost/demist)
 - 1D simulation of cool-down & heat-up performance
 - Component & system specification
 - HVAC & comfort system control function development & integration
 - Thermal comfort validation incl. thermal manikin testing according to ISO14505-2
- **Vehicle thermal & energy management development**
 - 1D & 3D simulation of thermal system on vehicle level
 - Component & system specification
 - Packaging, vehicle integration & supplier management
 - Plant model build up for SiL analysis
 - Functional control logic development & integration
- **Thermal system testing**
 - A/C & thermal system validation on test bench (component, module or complete system)
 - Function control logic validation and calibration on test bench
 - Complete vehicle validation on chassis dyno or test track
 - Functional control logic validation and calibration on chassis dyno or test track



Engine Services

- Engine testing services
 - RDE testing
 - HiL testbed for software validation and pre-calibration
 - Dynamic engine/powertrain testbeds
 - High altitude & climate engine testbed
 - Dynamic engine testbeds
 - Dynamic hybrid drive system testbeds 48V & HV
 - 4WD Chassis Dyno testbed
 - Temperature condition from -20°C up to 50°C
 - Proving ground
- Calibration services
 - Gasoline and diesel powertrains
 - Passenger cars and trucks
 - Marine application and nonroad machines
 - Function development
- System integration & homologation support
 - Concept definition and integration of new powertrain components and systems
 - Homologation support for customers with focus on emission and OBD



H2 System Integration

- Fuel cell system integration
 - H2 system architecture
 - FCS integration incl. air- and exhaust-lines
 - Software and control of H2 management
 - Safety/risk strategy for FC system integration
 - Cooling integration FCS (performance, architecture)
 - Mechanical integration of FCS
 - Planning and conducting of physical testing
 - FCS-HiL build
- H2 storage system integration
 - HSS architecture/layout
 - H2 tank integration and mechanics (packaging and pipe routing)
 - H2 refill system development
 - Risk/safety strategy
 - Control unit function and software development
 - Planning and conducting of physical testing
- H2 ICE integration
 - ICE integration incl. air- and exhaust-lines
 - Cooling integration
 - Mechanical integration of ICE and exhaust system
 - Planning and conducting of physical testing

