LS-DYNA and more

FINITE ELEMENT SOLUTIONS

DYNAmore GmbH

DYNAmore GmbH

DYNAmore GmbH is the largest distributor of the LS-DYNA simulation software worldwide. We also offer a full complement of services to our software solutions: expert support in all areas of application for the LS-DYNA and LS-OPT software packages and FEM calculation services as well as general consulting on any questions concerning structural dynamics. What is more, our fields of expertise include pilot and development projects for simulating nonlinear dynamic problems, software development for solver technologies and simulation data management as well as consulting and support for modern, massively parallel computer systems.
We are proud that more than 800 customers, both in Europe and abroad and both from industry and academia trust our expertise, including numerous automotive manufacturers and suppliers. DYNAmore's head office is located in Stuttgart, but we also have offices in Berlin, Sindelfingen, Wolfsburg, Dresden, Langlingen and Ingolstadt and subsidiaries in Sweden, France, Italy, Switzerland and the USA.

Portfolio

- Software solutions
- Method development
- Support and consulting
- Engineering services
- IT solutions for CAx and data management processes
- Training and information sessions
- Conferences

Facts

- Approx. 150 employees
- Subsidiaries in Germany, Sweden, Italy, France, Switzerland and the USA
- Offices in Ingolstadt, Dresden, Berlin, Langlingen, Wolfsburg, Linköping, Gothenburg, Turin, Versailles, Zurich and Dublin/Ohio
- 5 service centers at customers' sites
- More than 800 customers from industry and academia, both in Europe and abroad (including many OEMs)
- Worldwide use of our ATD models
- FEM experience since the early 1980s
- Ongoing development of LS-DYNA and LS-OPT

LS-DYNA

LS-DYNA is one of the world's leading finite element software systems. It is used for mathematical simulation of profoundly nonlinear physical problems in industry and research. LS-DYNA is suitable for investigating the phenomena of structural-dynamic problems such as large deformation, material failure and complex contact conditions. Typical areas of application for the solver are:

- Crashworthiness
- Passenger safety
- Metal forming
- Collision and drop tests
- Penetration problems
- Perforation problems
- Fluid-structure interaction
- Thermal-mechanical coupling
- Explosion
- Impact

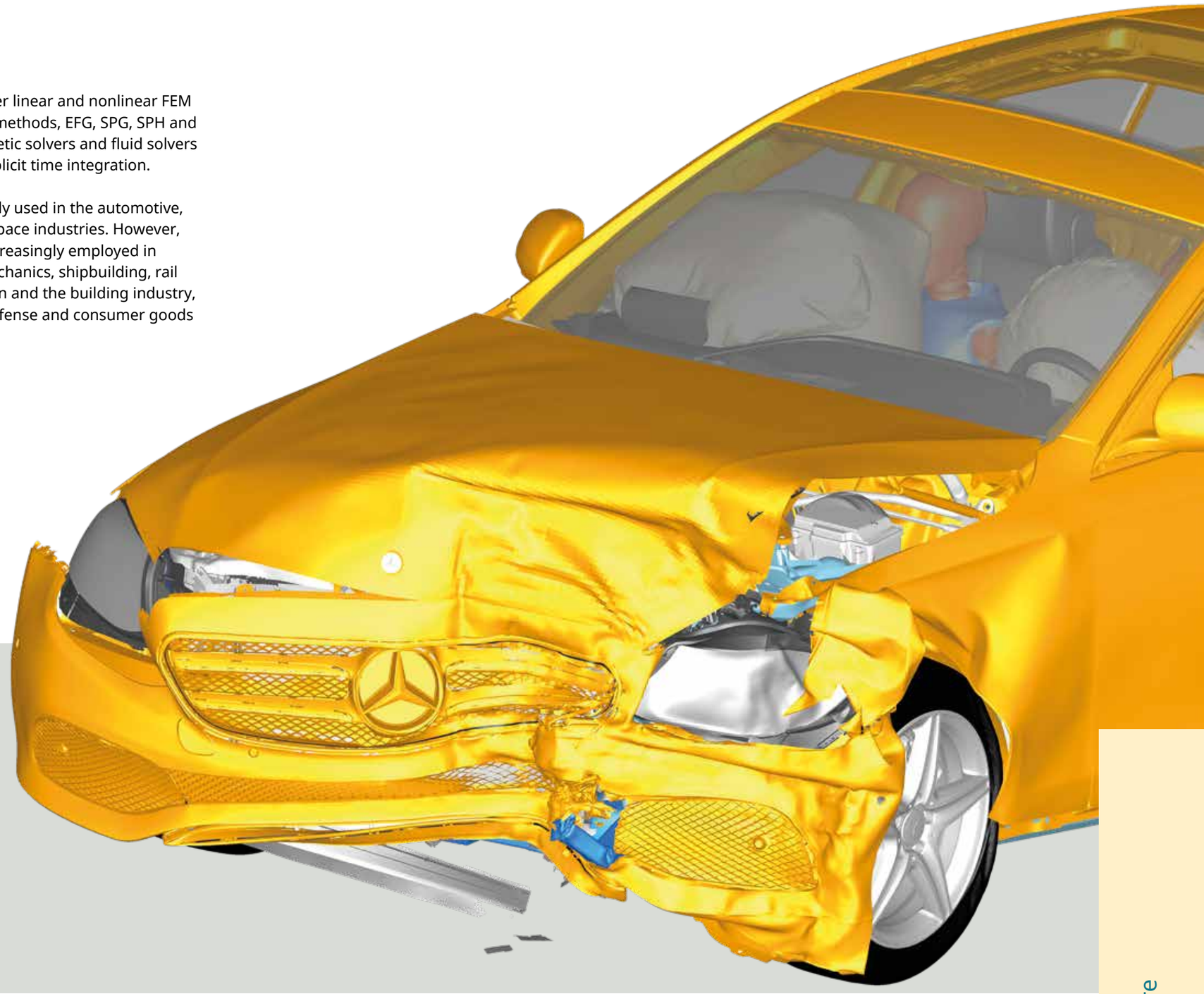
In addition, we offer linear and nonlinear FEM as well as particle methods, EFG, SPG, SPH and DEM, electromagnetic solvers and fluid solvers for explicit and implicit time integration.

LS-DYNA is primarily used in the automotive, aviation and aerospace industries. However, LS-DYNA is also increasingly employed in the fields of biomechanics, shipbuilding, rail vehicle construction and the building industry, as well as in the defense and consumer goods industry.

One-Code-Strategy

One of LS-DYNA's unique selling points is the One-Code-Strategy. This allows many features to be combined with each other, frequently making effective cross-process simulation viable. This is due to seamless integration of different solution algorithms, requiring the following software properties:

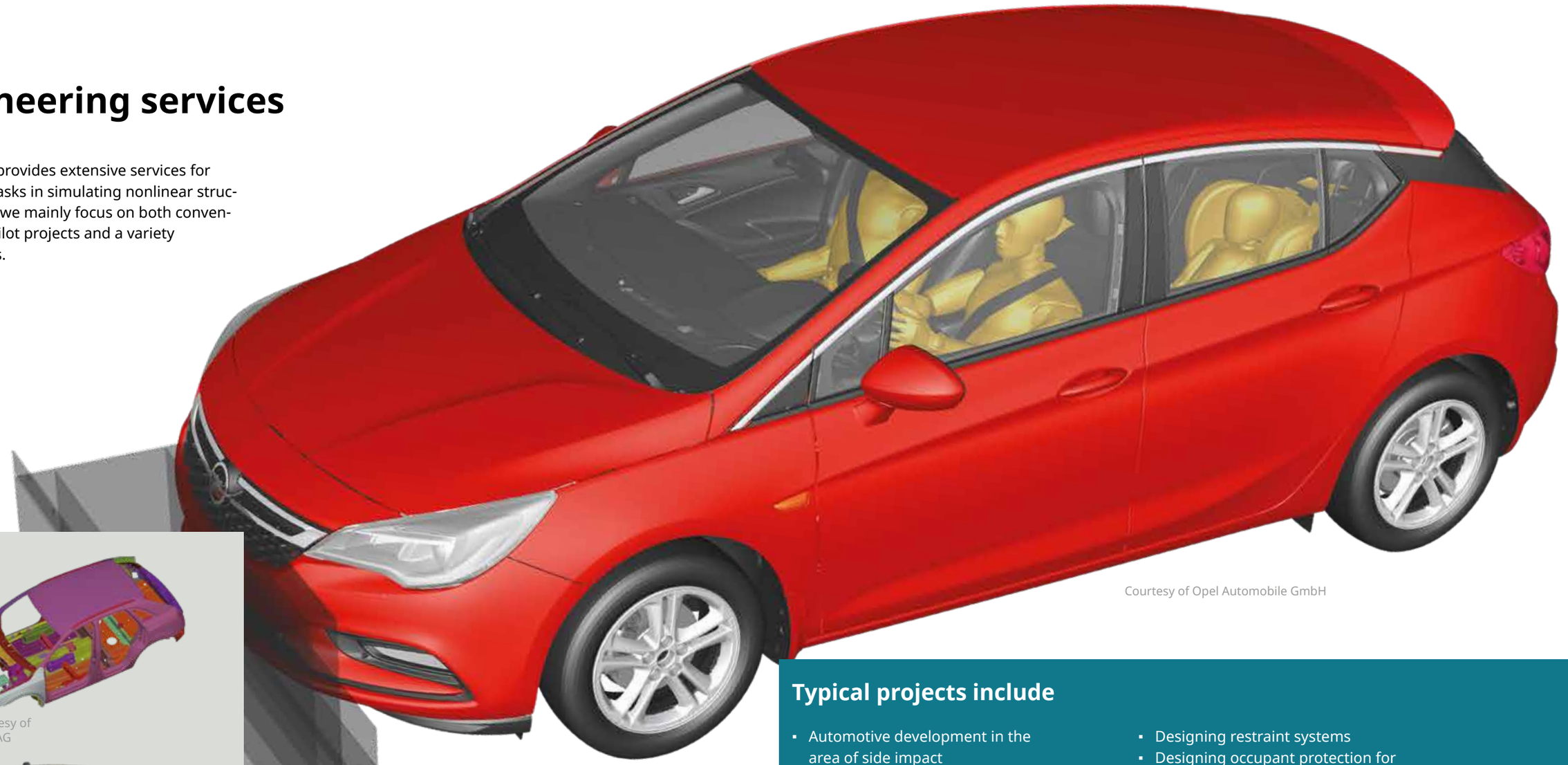
- Multi-physics
- Multi-stage
- Multi-processing
- Multi-scale



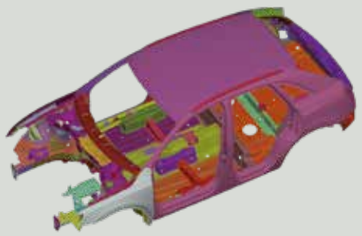
Courtesy of Daimler AG

Engineering services

DYNAmore provides extensive services for numerous tasks in simulating nonlinear structures. Here, we mainly focus on both conventional and pilot projects and a variety of industries.

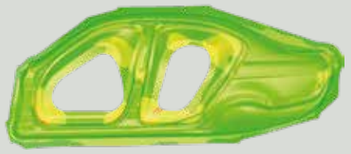


Courtesy of Opel Automobile GmbH



Courtesy of
Audi AG

Courtesy of
Ford Forschungszentrum Aachen GmbH



Courtesy of
BMW Group

Typical projects include

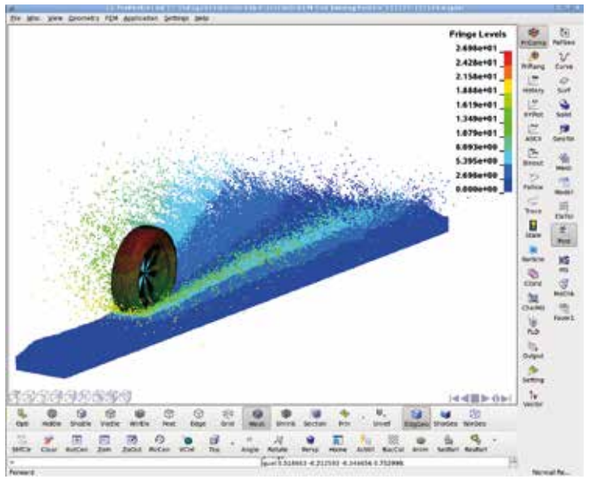
- Automotive development in the area of side impact
- Automotive development in the area of pedestrian protection
- Automotive development in the area of frontal impact
- Automotive and aerospace development of seat models
- Simulations for designing drivers' cabs for utility vehicles
- Designing a brake for freight trains
- Designing child seats
- Research work in biomechanics
- Designing presses and tools for deep-drawing
- Designing restraint systems
- Designing occupant protection for military vehicles
- Seat design for aircraft seats
- Designing explosion chambers for removing weaponry
- Designing crash barriers to achieve optimum absorption of energy in collisions
- Modeling injuries in human-robot interaction
- Developing active hood systems for pedestrian protection
- Developing seats to minimize whiplash injuries

LS-PrePost

The pre- and postprocessor LS-PrePost can be used to modify input decks and visualize the results computed in LS-DYNA. An intuitive graphical interface makes the program extremely user-friendly. LS-PrePost benefits from further ongoing development and improvements. This allows quick and uncomplicated integration of the newest trends and developments. No separate license is required for LS-PrePost – the program can be used together with LS-DYNA.

Scope of functions

- Import of Nastran, IGES, VDA, I-DEAS-Universal and Step files
- Print formats: PNG, TIFF, JPG, BMP, PCX, PS, PSIMAGE, GIF, VRML2
- Video formats: MPEG, AVI
- Command line interface
- Loading and editing of LS-DYNA keywords

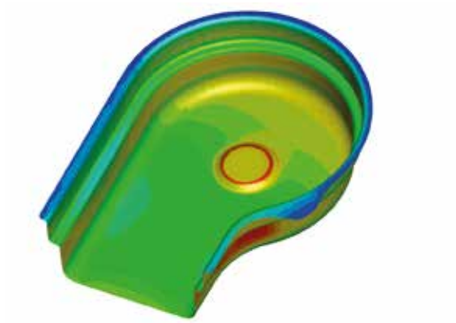


DYNAFORM

DYNAFORM from eta is an integrated pre- and postprocessor for forming processes. It reduces the time needed for preparation and consequently the costs incurred for the tooling design and the development cycle. DYNAFORM impresses with its ease of operation and numerous automated functions. This means simulation setup is fast, even in the case of complex forming processes. Furthermore, new tool designs can be created and existing designs can be imported.

Features

- Auto setup
- Automatic mesh generation
- Drawbead definition
- Process definition
- Automatic contact definition
- Tailor-welded blanks modeling
- Range of functions can be expanded



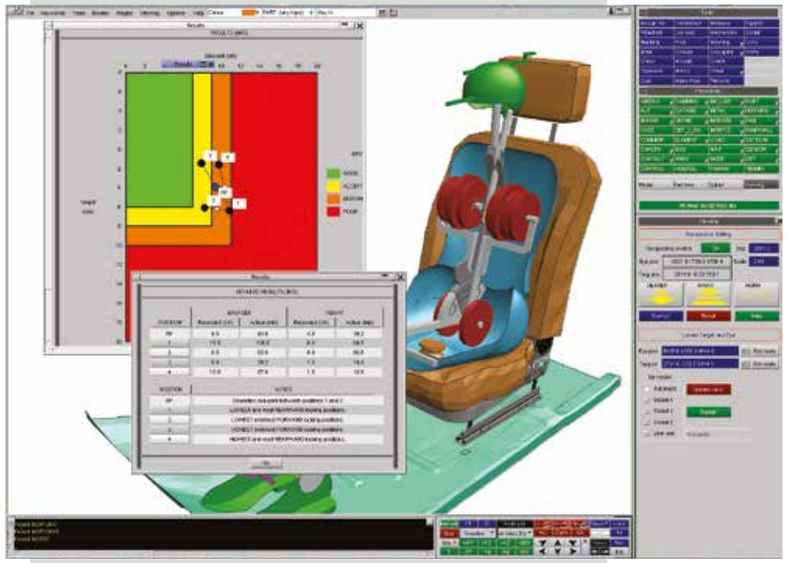
Courtesy of Egro Industrial Systems AG

PRIMER

Oasys PRIMER from Arup is a preprocessor developed exclusively for LS-DYNA. One of the numerous advantages is that all data from the keyword file are interpreted and no data can be accidentally lost or corrupted.

Benefits

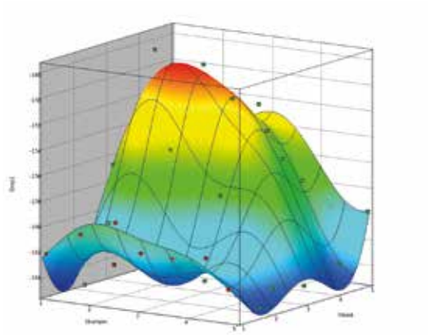
- Data integrity
- Easy to find and fix modeling errors
- Saves CPU and operating time
- Easy and quick to access all LS-DYNA data
- Rapid understanding of the model structure
- Special tools, such as:
  - Spot weld generation
  - Airbag folding
  - Seatbelt fitting
  - Mechanism (e.g. for seat adjustability)
  - Replacement of parts, etc.
- Easy to learn and operate
- Reduces time spent on assembly and modifications
- Increases number of fault-free LS-DYNA runs
- Multiple users can work on different components at the same time



LS-OPT

LS-OPT is LST LLC‘s standalone program for optimization. It is eminently suitable for resolving highly nonlinear optimization problems and therefore ideal for use in combination with LS-DYNA. It is however possible to combine LS-OPT with any other software package at any time. Multidisciplinary problems can thus also be solved. The program is suitable for solving system identification problems and for stochastic analysis as well. The main application areas for LS-OPT are:

- Optimization
- System- and parameter identification
- Design exploration
- Sensitivity studies
- Robustness analyses

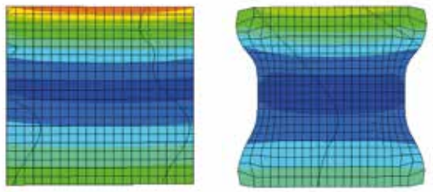


LS-TaSC

The LS-TaSC topology and shape computation tool is developed by LST LLC. It focuses on topology optimization of nonlinear problems involving dynamic loads and contact conditions. Modern mathematical programming methods allow multi-disciplinary topology optimization of huge problems including static, impact and NVH load cases. Additionally free surface design is available to redesign solid parts with the objective of a uniform stress distribution.

Applications

- Topology optimization
- Topometry optimization
- Free surface design



GENESIS

GENESIS is a fully integrated software package for finite element analysis and design optimization, which has been developed by VR&D. The analytical capabilities include:

- Statistical, normal modes
- Analysis of direct and modal frequency
- Random response analysis
- Heat transfer
- Calculating system buckling

Design optimization is based on the Advanced Approximation Concept for identifying an ideal design efficiently and reliably. Actual optimization is achieved with the tried-and-tested DOT and BIGDOT optimizers, also available from VR&D. Design capabilities include:

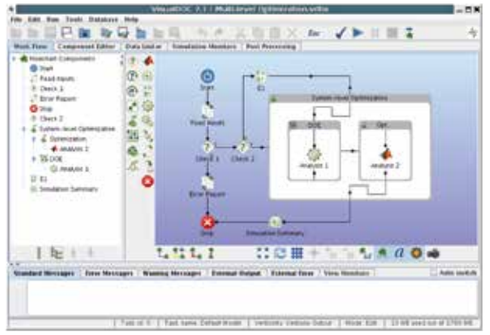
- Topology
- Shape
- Size
- Topography
- Topometry and freeform design optimization

For a seamless integration of GENESIS and LS-DYNA the optimization software ESLDYNA can be used. ESLDYNA takes advantage of the capability of GENESIS to solve large scale optimization problems based on the responses from a nonlinear finite element analysis.

- ESLDYNA Optimization can handle a very large number of design variables
- Reduced computational cost
- Ease of use enhanced by the Design Studio plugin
- Seamless integration between LS-DYNA and GENESIS
- Easy implementation of shape, sizing, topology, topometry, topography, and freeform design changes
- Multiple loading conditions

VisualDOC

The VisualDOC software for multidisciplinary design, optimization and process integration, which has been developed by VR&D, is a tool for defining, integrating, executing and automating design processes. The design modules included can be added to almost any analysis program. They enable the user to represent the workflow for connected components graphically and to define each component appropriately.



Benefits

- Automation of design processes
- Reduces costs and design cycle time
- Improves product quality and efficiency

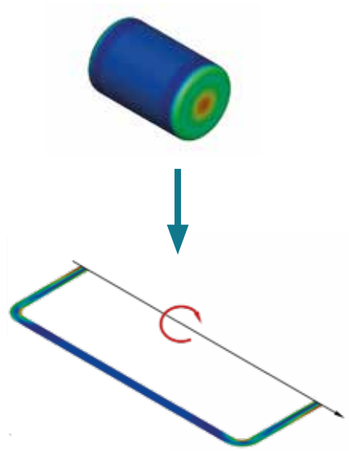
Envyo

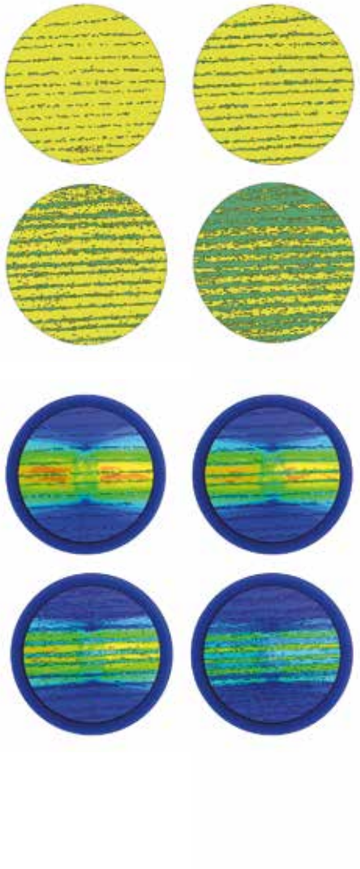
The Envyo multi-purpose mapping tool has been specially developed by DYNAmore for LS-DYNA. It allows simulation results to be transferred and manipulated between differently discretized meshes and from different solvers to the LS-DYNA special input format.

Arbitrary point cloud data (e.g. results from experiments) provided in csv format or through clustering methods, based on gray-scale images may also be taken into account in subsequent simulations. This is why Envyo provides an option for taking any type of previous results into consideration in subsequent numerical simulations and, consequently, cover the complete simulation process using LS-DYNA.

Common mapping methods

- Injection molding
- Sheet-metal forming
- Bake hardening
- Micro- and mesoscopic models
- Axisymmetric simulation results





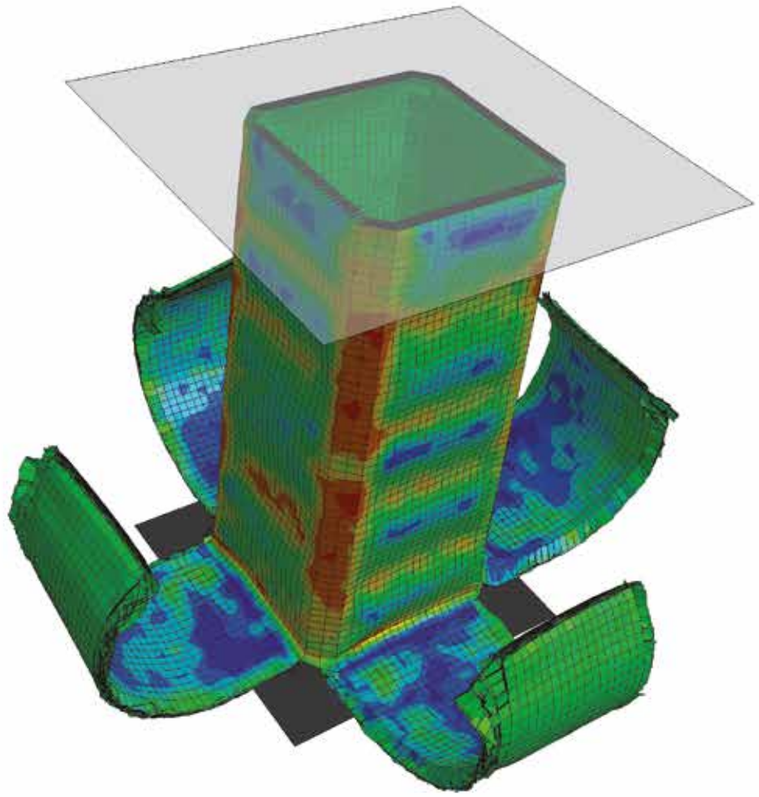
Courtesy of
Deutsche Institute für Textil- und Faserforschung

DIGIMAT

DIGIMAT from MSC Software is a state-of-the-art, nonlinear multi-scale platform for modeling materials and structures, which helps engineers to design and optimize composite materials fast and cost-effectively. From small-scale nanocomposites and honeycombed sandwich panels through to fiber-reinforced plastics, rubber and hard metals, DIGIMAT software covers a large variety of materials used in automotive, aerospace, consumer and industrial equipment industries.

Features

- Mean-field homogenization for fast and accurate prediction of nonlinear behavior
- Finite element analysis of representative volume elements (RVE)
- Material exchange platform for DIGIMAT users and vendors of materials
- Coupling of FEA software to enable a multi-scale analysis of composite materials and structures
- GUI-guided workflow tool for coupled analyses
- Prediction of micromechanical behavior of composite sandwich panels



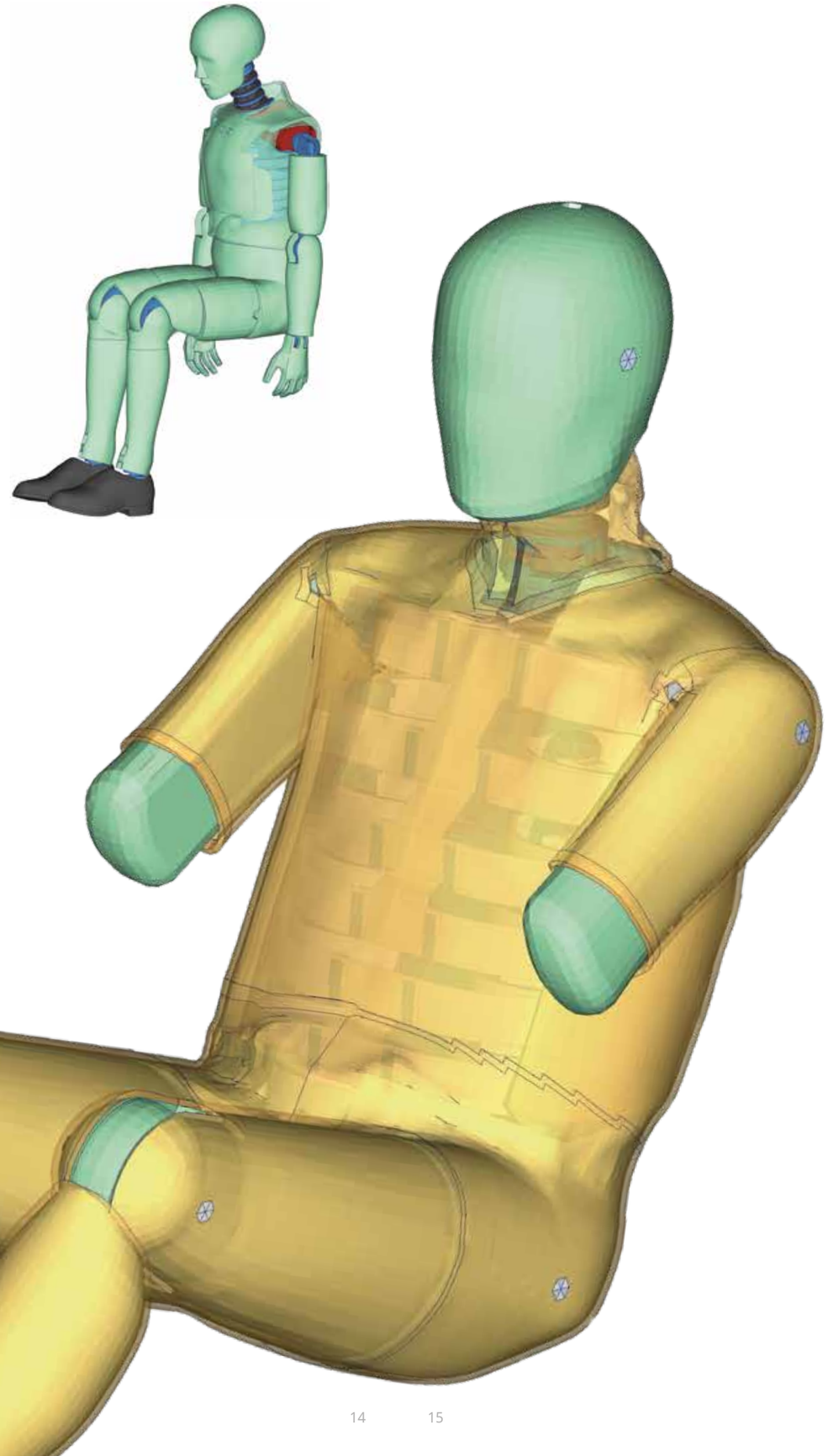
ATD models and barriers

To assess a vehicle, tests are carried out under comparable conditions. In order to describe the barriers and dummies accurately, they are validated against defined test environments. DYNAmore develops and distributes own finite element models and finite element models from Humanetics and LST LLC for various applications. DYNAmore‘s package includes the following:

- Side impact ATD models
- Front impact ATD models
- Rear impact ATD models
- Child ATD models
- Pedestrian impact models
- Free-motion head form models
- Side and rear barrier models
- Front barrier models
- Moose model
- Pendulum model

SUFEHM head model

The ”Strasbourg University Finite Elemente Head Model“ (SUFEHM) is a finite element model of the human head. It can be used to evaluate the risk of injury to the skull and the brain under real head-impact conditions.



THUMS Human model

The Total Human Model for Safety (THUMS™) is a computational model of the human body and can be used to investigate the human body in various impact scenarios. It has been actively developed by Toyota Motor Corporation and Toyota Central R&D Labs since around 2000. Model updates and new versions are thus provided regularly.
The THUMS model is commercially distributed by DYNAmore. Universities and research institutes may obtain a non-commercial license, which is however strictly limited to use in universities and research institutes.
The THUMS model is currently available in different versions, for example:

- Female and male occupant model
- Female and male pedestrian model
- Child models

THUMS™, developed by TOYOTA Motor Corporation and Toyota Central R&D Labs

Development of LS-DYNA and LS-OPT

DYNAmore provides comprehensive simulation and software development services when it comes to finite element technology. These include simulation services on commission, collaboration in research and development projects, general consulting and enhancements to the LS-DYNA, LS-OPT and LS-PrePost software packages.

Method development

DYNAmore has been working in the field of code development for LS-DYNA for many years. DYNAmore had already implemented material laws for composite materials in the 1990s. Today, a group at DYNAmore, actively involved in Release Management for LST LLC, is engaged in implementing new features and methods in LS-DYNA. Our clients are located in the USA, Europe and Asia. Our capabilities and skills cover the entire range of finite element technology.

In the past, we have already been involved in

- Development and implementation of spot weld models
- Development and implementation of failure models
- Development of a material model to describe the failure of laminated glass
- Development and implementation of material models for composite fibers
- Development and implementation of material models for high-resilience and rigid foam
- Development of mapping algorithms to enable seamless simulation of component manufacturing
- Development of methods for realistic simulation of airbag unfolding
- Modelling of human models for pedestrian protection
- Complete development of GUIs for LS-OPT
- Complete development of LS-RUN
- Managing development of the thermal solver in LS-DYNA
- Managing development of the implicit features in LS-DYNA

Courtesy of Dr. Ing. h.c. F. Porsche AG

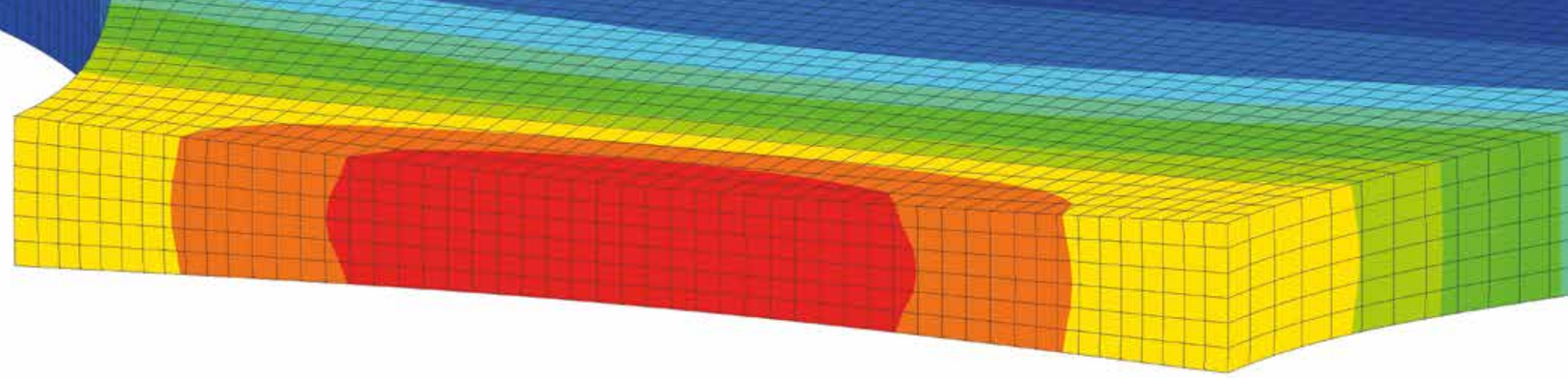
FEMZIP

The FEMZIP software tool has been specifically developed by Sidact to compress finite element simulation results. The algorithms and processes used focus on the particular characteristics of the LS-DYNA simulation results and therefore lead to exceptionally high rates of compression.
Costs for data management, storage and archiving can be significantly reduced by using the FEMZIP-L data compression tool. Simulation data compressed with FEMZIP are up to ten times smaller than LS-DYNA output files. The high compression factor obtained with FEMZIP yields the following benefits:

- Reduction in archive size
- Accelerated data exchange
- Fast access to data

LS-DYNA Tools

We have developed a number of useful tools for DYNAmore customers, making the every day work with LS-DYNA simpler for our clients. This includes tools for data compression, for determining intrusions, for model quality check, and much more.



Material Competence Center

Experiments

The mechanical properties of many materials that are required for simulation are often unknown. Defining these precisely is typically very expensive and often involves a considerable wait. In contrast, the experiments we select in accordance with the specific requirements of the client provide a quick and reliable basis for generating predictive material cards for polymers, metals and composite materials.

Material models and calibration

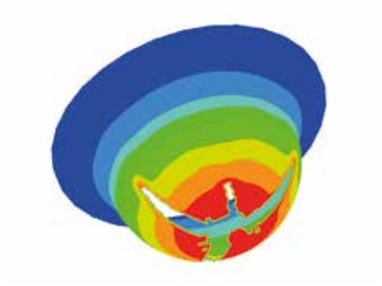
The quality of the material parameters has a significant influence on predictability in numerical calculations. In addition to advanced testing processes, our customers benefit from our engineers' many years of experience in the area of numerical description of mechanical material behavior.

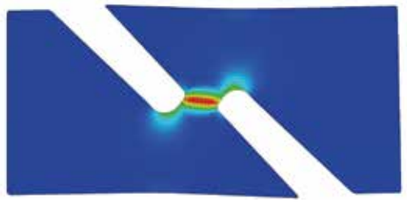
Deformation behavior

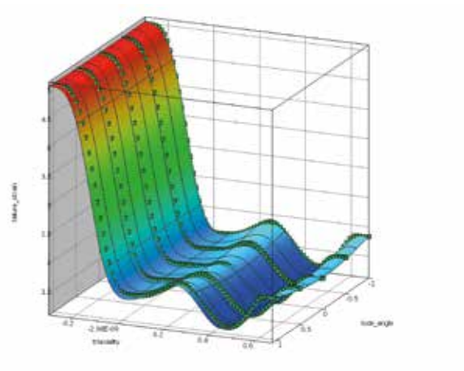
- Viscoelastic and viscoplastic
- Isotropic or anisotropic
- Tensile and compressive-asymmetric

Damage and failure modeling

- GISSMO (Generalized Incremental Stress State dependent damage Model)
- DIEM (Damage Initiation and Evolution Model)
- eGISSMO (Mat Add Generalized Damage)
- Damage development under cyclic load







Our services

- Static, dynamic and cyclic testing
- Tensile, compression, puncture and bending testing
- Component testing
- Sample conditioning
- Sample processing and collection from components, sheets and panels
- Optical 3D strain measurement and detailed evaluation of local distortion

Your benefits

- Testing and parameter identification from a single source
- Minimizes time and costs
- The LS-DYNA developer team is always available

Research

In cooperation with its partners in industry and academia, DYNAmore is involved in numerous funded research projects in the automotive, aerospace and automation industries as well as in the field of software development.

Research projects

- AIAx: further development of the machine learning process
- DigiBody: digital process chain for the illustration and optimization of joining technology in body-in-white
- 3DProCar: flexible process chains for thermoplastic integrally manufactured fibre-plastic composite components with complex geometry
- EXTREME: dynamic loading - pushing the boundaries of aerospace composite material structures
- ARENA 2036: the first „research campus: public-private cooperation for innovation“
- Swim-RTM: Development of algorithms and software tools for process engineering and design, applied to the RTM method
- T-Pult: Energy-efficient pultrusion process for the production of fiber composite components with thermoplastic matrix in series production
- TWIP4EU: Development of a simulation framework to accurately model the complex deformation and forming behaviour of TWIP steels

and many more

Events

In addition to regular conferences attended by over 500 delegates, DYNAmore organizes free information days, workshops and webinars on different subjects on an ongoing basis in order to encourage knowledge sharing.

Courtesy of
Hyundai Motor Company

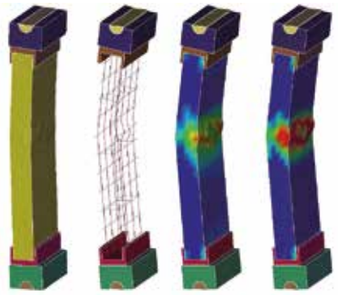
Courtesy of
Volkswagen AG

Seminars

DYNAmore offers more than 150 seminars, free information days and webinars on more than 65 topics. Training encompasses numerous courses in the fields of application for LS-DYNA and LS-OPT, as well as the field of pre- and postprocessors. All seminars can be adapted to meet specific company needs and held on-site in German or in English.

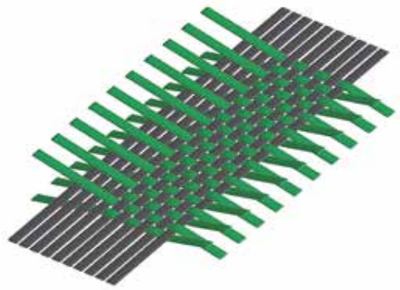
We offer courses in the following fields:

- Introductory courses
- Fundamentals/theoretical knowledge
- Crash
- Passive safety
- Forming/process simulation
- Material
- Implicit analysis
- Particle methods
- Multiphysics/biomechanics
- High-energy events
- Optimization
- Pre and post-processing
- CAE/IT



Courtesy of
Schwer Engineering

Courtesy of
Honda R&D Americas



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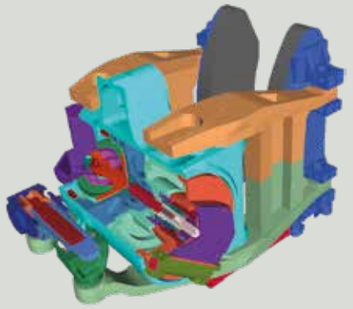


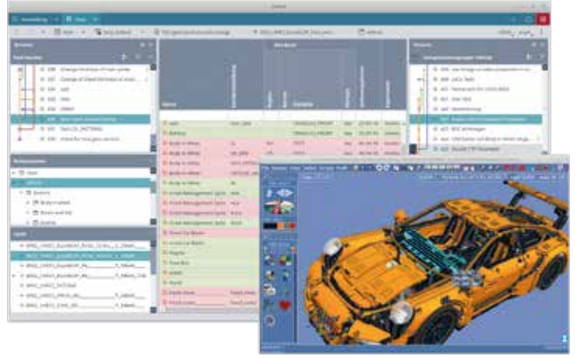
Courtesy of
Knorr-Bremse Systeme für Schienenfahrzeuge

SCALE
IT-Solutions for CAE

SCALE

SCALE provides software solutions and IT services for process and data management in the automotive industry and other sectors. As an affiliated company of DYNAmore GmbH, SCALE has a strong background in CAE applications and processes. Services offered by SCALE include, in particular, development of process and data management software, development of the finite element method as well as optimization for the functional design of vehicle components numerically. SCALE's portfolio encompasses LoCo, CAViT and Status.E for simulation data, process and requirements management, as well as IT services for bespoke software solutions upon request.

www.scale.eu

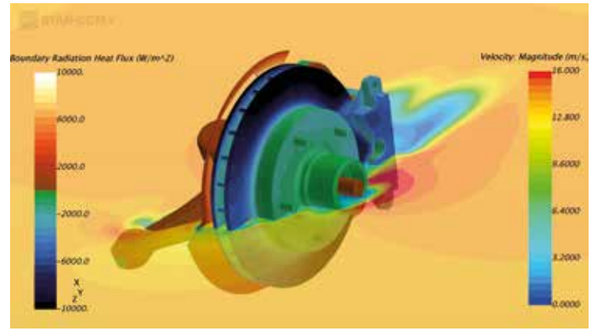


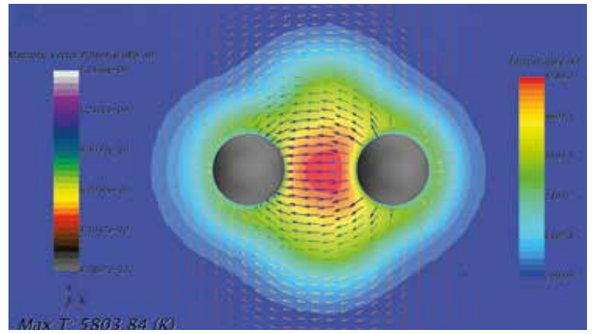
CASCATE

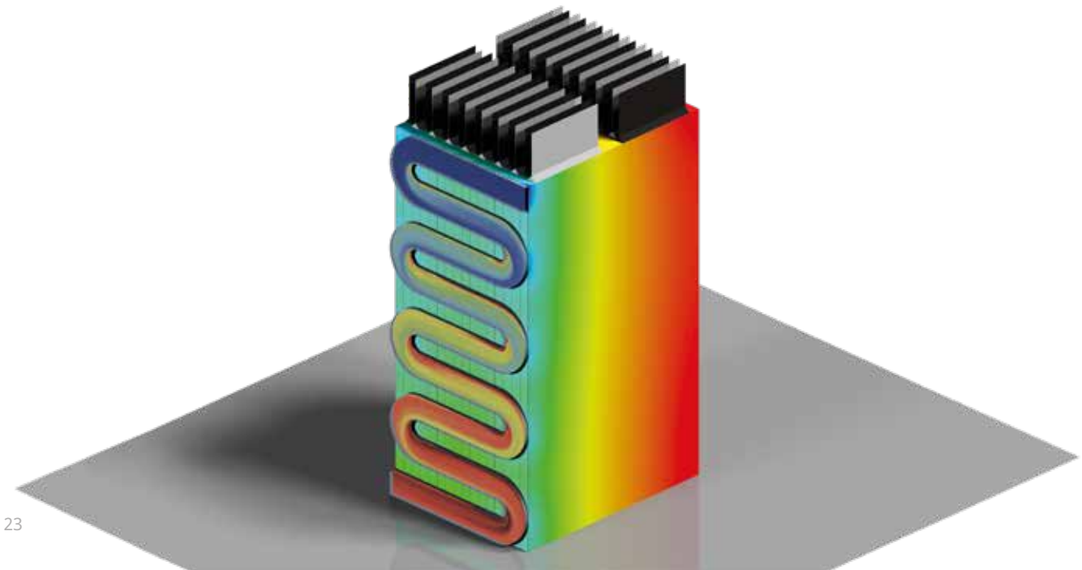
CASCATE

CASCATE GmbH's main focus is on professional consulting for all simulation solutions, in particular complex tasks in the fields of fluid mechanics, structural mechanics and fluid-structure interaction. As an affiliated company of DYNAmore GmbH, CASCATE can draw on its extensive experience in the field of simulation. In founding CASCATE GmbH, DYNAmore GmbH significantly expanded and strengthened its CFD simulation competence. In particular, an expert team for STAR-CCM+® was set up that was dedicated to addressing customer requirements in this special area. This team also conducts fluid-structure interactions and flutter analyses.

www.cascate.de







DYNAmore on the web

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www.dynasupport.com

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www.dynaexamples.com

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www.ls-dynacloud.com

/ HPC cloud solution for LS-DYNA

www.dummymodels.com

/ Overview of all models

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