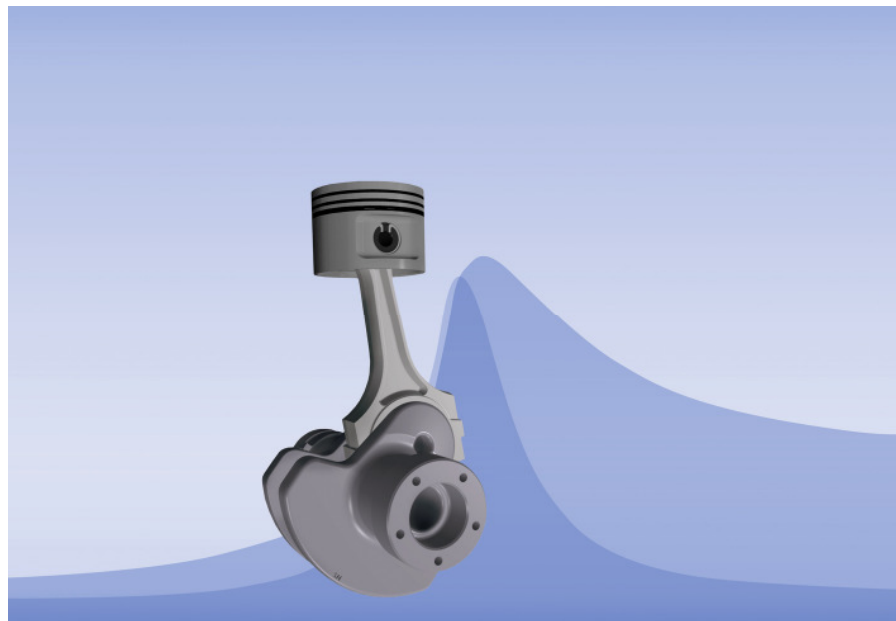


DYNA4 Engine THEMOS®

Real-Time Engine Simulation

Accelerating the Conceptual Design
of Internal Combustion Engines
and the Development and Testing
of Electronic Control Units



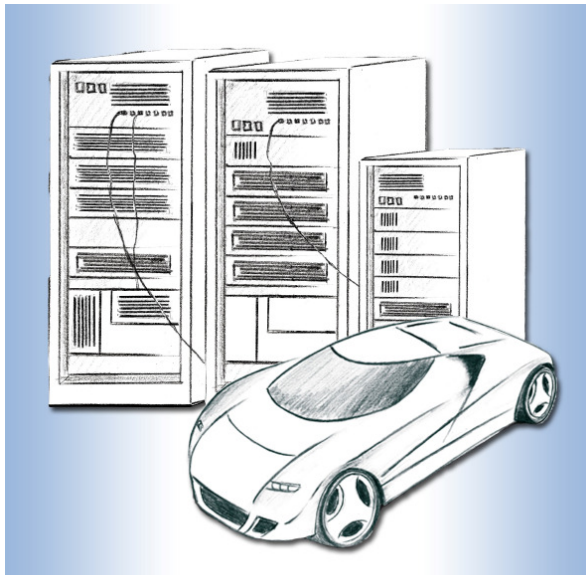
Applications

DYNA4 Engine Themos provides the plant models of realistic engine behavior, covering the whole range of engines powered by gasoline, diesel, and alternative fuels. Model your series-production engine, special high rev motorsports, heavy-duty or marine engine and use it for

- The conceptual design phase of engine development
- Model based controller design
- ECU software and hardware tests in HIL systems
- ECU pre-calibration

DYNA4 Engine Themos is, for instance, used in

- Design and control of supercharging, variable valve actuation, HCCI, and EGR
- Test and development of controllers for exhaust gas aftertreatment
- Hardware-in-the-loop tests for engine controllers with cylinder pressure sensing
- Feasibility studies and evaluation of engine designs



Model Features at a Glance

Engine Models

- Modular thermodynamic model of the gas paths. Separate modules for compressor, turbine (VGT, waste gate, multi-entry, etc.), and mechanical coupling. Easy configuration of various supercharging concepts, e.g. two-stage and mechanically or electrically supported supercharging, acoustic theory pipe model for variable length intake manifold.
- Time evolution of in-cylinder gas state calculated from zero-dimensional combustion model, the heat transfer through the cylinder walls and the piston kinematics. Different heat release models provided (e.g. Arrhenius, Vibe).
- Exhaust gas recirculation (internal and external). Physical model approach inherently reveals the effects of charge dilution on combustion and emissions.
- Fully variable valve train for exact control of in-cylinder charge. Individual or global control of valve lift and timing.
- Exhaust catalysts (DPF, DOC, TWC, LNT, SCR) for the development and test of exhaust gas aftertreatment control.
- Soft-ECU: Configurable and extendable block set to provide the desired functionality for customized engine models.

Block Based Modeling

- Library modules of elementary engine components are provided for cylinders, turbochargers, pipes, sensors, fuel system, exhaust gas aftertreatment, cooling system, etc.
- Customizable level of detail. Libraries with different model approaches (combustion, gas properties, heat transfers, etc.).
- Clear physical interfaces, standardized block and signal names for transparent and easy-to-understand models
- High accuracy and reliability due to plausibility checks at initialization and during runtime

Quick Start

Model Parameterization

- Powerful Preprocessing framework for easy and straightforward parameterization even of complex models
- Only standard engine data that is readily available is required. No delay or extra costs due to special measurements.
- Parameter consistency is ensured and measurement errors are eliminated. No need for manual parameter adjustments.
- Reproducible and reliable results
- Based on Matlab/Simulink: Integrate your own calculations

Ready-to-Use Examples

- Examples of diesel and gasoline engine models. Fast and easy modeling by using the examples as a starting point when creating your own models.
- Example parameterization and measurement data for a quick start and easy learning

Simulation Environment Advantages

Simulation Framework DYNA4

- Convenient management of simulation models and data
- Complete integration of your own Simulink models
- Uniform operation, independent from simulation target
- Customizable environment
- Easy driving cycle simulation using included vehicle and driver models
- Performs with all TESIS DYNAware products

Seamless Integration with Matlab/Simulink

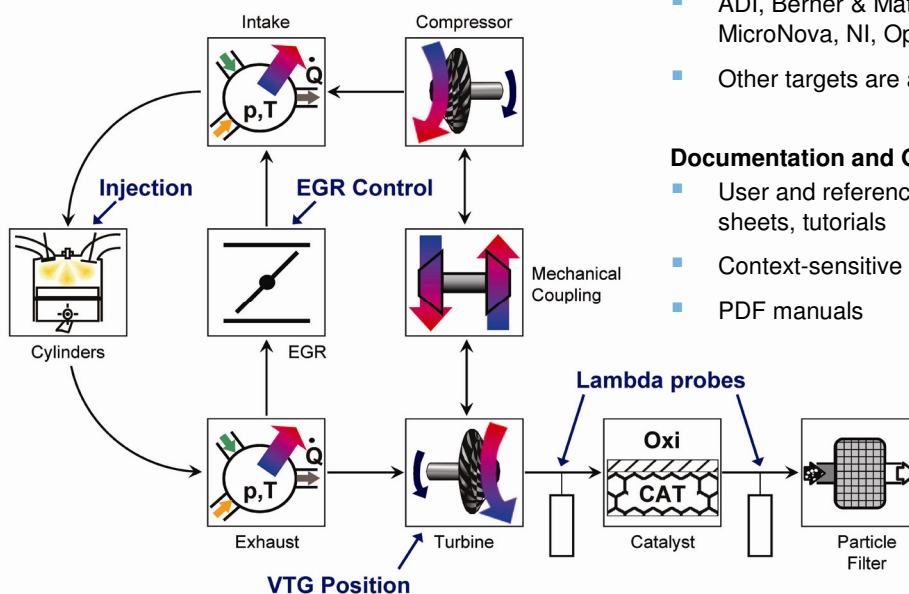
- Matlab interface: Powerful scripting for automated simulation control, model parameterization, result analysis, and report generation.
- Standard Simulink interface for user-defined model extension and integration of control functions.
- Use DYNA4 Engine Themos Libraries for your plant mode

All major Real-Time Platforms supported

- ADI, Berner & Mattner, dSPACE, ETAS, MicroNova, NI, Opal-RT, xPC
- Other targets are available on request

Documentation and Online-Help

- User and reference handbooks, data requirements sheets, tutorials
- Context-sensitive online-help
- PDF manuals



Your Benefits

Reliability

- Solid professional software, based on thorough modeling and real-time expertise
- Successfully employed in numerous projects

Cost Reduction

- Use one model throughout the ECU development process
- Software validation at early stages of development

Flexibility

- Compatible with all hardware platforms
- Open model structure in Matlab/Simulink permits arbitrary engine layouts
- Smooth integration of legacy models and application specific adjustments

Easy to Use

- Fully integrated in Matlab/Simulink
- Intuitive engine modeling
- Ready-to-use examples
- Comprehensive documentation

TESIS DYNAware and IAV Experience

DYNA4 Engine ThemOS for real-time simulation of combustion engines is long-term simulation know-how combined with comprehensive modeling and customer project experience – the result of a close cooperation of TESIS DYNAware and IAV engineers.



Contact and further Information

DYNA4 Engine ThemOS is the reliable solution for advanced engine simulation. Our specialists are available to support you in the commissioning and application of your engine model. For further information, please visit www.tesis.de/themos.

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