

DYNA4

Efficient Function Development in Closed-Loop System Tests

What is DYNA4?

DYNA4 is an open simulation environment for the virtual test driving of cars and commercial vehicles. The physical models include vehicle dynamics, powertrain, combustion engines, electric motors, sensors and traffic. Virtual test drives with DYNA4 facilitate safe and efficient function development and testing. Closed-loop simulations on the PC run faster than in real-time, e.g. for use in early development stages (MIL, SIL), or can be executed on Hardware-in-the-Loop systems (HIL) when ECUs are available. DYNA4's 3D environment simulation with road infrastructure and traffic provides virtual test fields for assisted and automated driving wherever environment perception plays a key role.

Overview of Advantages

- > Frontloading: testing and development of ECU functions before hardware prototypes are available
- > Safe testing in critical driving maneuvers, including near-crash situations or vulnerable road users
- > Efficient testing with parameter variations for thousands of automated driving tests
- > Weather independence: virtual tests under reproducible environment conditions with rain, snow, fog, wind etc.
- > Direct comparison of configurations, variants etc.
- > Optimization of complex systems, e.g. operating strategies with many application parameters
- > Traceability of test runs through management and versioning of simulation input and output

Highlights of Release 6

- > Improved **physics-based sensor models**
 - > Physical scene lighting parameters
 - > High dynamic range camera images
 - > Non-uniform angular resolution of lidar sensors
- > **Leap in visual quality** with new render pipeline
- > **Modular control unit structure** for easier integration of custom functions and more flexible composition of new vehicle models
- > Extended **ASAM OpenDRIVE support**
 - > New road viewer for analysis and route editing
 - > Road network generation including junctions
 - > US road signs
- > Extended **ASAM OSI support**
 - > Object-based sensors output OSI messages
 - > New lane detection sensor outputs OSI messages
- > **Improved workflows and usability**
 - > Improved data management of model parameters and result data
 - > Easier signal manipulation with externally available signal modifiers and dynamic signal sources
 - > New progress view about pending operations and simulation job progress with cancellation options
 - > Strengthened Python integration with dedicated editor and many pre-installed modules
 - > Many re-worked user interfaces including filter boxes, tooltips and other convenience features
 - > Many **new examples** for models and parameter sets
 - > Updated software and hardware compatibility



DYNA4: Test driving in a virtual environment with different light conditions

Functions

Virtual Vehicle

- > Seamless integration of vehicle control functions and strategies
- > One or more vehicles under test (multi-ego set-up), e.g. for cooperative driving
- > High-fidelity vehicle dynamics for cars, trailers, trucks and commercial vehicles
- > Pre-configured, modular drivetrain models with mechanical and electrical components
- > Engine dynamics based on mean-value or detailed thermodynamic cylinder models
- > Driver models for different applications

Environment, Sensors and Visualization

- > Impressive 3D visualization of your DYNA4 simulations
- > Comprehensive and user-extensible object library with signs, vehicles, cyclists, pedestrians, animals, etc.
- > Driving on OpenDRIVE road networks without conversion
- > Deterministic traffic to create specific scenarios with prescribed behavior, e.g. NCAP
- > Stochastic yet reproducible traffic for explorative testing, e.g. driving on highway in dense traffic
- > Sensor simulation on decision level with object lists or on perception level with signals from camera, lidar, radar or ultrasonic sensors

Workflows and Connectivity

- > Seamless integration of Simulink models, FMUs or C-code
- > Integrated test automation and parameter variation
- > Standard interfaces e.g. for CANoe, FMU, ROS
- > Integration of standalone DYNA4 runtime simulation projects into other tool environments for execution without MATLAB/Simulink
- > Continuous re-use of your tests from MIL, SIL to HIL
- > Integrated versioning and teamwork functionality
- > Model, data and results management
- > Support of all common HIL platforms

Applications

Virtual test driving throughout the entire development process from control function design to verification and validation.

Driver Assistance Systems and Autonomous Driving

- > Environment perception: Lane detection, traffic sign recognition, object detection, simultaneous localization and mapping (SLAM) etc.
- > Comfort functions: Adaptive cruise control (ACC), traffic jam assistant, parking pilot etc.
- > Safety systems: Pre-crash, front collision warning (FCW), automated emergency braking (AEB), lane keeping assistant, blind spot monitoring etc.
- > Connected and cooperative driving (Car2x)

Vehicle Dynamics Systems

- > Chassis control systems: Electronic stability control (ABS, ASR, ESC), active roll compensation, trailer stabilization, active suspension control etc.
- > Steering control: Power steering, rear-wheel steering, superposition steering etc.
- > Commercial vehicles with up to two trailers
- > Complete vehicle simulation for testing the interdependencies of networked ECUs

System Simulation and Energy Management

- > CO₂ reduction: Energy consumption prognosis for vehicles with conventional, hybrid or full electric powertrains and auxiliary units
- > Predictive energy management functions
- > Development, optimization and testing of hybrid control functions

Combustion Engines

- > Engine management functions and on-board diagnosis
- > Proof-of-concept studies during early development
- > HIL simulators for testing of engine ECUs

More information: www.vector.com/dyna4

