DYNA4
Open Simulation Framework with Flexible Support for Your Work Processes and Modular Simulation Model Library
DYNA4 Concept

DYNA4 is an open and modular simulation framework for efficient working with simulation models in the vehicle development process. You can seamlessly include your own models into the framework and combine them with models from the TESIS DYNAware library to create an integrated solution according to your application.

In accordance with the modular approach, DYNA4 consists of two main parts:

**DYNA4 Framework**

This flexible framework for transparent model and data management, documentation, automation, result management and visualization supports your simulation and testing processes efficiently. In order to obtain an optimum solution according to your requirements, your work processes can be represented in DYNA4, guiding the user step by step.

- For more efficiency, transparency, traceability and reproducibility.
- Support for teamwork in separate user groups with various settings for experts and simplified GUIs for model users.
- Consistent management of models, data, simulations and results in every process step.
- Provides powerful tools for automated simulation, model comparison and visualization.
- Allows flexible adaptation to your work processes
- Interfaces to your work environment for test automation, version control systems, reporting and MBS simulation tools.

**DYNA4 Model Repository**

The open DYNA4 Model Repository enables you to manage and parameterize your simulation models via comfortable user interfaces. You can stock the Model Repository with your own models or use proven TESIS DYNAware simulation models to perform virtual test drives on a PC or HIL environment. Thanks to the modular DYNA4 model concept, your models may be fully integrated into DYNA4, with identical GUI, parameterization process, data logging and all process-supporting functions.

- Assemble your virtual vehicles for test drives on a PC or HIL environment.
- Integrate your own simulation model seamlessly and take advantage of all framework functions.
- The Model Repository is furnished with a basic DYNA4 model library.
- You can add advanced DYNA4 simulation models (for more information, please see page “DYNA4 Product Versions & Packages” below)

Connection to Your Work Environment
DYNA4 can be used for a wide range of applications, depending on the models integrated. This is an overview based on the models available in the DYNA4 library. Further applications with customer models are possible.

Applications throughout the E/E development process
- Model-based design, function development.
- Testing and pre-calibration in SIL and HIL environments.
- Fail-safe and functional tests, including evaluation of vehicle response and drivability.
- Components-in-the-loop in physical or virtual component test rigs, e.g. for engine transmission, suspension, steering, tires and dampers.
- Fast parameter studies and optimization of vehicle components, e.g. drive train concepts, steering system and axle suspension.
- Fundamental analyses and variant studies of single or interconnected vehicle controllers or components.

Driver assistance systems
- Radar, ultrasonic and camera-based systems.
- Integrated safety systems, e.g. adaptive cruise control, lane change assistant and collision warning.
- Testing of camera-based systems in the lab using 3D graphics and a virtual environment, e.g. lane departure warning and traffic sign recognition.
- Testing of other assistance systems, such as blind spot detection, pedestrian protection, parking assistant, adaptive headlights, bends lighting.

Vehicle dynamics and drive train development
- Standard test maneuvers using a virtual prototype.
- Optimization of vehicle dynamics performance.
- Active safety systems such as global chassis control, ESP/ESC or trailer stabilization.
- Steering systems: design and testing of electric power steering and active steering systems.
- Ride comfort: air suspension, active damper control.
- Drive systems, e.g. active stability control, modern 4WD configurations or active torque differentials.
- Roll over protection, roll control, sky hook control, load leveling.
- Driving simulators

Engine design and control
- Evaluation of conceptual design for gasoline, diesel and alternative fuels.
- Function development and calibration of controllers, e.g. for supercharging, variable valve actuation, EGR or HCCI.
- HIL tests, e.g. for engine controllers with cylinder pressure sensing or controllers for exhaust gas aftertreatment.
- Car engines, motorsport, heavy-duty or marine engines.

Commercial vehicles
- Stability tests in critical driving situations, e.g. roll-over protection, skidding prevention.
- Safety analyses of commercial vehicles subject to road disturbances, e.g. lane grooves and patches of different road surfaces.
- Pre-calibration of control devices on the hardware-in-the-loop simulator.
- Development and hardware-in-the-loop testing of vehicle dynamics controllers for truck and trailer stabilization.
- Integration tests in laboratory vehicles.
- Homologation of ECUs for commercial vehicles.

Advanced powertrain development and energy management
- Fuel efficiency simulation for hybrid (HEV), electric (EV) or conventional vehicles.
- Analysis and optimization of operating strategies for fuel efficiency and driving performance.
- Function development, e.g. for hybrid drive torque coordination, engine start/stop or regenerative braking.
- Navigation data-based, predictive functions, e.g. for battery SOC management.
Open and Connective Simulation Framework

Modular and connective simulation framework

- **Enhance the usability of your Simulink models**
  Open and modular model architecture in Matlab/Simulink with transparent signal flow via extensions to the Simulink bus.

- **Benefit from all DYNA4 framework functions**
  Complete and seamless integration of your own Simulink models into the DYNA4 Model Repository; other models can be connected as an S-function.

- **Connect further useful software**
  Generic API to connect third party applications via XML RPC, e.g. to run DYNA4 from test automation software.

- **Free choice of the HiL system**
  TESIS DYNAware supports all common HiL platforms.

Flexible adjustment according to your needs

- **Individual model architecture**
  Adaptation to your needs or creation of a complete individual model structure.

- **User-defined model extension and integration of control functions**
  The standard Simulink interface enables you to work with your own models as you are accustomed.

- **Represent your work processes**
  Flexible integrated task mechanism for automated simulation control, model parameterization, parameter variation, result analysis and report generation.

- **Do you need even more flexibility?**
  TESIS DYNAware experts can provide any integration and engineering services for special requirements. (Please see page “Engineering” below)
Highly Functional for your Simulation

Automated simulations to compare numerous variations

- **Create and control various simulation routines**
  Powerful tools to create customized simulation tasks. Example of a task sequence: start with automated driving maneuvers, then perform interactive analyses and save results as PDF files.

- **Optimization via parameter studies**
  Easy-to-use GUI to run parameter variations.

- **Simulate standard maneuvers straight out of the box**
  Preconfigured tasks for standard simulations, e.g. ISO maneuvers and standard emission test cycles.

Analyze and present your simulation results

- **Automated report generation**
  Easily trace your parameter changes and their impact on simulation results utilizing automated, customizable reports.

- **Interactive result visualization**
  Analyze your simulation results and zoom in interesting details or compare relevant graphs.

- **Illustrative animations for your supervisor**
  Design descriptive presentations of your simulation results including 3D animation to make the results easily understandable.

Traceability and reproducibility

- **Efficient project organization for reproducibility**
  Organize your models, data, scenarios and results in DYNA4 simulation projects.

- **Central model management to track changes**
  Centralized model and data administration within DYNA4 allows versioned model management.

- **Review your former simulations**
  Results automatically contain software revision information and all data used for the simulation.

Easier working with simulation models

- **Transparency and Overview**
  Through clearly structured model architecture.

- **Quicker simulation results based on pre-configurations**
  Select prepared simulation routines and model configurations (For more information, please see next page).

- **Easy change tracking**
  Visual comparison of Simulink models via Medini Unite.
Teamwork Functions for more Efficiency

Teamwork with different roles

- **Greater flexibility for experts**
  Experts can define the model architecture with its interdependencies. On this basis, DYNA4 automatically generates GUIs for the model users.

- **Efficient application for simulation users**
  Users can select from a pre-designed model configuration, run various automated simulation tasks and generate automated plots or demonstrative animations.

Examples of possible roles in DYNA4

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Companywide teamwork

- **Provide approved models on a central server**
  Global version-controlled Model Repository offers users easy use of approved models in their local database (sandbox).

- **Support of the whole development process**
  Use the same models from function development up to HiL tests. Share your models or virtual prototypes companywide.

- **Easy tracking of model changes**
  Bidirectional comparison of the centrally managed Model Repository with the currently used Simulink model component in the local database.

- **Interactions between different development areas**
  DYNA4 can be used for various applications – the simulation models included can therefore be used across all departments.
DYNA4 Packages are ready-to-use combinations of the DYNA4 Framework and selected DYNA4 Elements. According to the modular concept, you have the flexibility to include your models or add any additional DYNA4 Element.

**DYNA4 Framework**

The core Framework is the base for any DYNA4 Package or your individually stocked Model Repository. If you want to optimize the working process with your own models, the DYNA4 Framework is the ideal solution for you.

**DYNA4 Car Professional**

Advanced vehicle dynamics simulation. The full virtual vehicle for chassis and drive train ECU development.

**DYNA4 Commercial Vehicles**

Full vehicle and dynamics simulation for controller development of trucks, truck-trailer combinations such as EuroCombis, busses and specialty vehicles.

**DYNA4 Advanced Powertrain**

Simulation of drive train configurations in hybrid, electric and conventional vehicles. Supporting function development for powertrain controllers and analysis of fuel consumption and driving performance.

**DYNA4 Driver Assistance**

Simulation and visualization of traffic, sensors, road, lane markings and test vehicle. Supporting development and test of advanced driver assistance systems.

**DYNA4 Test Driver**

Simulation environment with a virtual test driver and 3D road model. Use your own vehicle model for virtual test drives, e.g. ISO maneuvers, emission test cycles or individual tests at driving limits.

**DYNA4 Engine Professional**

Thermodynamic engine models for gasoline or diesel engines. Supporting test and function development of advanced engine control units.

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Element included in the package

DYNA4 Engine Professional contains either gasoline or diesel models.
Engineering

What's your application?
The DYNA4 model library offers a wide range of applications, with the possibility of adding new ones with your own models.

Please contact us. We will be glad to offer professional advice for the optimum solution. It can be based on a DYNA4 Package or an individual solution with the DYNA4 Framework.

Training is included
To take full advantage of optimized processes, we recommend starting with a training course.

Benefit from our integration and engineering services
- Simulation model support: model integration, model adaptations, data preprocessing.
- Adaptation of DYNA4 to your processes, e.g. special GUIs, views and reports.
- Development of customized simulation models and tools.
- Connection of DYNA4 to your work environment, e.g. test automation, requirement management, co-simulation.
- Model parameterization for various vehicle controllers.

Your Benefits

Speed up your innovation process
- Powerful automation tools accelerate routine jobs.
- Administration tools for transparent and efficient variant handling.
- Consistent handling at any process step.
- DYNA4 model library offers a wide range of proven models with different levels of detail and ready-to-use examples.

Flexibility
- One framework can be used for various applications; the appropriate models can be changed with a few mouse clicks.
- Smooth integration of your own models with easy adjustment to your needs.
- The open structure of the Model Repository allows you to administer your individual model stock.
- Free choice of hardware platform from a PC to all major HIL systems.
- Framework based on Eclipse and open for your enhancements.
- Interfaces to connect to your environment, e.g. version control systems, MBS tools or reporting.

Cost reduction
- Use the same simulation software to support appropriate model depths for all stages throughout the control unit development and testing process.
- Simulation knowledge can be focused.
- Reduction of prototype costs through early testing on a PC.

Read more in our customer project reports on our website: www.tesis-dynaware.com/customers

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