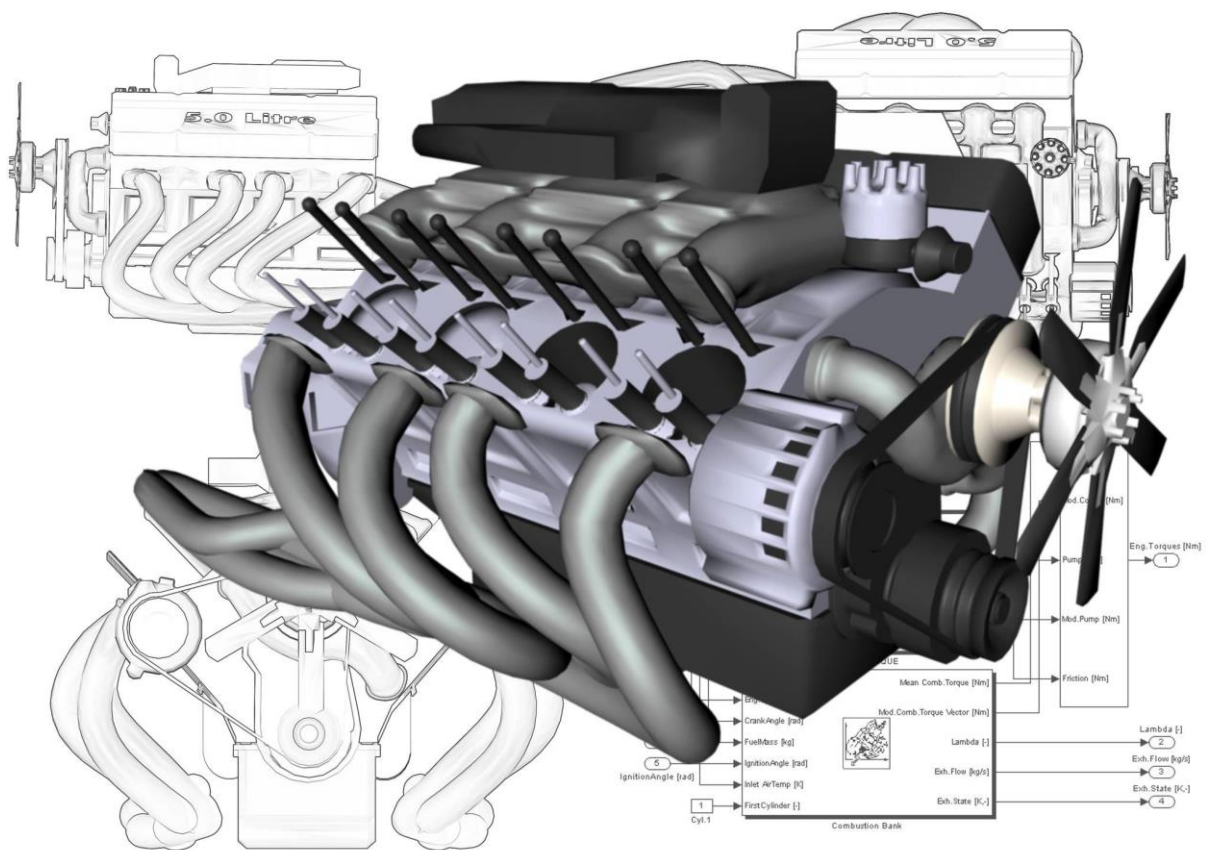


enDYNA

The virtual engine environment for function design and test during the entire development process of electronic control units

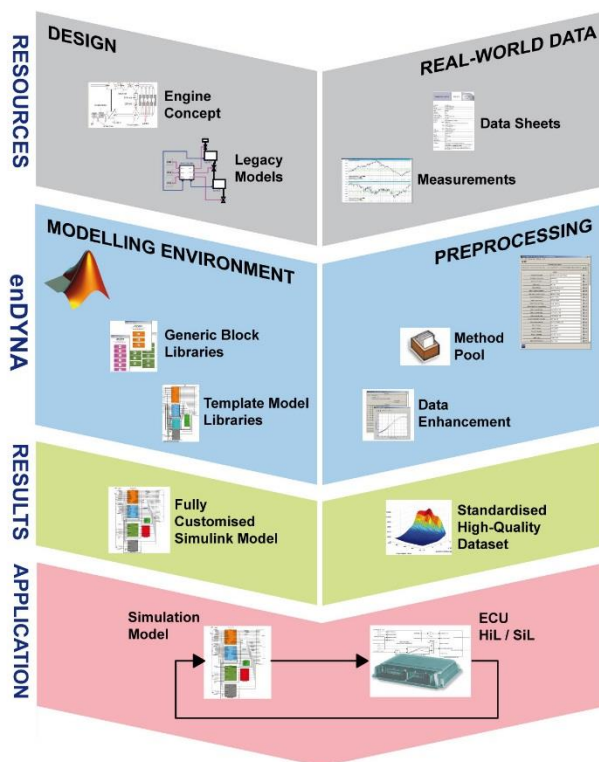


Professional Real-Time Simulation of Combustion Engines

Applications

enDYNA is the professional software environment for real-time simulation of combustion engines. enDYNA supports you during the complete development process of electronic control units in model-in-the-loop, software-in-the-loop and hardware-in-the-loop applications:

- Proof-of-Concept studies
- Development and test of engine control algorithms and on-board-diagnosis
- Controller and component tests in hardware-in-the-loop test benches
- Integration tests in laboratory vehicles
- ECU pre-calibration



The enDYNA Simulation Framework

Simulation Framework

enDYNA provides a comprehensive simulation framework designed to efficiently support you during all simulation tasks for maximum efficiency while achieving precise and reliable results.

- **Engine Models**
Real-time capable models of all common engine types comprising crank angle synchronous combustion, gas path, fuel system, cooling system, drivetrain, driver and soft-ECU.
- **Simulink Libraries**
Fundamental engine and vehicle components for all common types of combustion engines are provided as generic Simulink library modules to model almost unlimited engine configurations.
- **Powerful Model Parameterization Tool**
Significant simulation results require not only a very good model, but also a high quality parameterization. The enDYNA Preprocessing is a powerful tool to calculate a consistent set of model parameters from available standard data.
- **Ready-to-Use Examples**
Ready-to-use example models and parameters for all engine types, as well as preconfigured Matlab scripts and tables for typical driving manoeuvres and driving cycles.
- **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

Engine Models

- Mass flow based mean value models (enDYNA basic) or thermodynamic models with detailed gas dynamics and zero-dimensional combustion process simulation (enDYNA Thermo) in real-time.
- Optional extension of engine models by advanced models of a cooling system, an exhaust system or an electric power net system. All interfaces and interactions are already prepared by enDYNA standard modules for an easy integration.
- Open and modular architecture allowing easy access to model components and integration of own modules.
- Various possibilities for malfunction simulation, e. g. misfires.
- Driver model designed to retrace predefined driving cycles.
- Soft-ECU to take over basic engine control functions when no external ECU is connected.

Simulink Libraries

Flexible and fast creation of numerically stable engine models from proven and well documented modules.

Powerful Model Parameterisation Tool

- Using data that is readily available saves time and money – no delay or extra costs due to special measurements.
- Dedicated functions ensure parameter consistency and eliminate measurement errors. No expert knowledge necessary. No need for manual parameter adjustments.
- Data filter and fit tool operated via graphical user interface. Easy, highly flexible and transparent elimination of measurement errors for optimum parameter calculation results.
- Management of various preprocessings for reproducible results and comparison.

Ready-to-Use Examples

- Example models for all common engine types. Fast and easy modelling by using example models as templates.
- Example preprocessings and measurement data for a quick start and easy learning. Examples can be used as templates for own preprocessings.
- Matlab scripts and tables for typical driving manoeuvres are readily prepared, also serving as templates for user defined scenarios.

Documentation and Online-Help

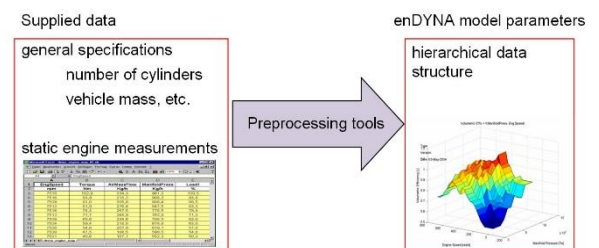
- User manual, data requirements, block- and function reference, tutorials, model overview.
- Printable documents
- Context-sensitive online-help

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

dSPACE, ETAS, Mathworks xPC, National Instruments. Other targets available on request.



Preprocessing Concept

en-DYNA® Product Lines

enDYNA basic

Mean value mass flow based engine models:

- **enDYNA basic FDI Package**
Simulation of naturally aspirated spark ignition engines, with direct or port fuel injection.
- **enDYNA basic FDITC Package**
Simulation of spark ignition engines, with direct or port fuel injection, with or without turbocharger.
- **enDYNA basic CRTD Package**
Simulation of turbocharged diesel engines with a common rail system or unit injectors.

enDYNA Thermo

Thermodynamic engine models with zero-dimensional combustion simulation:

- **enDYNA Thermo CRTD**
Simulation of diesel engines with a common rail system or unit injectors, with or without turbocharger. Including exhaust system with oxidation catalytic converters, SCR catalyst and particulate filter.
- **enDYNA Thermo FDITC**
Simulation of spark ignition engines with direct or port fuel injection, with or without turbocharger. Including multiple injections, fully variable valve train and Exhaust System Advanced.

enDYNA Add-Ons

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

- **Cooling System Advanced**
Dual-circuit cooling system with fans, heat exchangers and thermostats.
- **Exhaust System Advanced**
Exhaust system with catalytic converters, secondary air path and lambda sensors.
- **enDYNA Hybrid Toolbox**
Mechanical and electric powertrain components
Pre-configured examples (mild to full hybrid)
Standard driving cycles.

Your Benefits

- **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.

Contact us

All TESIS DYNAware products are continuously being enhanced and improved according to requirements of our customers. A team of specialists is available to help you realize individual and specific solutions.

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