

Professional Real-Time Vehicle Dynamics Simulation Environment

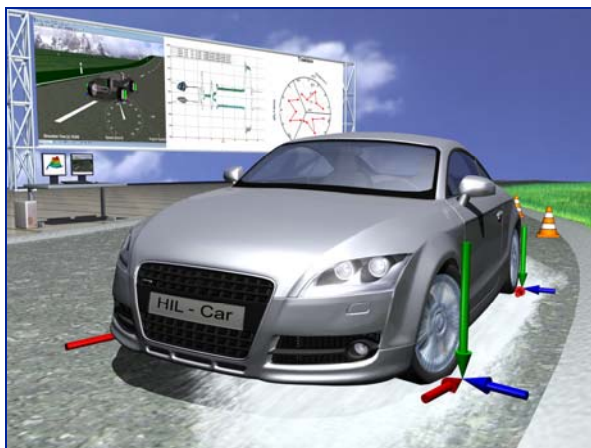
More efficiency in component and
controller development with comprehensive
vehicle dynamics simulation



Applications

veDYNA is the professional real-time vehicle dynamics simulation environment for virtual test drives. Typical applications from veDYNA range from the conceptual vehicle development at the PC to component tests in virtual or physical test rigs. The development of vehicle dynamics controllers is supported from rapid prototyping at the PC to tests in software- (SiL) and hardware-in-the-loop (HiL) environments. veDYNA is successfully applied in diverse fields of vehicle development:

- Parameter studies and optimisation of vehicle components, e.g. drivetrain concepts, steering system and axle suspension
- Handling studies and ride comfort investigations
- Driving performance and consumption calculations
- Investigation of driving stability for commercial vehicles
- Development and test of mechanical components in virtual and physical test rigs
- Model-based rapid controller prototyping
- Real-time simulation for design, test, calibration and verification of vehicle control systems, e.g. ABS, ACC and ESP, in SiL and HiL setups
- Pre-calibration of control devices on the hardware-in-the-loop simulator
- Integration tests in laboratory vehicles
- Function development and real-time tests of advanced driver assistance systems
- Virtual test drives and animation in the driving simulator



Vehicle Dynamics Analysis in Virtual Test Drives

Simulation Framework

veDYNA provides a comprehensive simulation framework designed to efficiently support all your simulation tasks achieving precise and reliable results. Different product levels and numerous model enhancements provide appropriate solutions for every user.

- **Vehicle Model**
Generic vehicle model suitable for the simulation of passenger cars, racing cars as well as trucks. Easy extension for user-specific applications.
- **3D Road Model**
Proving ground or two-lane road model with 3D layout and variable surface properties.
- **Manoeuvre Control**
Open-loop and closed-loop manoeuvre definition.
- **Driver Model**
Stable and robust driver controller, adjustable to reproduce typical human driver types.
- **Powerful Postprocessing**
Powerful postprocessing functions and graphical user interface for viewing results and generating commented simulation reports.
- **Run-Time Animation**
Run-time animation of simulation results with comfortable operation.
- **Graphical User Interface**
Graphical user interface for all important simulation tasks and guided data assignment.
- **Ready-to-Use Examples**
Pre-defined simulation models and data sets for typical vehicle types, test manoeuvres and tracks.
- **Documentation and Online-Help**
Comprehensive documentation, context-sensitive and printable.
- **Based on Matlab/Simulink**
Open Matlab/Simulink implementation for model based design and rapid controller prototyping.
- **All major Real-Time Platforms Supported**
RTW code generation for PC executables and all major real-time targets.

Features at a Glance

Vehicle Model

- Modular multi-body system with transparent architecture and easy access to all vehicle component models.
- Real-time capable multi-body axle models with hard point definition for detailed analysis of the axle design. Library of 20 common suspension types including bushings and rubber elements with up to 30 DoF per axle.
- Tabled axle kinematics. Independent definition of left & right wheel.
- Extensive axle compliance definition. Nonlinear compliance tables for elastic displacement of left & right wheel in all directions.
- Various steering system configurations, such as front and rear axle steering or independent steering. Interface for active steering systems.
- TM-Easy and Pacejka 96 tyre models. Interfaces for common CPI and STI tyre models and FTire.
- Generic front / rear / four-wheel drive with 13 DoF, elastic drive shafts, hang-on clutch. Extensive interface for external control inputs accounting for latest drivetrain developments.

3D Road Model

- Proving ground and two-lane road model with separate definition of horizontal and vertical road layout in a series of segments. Surface properties account for variable friction conditions and stochastic unevenness.
- Easy road definition via graphical user interface or automated GPS road data import.

Manoeuvre Control

- Flexible manoeuvre definition using a series of elementary manoeuvres with various open- and closed-loop control options. Defined over time / distance or event triggered.

Driver Model

- Stable and robust driver model for automatic guidance on specified target path and speed profile.
- Parametric controller to reproduce the behaviour of different human driver types.

Powerful Postprocessing

- Graphical user interface for comfortable visualisation of simulation results and comparison of multiple data sets.
- Automatic generation of commented simulation reports.

Run-Time Animation

- Run-time animation of simulation results on all supported PC and real-time platforms with the 3D-animation tool DYNAanimation.
- Various displays to highlight characteristic vehicle states.
- Programmable ActiveX interface
- Powerful options for impressive presentations of results.

Graphical User Interface

- Efficient support of the user by clearly arranged functions, commented model data, visual data check and data analysis.

Ready-to-Use Examples

- Standard manoeuvres, e.g. ISO lane change or braking on μ -split, as well as test courses of different complexity already preconfigured.
- Example parameter sets and simulation models for different vehicle types ready-to-use and as templates for user specific adjustments.

Documentation and Online-Help

- User manual, data requirements, block reference, example book, model overview.
- Printable documents
- Context-sensitive online-help

Based on Matlab/Simulink

- Matlab interface for external data assignment and script-based simulation control. Many options for automated test runs as well as programmed pre- and postprocessing.
- Standard Simulink interface for user-defined model extension and integration of control functions.

All major Real-Time Platforms Supported

- ADI, dSPACE, ETAS, Mathworks xPC, National Instruments, Opal-RT. Other targets available on request.

ve-DYNA® Product Line

ve-DYNA® Product Levels

veDYNA is available in three product levels, which are tailored for different fields of applications:

- **ve-DYNA® Entry**
Inexpensive entry into vehicle dynamics simulation with a ready-to-use Windows executable. Easy model parameterisation via intuitive user interface and readily available model data.
- **ve-DYNA® Light**
The step into HiL simulation with Simulink model configuration and code generation for real-time applications.
- **ve-DYNA® Standard**
The expert tool with detailed model definition, including a library of real-time capable multi-body axle models. For maximum flexibility in high-level development and application tasks.

ve-DYNA® Add-Ons

veDYNA models can be supplemented with the following add-ons:

- **Traffic Environment**
Simulation of the traffic environment with fully configurable test scenarios including fellow cars, static obstacles and sensors.
- **Truck & Trailer Extension**
Model enhancements for the simulation of commercial vehicles and vehicle-trailer combinations, such as multiple rear axles, twin tyres and trailer model.
- **Suspension Toolbox**
Automatic generation and evaluation of axle model parameters, interactive modification and concept studies of axle design variants.
- **Advanced Road & Driver**
Definition of very complex road layouts and exact calibration of the driver behaviour with a fully parametric driver model.

Your Benefits at a Glance

- **Proven Technology**
Reliable results due to high precision, proven models and numerical stability.
- **Efficiency Gain**
Universal software environment applicable from concept study to hardware test.
- **Great Flexibility**
Open and modular model architecture implemented in Matlab/Simulink provides extensive interface for test automation and user specific model extensions.
- **Easy Integration in Existing Processes**
Standard simulation environment for model based design and rapid controller prototyping.
- **Extendibility**
Smooth operation with other TESIS DYNAware tools for the simulation of the complete virtual vehicle.
- **Independency**
All major real-time platforms supported. The choice of hardware is up to you.



Configurable Traffic Situations for Test of Distance Control Systems

All DYNAware products are continuously being enhanced and improved according to requirements of our customers. A team of specialists is available to help you realise individual and specific solutions. Get more information at <http://www.thesis-dynaware.com> Write an e-mail to thesis.dynaware@thesis.de or call us: +49 89 74 73 77-0.

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