LS-DYNA and more

FINITE ELEMENT SOLUTIONS

DYNAmore Nordic AB

DYNAmore Nordic

In many industries, realistic simulation is a key driver for faster and more cost-effective development of products and manufacturing processes. This key driver is our focus: to provide the state-of-the-art simulation software LS-DYNA to companies, engineers, researchers and students in the Nordic countries and Baltic states.

In addition to our simulation software portfolio, we offer expert level support, training, engineering consultancy services, simulation software development, and computer systems for LS-DYNA. We have more than 20 years of experience and 25 employees at our offices in Linköping and Gothenburg. Furthermore, we are part of DYNAmore Group, one of the largest distributors of LS-DYNA simulation software worldwide. Major corporations and universities throughout the Nordic region are convinced by our expertise, including many in the automotive industry. You are welcome to contact us directly to learn more about what we can do for you.
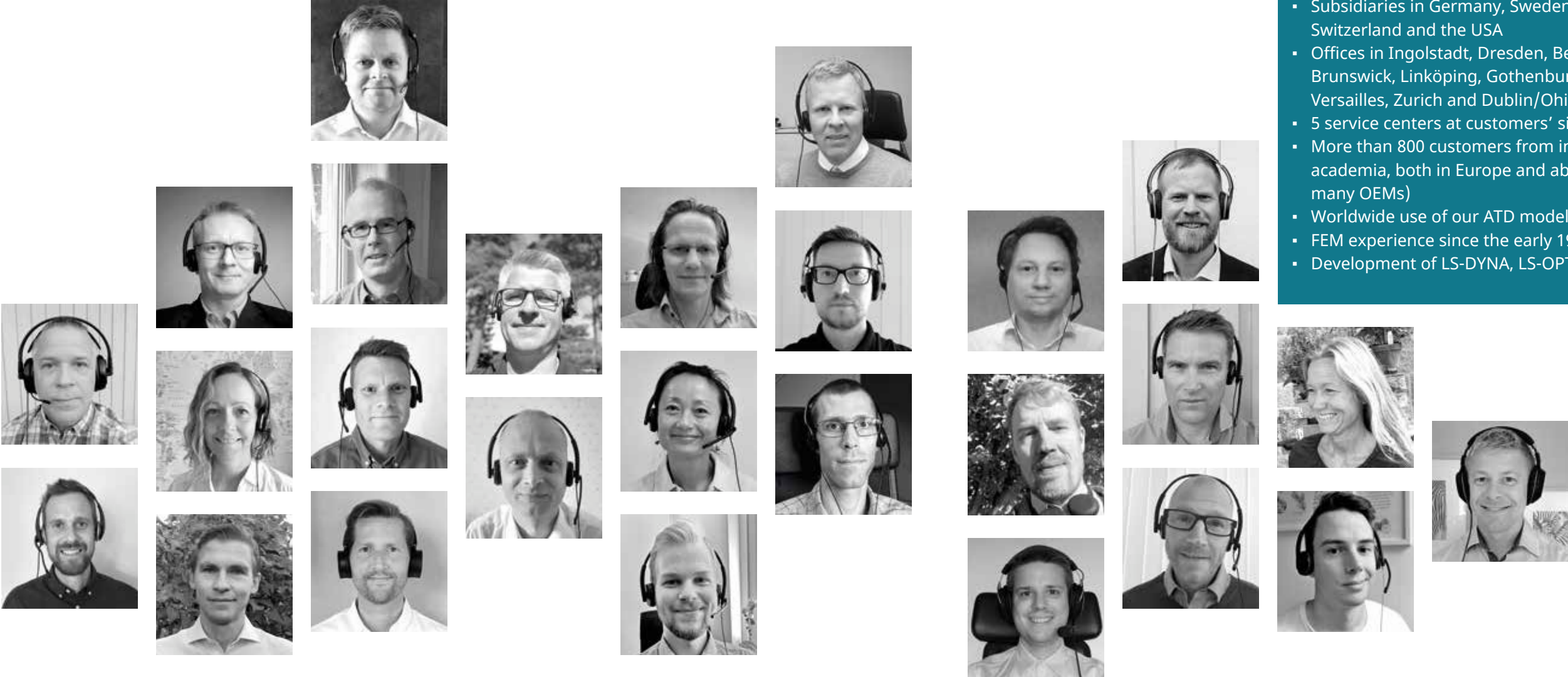
Portfolio

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

Facts DYNAmore Nordic

- Offices: Linköping (head office) and Gothenburg, both in Sweden.
- Sales region: the Nordic Countries and Baltic States
- Approx. 25 employees
- Approx. 100 customers
- Development of LS-DYNA, LS-OPT, and LS-PrePost

Facts DYNAmore Group

- Head office in Stuttgart, Germany
- Approx. 150 employees
- Subsidiaries in Germany, Sweden, Italy, France, Switzerland and the USA
- Offices in Ingolstadt, Dresden, Berlin, Langlingen, Brunswick, 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
- Development of LS-DYNA, LS-OPT, and LS-PrePost

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, LS-DYNA offers linear and non-linear FEM as well as particle methods (EFG, SPH, SPG, 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
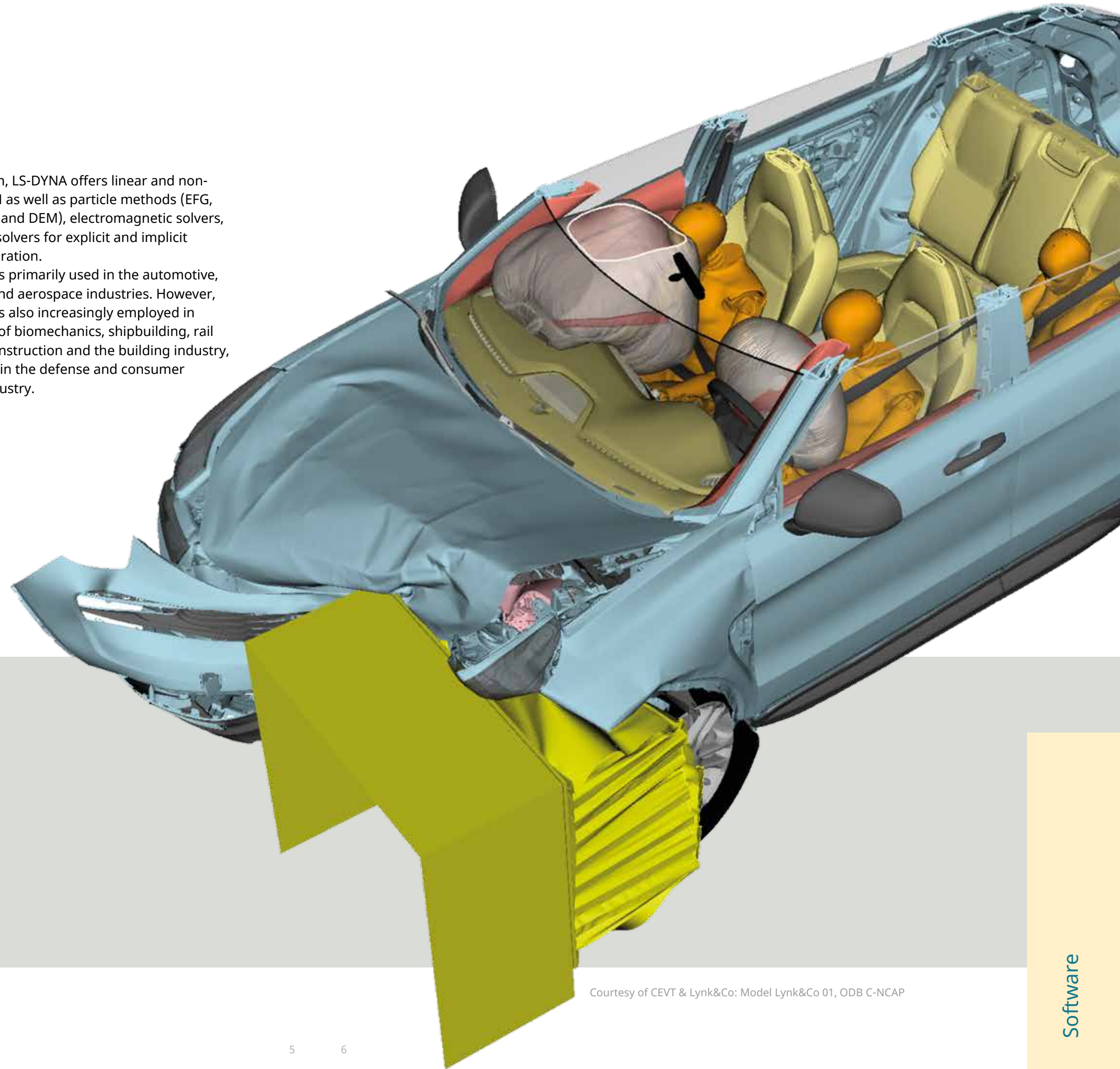
Courtesy of CEVT & Lynk&Co: Model Lynk&Co 01, ODB C-NCAP

Software

BETA products

BETA CAE Systems' FEM and CFD pre- and postprocessors, EPILYSIS solver and SPDRM simulation process-data-manager are well known and hold a worldwide leading position across a range of industries including automotive, railway vehicles, aerospace, motorsports, chemical processes engineering, energy, electronics, heavy machinery, power tools, and biomechanics.

- ANSA Preprocessor
- META Postprocessor
- EPILYSIS Solver
- SPDRM Simulation-process-datamanagement

ANSA

ANSA is an advanced multidisciplinary CAE pre-processing tool that provides all necessary functionality for a full-model build up, from CAD data to ready-to-run solver input files, in a single integrated environment. ANSA supports LS-DYNA and other popular FEM and CFD simulation software products and supports import of geometry data from most common CAD systems.

META

META offers all you need from an advanced yet easy to use postprocessing platform for FEM and CFD. It combines outstanding performance and smart functionality in handling large models with advanced process automation. With the GUI customization capabilities, you will significantly accelerate your postprocessing.

Benefits

- Efficient data handling for intricate model structures
- Fast and high quality modeling of complex geometries
- Capability to interoperate between models built for different solvers
- Highly automated processes and model set-up tools in one environment
- Reduced user-dependent error-prone operations
- Complete model build-up for numerous solvers in one environment
- Unique capability for building a common model as a basis for modeling for different disciplines
- Significant modeling time reduction and quality increase
- Short learning curve and deployment time

B E T A
SIMULATION SOLUTIONS

A N S A
PRE PROCESSOR

M E T A
POST PROCESSOR

Software
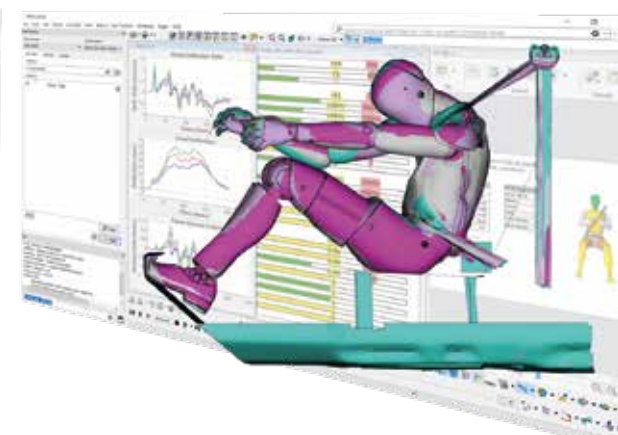
Moldex3D

Moldex3D from CoreTech System Co. is the world's leading CAE tool for plastic injection molding. With Moldex3D it is possible to simulate a variety of plastic molding processes to improve product design and manufacturability, as well as shorten the time-to-market.

The user-friendly pre- & postprocessor Moldex3D Studio allows for easy creation of good quality models, efficient evaluation of results, and automatic report generation. Simulation results such as fiber orientation and material anisotropy can be exported to most FEA software, e.g. LS-DYNA or ANSYS, via the FEA interface.

Moldex3D can improve the process regardless if it concerns the part design, mold development, or production. Achieve higher product quality and increase yield by identifying and fixings defects. Lower the production cost through reduced cycle time and less time spent on mold trials.

The three available packages: eDesign, Professional, and Advanced, together with the rich selection of add-ons, makes it easy to get a tailored solution that meets your specific needs.

- Injection Molding (IM)
- Reaction Injection Molding (RIM)
- Resin Transfer Molding (RTM)
- Multi-Component Molding (MCM)
- In-Mold Decoration (IMD)
- Co-Injection Molding (CoIM)
- Bi-Injection Molding (BiIM)
- Foam Injection Molding (FIM)
- PU Chemical Foaming Molding (CFM)
- Compression Molding (CM)
- Injection Compression Molding (ICM)
- Gas/Water-Assisted Injection Molding (GAIM/WAIM)
- Powder Injection Molding (PIM)

Features

- Integrated geometry fix tool – CADdoctor
- Highly automated meshing
- Fiber orientation and fiber interaction
- FEA & Micromechanics interface
- DOE & Optimization
- Comprehensive material database
- High performance computing & parallel processing
- Advanced hot runner modelling with moving pin
- 3D Coolant CFD & Transient cooling
- IC packaging
- Fluid structure interaction (FSI)
- Optics, flow- or thermally-induced defects
- Automatic report generation

Software
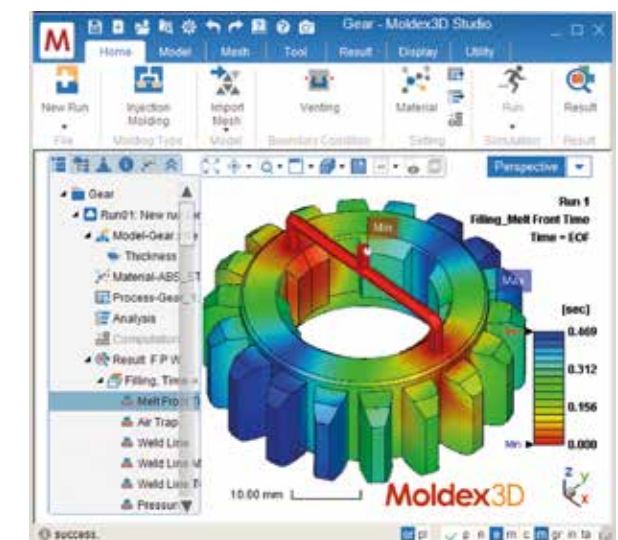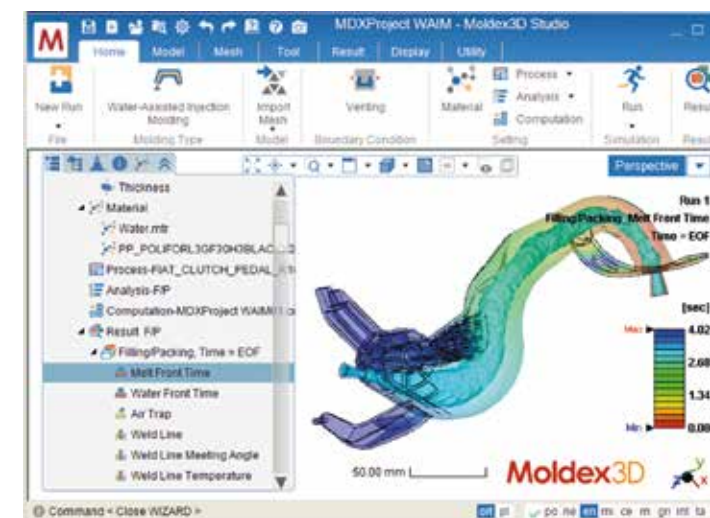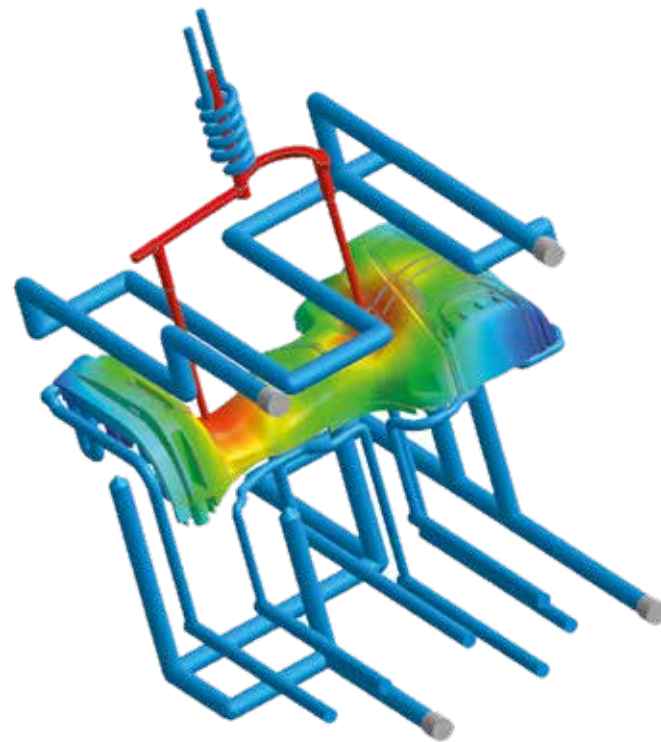
Engineering services

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.

We regularly carry out simulation methodology development where our senior engineers and application experts develop or benchmark customer modeling and simulation procedures. This is especially valuable when faced with new LS-DYNA simulation challenges.
We have experience from many industries and applications, from automotive, manufacturing, and machinery to defense and biomechanics.
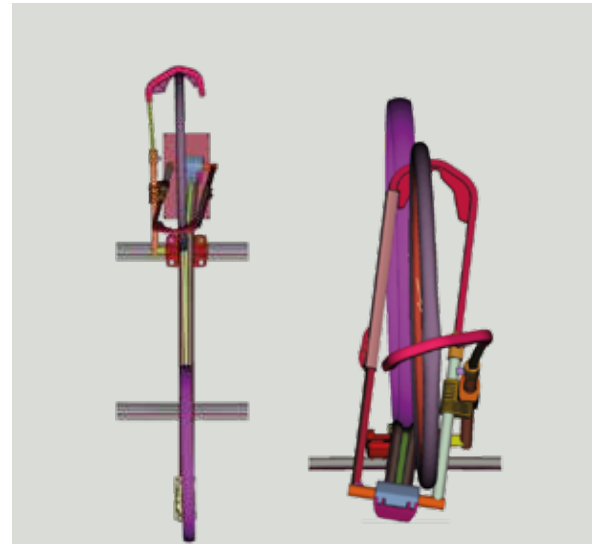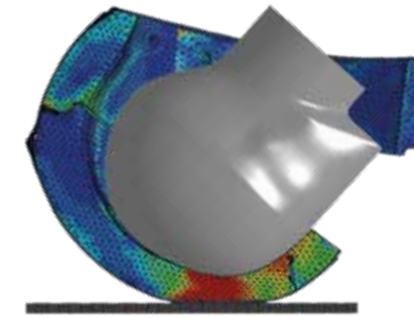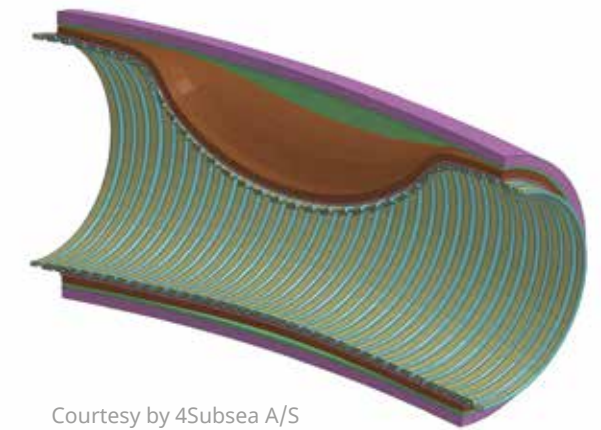

Courtesy of Thule Group
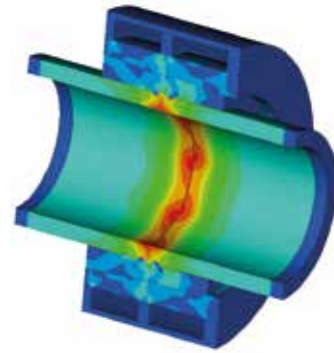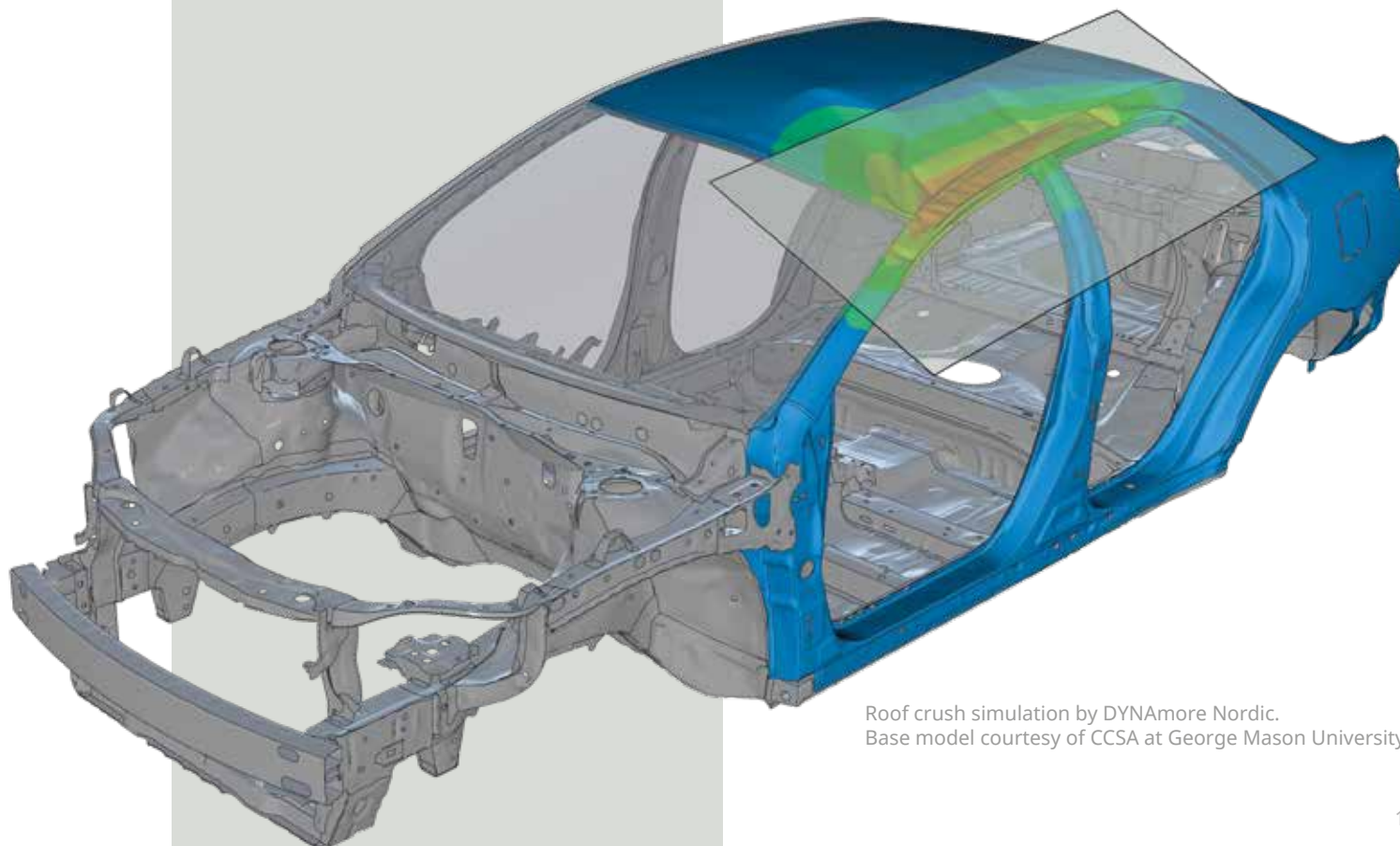

Simulation of an offshore pipeline coupling

Courtesy of Volvo Car Corporation
Crash of Volvo X90

Courtesy of MIPS: Simulation of test for FIM Racing Homologation Programme for helmets.

Courtesy by 4Subsea A/S
Carcass collapse analysis.

Roof crush simulation by DYNAmore Nordic.
Base model courtesy of CCSA at George Mason University.

Typical simulation service projects

- 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
- Developing active hood systems for pedestrian protection
- Developing seats to minimize whiplash injuries
- Development of cabin safety structures for heavy equipment according to ROPS & FOPS
- Development of couplers, adapters and gangways for trains
- Development of pneumatic breakers and other construction equipment

- Design of containment chambers for removal and transport of explosives and other dangerous materials
- Designing presses and tools for deep-drawing
- Development of top hammer rock drills, rock breakers and similar heavy-duty machinery
- Development of simulation methodology for 3D roll forming
- Development of pallet drones and other machinery for warehouse automation
- Development of syringes and other medical devices
- Designing occupant protection for military vehicles

Engineering

LS-PrePost

The pre- and postprocessor LS-PrePost can be used to create & edit 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.

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
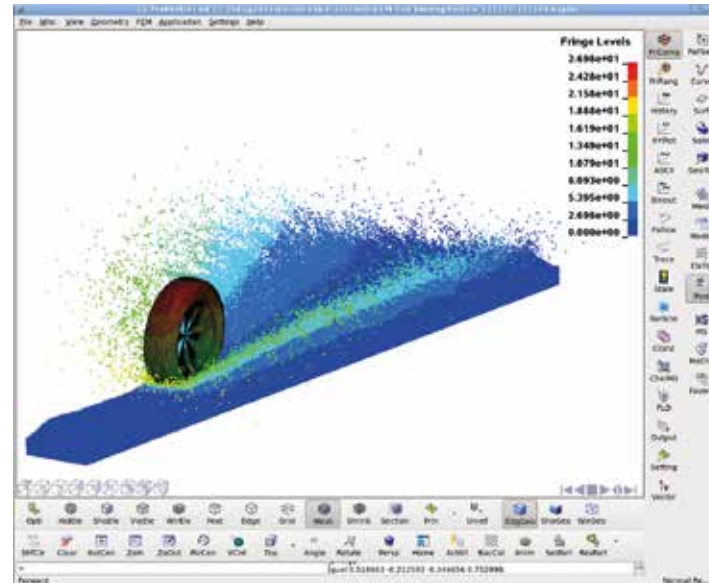
DYNAFORM

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.

Features

- Auto setup
- Automatic mesh generation
- Drawbead definition
- Process definition
- Automatic contact definition
- Tailor-welded blanks modeling
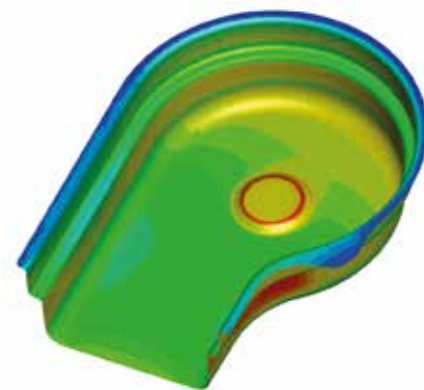
Courtesy of Egro Industrial Systems AG

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

Pre- and postprocessors
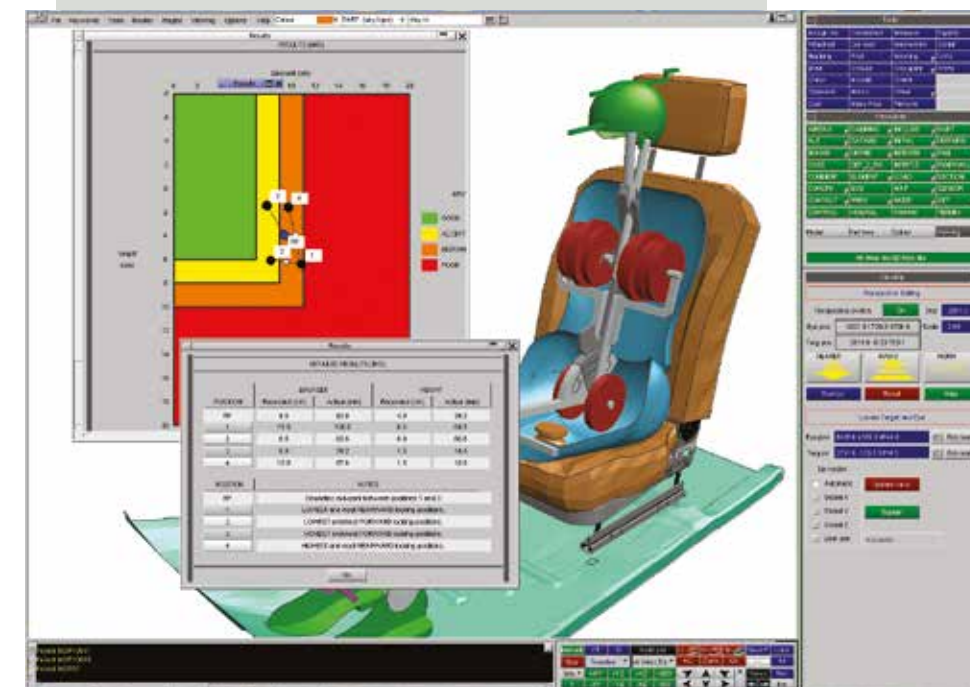
LS-OPT

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.
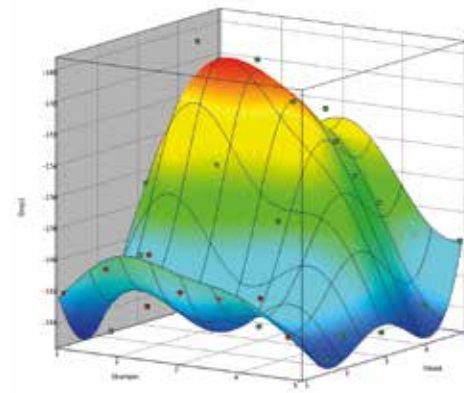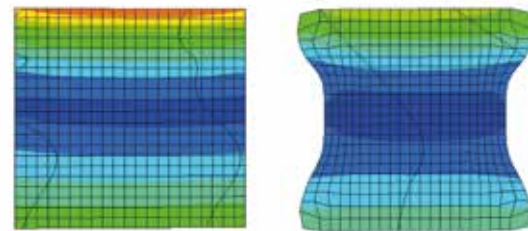
Main applications

- 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

Forming Technologies

HEXAGON | Fti FORMING TECHNOLOGIES

Founded in 1989, Forming Technologies (FTI®) is the world's leading provider of easy to use and capable software solutions for the design, feasibility, and costing of sheet metal components.
FTI® provides OEMs and suppliers in the automotive, aerospace, electronics, and appliance industries with innovative solutions designed to reduce development time and material costs.

- FASTFORM Advanced
- FORMINGSUITE Professional
- COSTOPTIMIZER
- COSTOPTIMIZER Advanced
- and more ...

Features

- Easy to use flowchart GUI
- Onestep solver
- Blank shape development
- Formability risk assessment
- Part price estimate
- Optimizing nesting layouts
- Automatic report

HPC-Computers

The DYNAmore ReadyToRun Linux clusters are for running LS-DYNA, pre- and postprocessing, and storing simulation project data and results. It is a complete solution - Ready to Run! The system is designed and built by DYNAmore and is based on our experience of using LS-DYNA every day. The system works with client laptops and workstations (Windows or Linux). It is an easy to use and scalable solution, from 40 to more than 1000 cores.
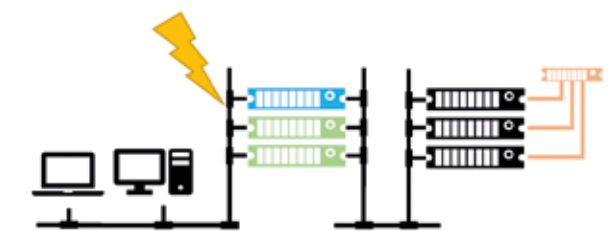
Benefits

- A modern state of the art solution
- Mobility - work from almost anywhere
- Performance - state of the art
- Economic and less administration
- Security against data loss and theft
- Tried out solution - developed in cooperation with heavy CAE users.
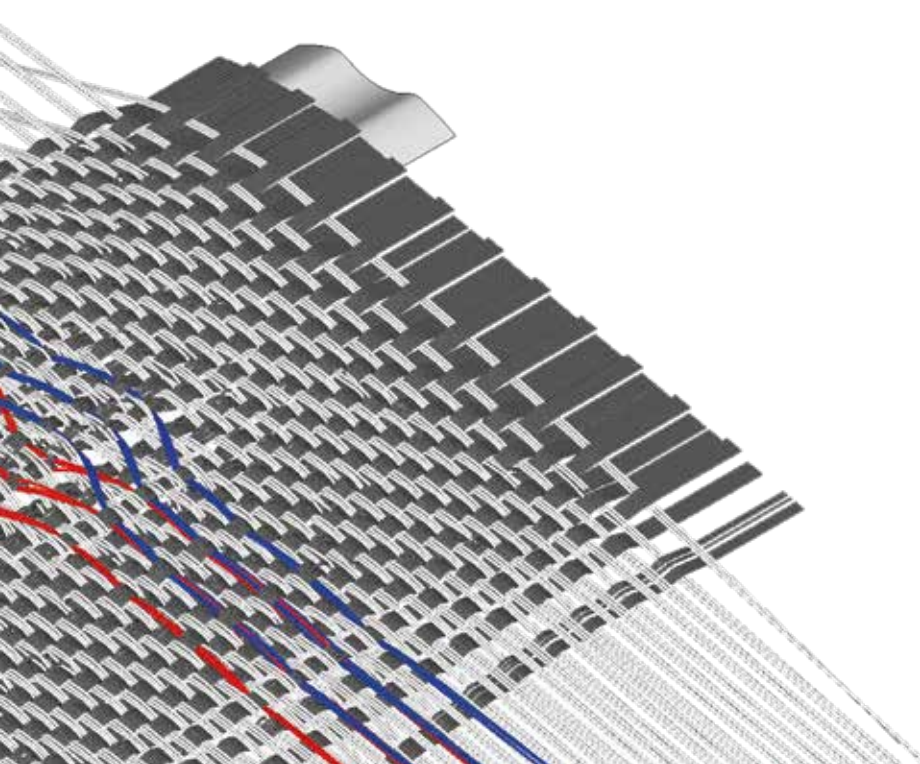
Optimization, HPC and Forming
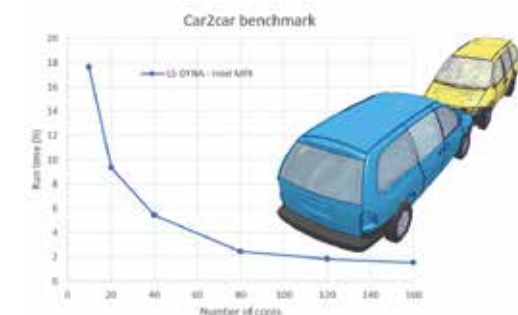
Envyo

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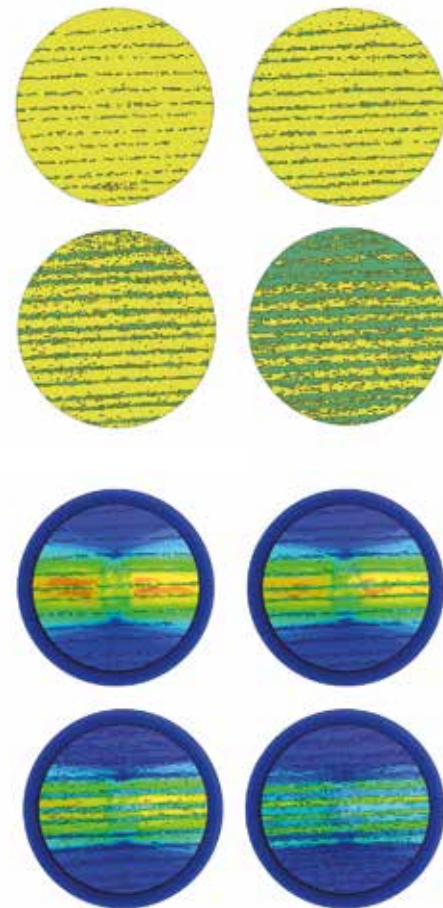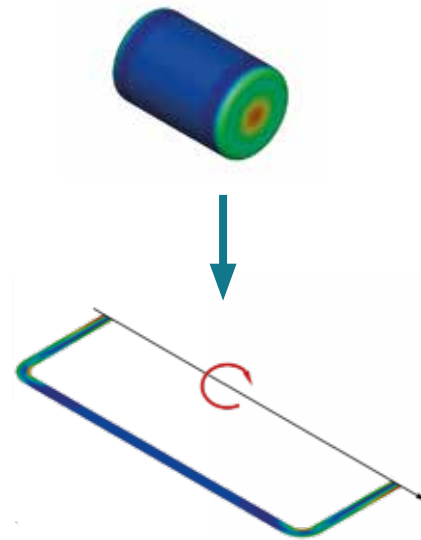
Arbitrary point cloud data (e.g. results from experiments) provided in csv format or through clustering methods, based on gray-scale images may also be taken into account in subsequent simulations. This is why Envyo provides an option for taking any type of previous results into consideration in subsequent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

Common mapping applications

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

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

Courtesy of
Deutsche Institute für Textil- und Faserforschung

Process chain
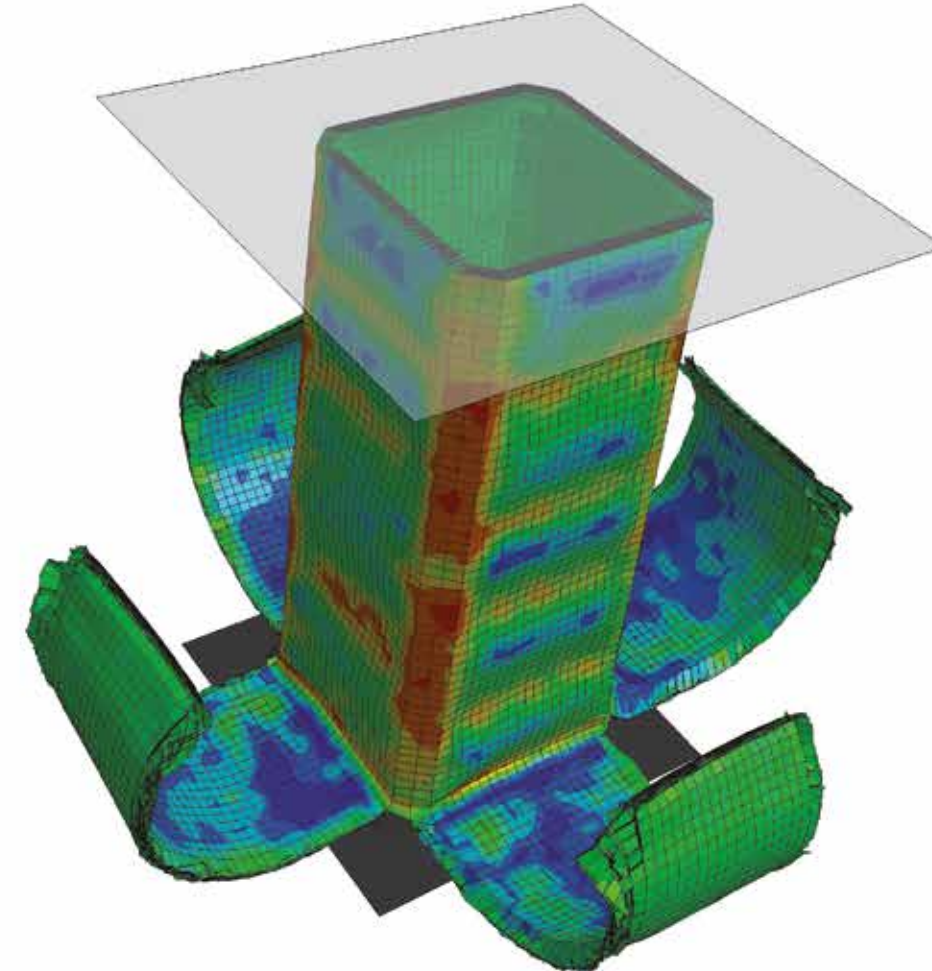
ATD models and barriers

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
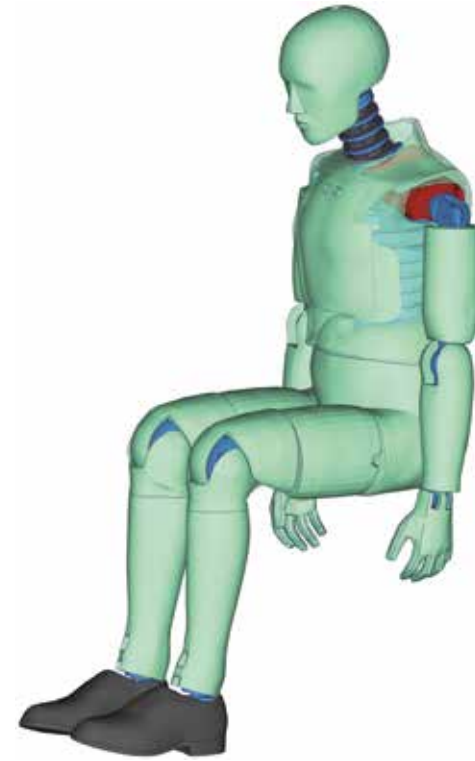
SUFEHM head model

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.
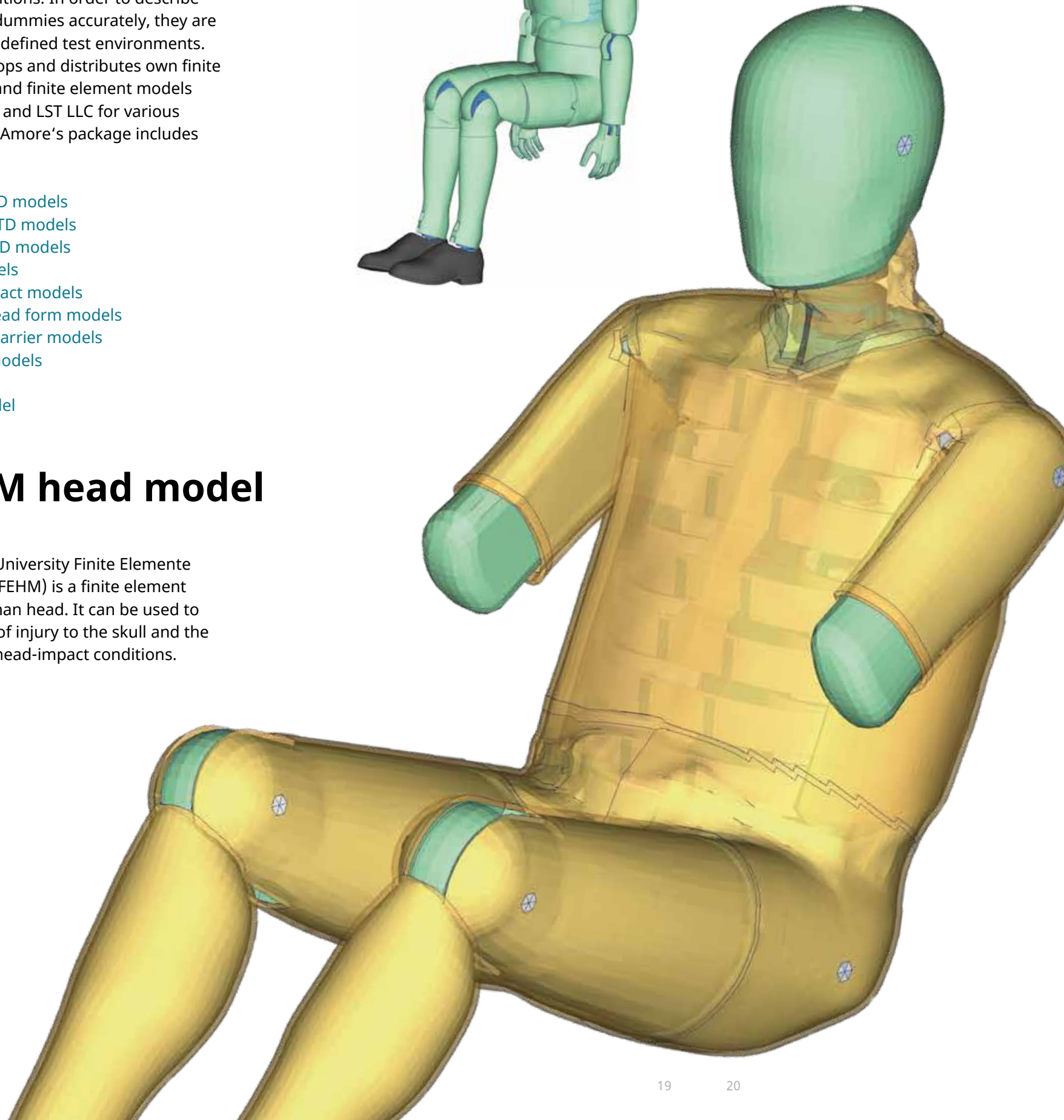
THUMS Human model

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 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

ATD and human models

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.

FEMZIP & Diffcrash

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.

Courtesy of Husqvarna

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

Services and Tools

Material Competence Center
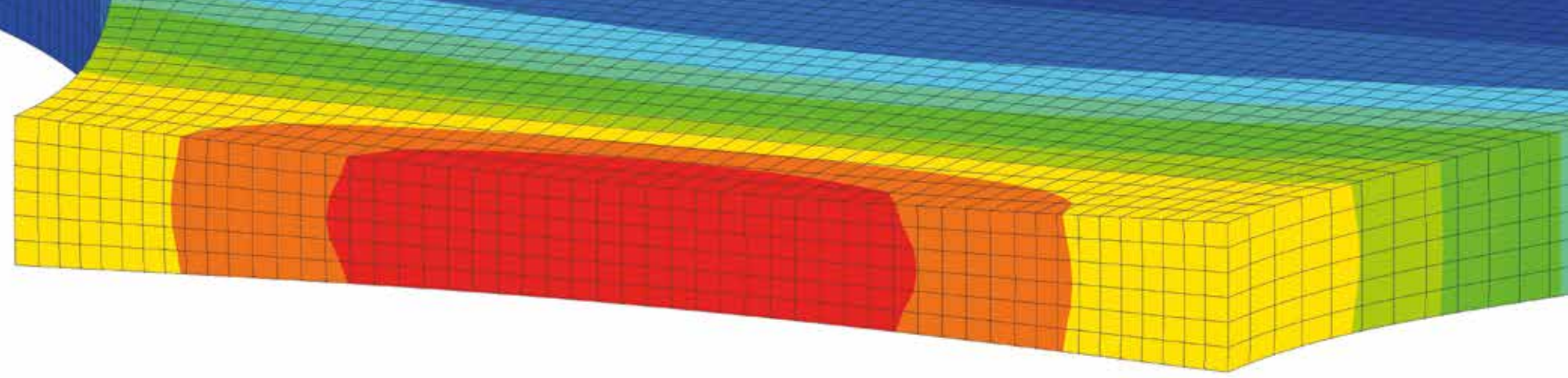
Experiments

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
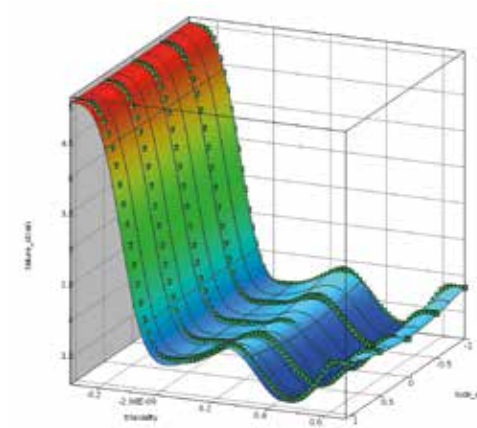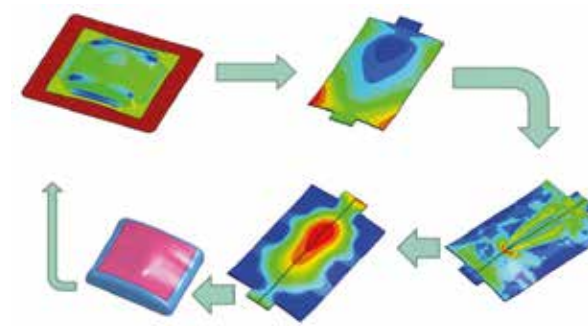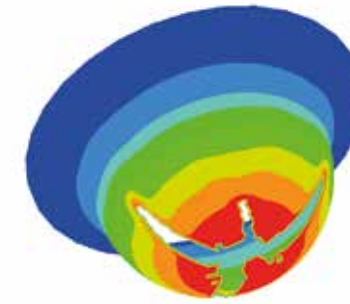
Research

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
- Joint Industrial Project (JIP): Development of non-linear finite element methodology for determination of structural capacity for offshore applications
- Digi3D: Lighter tools for metal forming & molding with a shorter turnaround using 3D metal printing
- VIRTUAL: Open access virtual testing protocols for enhanced road user safety including human body models for men and women with active muscles.
- Vinnova project: Simulation of the manufacturing chain of forming and welding of a double-curved aerospace component in superalloy 718.

  and many more

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

Services

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.
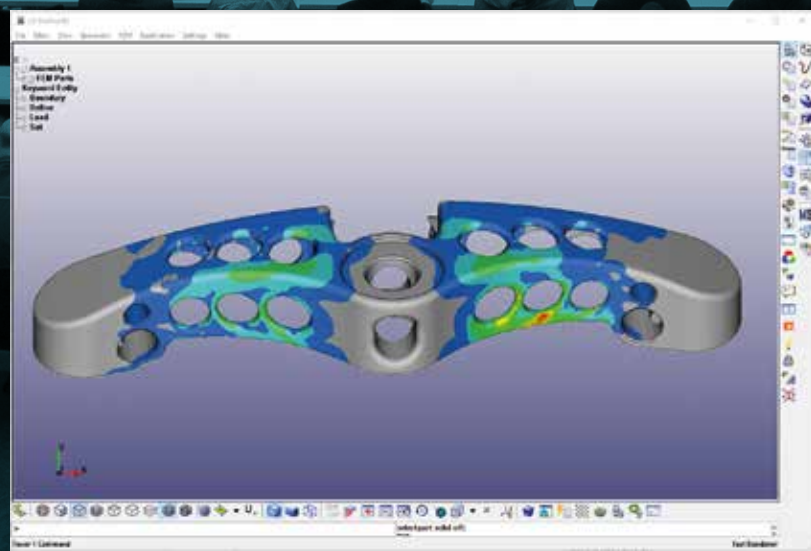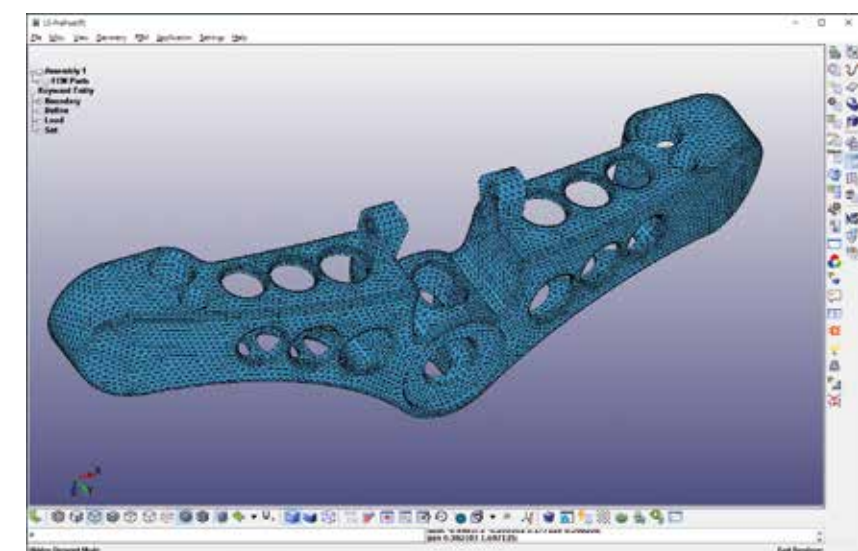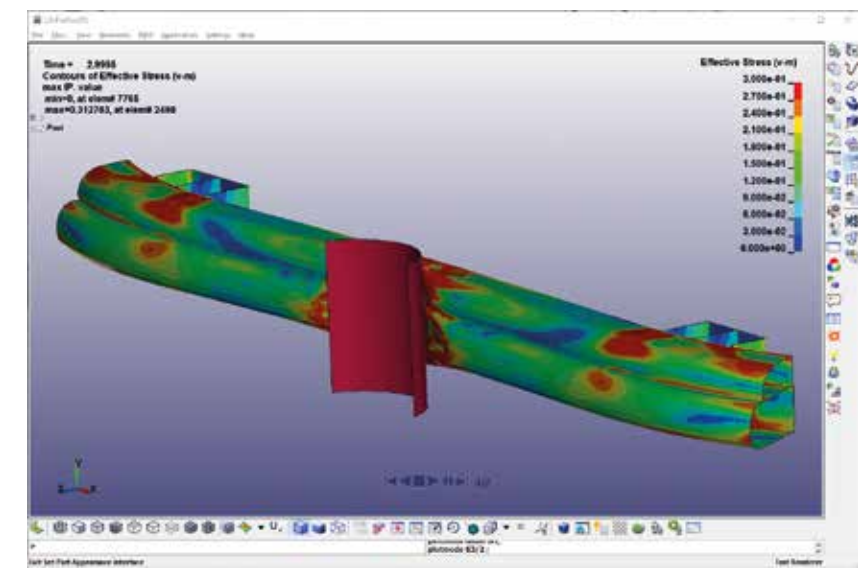
Seminars

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 Swedish 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 postprocessing
- CAE/IT

Seminar "Introduction to LS-DYNA"
Learn how to use LS-DYNA to do useful real life analyses

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 CadMe, LoCo, CAViT and Status.E for simulation data, process and requirements management, as well as IT services for bespoke software solutions upon request.

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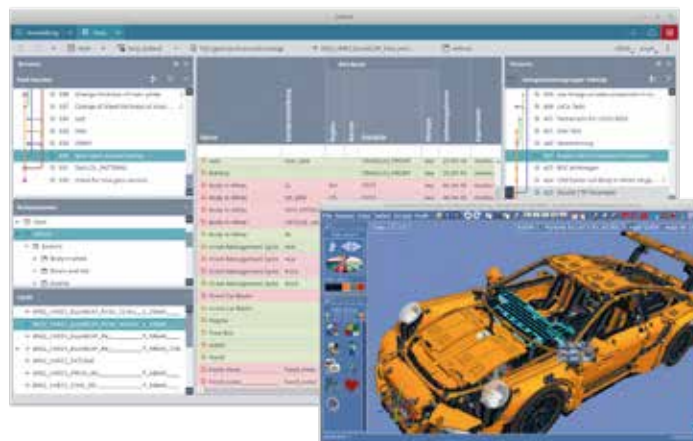
CASCATE

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.

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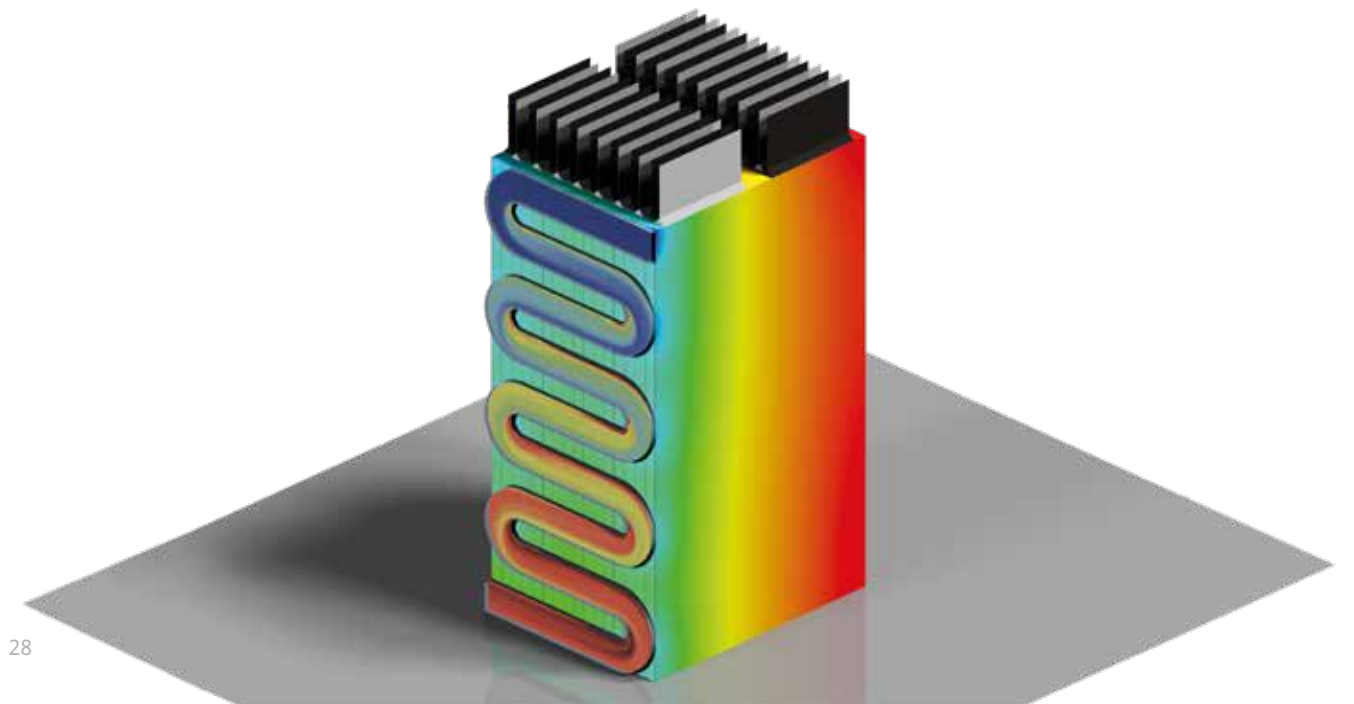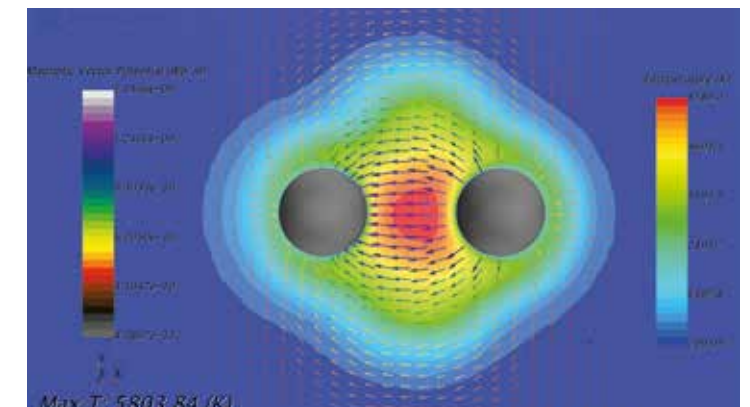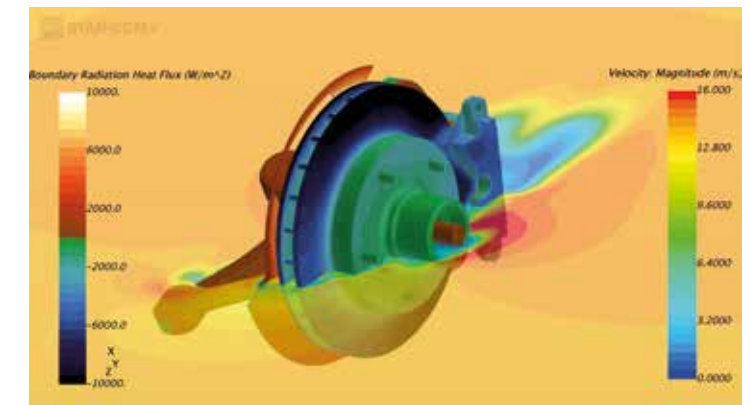
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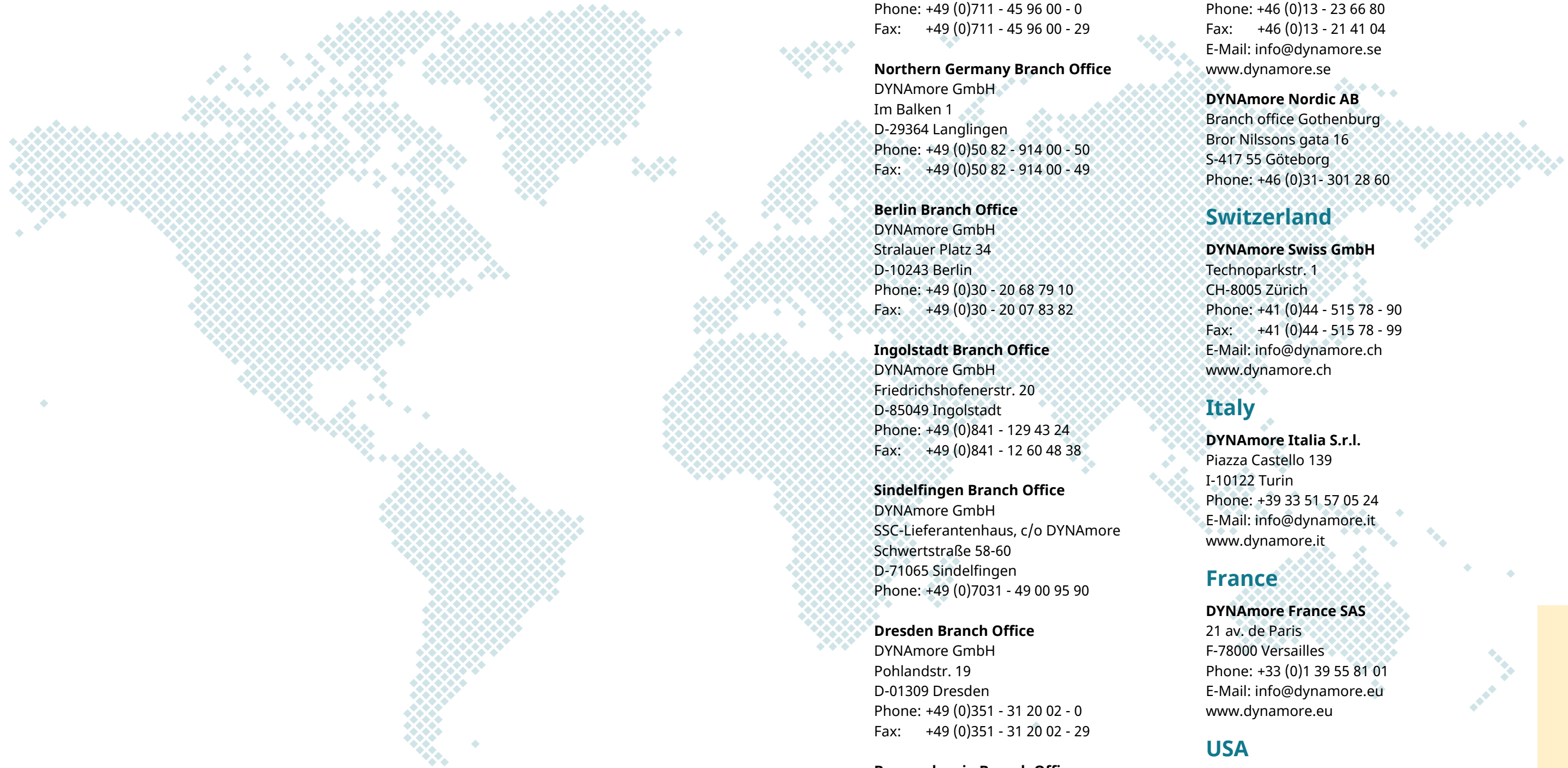## www.lsoptsupport.com

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