DYNA
MORE

NEW:
All seminars are available in
English language on demand.

2014

Seminars

Information days

Webinars

Support days

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

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BASICS/THEORY

CRASHWORTHINESS

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PASSIVE SAFETY

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MULTIPHYSICS/NEW METHODS

BIOMECHANICS

OPTIMIZATION

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CAE/IT

Seminars	Information days	Webinars	Support	On site Individual
Introductions	Crashworthiness	Passive Safety	Forming/Processes	Materials
Basics	Implicit	Multiphysics	Biomechanics	Optimization
Theory	CAE/IT	Defense	Civil Engineering	Pre-/Postprocessing

Dear reader,

This year again, we are pleased to offer you our new seminar brochure for 2014. After adapting the content to current technical developments you will find in addition to our wide range of seminars a variety of free information events, webinars and support days.

In the area of occupant safety, we have summarized the existing seminars on airbag modeling and train henceforth all relevant topics for the simulation of airbag deployment within one day using the corpuscular method (CPM). Because of the many innovations, the seminars on fluid-structure interaction with the ALE solver as well as the seminars on the meshless methods SPH and EFG have been extended to two days. In particular, simulations using EFG now offer an efficient way for the implicit calculation of bulk forming and forging processes.

As we continue to experience an increasing level of interest in coupled multiphysics solutions, we included in addition to the seminars on electromagnetism (EM) and incompressible fluids (ICFD) also a seminar on the compressible fluid solver CESE. Furthermore, the information day on pure CFD was combined with the information day on Multiphysics, as the new CFD solvers are often used in the context of fluid-structure interaction or cooling.

Due to increasing demand we now offer all seminars also in English language. To keep the organization as flexible as possible, the choice of language is determined individually according to your needs. In the future, seminars will also be offered in our new office in Torino, Italy.

A detailed description of all offered events can be found on the subsequent pages of this seminar brochure. The seminars are directed at engineers wanting to learn how to handle and specifically utilize LS-DYNA and other software solutions. Information days are events, where new applications and new possibilities of our software products are presented. During our support days every third Friday of the month you can receive personal assistance with your technical problems.

If the offered seminars do not fully suit your needs, we are pleased to meet your individual requirements by arranging tailored on-site training courses on your company premises. Following this, you have the option of combining the contents of our available seminars to adapt them to your own custom requirements.

Up-to-date announcements on planned webinars or information days as well as any modification to dates or course contents can be found on our website www.dynamore.de. Moreover, you can directly register for any of our events online or download the presentation slides of past informations days. It is therefore worthwhile to take a look from time to time.

We hope that we have aroused your interest and are looking forward to welcoming you to one of our events.

Kind regards,

N. Karajan

Dr.-Ing. Nils Karajan

Your contact partner for any questions

Organization

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Seminar titel	Jan.	Feb.	March	April	May	June	July	Aug.
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Blast Modeling with LS-DYNA [1]								
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Hot Forming with LS-DYNA	28-29					5-6		
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Modeling Polymers and Elastomers in LS-DYNA			31.3-1.4					
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Information day: Simulation of Plastics with LS-DYNA								
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4

[1] = English course
[2] = Date and delegate fee on request
[3] = Euro per delegate plus VAT
[4] = Topics and dates on web
[I] = Ingolstadt, Germany
[D] = Dresden, Germany
[B] = Berlin, Germany
[TO] = Torino, Italy
[A] = Attendorn, Germany
[Z] = Zurich, Switzerland

Sept.	Oct.	Nov.	Dec.	Sem	Web	Info	S/W	Fee[3]	Page	Seminar titel
										INTRODUCTION
23-25	29-31[T] / 22-24[TO]	5-7 / 12-14[I]	16-18	■				1.425	6	Introduction to LS-DYNA
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										BASICS/THEORY
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				■				475	8	User Interfaces in LS-DYNA
						■		–	9	Information day: Verification and Validation of Numerical Simulations
										CRASHWORTHINESS
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26	8[G]			■				475	10	Contact Definitions in LS-DYNA
		21-22		■				950	11	Joining Techniques for Crash Analysis with LS-DYNA
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						■		–	12	Information day: Simulation of Drop Tests with LS-DYNA
										DEFENSE
	13-14			■				1.100	13	Blast Modeling with LS-DYNA [1]
	15-16			■				1.100	13	Penetration Modeling with LS-DYNA [1]
	17			■				550	13	Explosives Modeling for Engineers [1]
										PASSIVE SAFETY
15-16				■				950	14	Introduction to Passive Safety Simulation using LS-DYNA
		19		■				475	15	CPM for Airbag Modeling
				■				475	15	LS-DYNA Dummy and Pedestrian Impactor Modeling
						■		-	16	Information day: Dummy Models – Overview and New Developments
						■		-	16	Information day: Human Models – Overview/Extension Possibilities
										METAL FORMING/PROCESS SIMULATION
	15-16			■				950	18	Applied Forming Simulation with eta/DYNAFORM
		10-11		■				950	18	Metal Forming with LS-DYNA
				■				950	19	Hot Forming with LS-DYNA
22						■		–	20	Information day: Forming Trends in LS-DYNA and eta/DYNAFORM
						■		–	20	Information day: Electromagnetical/Thermomechanical Forming
										MATERIALS
		10-11		■				950	21	Fundamentals of Modeling Metallic Materials
		12-13		■				950	21	Damage/Failure Models taking into account Mesh Dependency/Triaxiality
		14		■				475	22	Parameter Identification with LS-OPT
			12	■				270	22	User Materials in LS-DYNA
		24-25		■				1.100	23	Modeling Polymers and Elastomers in LS-DYNA
	9-10			■				1.100	23	Concrete and Geomaterial Modeling [1]
		27-28		■				950	24	Introduction to Composite Modeling with LS-DYNA
		26				■		–	24	Information day: Composite Analysis with LS-DYNA
	23					■		–	25	Information day: Simulation of Plastics with LS-DYNA
	23					■		–	25	Information day: Dynamic Material Characterisation with 4A-Impetus
										IMPLICIT CAPABILITIES
18-19				■				950	26	Implicit Analysis with LS-DYNA
17						■		–	26	Information day: Possibilities with LS-DYNA/Implicit
	1-2			■				1.100	27	NVH and Frequency Domain Analysis [1]
		21				■		–	27	Information day: Acoustics Simulation/NVH Analysis with FEM/BEM
										MULTIPHYSICS/NEW METHODS
	9-10			■				1.100	28	ALE and Fluid-Structure Interaction in LS-DYNA [1]
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	1-2			■				1.100	29	Meshless Methods in LS-DYNA - SPH [1]
				■				550	30	Electromagnetism in LS-DYNA [1]
				■				1.100	30	ICFD - Incompressible Fluid Solver in LS-DYNA [1]
				■				550	31	CESE - Compressible Fluid Solver in LS-DYNA [1]
		7				■		–	31	Information day: Multiphysics
										BIOMECHANICS
			12			■		–	32	Information day: Biomechanics
	20			■				475	32	3D Image Segmentation and Meshing with Simpleware
										OPTIMIZATION
			1			■		–	33	Information day: Optimization/DOE/Robustness
			2	■				550	33	Basics of Structural Optimization
2-4[L]		26-28[TO]	3-5	■				1.425	34	LS-OPT – Optimization and Robustness
			8-9	■				950	35	Structural Optimization with GENESIS
						■		–	35	Information day: Integrated Optimization with ANSA, LS-OPT, META
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	17					■		–	36	Information day: LS-DYNA for Civil Engineering Applications
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										SUPPORT/WEBINARS
19	17	14					■	–	39	Support Day: LS-DYNA
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						■		–	41	Information day: Utilization of Cloud Technology for LS-DYNA

[L] = Linköping, Sweden
[G] = Göteborg, Sweden
[T] = Traboch, Austria

Sem = Seminar
Info = Information day

Web = Webinar
S = Support day

Registration form: pages 53-55
General course information: page 50

■ INTRODUCTION TO LS-DYNA

Type:
 Seminar
Duration:
 3 days
Seminar fee:
 1.425 Euro
 (475 Euro per day,
 can be booked
 separately)
Lecturers:
 Dr. Tobias Graf,
 Dr. Filipe Andrade,
 Dr. Nils Karajan
 all DYNAmore
Dates:
 11-13 February
 25-27 March
 26-28 March [TO)]
 02-04 April [Z)]
 09-11 April [T)]
 21-23 May
 03-05 June [TO)]
 24-26 June
 22-24 July
 23-25 September
 22-24 October [TO)]
 29-31 October [T)]
 05-07 November
 12-14 November [I)]
 16-18 December

 [I)] Ingolstadt, Germany
 [Z)] Zurich, Switzerland
 [TO)] Torino, Italy
 [T)] Traboch, Austria

Basics (Days 1 and 2)

The introductory seminar gives a quick, comprehensive introduction to the application of LS-DYNA and is recommended for simulation engineers who want to use LS-DYNA as a finite element code to simulate general nonlinear problems. Prior knowledge is not required.

The main application areas of LS-DYNA are crash simulations, metalforming simulations and the simulation of impact problems and other strongly nonlinear tasks. LS-DYNA can also be used to successfully solve complex nonlinear static problems in cases where implicit solution methods cannot be applied due to convergence problems. The seminar participant works on exercise examples independently to help him/her understand the application of LS-DYNA.

Content
- What kind of problems can be solved using LS-DYNA?
- What is the difference between implicit and explicit time integration and how are both methods used in LS-DYNA?
- How is a simulation started in LS-DYNA?
- What element types are available?
- How are the various contact definitions implemented?
- How are crash simulations and other dynamic calculations executed?
- How can quasi-static problems be handled?
- What input/ output data is available and what does it contain?
- How can results be analyzed and compared?

We strongly recommend LS-DYNA novices to attend this seminar. Beginners of numerical simulation we additionally recommend the attendance of the seminar "Introduction to LS-PrePost".

Advanced Topics (Day 3)

To carry out realistic FE simulations, appropriate constitutive models need to be selected with the requirement of an identification of the involved material parameters to reproduce the properties of the materials used. In this regard, there is often a possibility to simplify the overall model if certain areas can be modeled either as rigid bodies or with the aid of discrete elements. Moreover, several components are often joined with connectors which also need to be modeled appropriately, to accurately predict the behavior of the overall system.

The aim of this seminar is to facilitate the novice's first steps in material modeling. Following this, the most common constitutive models for typical applications are presented, such as crash, drop or impact simulations. A wide range of the material properties of simulation models are explained in detail using simple examples, and thus enabling associated engineering problems to be dealt with competently and quickly. If required, basic material theory can also be discussed. Additionally, the course participants learn how to define rigid bodies and discrete elements in LS-DYNA and what they need to bear in mind when doing so.

Finally, modeling techniques for the most common types of connectors such as spot-welds and bolt connections are shown to demonstrate how they can be represented in a finite element model using LS-DYNA.

Content
- Presentation of the most common material models for metals, foams, elastomers and polymers
- Composition of a material card for a steel material on the basis of test data
- Modeling rigid bodies with LS-DYNA
- Definition of discrete elements and discussion of corresponding material models
- Modeling techniques for common connectors such as spot-welds, adhesive joins, bolt connections, etc.
- Consolidation of learned knowledge using simple exercise examples
- Tips and guidelines regarding the definition of material cards

To attend the module "Advanced Topics", we recommend prior attendance at the module "Basics".

Courtesy of Adam Opel AG

DYNA
MORE

INTRODUCTION TO LS-PREPOST

LS-PrePost is the pre- and postprocessor of LSTC which can be used to generate or modify LS-DYNA models as well as to visualize the results of finite element analyses that were carried out with LS-DYNA. In particular, LS-DYNA input decks can be loaded into LS-PrePost to edit the keywords cards using the graphical user interface. Over the past years, the capabilities of LS-PrePost have been constantly advanced to account for the latest developments in LS-DYNA. This holds especially for the pre-processing where many new features have been added.

The goal of this one day seminar is to demonstrate the application of LS-PrePost and to explain its practical usage. Attendees will learn how to use the functionality of the graphical user interface with a focus on typical applications.

Content
Preprocessing
- Basic pre-processing operations in LS-PrePost
- Visualizing and editing LS-DYNA input decks
- Working with include structures in the model
- Simple meshing features
- Editing and correction of existing FE meshes
- Checking the quality of the mesh

- Definition of contacts, element types and materials
- Prescribing boundary conditions
- Definition, assignment and visualization of load curves

Postprocessing
- Handling different LS-DYNA output files
- Plot and modification of curves (summation, scaling, filtering)
- Printing and preparing results for presentations
- Color plots of physical quantities on the model (fringe plots)
- Vector plots, cross sections of the model, ...
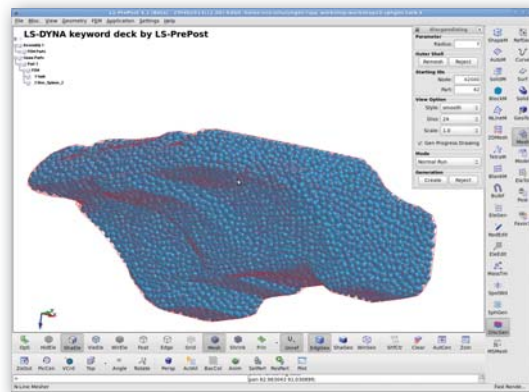
Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturer:
  Markus Künzel,
  DYNAmore
Dates:
  10 February
  24 March
  01 April [Z]
  08 April [T]
  23 June
  21 July
  22 September
  28 October [T]
  11 November [I]
  15 December

[I] Ingolstadt, Germany
[Z] Zurich, Switzerland
[TO] Torino, Italy
[T] Traboch, Austria

INFORMATION DAY: DYNASTART – GETTING STARTED WITH LS-DYNA

The objective of this information day is to walk through the first steps in LS-DYNA along with you. The functionality of LS-DYNA is explained and the fundamental configuration of an LS-DYNA input deck is shown using simple examples. Once the sample input files have been loaded into LS-DYNA and the simulation is finished, the visualization and evaluation of results is demonstrated.
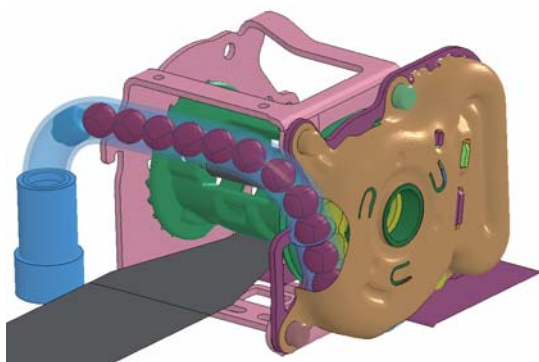
Courtesy of TAKATA-PETRI AG

Moreover, you will be given an overview of the many different areas of application of LS-DYNA by means of selected sample demonstrations. Some of these applications are certainly also of interest to you. We will be happy to consult with you regarding your special requirements.

The offered software packages "DYNAstart Personal" and "DYNAstart Professional" are intended to facilitate the introduction to nonlinear dynamic calculation with LS-DYNA for private and professional use, respectively.

Note that this information day is not a substitute for the seminar "Introduction to LS-DYNA".

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Dates:
  23 January
  26 February [B]
  14 March [D]
  31 March [Z]
  07 April [T]
  30 June [I]
  28 July
  16 September [B]
  27 October [T]
  03 November
  01 December [Z]

[B] Berlin, Germany
[D] Dresden, Germany
[I] Ingolstadt, Germany
[Z] Zurich, Switzerland
[T] Traboch, Austria

■ ELEMENT TYPES AND NONLINEAR ASPECTS

Type:
 Seminar
Duration:
 1 day
Seminar fee:
 475 Euro
Lecturers:
 Dr. André Haufe,
 DYNAmore;
 Prof. Dr. Karl
 Schweizerhof,
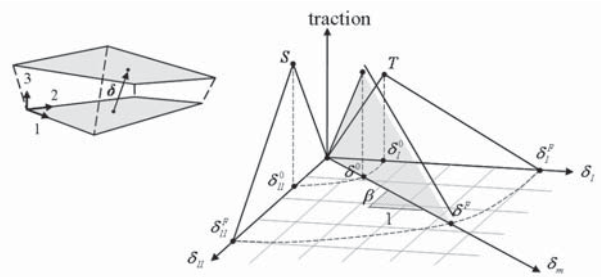 DYNAmore / KIT
Date:
 03 July

This seminar is a collection of different topics on nonlinear aspects with respect to LS-DYNA. Emphasis is directed towards element technology and the various specific elements implemented in LS-DYNA. In particular, the theoretical background as well as the corresponding practical usage will be discussed. Additionally, adaptive schemes for nonlinear problems are presented. Since more and more implicit features are included in LS-DYNA, the seminar will also provide information on implicit solver technology for linear and nonlinear problems.
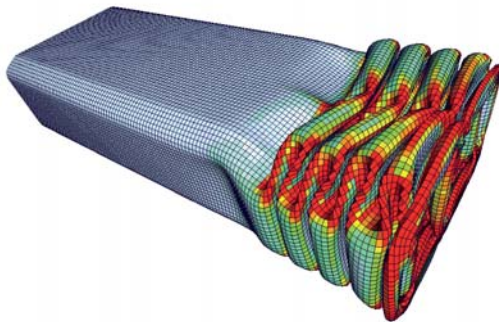
This class is intended for participants with pre-existing knowledge in finite element technology and LS-DYNA who would like to learn more about various aspects of nonlinearities and their implementation in LS-DYNA and who are also interested to obtain better insight into the theoretical background.

Content
- Element formulations implemented in LS-DYNA
- Application field and pros/cons of the different element types
- Theoretical background of various element formulations
- General aspects of nonlinear problems in finite element theory
- Solvers for implicit analyses with specific emphasis on LS-DYNA
- Various example problems using LS-DYNA

■ USER INTERFACES IN LS-DYNA

Type:
 Seminar
Duration:
 1 day
Seminar fee:
 475 Euro
Lecturer:
 Dr. Tobias Erhart,
 DYNAmore
Date:
 30 June

Beyond the possibility to implement custom material models in the program code, LS-DYNA provides the option to extend or modify the code in various areas by adding your own program routines. For example, user interfaces are available for element formulations, friction models, equation solvers, load application, and airbag sensors.

For this purpose, the user-developed routines are compiled and linked to the corresponding LS-DYNA object files. This seminar is designed for users in both industrial and academic research who intend

to integrate their own routines in LS-DYNA and to share their implementation experience with a larger audience.

Content
- Overview of various user interfaces
- Presentation of the coupling approach for your own code
- Recommended compilers and compiler options
- Additional libraries that may be required
- Access to data structures
- Exemplary implementation of a custom routine in LS-DYNA
- If required, discussion of your own routines developed prior to the seminar

```
      include 'nlqparm'
      dimension bmtrx(nlq,3,3,48),gmtrx(nlq,3,3),gjac(nlq)
c
c     Compute b and g matrix for user defined shell 101
c
      do i=lft,llt
      bmtrx(i,1,1,1) =dn1dxi
      enddo
c
      return
      end
```

■ INFORMATION DAY: VERIFICATION AND VALIDATION OF NUMERICAL SIMULATIONS

Increasing demands for improved prediction accuracy in FE calculations and, for example, reliable forecasts about structural and component failures, place much higher requirements on model quality than was generally the case in the past.

Not only approved and tested modeling techniques are of vital importance but also newer and more complex material models as well as assured process steps, such as the consideration of forming simulations in crash analysis. The evaluation of simulation results with regard to their significance and reliability is highly relevant to the quality of predictions.
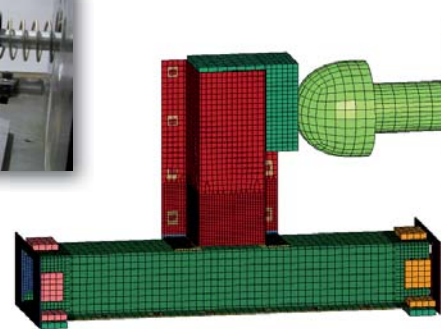
When used in this context, the terms verification and validation are often synonymous with the additional effort required to achieve better predictive accuracy. Probability tests to estimate uncertainties in simulations are also becoming increasingly important.

The aim of the information day is to bring together different experts from the fields of testing, simulation and teaching to channel their knowledge in an interesting presentation program and to stimulate discussion and the exchange of experiences in this fascinating field.

Type:
Information day
Duration:
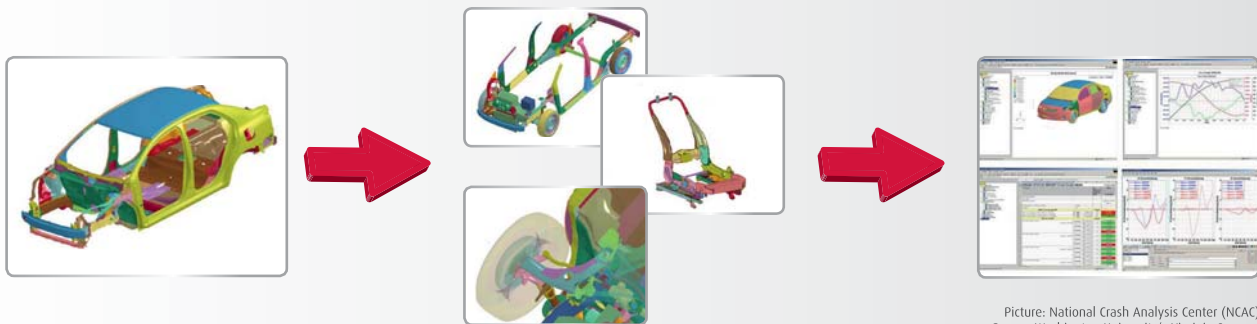1/2 day
Fee:
Free of charge
Date:
21 July

Courtesy of LWF-Paderborn 2013

Courtesy of F. Burbulla (Dr. Ing. h.c. F. Porsche AG),
A. Matzenmiller (University Kassel),
LS-DYNA Anwenderforum, Filderstadt, 2013

■ CRASHWORTHINESS SIMULATION WITH LS-DYNA

Type:
  Seminar
Duration:
  4 days
Seminar fee:
  1.800 Euro
Lecturer:
  Paul Du Bois,
  Beratender Ingenieur
Dates:
  13-16 May
  18-21 November
  02-05 December [L)]

[L)] Linköping, Sweden

This is an advanced course and applies to engineers who have experience in the application of explicit programs or basic knowledge in the field of dynamic and nonlinear calculation with implicit programs. The aim of the course is to show how to perform a crashworthiness simulation in the automobile industry using LS-DYNA, whereby the presented methods are transferable to other kinds of crashworthiness simulations (rail vehicles, components of vehicles, airplanes, vans, etc.).

Each crashworthiness simulation is a compromise between profitability and accuracy. At the moment there is no kind of a guideline for modeling and calculating crash. Therefore, the user has to be aware of advantages and disadvantages of different kinds of modeling procedures depending on the purpose of the simulation. In particular, the aim of the course is to show how to perform an accurate and reliable crashworthiness simulation by thorough modeling and further understanding of the procedure.

This course is designated for new employees from automotive development departments of car manufacturers and suppliers of the automobile industry as well as engineering companies and other users in related industrial sectors. The course instructor is an expert in crashworthiness simulation and is working for several car manufacturers using different FE-codes worldwide. He is also an excellent and popular teacher.
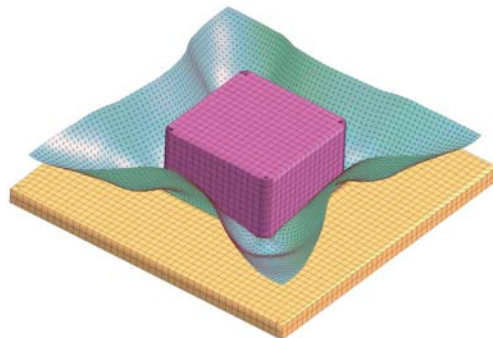
Content
■ Introduction to crash simulation using LS-DYNA
  - Possibilities and technical limits
  - Accuracy and reliability problems
  - Current and future developments
■ Modeling techniques for parts of car bodies
  - Timestep control
  - Mesh outlay, quality and convergence
  - Element quality
  - Flanges, weld spots, etc.
■ Influence of the mass of components
■ Contact definition for crash simulation
■ Selection and description of suitable material models for steel materials
■ Introduction to modeling techniques for foams and plastics
■ Element formulation for shells and volume elements, hourglass stabilization
■ Initialization of models, gravity and pre-tension
■ Component models
■ Quality control of FE models as well as analysis and evaluation of the results

Courtesy of Daimler AG

■ CONTACT DEFINITIONS IN LS-DYNA

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturers:
  DYNAmore staff
  members
Dates:
  28 March
  13 May [L)]
  27 June
  26 September
  08 October [G)]

[L)] Linköping, Sweden
[G)] Göteborg, Sweden

LS-DYNA offers extensive possibilities to model contact. In total there are more than 30 different contact types available and each type supports numerous special settings. While this generous selection guarantees extreme flexibility for the contact definition, it also requires a great deal of knowledge on the user's part.

The objective of this seminar is to provide the user with a summary of the possibilities and limits of the various contact formulations. In particular, the discussion focuses on the selection of a suitable contact type for the application in question. Furthermore, the effects of the various contact options on the simulation results are explained with examples.

Prior attendance of the seminar "Introduction to LS-DYNA" is recommended.

Content
■ Which contact types exist in LS-DYNA?
■ When do I use which contact formulation?
■ How do the various contact formulations differ – how can they be classified?
■ Penalty vs. Constraint treatment
■ Definition of a contact
■ What is an "Automatic contact"?
■ How does a single-surface contact work?
■ What if a contact does not hold?
■ Tied contacts
■ Most recent contact options and current developments in LS-DYNA

Courtesy of Benteler SGL GmbH & Co. KG

■ JOINING TECHNIQUES FOR CRASH ANALYSIS WITH LS-DYNA

In this seminar you will gain insight into the possibilities to model and simulate component connections in LS-DYNA. The most frequently used connections, such as adhesive bonding, bolt fastening, welding, spot-weld adhesive bonding or riveting, each require a specific structural and material model for numerical simulation. For this reason, we will thoroughly discuss the load carrying action of the individual connections as well as their structural stability and demonstrate possible modeling approaches (in conjunction with flange models).

Currently used models will be discussed and the reliability of the obtained results is critically reviewed with particular emphasis on scenarios that include connection failure. Especially for welded and bolted connections, most recent LS-DYNA releases now include a large number of new features and improvements. For example, the contact treatment of flanges has been expanded to enable a better assessment of the spot-weld forces at solid and beam elements. Further failure options have also been introduced. In addition, a new keyword is available to model bolted connections, which allows for a simplified definition of prestress.

The seminar is designed for engineers with practical simulation experience who wish to broaden their knowledge in the field of connection simulations using LS-DYNA.

Content
- Spot-welds/rivets
  - Options to model spot welds
  - Discussion of element types and formulations
  - Tied contacts, flange-flange contact
  - Material modeling of spot-welds
  - Definition of damage and failure
  - Analysis of spot-weld forces
- Prestressed and non-prestressed bolted connections
  - Options to model bolted connections
  - Contact formulations for bolts
  - Analysis of bolt forces
  - KEYWORD: INITIAL_STRESS_SECTION for automated bolt prestressing
- Adhesive bonds
  - Types of adhesive bonds: assembly adhesives, structural adhesives
  - Modeling the adhesive joint
  - Element formulation for continuum elements
  - Special hourglass control
  - Application and use of cohesive elements
  - Connection by tied contacts
  - Established and new material models
- Spot-weld adhesive bonding
- Verification and validation of connection technology models
- Spot-weld adhesive bonding

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Dr. Markus Feucht,
  Daimler AG;
  Dr. Tobias Graf,
  Dr. André Haufe,
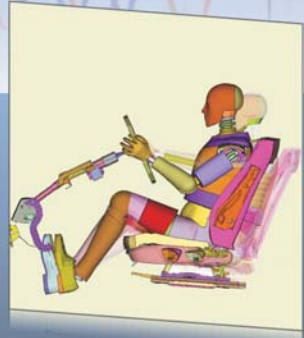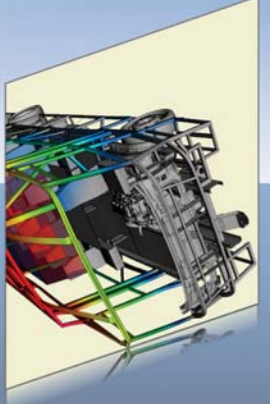 DYNAmore
Dates:
  20-21 February
  21-22 October
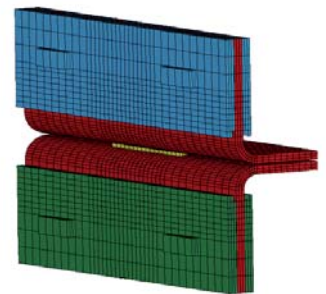
Courtesy of F. Burbulla (Dr. Ing. h.c. F. Porsche AG), A. Matzenmiller (University Kassel), LS-DYNA Anwenderforum, Filderstadt, 2013

■ FAILURE OF FIBER-REINFORCED POLYMER COMPONENTS IN CRASH ANALYSIS

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturers:
  e-Xstream staff
  members
Language:
  German / English
Date:
  25 July

Using the software DIGIMAT, anisotropic nonlinear material formulations can be calibrated in dependence upon strain rates and temperature. The micromechanical basis of this concept enables failure indicators to be defined directly at fiber or matrix level of the material, or allows to derive the failure criteria of a material individually from its microstructure with a definition on component level.

Thus, the DIGIMAT material characterization bridges the injection molding simulation, which predicts the position of fibers in a component, with the simulation of structures with LS-DYNA. By coupling LS-DYNA with DIGIMAT, much more accurate results are obtained when predicting the failure of injection-molded polymer components.

The seminar discusses in detail the coupling of LS-DYNA with DIGIMAT for crash simulations involving glass fiber reinforced polymer components. The user receives an overview of the strategy of the concept.

At the beginning of the course, the required experimental data, the basics of material models as well as their calibration are discussed and failure indicators are defined. Explanations are then given about how to map fiber orientations and link the models to LS-DYNA. To consolidate the learned lessons, the content of the seminar is directly applied to practical examples.

In collaboration with

Courtesy of e-Xstream engineering / Rhodia

■ INFORMATION DAY: SIMULATION OF DROP TESTS WITH LS-DYNA

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  25 February

Many of the product checks include the testing of impact loading. Typically, the resistance of consumer goods is examined due to an impact after a free fall out of heights that represent their respective usage. Examples for such consumer goods are laptops, cell phones, drilling machines or beverage cartons or cans. Furthermore, the package industry shows large interest to assure a good impact reliability during transport.

During this information day, the computational possibilities of LS-DYNA will be demonstrated in the context of impact and falling test simulations and application examples will be provided. Special attention will be drawn on the modeling possibilities of LS-DYNA with regard t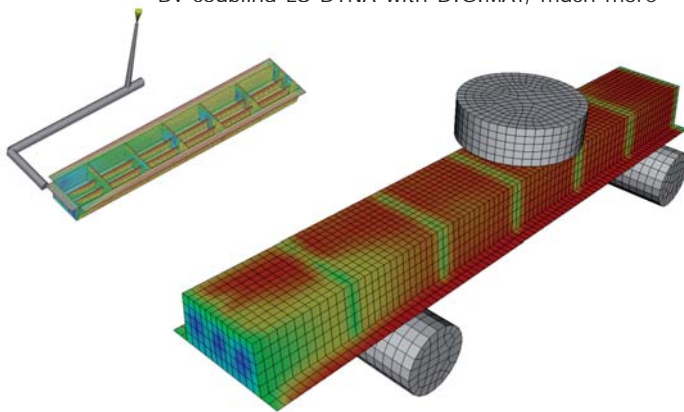o plastics and foam materials. The approaches for the identification of the associated material parameters will be also be illustrated.

Content
- ■ Introduction
- ■ Physics for the propagation of stress waves during the drop test
- ■ Characteristics of plastics materials at sudden impact
- ■ Recommendations for the contact formulation for drop tests
- ■ Liquid filled containers
  - Modeling of the liquid, the structure as well as the boundary conditions
  - Methods for fluid-structure coupling in LS-DYNA (ALE, ICFD, SPH, Lagrange elements)
  - Interpretation of the results
- ■ Possible applications and limitation for the simulation of drop tests
- ■ Validation with experimental results
- ■ Examples
  - Analysis of drop tests of an electronic machine with and without packing
  - Impact of a liquid filled package

Courtesy of Hilti Entwicklungsgesellschaft mbH

■ BLAST MODELING WITH LS-DYNA

Blast events form a class of simulation environments well suited to the solution capabilities of LS-DYNA. LS-DYNA is unique in offering the analyst the choice of Lagrangean, Eulerian (ALE) and simple engineering solvers, and combinations of these, for simulating high energy events such as blast loading. In addition to air blast, the traditional focus of blast modeling, buried explosive charges have recently become important in the design of troop transportation.

This class focuses on the application of LS-DYNA for the simulation of high energy events. The analysis methods, and modeling, are illustrated through case studies. An emphasis is placed on modeling techniques: guidelines for which technique(s) to select, insights into which techniques work well and when, and possible pitfalls in modeling choice selections.

Sufficient mathematical theory is presented for each technique to provide the typical user with adequate knowledge to confidently apply the appropriate analysis technique. However, this training class is not a substitute for the in-depth treatments presented in the associated LS-DYNA training class, i.e. "ALE and Fluid-Structure Inter-action."

Mach Stem Formation
Courtesy of Schwer Engineering & Consulting Services

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  1.100 Euro
Lecturers:
  Paul Du Bois,
  Consultant;
  Dr. Len Schwer,
  Schwer Engineering &
  Consulting Services
Language:
  English
Date:
  13-14 October

■ PENETRATION MODELING WITH LS-DYNA

Penetration events form a class of simulation environments well suited to the solution capabilities of LS-DYNA. LS-DYNA is unique in offering the analyst the choice of Lagrange, Eulerian (ALE) and meshfree methods, and combinations of these methods, for simulating high energy events such as penetration and perforation. In addition to high energy, these events are typically associated with large deformations, damage, and failure both on the material and structural level. During the past decade successful modeling of such damage and failure has moved steadily from a 'Black Art' to a widely accepted engineering practice.

This class focuses on the application of LS-DYNA for the simulation of high energy events. The analysis

methods, and modeling, are illustrated through case studies. An emphasis is placed on modeling techniques: guidelines for which technique(s) to select, insights into which techniques work well and when, and possible pitfalls in modeling choice selections.

Sufficient mathematical theory is presented for each technique, especially meshfree methods, to provide the typical user with adequate knowledge to confidently apply the appropriate analysis technique. However, this training class is not a substitute for the in-depth treatments presented in the associated LS-DYNA training classes, i.e. "ALE and Fluid-Structure Interaction" and "Meshfree Methods (SPH/EFG)", respectively.

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  1.100 Euro
Lecturers:
  Paul Du Bois,
  Consultant;
  Dr. Len Schwer,
  Schwer Engineering &
  Consulting Services
Language:
  English
Date:
  15-16 October

■ EXPLOSIVES MODELING FOR ENGINEERS

This class focuses on the application of LS-DYNA to modeling explosives. LS-DYNA simulations involving explosives can be modeled on several engineering levels from simple application of equivalent pressure histories via *LOAD_BLAST_ENHANCED, explicit inclusion of explosive charges using equations-of-state and detonation via *INITIAL_DETO-NATION, and detonation of explosive due to impact using *EOS_IGNITION_AND_GROWTH_OF_REAC-TION_IN_HE. The analyst selects the appropriate degree of model sophistication to satisfy the intended use of the model results.

The modeling methods are illustrated through case studies with sufficient mathematical theory

to provide the user with adequate knowledge to then confidently apply the appropriate modeling method.

This training class is intended for the LS-DYNA analyst possessing a comfortable command of the LS-DYNA keywords and options associated with typical Lagrange and Multi-Material Arbitrary-Lagrange Eulerian (MM-ALE) analyses. The training class will attempt to provide the analyst with the additional tools and knowledge required to model explosives for a range of applications. The theory and illustrations portions of the class will benefit LS-DYNA users and non-LS-DYNA users alike.

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  550 Euro
Lecturers:
  Paul Du Bois,
  Consultant;
  Dr. Len Schwer,
  Schwer Engineering &
  Consulting Services
Language:
  English
Date:
  17 October

Applications to protective structures, vehicles and homeland security threats

These training classes are intended for the LS-DYNA analyst possessing a comfortable command of the LS-DYNA keywords and options associated with typical Lagrange analyses. The training classes will attempt to provide the analyst with the additional tools and knowledge required to model the above described class of high energy events. The typical attendee is likely to have a background in defense applications, to include protective structures and vehicle vulnerability, Homeland Defense topics, and terrorist threat mitigation techniques. Because the class uses example problems to illustrate concepts and techniques, numerous modeling 'tricks' and options are discussed, and this knowledge would benefit any LS-DYNA user.

■ INTRODUCTION TO PASSIVE SAFETY SIMULATION USING LS-DYNA

Particularly due to the growing amount of relevant legislation and consumer tests, the field of occupant safety in vehicle technology has become more important and also gained in complexity. The goal of this seminar is to present the most important features included in LS-DYNA in relation to occupant safety simulations. Moreover, insights are provided on how to deal with the various components involved, such as airbags, seatbelts, crash-test dummies and seats. During this training, particular emphasis will be laid on modeling methods and the practical application of the features.

The seminar will describe the fundamentals regarding the composition of an LS-DYNA occupant safety simulation, including the positioning and fitting of seatbelts to the dummy, the definition of recommended contacts between the safety systems, and the design of uniform-pressure airbag models.

This seminar is mainly designed for beginners working in the field of occupant safety (especially dealing with side, frontal and rear impact). During the event, attendees will be given the opportunity to use the knowledge acquired in sample exercises.

Content
- Overview of current impact load cases (side, frontal, rear)
- Barrier models available in LS-DYNA
- Dummy models available in LS-DYNA, and their validation methods
- Materials, elements and links used for occupant safety simulations
- Use and positioning of dummies
  - How to position the dummy in the vehicle?
  - How to prestress the seat foam?
  - How to analyze signals of interest at a dummy?
  - What are the injury criteria?
- Definition and fastening of seatbelts
  - How to model seatbelt, belt deflector/ tensioner?
  - How to fit the seatbelt to the dummy?
- Airbag technology
  - How does an airbag system work?
  - Tank test
  - Control volume approach
  - Wang-Nefske formulation
  - Possibilities and limits
  - Syntax and fundamental terms of airbag simulations with LS-DYNA
  - Specific options to define materials
  - Surrogate models for airbag restraints, fire proofing
  - Surrogate models for outlet openings
  - Jetting
  - Composition of an LS-DYNA simulation model
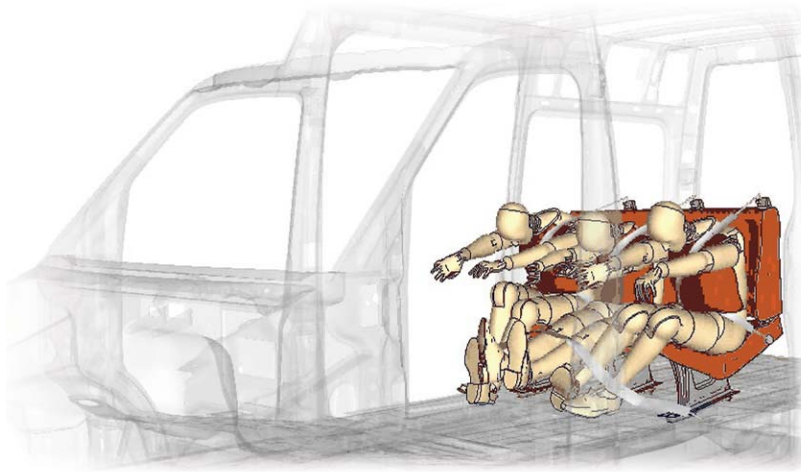
Courtesy of Daimler AG

■ CPM FOR AIRBAG MODELING

Airbags are one of the most important components of a motor vehicle occupant protection system. In addition to standard airbags for the driver and front passenger, an increasing number of specialized airbag variants such as curtain airbags, kneebags, etc. are used. Each airbag must be specifically designed and optimized for its intended purpose. A sensible and comprehensive simulation that captures the behavior of airbags as part of a simulation of the entire restraint system is essential.

This course illustrates the basics that are required to set up an airbag simulation in LS-DYNA. Starting from the simple uniform-pressure (UP) approach for airbag deployment, the seminar will focus on the more recent corpuscular method (CPM). The CPM is based on a particle method and due to its accuracy and numerical efficiency it has been successfully applied to out-of-position (OoP) load cases.

Apart from the deployment technology per se, the seminar also addresses other influencing factors like contact settings, discharge opening and porosity parameters. Moreover, as the material behavior also has a significant influence on the deployment kinematics, some of the latest implementations in LS-DYNA with respect to material definitions are discussed.

Content
- Introduction to the topic
- Fundamentals of airbag simulations
- Uniform-pressure method
  - Wang-Nefske formulation and hybrid inflators
  - Possibilities and limits of UP deployment calculations
  - Jetting definition for UP airbag models
  - Surrogate models for discharge openings
- Model composition
  - Keywords to define UP and CPM Airbags
  - Definition of a reference geometry
  - Possibilities for material definitions (nonlinearities, porosity and validation)
  - Discussion of tank tests and airbag validation
  - Presentation of the process chain for model configuration
  - Postprocessing of results
- Corpuscular method
  - Basic theoretical aspects
  - Application of the method in LS-DYNA
  - Merits and limits of the methodology
  - Comparison to the uniform-pressure approach
- Examples

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturers:
  Reuben D´Souza,
  Sebastian Stahlschmidt,
  both DYNAmore
Dates:
  26 May
  09 June [G)]
  19 December

[G)] Göteborg, Sweden
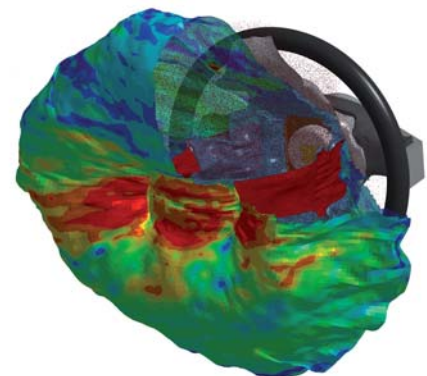
Courtesy of Daimler AG

■ LS-DYNA DUMMY AND PEDESTRIAN IMPACTOR MODELING

The aim of the seminar is to give participants an overview of how LS-DYNA crash test dummy models and pedestrian impactors can be implemented successfully in passive safety.

The course is recommended for engineers interested in analyzing side, front or rear impacts or pedestrian safety. Other related problems, such as the behavior of seats under a dynamic loading of the dummies, are also discussed. To measure the loads affecting a pedestrian from a collision, a range of impactors has been developed which can be shot/projected at the front of the vehicle in various test configurations. Moreover, an overview of the available impactors is also given.

All instructors have years of experience working on the development of FAT side impact dummy models, which are used throughout the world, and recently also on the FAT rear impact dummy model BioRID 2. These models have been developed in collaboration with the German automotive industry.

Content
- Dummy models available for LS-DYNA
- Differences between front impact dummy models from FTSS and LSTC
- When should which model be used?
- FAT side impact dummy models
- FAT rear impact dummy model BioRID 2
- Limits of modeling dummies
- Positioning dummies in vehicles
- Modeling seat belts, belt deflectors and belt pre-tensioners
- Putting the seat belt on the dummy
- Characterization of the impactor model: head, hip and leg impactors (construction and materials used)
- Comparison of impactor models from different software manufacturers
- How to avoid problems when modeling soft foams

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturers:
  Sebastian Stahlschmidt,
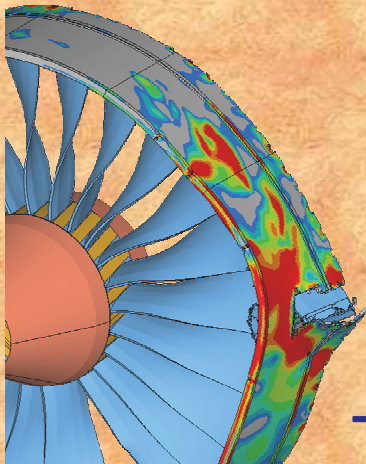 Alexander Gromer,
  both DYNAmore
Date:
  27 May
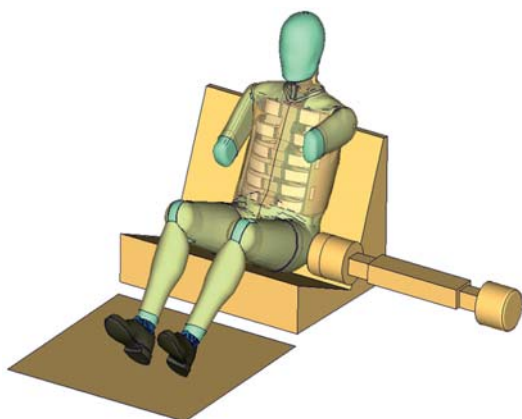
■ INFORMATION DAY: DUMMY MODELS – OVERVIEW AND NEW DEVELOPMENTS

This information day gives a summary and future outlook on occupant simulation using LS-DYNA dummy models from Humanetics Innovative Solutions and DYNAmore. Front, side and rear crash dummy models are discussed.

Humanetics Innovative Solutions is the world's largest manufacturer of crash test dummies and also develops finite element models. The speakers from DYNAmore were involved in the development of the side impact dummy models and also the rear impact dummy model BioRID 2 from the Association for Research in Automotive Technology (FAT).

As well as giving an overview of existing models, a review of the latest developments in legislation and consumer protection organizations will also be presented. The focus will be on demands regarding the future development of models for simulations.

Content
- Which dummy models are available for LS-DYNA?
- Presentation of the models
  - Child models
  - Adult models for front and rear crash
  - WSID 50% model for side crash
  - AT models for side crash
- Free dummy models
- Where are the limits in dummy modeling?
- Future dummies
- On request, the FMVSS214 head model is also discussed

Courtesy of Rheinmetall Landsysteme GmbH

■ INFORMATION DAY: HUMAN MODELS – OVERVIEW AND EXTENSION POSSIBILITIES

The aim of the information day is to give an overview of the possibilities to simulate a human body using LS-DYNA. Herein, the "Total Human Model for Safety" (THUMS) and its validation basis will be presented and explained with the aid of various applications.

In addition, brief discussions about other, more-detailed models currently used in science are also planned. These will be especially concerned with the active control of the human model via internal muscle forces, which can be applied not only one-dimensionally in the modified Hill muscle but also three-dimensionally in the modeled muscle itself.

The human model THUMS was developed by Toyota Central R&D Labs. Inc, Toyota System Research Inc., and Toyota Motor Company in collaboration with universities and is commercially available via DYNAmore. The major objective of THUMS is the simulation of driver and pedestrian injuries. However, due to the accurately detailed geometric resolution of various organs, it can also be used in other applications, such as man-machine inter-action.

Courtesy of Daimler AG

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

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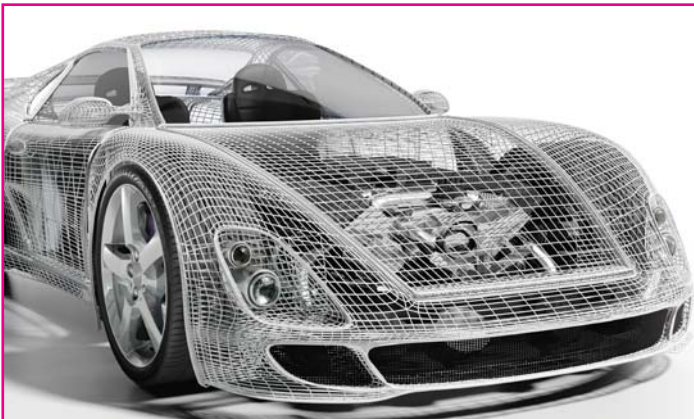
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■ APPLIED FORMING SIMULATION WITH ETA/DYNAFORM

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Peter Vogel,
  Markus Künzel,
  both DYNAmore
Dates:
  30-31 January
  03-04 June
  15-16 October

This seminar provides an introduction to the simulation of sheet-metal and hydroforming processes with eta/DYNAFORM and LS-DYNA. All steps required to set up a LS-DYNA forming simulation are covered. The eta/DYNAFORM program is a special preprocessor for simulation of forming processes with LS-DYNA. Moreover, the program LS-PrePost is presented for postprocessing purposes.

The seminar is practice-oriented, with an emphasis on industrial applications. This seminar is suitable for users from the area of metal forming who wish to learn how to use eta/DYNAFORM and LS-DYNA to simulate sheet-metal forming processes or who wish to deepen existing knowledge.

Courtesy of BMW Group

Content
- Introduction to the simulation of sheet metal forming processes
- Introduction to the software eta/DYNAFORM
- Preprocessing with eta/DYNAFORM
  - Meshing of the tool geometry and the blank
  - Definition of the blank: Selection of the material model, choosing an element type, setting symmetry boundary conditions
  - Definition of the tools: Selection of the contact formulation, defining friction
  - Positioning of the tools
  - Applying force- and displacement-boundary conditions on the tools
  - Definition of draw beads
  - Definition of adaptive meshing
  - Determination of the sheared blanks
  - Trimming of the sheet with eta/DYNAFORM
- Starting simulations and job control of the LS-DYNA runs
- Multi-stage process definition: Gravity loading analysis, binder closing, drawing simulation
- Forming limit diagram
- Postprocessing with LS-PrePost (thickness distributions, plastic strains, ...)
- Application examples

■ METAL FORMING WITH LS-DYNA

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Dr. Bernd Hochholdinger,
  Dr. André Haufe,
  Markus Künzel,
  all DYNAmore
Dates:
  28-29 April
  10-11 December

The two-day seminar communicates the fundamentals of the simulation of sheet-metal forming processes with LS-DYNA and provides notes and hints for everyday practical application. Particular attention will be drawn on the forming-specific settings and features in LS-DYNA. The focus of the first day is primarily on introductory remarks about forming simulation in LS-DYNA. Required keywords, settings, correlations and typical procedures will be explained in detail. Another aspect will be the critical consideration and examination of the simulation results and possibilities to overcome problems by means of alternative approaches and methods.

The goal of the seminar is to enable the user to independently select the correct settings and parameters for a specific task. On the second day, the understanding of the fundamental theory imparted will be deepened, and its limits will be discussed.
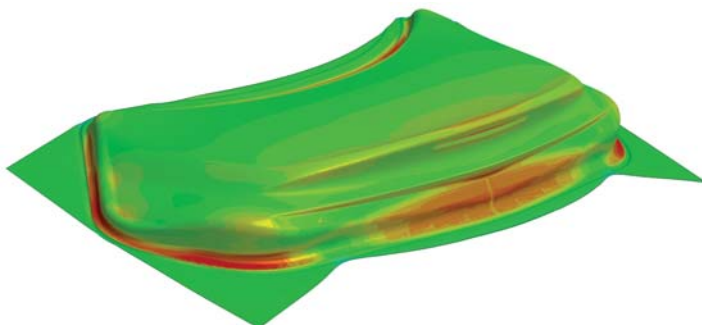
Courtesy of Adam Opel AG

This seminar is suitable for users from the area of metal forming who wish to learn how to use LS-DYNA for the simulation of sheet metal forming processes or who wish to deepen existing knowledge.

Content
- Discussion of specific settings and features for the forming process in LS-DYNA
  - Contact settings
  - Shell element types
  - Definition of displacement and force boundary conditions regarding global and local coordinate systems
  - Adaptive mesh refinement: minimization of the discretization error and correct choice of parameters
  - Analytical draw bead model
  - Trimming with LS-DYNA
- Procedure to compute multistage forming processes
  - Gravity simulation (explicit or implicit dynamic)
  - Forming simulation
  - Springback simulation (implicit static)
  - Simulation of postforming operations
- Model checking and postprocessing with LS-PrePost
- Foundations of computational plasticity and modeling assumptions
- Characteristic of available material models
  - isotropic/anisotropic plasticity
  - kinematic/isotropic hardening
  - Discussion of the different models and their suitability for certain steel grades
- Possibilities for parameter identification

■ HOT FORMING WITH LS-DYNA

In this seminar, participants are taught the basics of thermal and thermomechanically coupled simulations using LS-DYNA. In addition, the definition and basic forms of heat transfer will be reviewed.

Due to its increasing relevance, special attention will be drawn on the application of thermal and coupled simulations of hot and cold forming processes. Among other things, the available material models will be described covering plasticity, viscoplasticity, anisotropy, and structural transformation of steel. Besides the modeling methods of the main physical effects, a focus is placed on illustrating efficient modeling techniques that are adapted to the calculation task at hand.

Content
- Basics of thermal computations
- Linear and nonlinear simulations
- Heat transfer during contact
- Thermomechanical coupling in LS-DYNA
- Material models for coupled calculations
- Temperature-dependent elasticity, viscoplasticity and anisotropy

- Thermomechanically coupled forming simulation
- Incorporate microstructural transformations during hot forming
- Calculation of the cooling or warming of hot forming tools
- Special applications in process simulation
  - Localized heat treatment of aluminum components
  - Heating by welding,
  - Induction heating, etc.

Type:
 Seminar
Duration:
 2 days
Seminar fee:
 950 Euro
Lecturers:
 Dr. Bernd Hochholdinger,
 Markus Künzel,
 both DYNAmore
Dates:
 28-29 January
 05-06 June
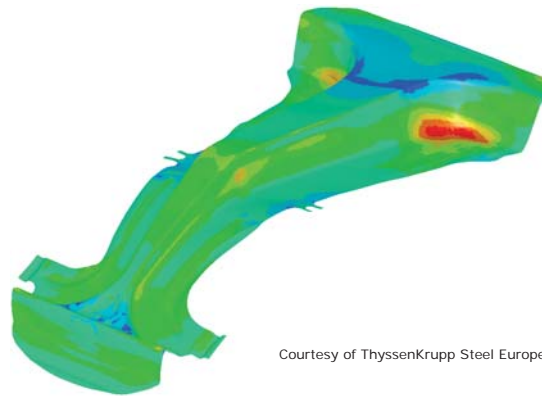
Courtesy of ThyssenKrupp Steel Europe AG

■ INFORMATION DAY: FORMING TRENDS IN LS-DYNA AND ETA/DYNAFORM

Type:
Information day
Duration:
1/2 day
Fee:
Free of charge
Dates:
12 March [A)]
24 June [D)]
22 September

[A)] Attendorn, Germany
[D)] Dresden, Germany

The software eta/DYNAFORM is an effective pre- and postprocessor that has been especially designed for forming simulations. Together with the solver LS-DYNA, it forms a complete package, which fully covers all forming simulation requirements.

Applications, such as determining preliminary sheet metal blanks, generating tool geometries and compensating for springback are covered by the main functions of the software package. Further functions allow defining a complete multistep forming processes based on blank positioning under the influence of gravity right up to simulating springback. Typical output of the simulation include sheet metal thickness distributions, forming forces, the amount and direction of springback or compensated tool geometries as well as the prediction of tear and fold formation.

The event addresses interested tool designers and method developers in the field of metal forming who wish to be kept up to date about the latest trends and developments in LS-DYNA and eta/DYNAFORM.

This information day presents the latest topics concerned with forming simulation using LS-DYNA and eta/DYNAFORM. Herein, new requirements, new developments and the current possibilities and limits of various concepts will be discussed.

For more information and event schedules sign up for our information mail or visit us on our website www.dynamore.de.

Content
- Integration of forming simulations into the development process
- Process characterization
- Add-ons and pre-simulation
- Trimming and cutting
- Analyzing calculations
- Calculating springback
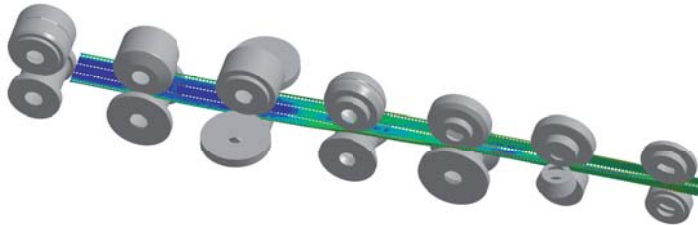
Courtesy of Ubeco GmbH
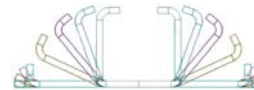
■ INFORMATION DAY: ELECTROMAGNETICAL/THERMOMECHANICAL FORMING

Type:
Information day
Duration:
1/2 day
Fee:
Free of charge
Date:
02 June

This information day is directed at interested LS-DYNA users who would like to be informed about the thermomechanically and electromagnetically coupled process simulation with LS-DYNA.

With the aid of simulation examples, a variety of coupled problems and their solution will be discussed. In particular, besides the already-established application of a thermomechanical coupling in hot forming processes, concepts to account for the microstructure in material models for metal plasticity will also be illustrated.

Moreover, the simulation of electromagnetic high-speed forming processes using LS-DYNA is also presented. In such simulations, one proceeds

from multiple couplings of the actual mechanical problem with the calculation of temperature as well as electrical currents and the magnetic field.

Content
- Thermomechanical coupling
- Phase transition in steel materials
- Consideration of the microstructure in material models
- Electromagnetic coupling
- High-speed forming
- Resistance spot welding
- Induction
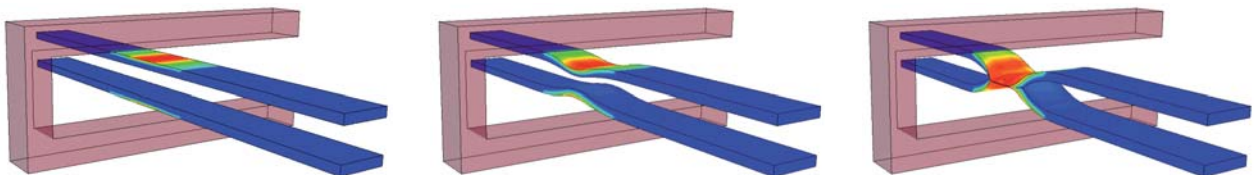
FUNDAMENTALS OF MODELING METALLIC MATERIALS

Meanwhile there are dozens of material models available in LS-DYNA which are suitable to represent metallic materials. However, a profound understanding of the applied material models is still needed to obtain reasonable and reliable FE simulation results.

The aim of this seminar is to give practical guidelines about the application of the most commonly-used material formulations. The focus will be especially on the underlying basic theory as well as on the assumptions made for the corresponding material formulations. Moreover, besides the practical information about particular input formats and the relevance of special settings, the algorithmic background of the various model assumptions will also be explained. Finally, diverse applications for the most-commonly used metallic material models in LS-DYNA will be illustrated with the aid of small exercise example.

To attend this seminar, prior attendance at the seminar "Introduction to LS-DYNA" is recommended.

Content
- Theoretical aspects of modeling materials
  - Stress and strain measures
  - Rheological models
  - Isotropy and anisotropy
- Classification and differentiation between material models in LS-DYNA
- Research-oriented remarks on modeling materials in LS-DYNA
- Introduction
  - Linear elastic, elastoplastic models and projection algorithms
  - Visco-elastic and visco-plastic models
  - Anisotropic material models for 2-d and 3-d discretizations
  - Identifying parameters to take the effects of strain rates into account
  - Damage and failure models in cases where they are theoretically linked to the basic models (e.g. Gurson)
- Differentiation between various metallic materials with corresponding discussion
- Examples to be worked through by course participants

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Dr. Filipe Andrade,
  Dr. André Haufe,
  Dr. Thomas Münz,
  all DYNAmore
Dates:
  09-10 April [TO]
  05-06 May
  10-11 November

[TO] Torino, Italy
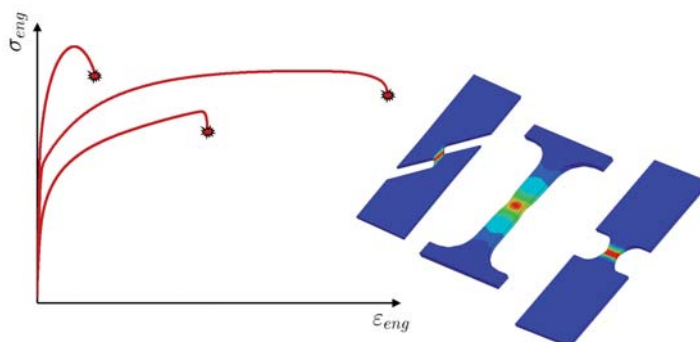
DAMAGE AND FAILURE MODELS TAKING INTO ACCOUNT MESH DEPENDENCY AND TRIAXIALITY

This two-day seminar will discuss and clarify issues related to the complex adjustment of material models considering damage and failure. Starting with the design process of the experimental layout, the seminar will embrace everything to the point of actually creating material cards using LS-DYNA, thereby reflecting the entire verification and validation process.

Herein, a detailed explanation of the conversion of experimental data into true Cauchy stresses and logarithmic strains will be given. Moreover, the dependency of deformations on anisotropy and triaxiality will be discussed under inclusion of the complex descriptions of failure. Of particular interest will be the influence of the model reduction with shell elements and their influence on failure models of, e.g., Wierzbicki, on the basis of Gurson, Johnson-Cook and extended Barlat models.

The influence of the element size dependency on the failure behavior will be discussed in the context of strain and energy equivalence. The issues of material stability and softening will be discussed in detail using the Gurson material model. Exercise examples illustrate the theoretical findings.

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Dr. Markus Feucht,
  Daimler AG;
  Dr. André Haufe,
  DYNAmore
Dates:
  07-08 May
  12-13 November

Courtesy of FVV (Forschungsvereinigung Verbrennungskraftmaschinen e.V.) and Inprosim GmbH

■ PARAMETER IDENTIFICATION WITH LS-OPT

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturer:
  Katharina Witowski,
  DYNAmore
Dates:
  09 May
  14 November

The use of new materials, such as plastics, composites, foams, fabrics or high-tensile steels, demands the application of highly complex material models. These material formulations are generally associated with numerous material parameters. The optimization program LS-OPT is ideally suited for identifying these parameters. In the identification process, an automatic comparison is carried out between the experimental results and the simulation results of LS-DYNA. Thereafter, the error between experiments and simulations is minimized.

In this seminar, a brief introduction in LS-OPT is made with a focus on the application of LS-OPT to determine material parameters. No prior knowledge about optimization or the application of LS-OPT is required.

Content
■ The optimization problem for the parameter identification
  - Objective function: minimization of deviations between simulations and experiments (least-squares principle)
  - Constraints
  - Optimization variables
  - Normalization and weighting
■ Brief introduction to LS-OPT
■ Graphical User Interface (GUI)
■ Simultaneous adaptation of several experiments (e.g. tensile, shear and biaxial tests)
■ Starting LS-DYNA simulations and job control in LS-OPT
■ Analysis and evaluation of optimization results
■ Execution of examples
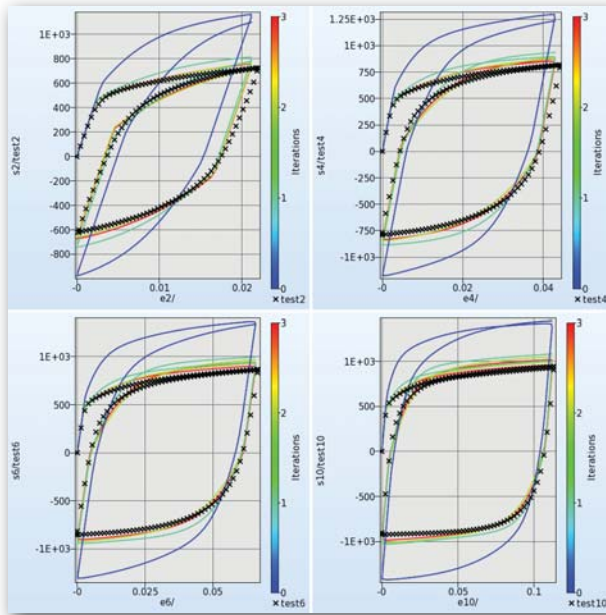
■ USER MATERIALS IN LS-DYNA

Type:
  Seminar
Duration:
  1/2 day
Seminar fee:
  270 Euro
Lecturer:
  Dr. Tobias Erhart,
  DYNAmore
Dates:
  07 February
  12 December

LS-DYNA offers the possibility to implement custom material models into the code of the program. In this regard, the user-developed material routines will be compiled and linked with the corresponding LS-DYNA object-files. The seminar aims at users from industrial as well as academic research facilities who would like to integrate their own material models in LS-DYNA and are interested in discussing their experience with the implementation in a wider circle of users.

Content
■ Demonstration of the development procedure
  - Recommended compiler and compiler options
  - Potential additionally required libraries
■ Access to data structures
■ Implementation of a custom material routine in LS-DYNA
■ On request, your custom models can be discussed and edited during the seminar
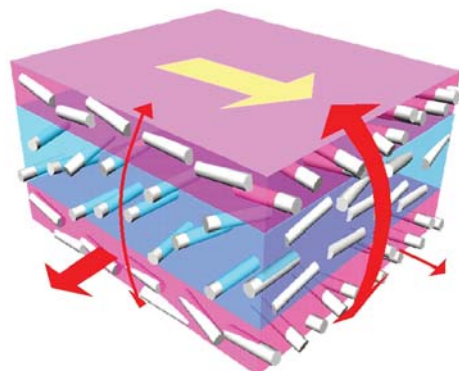
Courtesy of BASF AG

DYNAMORE

■ MODELING POLYMERS AND ELASTOMERS IN LS-DYNA

For a variety of industrial applications, polymers (i.e. thermoplastics, foams and rubber materials) have become more and more important. Especially foams are widely used in the automotive industry because of their energy absorbing properties and their beneficial stiffness to density ratio. Compared to other commonly used materials, as for example, steel or aluminum, the material behavior of foams is much more complex. Rubber and glue materials are in general nonlinear elastic. Especially for rubber materials, rate-dependency and damage have a great influence on the hysteresis formation. Thus, these properties need to be considered in the constitutive material formulation. Moreover, thermoplastics exhibit a very complex material behavior ranging from viscoelasticity to viscoplasticity with fundamental differences to the properties of metallic materials.

Following this, the reproduction of the material behavior of thermoplastics, foams, glue and rubber materials within a finite element analysis represents a challenging task for the simulation expert. The program LS-DYNA offers its users a wide range of material models that have been developed exclusively for the modeling of these materials. The choice and the application of such special material models require thorough knowledge of the theoretical as well as the numerical background.

The goal of this seminar is to provide an overview of the available material models for thermoplastics, foams, rubbers and glues in LS-DYNA and to give guidance to apply them properly. Additionally, their practical usage will be discussed and the theoretical background of these models will be presented. Also addressed will be the topics parameter identification, experimental set-up and evaluation of experimental results.

Small example problems will illustrate various application cases of the material models implemented in LS-DYNA.

Content
- Presentation of various applications
- Discussion of the material behavior of polymers
- Foams: reversible, crushable and semi-crushable foams; appropriate material models; preparation of test results
- Rubber materials: quasi-static and dynamic behavior; Incompressibility; Experimental set-up; data preparation; parameter identification
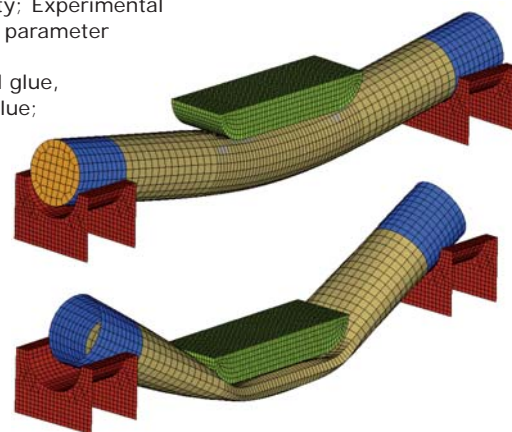- Glue materials: Structural glue, installation glue, screen glue; modeling of a glue lines; material behavior and material modeling of glue; experiments for the evaluation of material parameters
- Thermoplastics: material models for small and large deformations; experimental set-up, data preparation; validation and verification

Courtesy of Dow Deutschland Anlagengesellschaft mbH

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  1.100 Euro
Lecturer:
  Prof. Dr. Stefan Kolling,
  TH Mittelhessen
Dates:
  31 March - 01 April
  24-25 November

■ CONCRETE AND GEOMATERIAL MODELING

Constitutive models for concrete and geomaterials (rock and soil) are typically based on the same mathematical plasticity theory framework used to model common metals. However, the constitutive behavior of concrete and geomaterials differs from that of metals in three important ways:

1. They are (relatively) highly compressible, i.e. pressure-volume response;
2. Their yield strengths depend on the mean stress (pressure), i.e. frictional response; and
3. Their tensile strengths are small compared to their compressive strengths.

These basic differences give rise to interesting aspects of constitutive modeling that may not be familiar to engineers trained in classical metal plasticity.

The course starts from the common ground of introductory metal plasticity constitutive modeling and successively builds on this base adding the constitutive modeling features necessary to model concrete and geomaterials. The LS-DYNA constitutive models covered are adequate for modeling most types of rock, all concretes, and a large class of soils. The course is intended for those new to concrete & geomaterial constitutive modeling, but will also be useful to those seeking a more in-depth explanation of the LS-DYNA concrete and geomaterial constitutive models covered.

A significant portion of the course is devoted to understanding the types of laboratory tests and data that are available to characterize concrete and geomaterials. Unlike most metals, whose strength is characterized by a single value obtained from a simple uniaxial stress test, concrete and geomaterial characterization requires a matrix of laboratory tests. A knowledge of how these tests are performed, the form and format, of typical laboratory test data, and the interpretation of the data for use with a concrete or geomaterial constitutive model, is essential to becoming a successful concrete & geomaterial modeler.

The basic mathematics of the LS-DYNA concrete and geomaterials constitutive models are covered, with an emphasis on how the mathematics can aid the modeler in fitting constitutive models to the available laboratory data. The mechanics of the constitutive model are emphasized to provide the modeler with the insights necessary to easily separate cause and effect in these complicated constitutive models. Exercises in fitting the LS-DYNA concrete and geomaterial constitutive models to typical laboratory data are used to illustrate the data and the constitutive models.

The lecturer, Dr. Len Schwer, works for more than 25 years on the development of material models for geomaterial applications. The so called "Smooth Cap Model" for geomaterials was implemented by himself in LS-DYNA. Since 1997 he works with the professors Belytschko and Liu from the Northwestern University on the application of meshless methods for the modeling of concrete.

Recommended requirements:
Basic knowledge of LS-DYNA.

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  1.100 Euro
Lecturer:
  Dr. Len Schwer,
  Schwer Engineering &
  Consulting Services
Language:
  English
Date:
  09-10 October

■ INTRODUCTION TO COMPOSITE MODELING WITH LS-DYNA

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  Dr. Stefan Hartmann,
  Dr. Thomas Klöppel,
  Christian Liebold,
  all DYNAmore
Dates:
  18-19 March [G]
  03-04 April
  25-26 June [TO]
  27-28 November

  [G] Göteborg, Sweden
  [TO] Torino, Italy

Increasing requirements on resistance and durability in conjunction with weight reduction have advanced the development of composite materials very strongly within the last decades. Composites are no longer used for special applications or subordinate components, but increasingly for components in volume production. Hence, concepts are on demand to capture the complex mechanisms of load transfer and failure within numerical simulations.

A very important subgroup of "composites" consists of long-fiber-reinforced composite materials. They typically consist of high-strength carbon or glass fibers which are unidirectionally embedded in thin layers of an epoxy resin matrix.

This seminar gives an overview on potential modeling techniques of this subgroup. The strong anisotropy of these composite structures leads to a complex mechanical behavior which has to be captured in the simulation. Therefore, the available material models in LS-DYNA are introduced and discussed in-depth. Some of these models are implemented and co-developed with the support from DYNAmore employees. Furthermore, different possibilities to model the phenomena of delamination are shown. The applicability and limits are demonstrated by means of small numerical examples.

Content
- Introduction to composite materials
- Laminate theory
- Structure modeling and model assumptions
- Material modeling
  - Discussion of existing material models in LS-DYNA
  - Failure criteria of Chang-Chang, Tsai-Wu and Hashin
- Modeling of delamination
  - Cohesive-elements and tiebreak contact
- General effects by means of examples
- Visualization of simulation results with LS-PrePost
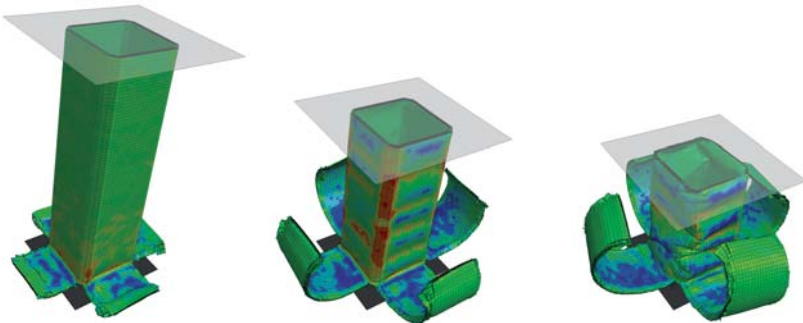
■ INFORMATION DAY: COMPOSITE ANALYSIS WITH LS-DYNA

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Lecturers:
  DYNAmore and
  e-Xstream staff
  members
Language:
  German/English
Dates:
  02 April
  26 November

Due to the increasing importance of lightweight construction, where the aim is not only to economize on weight but also to improve rigidity and strength, the use of composite materials has increased dramatically over recent years. If considerations are made regarding the use of such materials for crash-relevant components, the requirements of simulation tools increase enormously - especially in automotive construction. As a consequence, numerous enhancements have been implemented in LS-DYNA.

The aim of this information day is to inform participants about the state of the art in simulating composite materials. In particular, an overview of existing options in LS-DYNA for simulating composite materials is given and current developments will also be discussed. A further focus will be on the presentation of the software DIGIMAT, which allows to analyze the microstructure of composite materials. The possibility of coupling DIGIMAT with LS-DYNA will also be addressed.

Content
- Overview of techniques to model composite materials in LS-DYNA
- Insight into the latest developments in LS-DYNA regarding composite materials (material formulations, elements, delamination mechanisms)
- Visualization of simulation results
- Overview of the application of DIGIMAT for composite materials
- Coupling DIGIMAT with LS-DYNA

In collaboration with

■ INFORMATION DAY: SIMULATION OF PLASTICS WITH LS-DYNA

Today, mechanically loaded plastic components are used in nearly all engineering environments. In recent years, their use has particularly increased in the automotive industry. Herein, extremely complex material models are needed to model such components realistically in a finite element simulation. Plastics are usually much more complicated in their material behavior than, for example, steel or aluminium. Frequently encountered properties of plastics are nonlinear elasticity, viscoelasticity, viscoplasticity, strain rate-dependent failure and anisotropic material behavior. Moreover, the usual von Mises flow criterion is normally insufficient for a description of elastoplasticity.

During this information day, experts will report on their experience with material modeling and the simulation of plastics. Part of the lectures will be different experiments for the identification of material parameters and classification of different plastic types.

Application examples from the calculation of relevant components will also be covered in the presentations. DYNAmore experts will provide information on current possibilities and the latest developments in LS-DYNA regarding material modeling of plastics. In a final discussion, participants will have an opportunity to ask questions and to exchange their experience with others.

Content
- What are the problems when modeling plastics?
- Discussion of elastic, visco-elastic and visco-plastic material models
- Failure/ localization / softening
- Classification of plastics
- Material models in LS-DYNA
- Experimental techniques:
  - Quasi-static, dynamic experiments
  - Local strain measurement
- Identification of material parameters
- How does the manufacturing process influence the mechanical behavior of plastics?
- User subroutines with custom material laws
- Examples of use

Type:
Information day
Duration:
1/2 day (morning)
Fee:
Free of charge
Date:
23 October

■ INFORMATION DAY: DYNAMIC MATERIAL CHARACTERIZATION WITH 4A-IMPETUS

A core aim of R&D is to reduce development times and cost. Due to higher requirements in a wide range of applications and especially in plastics technology, the number of different types of materials is constantly increasing. As a result, it is practically impossible to gain fast and flexible access to reliable material parameters which are essential for virtual simulation.

For the first time, 4a Impetus provides a closed pathway for generating validated material maps of manufacturing-aware test pieces under realistic loading conditions with the aid of numerical methods. Based on the available database, the input decks (material cards) are compiled automatically for numeric FE solvers such as LS-DYNA. With LS-OPT, an automatic comparison between the simulation and the test is carried out using the least-squares method. Material parameters are identified by minimizing errors between the test curves and the simulation curves.

The 4a Impetus pendulum test system is so compact that it can be placed on a desktop and directly set up in a development department. Using the double pendulum model, test velocities up to 10 m/s can be achieved, with the system working almost impulse-free towards the "outside".

With the aid of test specimen configurations, the system has been designed to investigate various materials such as elastomers, non-reinforced and reinforced thermo-plastics, foams, thermoset plastics and fiber-reinforced composites.

The information day gives you the opportunity to get familiar with the test system and also to discuss the subject of "dynamic material characterization" with experts and other participants. Tests will be performed on prepared samples during the course of the event and material cards for LS-DYNA will be identified on the basis of these tests.

Content
- Presentation of the test system (motivation, measuring technique, test execution, sample specimens)
- Methods applied (material parameter identification with LS-OPT, formation of substitute areas using neural networks and LS-OPT)
- Example Applications for
  - Foam materials
  - Compact thermoplastics
  - Elastomers

In collaboration with our partner 4a engineering GmbH.

Type:
Information day
Duration:
1/2 day (afternoon)
Fee:
Free of charge
Date:
23 October
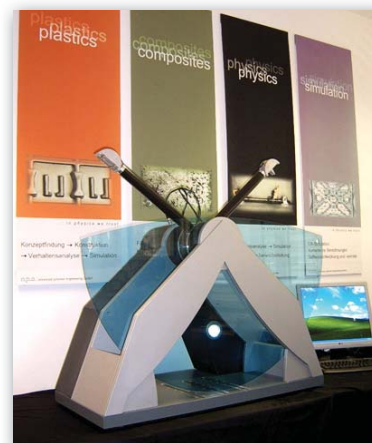
■ IMPLICIT ANALYSIS WITH LS-DYNA

Type:
 Seminar
Duration:
 2 days
Seminar fee:
 950 Euro
Lecturers:
 Dr. Tobias Erhart,
 Dr. Nils Karajan,
 both DYNAmore
Dates:
 18-19 February
 18-19 September

In recent years, the simulation possibilities in LS-DYNA using implicit time integration have been enhanced extensively. The main areas of application for implicit analyses include linear and nonlinear static computations, natural frequency analyses, springback, lengthy transient simulations, systems with preload, etc.

The aim of the seminar is to give participants an overview of the possibilities and limits of implicit simulations using LS-DYNA. In particular, attention will be drawn on the required input cards for such simulations.

The seminar is recommended for engineers intending to use LS-DYNA to carry out implicit simulations. In addition, experienced "explicit users" have the opportunity to learn about what to bear in mind when converting explicit input decks to implicit input decks. Examples will be given during the seminar to illustrate the functionality of the implicit options.

Content
- When does it make sense to run implicit or explicit analysis?
- Differences between explicit and implicit: theory, application, examples
- How does the input syntax look like for the implicit control cards?
- Linear static analysis: options, linear elements, boundary constraints, direct/iterative solvers, accuracy
- Dynamic analysis: Newmark method, input parameters, lumped/consistent mass matrix
- Nonlinear analysis: solution methods (Newton, BFGS, arclength), convergence, tolerances, output, automatic step size strategy
- Eigenvalue analysis: options, modeling aspects, intermittent output
- Modal analysis, linear buckling
- Frequency response function
- Switching: implicit/explicit, explicit/implicit
- Element types for implicit: linear and nonlinear elements
- Material models for implicit analyses
- Contact types for implicit: options, Mortar contact
- Troubleshooting convergence problems
- Summary with checklist of most important settings for implicit calculations

Basic knowledge of LS-DYNA or prior attendance at the seminar "Introduction to LS-DYNA" is recommended.

■ INFORMATION DAY: POSSIBILITIES WITH LS-DYNA/IMPLICIT

Type:
 Information day
Duration:
 1/2 day
Fee:
 Free of charge
Dates:
 17 February
 17 September

The goal of this information day is to present the current possibilities and recent developments of LS-DYNA/Implicit. Herein, various applications will be presented and the functionality of LS-DYNA/Implicit will be demonstrated with the aid of quasi-static as well as dynamic examples problems.

Content
- Status quo of LS-DYNA/Implicit
- For which problems does it make sense to use LS-DYNA/Implicit?
- Application possibilities and limits
- Demonstration of different LS-DYNA/Implicit applications
- Planned future development
- Development status of the MPP parallelization

This Information day is not a substitute for the seminar "Implicit Analysis with LS-DYNA". It merely wants to demonstrate the possibilities of LS-DYNA/Implicit not focusing on the specific usage by the user.

Explicit

Implicit
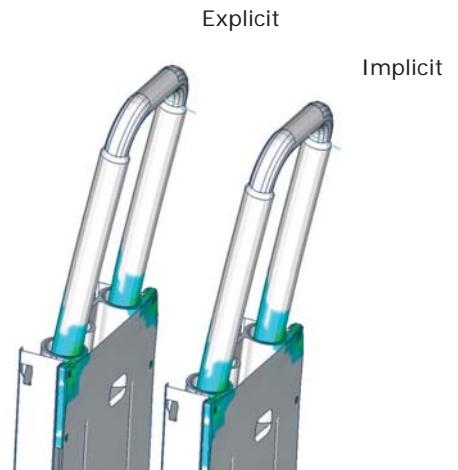
Courtesy of PENG - Prof. Pitzer, Gießen

■ NVH AND FREQUENCY DOMAIN ANALYSIS

The objective of the training course is to introduce the frequency domain vibration and acoustic features of LS-DYNA to users, and give a detailed look at the application of these features in vehicle NVH simulation.

This course is recommended for engineers who want to run NVH or other frequency domain vibration and acoustic simulation problems with LS-DYNA. This course is useful for engineers and researchers who are working in the area of vehicle NVH, aircraft/spacecraft vibro-acoustics, engine noise simulation, machine vibration testing and simulation, etc.

Content
- ■ Introduction
  - Overview of the frequency domain features of LS-DYNA
  - Application
  - NVH theory and lab testing technology
  - Frequency domain analysis vs. time domain analysis
  - Fourier transform
  - Windowing technique
- ■ Frequency Response Functions
  - Modal superposition method
  - Damping
  - Prestress condition
  - Nodal force / resultant force FRF
- ■ Steady state dynamics with harmonic loading
  - Large mass method for enforced motion
- ■ Random vibration with PSD loading
  - Correlated multiple excitations
  - Acoustic wave environment
  - Restart feature
  - Prestress condition

- Random fatigue
- Miner's rule
- S-N fatigue curve
- Steinberg's three band technique
- Dirlik method
- ■ BEM acoustics
  - Helmholtz integral equation
 - Approximate methods (Kirchhoff method/ Rayleigh method)
  - Collocation BEM
  - Dual collocation BEM for irregular frequency problems
  - Variational indirect BEM
  - Half-space problem
  - Impedance boundary condition
  - Panel contribution analysis
  - Muffler transmission loss analysis
- ■ FEM acoustics
  - Elements used in FEM acoustics
- ■ Coupling of vibration and acoustic analysis
  - Transient simulation followed by acoustic analysis
  - Frequency domain simulation followed by acoustic analysis
  - Full coupling analysis using Kirchhoff method
- ■ Response spectrum analysis
  - Input earthquake spectrum
  - SRSS method
  - NRC grouping method
  - CQC method
  - Double sum method
  - NRC sum method
- ■ Postprocessing of analysis results
  - Binary plot databases (d3ssd, etc.)
  - ASCII databases (nodout_ssd, elout_ssd, etc.)
- ■ Workshop

Type:
 Seminar
Duration:
 2 days
Seminar fee:
 1.100 Euro
Lecturer:
 Dr. Yun Huang, LSTC
Language:
 English
Date:
 01-02 October
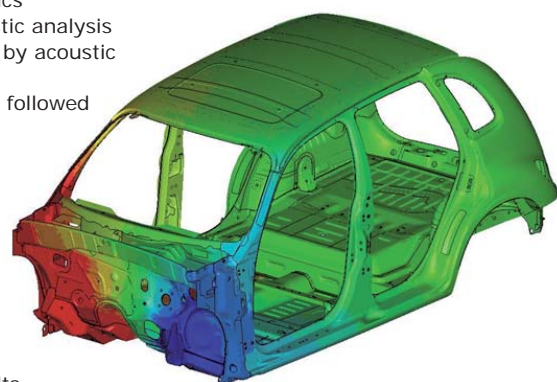
■ INFORMATION DAY: ACOUSTICS SIMULATION AND NVH ANALYSIS WITH FEM AND BEM

At this information day, the theoretical basics of predicting acoustic phenomena will be discussed. The methods are typically based on the boundary-element method (BEM) and the finite element method (FEM). Practical application examples will also be presented and the possibilities and limits of the methods with respect to industrial applications are discussed.

In LS-DYNA, acoustics simulations can be carried out using the BEM and FEM. For this reason, it is possible to investigate acoustic and vibro-acoustic problems in the time as well as in the frequency

domain. Based on these computations, quantities such as the acoustic pressure (Pa) and the sound pressure level (dB) can be analyzed.

The aim of the event is to give general information about calculating problems in acoustics. The current state-of-the-art technology and typical industrial problems will be presented, and the possibilities and limits of simulating acoustics using LS-DYNA are discussed.

Content
- ■ Possibilities and areas of application of acoustics simulations
- ■ Basic theory
- ■ Coupled simulations (FEM/BEM)
- ■ Practical examples
- ■ Acoustics simulation using LS-DYNA
  - Possibilities and current developments
  - Control cards, definition of the problem, model generation
  - Evaluation of the results

Type:
 Information day
Duration:
 1/2 day
Fee:
 Free of charge
Date:
 21 November
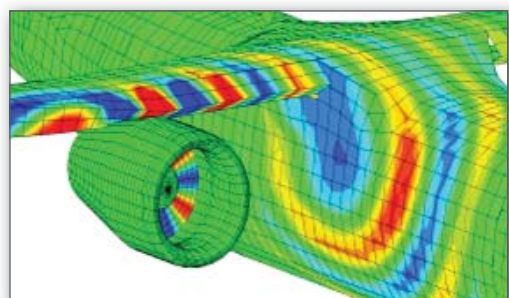
Courtesy of Hamburg University of Technology

■ ALE AND FLUID-STRUCTURE INTERACTION IN LS-DYNA

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  1.100 Euro
Lecturer:
  Prof. Mhamed Souli,
  Universität Lille /
  LSTC
Language:
  English
Dates:
  11-12 March
  09-10 October

In this seminar, you receive comprehensive information about the latest developments in LS-DYNA to analyze fluids and, in particular, the fluid-structure interaction using its Arbitrary Lagrangean Eulerian (ALE) capabilities. Attendees will learn about the theoretical background how fluids are implemented in LS-DYNA using ALE and will gain a deep understanding of these concepts with the aid of many hands-on examples.

The seminar is directed towards advanced LS-DYNA users, who would like to solve problems in the fields of aquaplaning, tank sloshing, tank dropping (partially and completely filled), bird strike, viscous flow, ship collision, underwater explosion and acoustics in air and water. Prior knowledge of fluid dynamics is not required.

The course instructor Prof. Mhamed Souli of the University of Lille is a longtime program developer at LSTC who implements new features for ALE/SPH in LS-DYNA.

Content
■ Basic theoretical background
  - Navier-Stokes equation
  - Mass- and energy balance
■ Selection of material models
■ Selection of equations of state
■ Discretization and numerical Solution
  - Lagrangean formulation
  - Eulerian formulation
  - ALE formulation
  - Moving Eulerian mesh
  - Operator-Split method
  - Advection schemes
  - Algorithms for mesh smoothing
■ Multi-material ALE
  - Pressure relaxation based on volume fractions
  - Interface reconstruction
■ Fluid-structure interaction
  - Constraint method
  - Penalty method
  - Leakage and methods to avoid it
■ Vibro-Acoustic
■ Explosions
■ Practice examples
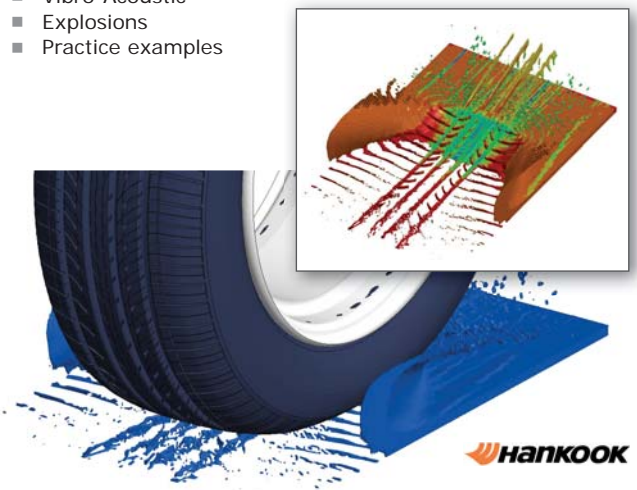
Courtesy of Hankook Tire Co.

DYNAMORE

■ MESHLESS METHODS IN LS-DYNA – EFG

Attendees of this seminar will be introduced to the application of the meshless method "Element-Free Galerkin" (EFG) in LS-DYNA. The seminar will outline the theoretical foundations and thoroughly refer to the settings required in the LS-DYNA input deck to carry out a successful nonlinear EFG simulation. Herein, the difference between the conventional EFG formulation and the adaptive or discontinuous formulations will be explained.

Common applications of the conventional EFG formulation are materials made of rubber or foam that undergo large deformations. The adaptive EFG formulation is the method of choice for the efficient simulation of cutting, bulk forming and forging processes. In particular, the new features of local mesh refinement in combination with the implicit time integration are the key enablers for these processes. Moreover, fracture simulations can be carried using the discontinuous EFG formulation. With the aid of many workshop examples, the attendees will receive a good understanding of how to use the different EFG formulations.

The instructor Dr. Cheng-Tang Wu is a senior software developer at LSTC and was significantly involved in the development and implementation of the meshless method EFG in LS-DYNA. This seminar is recommended for engineers who have already worked with LS-DYNA and would like to use a meshless method.

Content
- ■ Introduction
- ■ Overview of current meshless methods
  - Galerkin method vs. collocation method
  - Advantages and disadvantages
- ■ Conventional EFG formulations
  - Lagrangean, Semi-Lagrange and Eulerian Kernel
  - Treatment of boundary conditions
  - Volume integration and patch test
- ■ Adaptive EFG formulation
  - Global and local adaptivity
  - Interactive adaptivity control
- ■ Discontinuous EFG formulation
  - Brittle fracture and ductile failure
- ■ Coupling EFG with the finite element method
- ■ Thermomechanical coupling
- ■ Implicit and explicit time integration
- ■ Advantages and limitations of the method
  - Incompressibility limit
  - Numerical aspects
- ■ Industrial applications
- ■ Current status and future plans

Type:
 Seminar
Duration:
 2 days
Seminar fee:
 1.100 Euro
Lecturer:
 Dr. Cheng-Tang Wu,
 LSTC
Language:
 English
Dates:
 19-20 May
 09-10 October
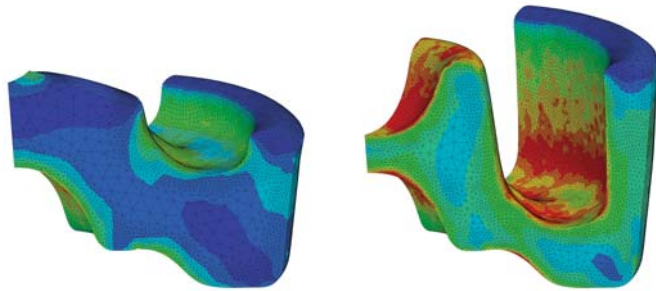
■ MESHLESS METHODS IN LS-DYNA – SPH

Attendees of this seminar will be introduced to the theoretical basics of the meshless method "Smoothed Particle Hydrodynamics" (SPH) and receive guidance for its practical application in LS-DYNA. The seminar will thoroughly illustrate the necessary configurations in the LS-DYNA input deck to realize a successful nonlinear SPH simulation and will furthermore clarify the differences to conventional FEM.

Due to the true meshless nature of SPH, the method is perfectly suitable in situations with very large deformations. Typical applications of SPH in LS-DYNA include impact simulations of fluids or solids or other scenarios where it is essential to capture the momentum exchange accurately. Attendees will learn the application of the SPH with the aid of many workshop examples.

The course instructor Prof. Mhamed Soul of the University of Lille is a long-term software developer at LSTC and is frequently implementing new features for the methods ALE and SPH in LS-DYNA. This seminar aims at engineers who have already worked with LS-DYNA and would like to use SPH as a meshless method.

Content
- ■ Introduction
- ■ General possibilities/applications
- ■ Development and classification of the method
- ■ Principal idea of the SPH method
  - Particle approximation of field functions
  - Characteristic length scales

- Renormalization
- Tension instability and possible countermeasures
- Available formulations
- Comparison of SPH with FEM
- ■ Symmetry boundary conditions
- ■ Contact modeling
  - SPH to FEM
  - SPH to SPH
  - SPH to DEM
- ■ Conversion of finite elements to SPH at failure
- ■ Input parameters
  - Control settings
  - Output settings
- ■ Pre- and postprocessing with LS-PrePost
- ■ Sample applications

Type:
 Seminar
Duration:
 2 days
Seminar fee:
 1.100 Euro
Lecturer:
 Prof. Mhamed Souli,
 Université Lille / LSTC
Language:
 English
Dates:
 13-14 March
 01-02 October

■ ELECTROMAGNETISM IN LS-DYNA

This course provides an introduction to the Electromagnetics (EM) solver in LS-DYNA. Herein, the Maxwell equations are solved in the Eddy-Current approximation, which is suitable for cases where the propagation of electromagnetic waves in air (or vacuum) can be considered as instantaneous. The solver is coupled with the solid mechanics and thermal solvers of LS-DYNA allowing the simulation and solution of applications such as magnetic metal forming, welding, bending, induced heating, resistive heating and so forth.

The course includes a presentation of the solver's general principles and applications, a complete keyword description for setting up an Eddy-Current problem, an introduction to the more advanced features (Inductive heating problems, exterior magnetic field, magnetic materials and so forth) as well as an advanced description of the available controlling tools to ensure a safe analysis. Key electromagnetic concepts are reviewed throughout the course and a general knowledge about electro-magnetics is therefore appreciated but not manda-tory.

Content
- Introduction and applications
- General principles
- Maxwell equations
- FEMSTER library
- FEM and BEM coupled system
- Setting up an EM problem step by step
- The EM timestep
- Circuits
- EM materials and equation of states
- Advanced functionalities
- Controlling and monitoring the analysis

■ ICFD – INCOMPRESSIBLE FLUID SOLVER IN LS-DYNA

This course provides an introduction to the in-compressible fluid solver (ICFD) in LS-DYNA. It focuses on the solution of CFD problems, where the incompressibility constraint may be applied, e. g. ground vehicle, aerodynamics, hemodynamics, free-surface problems, ship hydrodynamics, etc. The solver may run as a stand-alone CFD solver, where only fluid dynamics effects are studied, or it can be coupled to the solid mechanics solver to study loosely or strongly coupled fluid-structure interaction (FSI) problems.

The course includes a presentation of the general principles and applications of the solver, a step by step guide to setting up a simple CFD problem, advanced feature introduction (FSI, conjugate heat transfer) and so forth. A brief review of basic fluid mechanics and CFD concepts are also offered such that no expert knowledge of fluids is required.

Content
- Introduction and supported applications
- General principles
- Fluid mechanics and CFD concepts
- Fluid volume mesher
- Setting up a pure CFD problem
- Step by step keyword description
- Mesh refinement tools
- Multi-phase problems
- User defined mesh
- Advanced controlling and monitoring tools
- FSI and thermal coupling
  - Loose FSI coupling
  - Strong FSI coupling
  - Conjugate heat transfer problems
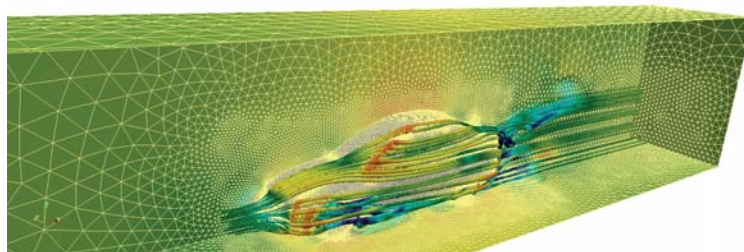
CESE – COMPRESSIBLE FLUID SOLVER IN LS-DYNA

In fluid mechanics, the flow is considered compressible when the fluid density varies significantly in response to a change in pressure. These compressibility effects are typically considered significant if the Mach number (the ratio of the flow velocity to the local speed of sound) of the flow exceeds 0.3 or if the fluid undergoes very large pressure changes. The most distinct phenomenon associated with high speed flows is the existence of shock waves or non-isentropic solutions.

The new compressible flow solver CESE in LS-DYNA is based on a novel numerical framework originally proposed by Dr. Chang of the NASA Glenn Research Center. The method exhibits many non-traditional features, including a unified treatment of space and time, the introduction of a conservation element (CE) and a solution element (SE), and a novel shock capturing strategy without using a Riemann solver, which is able to simultaneously capture both strong shocks and small disturbances. Moreover, the spatial gradients are treated as unknowns which allows for more accurate solutions of the shock waves than normal second order schemes.

So far, this method has been used to solve many different types of flow problems, such as detonation waves, shock/acoustic wave interaction, cavitating flows, and chemical reaction flows. In LS-DYNA, it has been extended to also solve fluid-structure interaction problems with the embedded (immersed) boundary approach or moving (fitted) mesh approach.

Content
- Introduction
- General principles and applications
- The CE/SE scheme
- Setting up a pure CFD/CESE problem
- Setting up an FSI/CESE problem
- Advanced capabilities
- Post treatment
- Documentation

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  550 Euro
Lecturer:
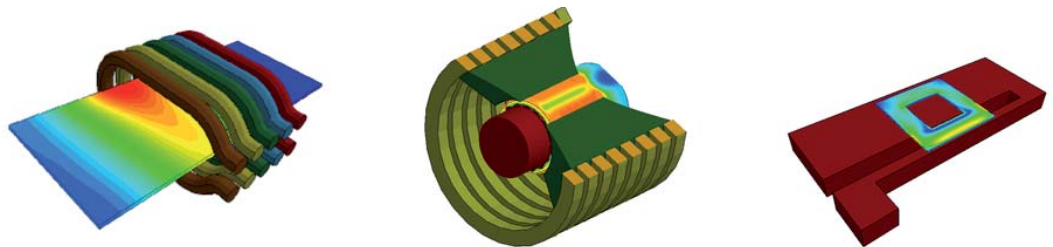 Iñaki Çaldichoury,
  LSTC
Language:
  English
Date:
  19 March
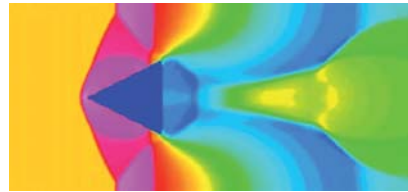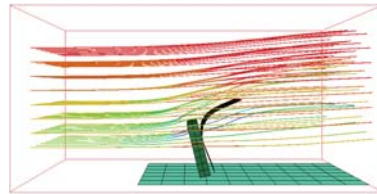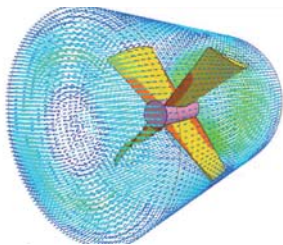
INFORMATION DAY: MULTIPHYSICS

The modern term "Multiphysics" can be understood as a synonym for the solution of generally coupled problems. Following this, multiphysical applications are often classified according to the nature of their coupling in terms of a weak or strong interaction of the involved processes, methods, materials, physical fields or scales as well as combinations thereof.

Moreover, the interacting quantities may result in either volume- or surface-coupled problems. Thus, the success of multiphysical simulations strongly depends on the coupling abilities of the underlying simulation platform. In the case of LS-DYNA, this is achieved in a unified simulation environment.

The goal of this information day is to enlarge upon the basic difficulties with the set-up of multiphysical simulations and to provide suitable solutions by embracing the available discretization schemes in space and time in LS-DYNA. In particular, a great variety of finite elements in a Lagrangean, Eulerian or Arbitrary-Lagrange-Eulerian formulation can be coupled with boundary elements, isogeometric elements or even meshfree methods like SPH, EFG or DEM. Moreover, implicit as well as explicit time integration schemes are provided and can be combined depending on the strength of the coupling.

On the basis of practical examples, an overview on the current coupling abilities in LS-DYNA is given. Herein, the attention is mainly on the mutual interaction of solids and fluids with thermal and electromagnetical fields.

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Dates:
  17 March
  07 November
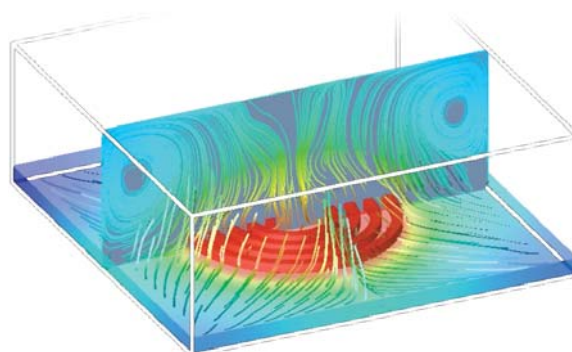
■ INFORMATION DAY: BIOMECHANICS

Type:
 Information day
Duration:
 1/2 day
Fee:
 Free of charge
Date:
 12 December

Regardless of whether you're working at a research institute or in industry, the topic of biomechanics is of growing interest. However, from a historical point of view, biomechanics is not a new subject at all because nature has been inspiring engineers for many years, as illustrated by the example of stress-driven structural optimization according to the paradigm of the trabecular structure in bones. Driven by an ever-increasing lifespan, the desire to better understand processes inside humans has emerged to allow engineering expertise to be used for medical purposes.

Combined with coupled multiphysical simulation methods, there are numerous application possibilities, such as modeling skeletal muscles and heart muscles which can be stimulated electrically, heart valves in circulating blood flows, the interaction between vessel-widening stents and arte-

ries, among many other tasks. However, typical problems associated with the purely-mechanical design of implants under the effect of the constantly-changing system "man" continue to be of great interest.

The aim of the information day is to discuss modeling difficulties in biomechanics and also to demonstrate the various solutions offered by LS-DYNA. Besides the simulation possibilities, a powerful preprocessor is also required to geometrically capture and discretize irregular biological structures. The software package Simpleware supplies a user-friendly solution to this and also has an interface to LS-DYNA.

Courtesy of Prof. Röhrle, Virtual Orthopedic Lab, Fraunhofer IPA

■ 3-D IMAGE SEGMENTATION AND MESH GENERATION WITH SIMPLEWARE

Type:
 Seminar
Duration:
 1 day
Seminar fee:
 475 Euro
Lecturers:
 Dr. Nils Karajan,
 DYNAmore; Simpleware staff member
Date:
 20 October

The software Simpleware is a program which is suitable for the conversion of 3-d image data into high quality models for 3-d printing or CAD systems as well as for further finite element analyses. Based on a stack of images stemming from computer tomography (CT or MicroCT), magnetic resonance imaging (MRI) or ultrasound, Simpleware offers many tools for image manipulation and feature recognition, which allow for an easy gray level segmentation of image data into 3-d objects.

The resulting geometries can be further analyzed, manipulated or merged with other CAD data. After an optional mesh generation step, Simpleware offers a wide range of export formats, even for direct usage in finite element codes like LS-DYNA. Moreover, many of the required processing steps can be automated using the scripting functionality together with the convenient macro recording function. Following this, Simpleware is not only applied in the fields of biomechanics but is also common among other application fields like material science, geological and extractive industries or production processes.

The seminar serves as an introduction to Simpleware and aims at its efficient usage. With the aid of practical examples, the whole workflow will be addressed starting from image manipulation to the meshing generation of the resulting geometries.

Content
- Generation of computer models from 3-d image data
  - Model analysis
  - Image manipulation
  - Segmentation
- Insertion and positioning of CAD data
- Generation of a multi-part volume mesh
- Export functions to
  - Finite element software like LS-DYNA
  - CAD software

In collaboration with **simpleware**

■ INFORMATION DAY: OPTIMIZATION/DOE/ROBUSTNESS

On this information day, several presentations will be given on examples of use as well as on solution strategies addressing optimization problems, sensitivity studies, design studies with meta-models or robustness and reliability investigations. Moreover, new developments in our software products LS-OPT and GENESIS will be illustrated as well as planned future developments are discussed.

With the aid of specific examples, new applications will be presented that demonstrate the practical usability of our software solutions. This stimulates participants to consider areas of application where LS-OPT or GENESIS can be effectively implemented as optimization software.

The optimization program LS-OPT

- is ideally suited for solving strongly nonlinear optimization problems and can thus be optimally combined with LS-DYNA,
- functions on the basis of the highly efficient Response Surface Method,
- contains stochastic methods for assessing the robustness of FE models and for determining dependencies between disturbance variables and system answers,
- enables significant and insignificant variables to be identified (variable screening, sensitivity analyses),
- can simultaneously combine several FE applications of different analysis types with different definitions of variables (multidisciplinary optimization (MDO)),
- is based on a clearly-arranged graphical user interface which enables optimization problems to be defined in a very simple way.

GENESIS of Vanderplaats R&D

- is a fully-integrated FE analysis and optimization software program,
- enables conceptual designs of shape, form and material to be optimized by providing the user with highly-efficient methods for topology, topometry, topography, sizing and shape optimization
- is ideally suited to optimize linear problems with a large number of design variables (>1 million),
- has an intuitively operated graphical user interface,
- is almost 100% compatible with Nastran.

Type:
Information day
Duration:
1/2 day
Fee:
Free of charge
Dates:
07 April
01 December
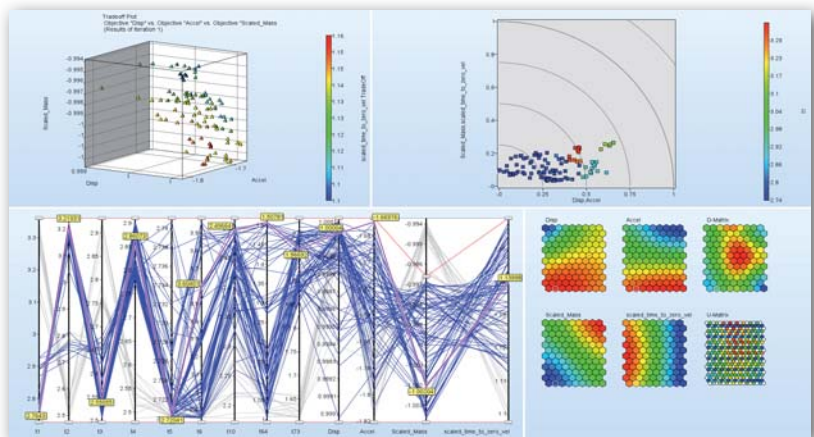
■ BASICS OF INDUSTRIAL STRUCTURAL OPTIMIZATION

The aim of this class is to provide interested users of optimization software with background information on optimization strategies and the associated algorithms. There exist many different terms for the available methods in the field of optimization, e. g. topology, topography and topometry optimization, which are often hard to categorize for the user. These methods are usually applied in combination with linear finite element analyses. For the optimization of nonlinear systems, special gradient-based methods (numerical/analytical), response surface methods, or genetic and stochastic search methods are frequently applied.

The aim of this class is to discuss the capabilities and limits of these methods such that the participants learn how to distinguish between the different structural optimization techniques. How the methods work as well as their practical application will be illustrated with examples particularly from the automotive industry.

Content:
- Introduction to the basics of mathematical optimization
- Classification and explanation of different methods
- Selection of the right method based on the application
- Possibilities and limits of the different methods
- Effectivity analysis of the algorithms
- Pros and cons of the methods
- Correct definition of an optimization problem
- Interpretation of results

Type:
Seminar
Duration:
1 day
Seminar fee:
550 Euro
Lecturer:
Dr. Stefan Schwarz,
Dr. Ing. h.c. F.
Porsche AG
Dates:
08 April
02 December
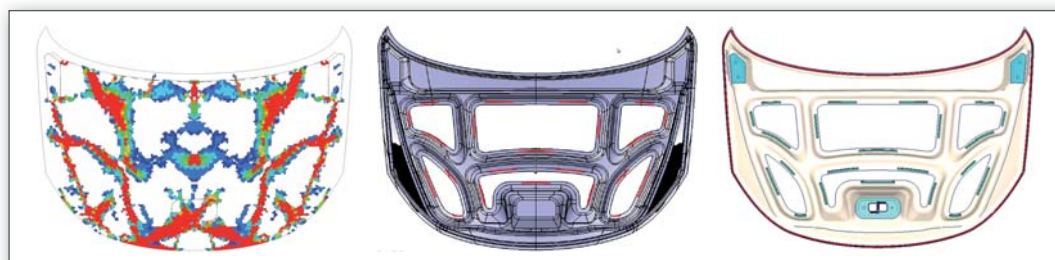
Courtesy of Magna Steyr Engineering AG & Co KG

■ LS-OPT - OPTIMIZATION AND ROBUSTNESS

LS-OPT is an independent comprehensive, optimization program which is designed and developed by LSTC. It is ideal for solving strongly nonlinear optimization problems and is thus highly suitable for the usage in combination with LS-DYNA. However, LS-OPT can also be combined with any other solver, which offers the possibility to also solve multi-disciplinary problems.

LS-OPT is based on very effective response surface methods and offers also other genetic algorithms. Moreover, the program includes stochastic methods to asses the robustness of FE models and to illustrate dependencies between optimization variables and objective functions. The definition of the optimization problem is supported with the aid of a comfortable graphical user interface.

The aim of this course is to give participants a comprehensive overview of the practical application of stochastic methods and robustness analysis using LS-OPT. Additionally, basic knowledge of statistics and probabilistic will be given and the methods implemented in LS-OPT will be discussed.

Introduction and Optimization (2 days)

The seminar gives an introduction to the program LS-OPT. General theoretical aspects of the Response Surface Method are presented and the possibilities of applying this method in LS-OPT are explained. In particular, the application of LS-OPT in combination with nonlinear FE solvers will be discussed in more detail. Seminar participants will be given the chance to implement their newly-gained knowledge with the aid of hands-on workshop examples.

Content
- Overview of optimization methods for strongly nonlinear problems
- Formulation of an optimization problem (objective function, constraints, design variables, etc.)
- DOE (Design of Experiments)
- Theory of the Response Surface Method (RSM)
- Interpretation of approximation errors of metamodels
- Multidisciplinary Optimization (MDO)
- Sensitivity analysis (ANOVA, Sobol)
- Parameter Identification
- Multi-objective Optimization (MOO, Pareot frontiers)
- LS-OPT graphical user interface
- Visualization of optimization results in LS-OPT
- Application examples

Robust Design (1 day)

Methods for stochastic analysis to judge the robustness of FE models as well as influences of design variables on responses have been implemented in LS-OPT.
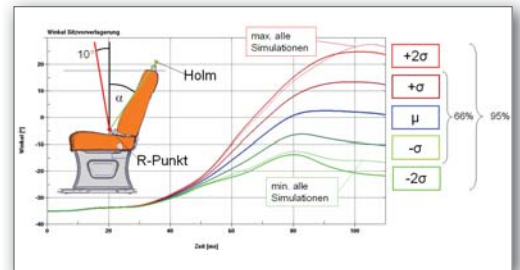
Courtesy of Daimler AG

These features allow answering questions such as:

- What is the probability of a specific failure limit being exceeded?
- Is my solution robust or does a minor variation of my input variables lead to a completely different result?
- Is the dependence between input variables and the response (solution) chaotic or predictable?
- Is there a correlation between variables and responses or between responses and responses?

To attend the module "Robust Design", prior attendance at the module "Introduction and Optimization" is recommended.
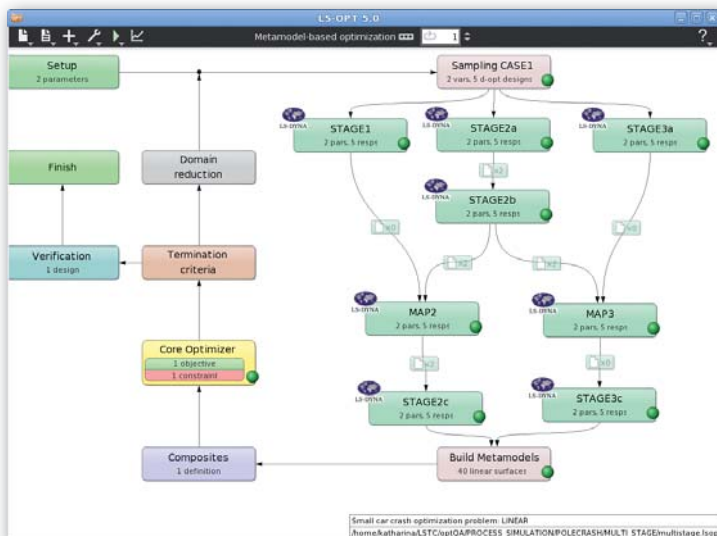
LS-OPT V5 graphical user interface

■ STRUCTURAL OPTIMIZATION WITH GENESIS

GENESIS is an integrated FE analysis and optimization software program from Vanderplaats R&D. Among other things, GENESIS can be used to carry out comprehensive linear static structural analyses, perform time and frequency dynamic analyses, determine normal modes and natural oscillations as well as calculate heat transfer problems and composite structures. GENESIS enables conceptual designs of shape, form and material to be optimized providing the user with highly-efficient methods for topology, topometry, topography, sizing and shape optimization.

The implemented optimization strategies (DOT, BIGDOT) and the close interaction of FE analysis with the optimization algorithms allow the identification of an optimal design both efficiently and reliably. This is also the case for complex problems, generally requiring only a few FE analyses. The execution and analysis of an optimization is fully graphically supported by Design Studio for GENESIS.

The seminar gives an introduction to the GENESIS program and to the graphical user interface Design Studio for GENESIS. The various optimization concepts (topology, topometry, topography, sizing and form optimization) as well as areas of application are presented and discussed. Selected problems are also solved by participants using GENESIS during the seminar.

Content
- Introduction to topology, topometry, topography, sizing and form optimization
- Pre- and postprocessing with Design Studio for GENESIS
- Visualization of results using Design Studio for GENESIS
- Optimization, taking manufacturing constraints into account
- Optimization of natural structural oscillations/ vibrations (with mode tracking)
- Application examples

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  950 Euro
Lecturers:
  VR&D and DYNAmore
  staff members
Dates:
  29-30 July
  08-09 December

Corvette Daytona Prototype – Designed and built: Pratt & Miller
Courtesy of
Vanderplaats Research and Development, Inc.
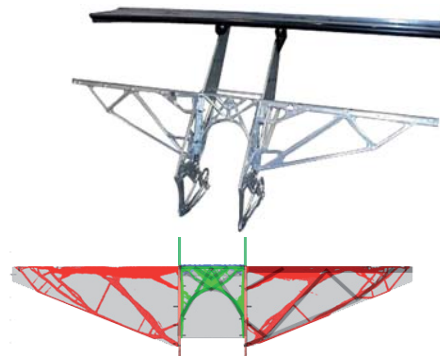
■ INFORMATION DAY: INTEGRATED OPTIMIZATION WITH ANSA, LS-OPT AND META

The current versions of LS-OPT and ANSA support simple coupling between ANSA and LS-OPT. For example, ANSA offers excellent possibilities to realize parameterized changes of FE meshes by means of morphing technologies. The control parameters for morphing are passed to LS-OPT, where they are controlled and modified. Thus, form optimizations or robustness analyses taking into account geometrical changes can be realized straightforward. Following this, any desired optimization variable can be defined in the FE input files in ANSA and can be passed to the optimization process in LS-OPT.

Moreover, the META postprocessor from BETA CAE Systems can be used to extract simulation results, which can then be automatically imported by LS-OPT as history or response quantities. This is of particular interest, if FE solvers other than LS-DYNA are to be used for optimization.

This information day shows how ANSA and META can be used in combination with LS-OPT to realize optimization and stochastic analyses. Examples from industrial practice will also be presented.

Content
- Short introduction to the morphing technologies of ANSA, Live demo with examples
- Application of the task manager in ANSA for the optimization
- Definition of design variables in ANSA
- Interface in LS-OPT for ANSA
- Use of META for simulation data extraction for LS-OPT
- Practical examples

In collaboration with LASSO

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  24 February
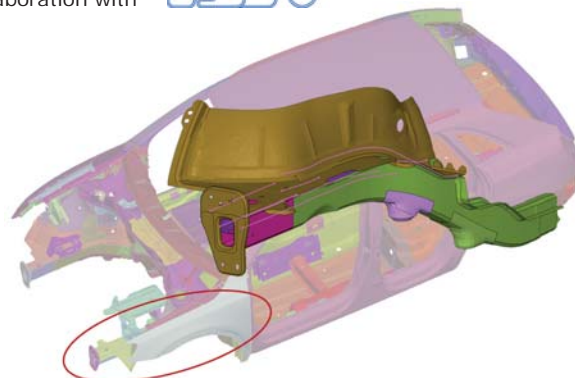
Courtesy of Audi AG

■ INFORMATION DAY: LS-DYNA FOR CIVIL ENGINEERING APPLICATIONS

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  17 October

With the increasing number of possibilities offered by LS-DYNA in implicit dynamics, engineering problems in long time dynamics can now also be examined and solved efficiently. Especially for challenging problems in civil engineering these functionalities are very interesting. Besides the classical tasks such as the vibration analysis of bridges and high-risers due to earthquakes, now serviceability problems, like the vibrations started by pedestrians or machine dynamics can be computed.

Furthermore LS-DYNA is said to be one of the world's leading software codes in the field of short time dynamics. Here typical civil engineering applications such as simulation based pendulum impact tests, vehicle impact on bridge structures, as well as - especially lately - civil defense or terror prevention problems can be solved. The excellent possibilities in LS-DYNA for the solution of fluid-structure-interaction problems can now be used to master the increasing challenges of facade-structures subjected to blast loads. Thus state-of-the-art simulation techniques can contribute to a more efficient dimensioning of cross sections.

The goal of this information event is to show experts in the field of civil engineering the various possibilities of LS-DYNA in the above mentioned areas. Particularly a more realistic estimation of loads for complex problems, thus leading to safer designs, as well as the potential of more economic dimensioning of structures will be the benefit.

Content
- Introduction of LS-DYNA
  - Explicit and implicit applications
  - Soil and concrete models
  - ALE for concrete, etc.
- Bridge design
  - Implicit vibration examination
  - Earthquake (beam models)
- Structural engineering
  - Glass models
  - Pendulum impact tests
  - Vehicle impact
- Civil defense (explicit):
  - Blast loads on facade surfaces and mountings
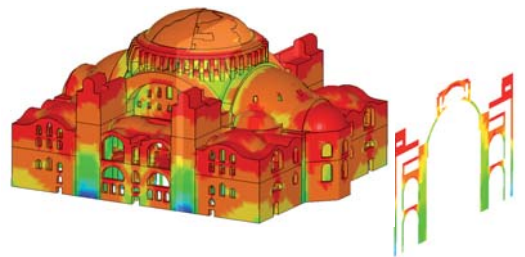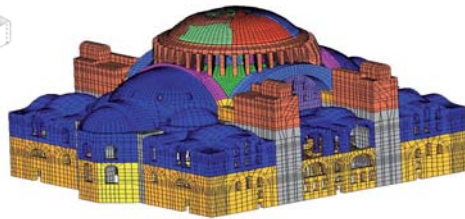
Earthquake hazard of the Hagia Sophia in Istanbul, numerical analysis models for dynamic loads, DFG-Project SCHW307-32-1
K. Schweizerhof, G. Blankenhorn (now LSTC), F. Wenzel, C. Duppel (Karlsruher Institut für Technologie, KIT, Germany)
Courtesy of Institut für Mechanik, Karlsruher Institut für Technologie KIT, Germany

DYNAMORE

■ INTRODUCTION TO PRIMER

The PRIMER preprocessor provided by our partner Arup is a high-performance solution to process and control LS-DYNA models. In addition to the range of features usually offered by a preprocessor, PRIMER can be used to adjust very specific LS-DYNA settings, such as all available contact options, special joints or highly complex material models.

PRIMER has been specially and exclusively designed for LS-DYNA as an FE solver. In many cases, PRIMER is also applied to check LS-DYNA models for errors or to remove redundant entries that may cause problems. In addition, the program offers a range of special properties to model occupant safety simulations, such as dummy positioning, seat adjustment, seatbelt fitting, or airbag folding.

Participants of this seminar will learn the practical use of PRIMER. All important functions are described and demonstrated with the aid of workshop examples such that everybody will enhance their

capabilities in the safe operation for different areas of application.

Content
- Introductions
- Area of application
- User interface and appearance
- Basic functions
- Model checking
- Other methods of checking a model, e. g., contour plots, etc
- Working with several models, model merge
- Replacing parts
- Working with include files
- Checking and fixing of initial contact penetrations
- Demonstration of further functions
- Q&A / Discussion

In collaboration with ARUP

Type:
  Seminar
Duration:
  1 day
Seminar fee:
  475 Euro
Lecturer:
  Daniel Keßler,
  DYNAmore
Language:
  German
Date:
  12 May
  17 November

■ INFORMATION DAY: PRIMER AS PREPROCESSOR FOR LS-DYNA

The preprocessor PRIMER is developed by our partner Arup and offers a high performance solution to process and control LS-DYNA models. It is especially designed for LS-DYNA and supports almost 100% the available control cards and input options in LS-DYNA.

The program also offers a range of special properties to model occupant safety simulations, such as dummy positioning, seat adjustment, seatbelt fitting, or airbag folding.

This information day will provide attendees with an overview of the capabilities and limitations of the preprocessor PRIMER. This will be done with the aid of selected examples as well as live demonstrations.

In collaboration with ARUP

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  10 March

ANSA AND METAPOST FOR LS-DYNA

Type:
  Seminar
Duration:
  2 days, can be
  booked separately
Seminar fee:
  On request
Location:
  Stuttgart / Leinfel-
  den-Echterdingen
Date:
  On request

The two-day seminar is suitable for engineers who are interested in using LS-DYNA in connection with the preprocessor ANSA and the postprocessor METApost. Besides its excellent meshing capabilities, ANSA offers an extensive interface to LS-DYNA. Speakers from LASSO and DYNAmore will give participants an insight into the entire simulation process chain using ANSA – LS-DYNA – METApost.

Content
1st day: ANSA preprocessing
- Which problems can be solved with LS-DYNA?
- How is a LS-DYNA input deck generated with ANSA?
- Which element types are available in LS-DYNA, how are they defined in ANSA?
- How are different contact options adjusted in ANSA, what do these options mean?
- How can a material model be specified?

Content
2nd day: METApost postprocessing
- Introduction to the LS-DYNA interface of METApost:
  - 3-d result evaluation and x-y plots with METApost
  - Exercises
- Interpretation of results
- Important plausibility checks
- Result evaluation with practical crash-examples

The seminars ANSA and METAPOST can be booked independently.

In collaboration with **LASSO**

MEDINA INTERFACE AND MIDAS FOR LS-DYNA

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  On request
Location:
  Stuttgart / Leinfel-
  den-Echterdingen
Date:
  On request

During the seminar, the interface of MEDINA to LS-DYNA will be explained. Herein, possible element types, material definitions, contact types, boundary conditions as well as respective optional adjustments. Experienced employees of T-Systems will present the realization of these specifications using MEDINA.

This seminar is dedicated to engineers who are interested in the application of LS-DYNA using MEDINA as a pre- and postprocessor and MIDAS for data management. Basic knowledge of MEDINA is required to participate.

Content
- Which problems can be solved with LS-DYNA and how are they defined using MEDINA?

- Which element types are available and how to define them in MEDINA?
- How to use the different contact definitions and how to adjustment their settings in MEDINA?
- How is a material model specified in MEDINA?
- Model check in MEDINA using criteria for LS-DYNA
- Handling of computation variants and mesh modifications
- Data management and automated evaluation of results using MEDINA
- Tutorial: Model setup and evaluation of results by means of practical examples

In collaboration with **··T··Systems·**

HYPERWORKS FOR LS-DYNA

Type:
  Seminar
Duration:
  2 days
Seminar fee:
  On request
Location:
  Stuttgart / Böblingen
Date:
  On request

The main application areas of LS-DYNA are crash worthiness simulation, metal forming, impact problems or other highly nonlinear problems. Furthermore, LS-DYNA can be used advantageously for solving highly nonlinear static problems, where implicit solution methods fail due to convergence problems.

The two-day introductive seminar is suited for engineers interested in computing nonlinear problems using LS-DYNA. The seminar provides a direct introduction into the application of LS-DYNA and into the LS-DYNA interface integrated in HyperMesh.

Content
- Which problems can be solved by LS-DYNA?
- Available element types and their definition in HyperMesh
- How to use the different contact options in HyperMesh?
- How to specify a chosen material model in HyperMesh?
- How to implement crash simulations and other dynamical computations and how to edit these models in HyperMesh?
- Treatment of quasi-static problems
- Evaluation of results using HyperMesh/ yperView/HyperGraph
- Tutorials

In collaboration with **Altair**

ANSA, MEDINA and HYPERWORKS seminars on request. Please contact us.

■ SUPPORT DAY: LS-DYNA

At the support days you are invited to come to our office in Stuttgart-Vaihingen bringing along the output of your LS-DYNA simulation as well as your input decks. It has been proven that a direct consultation with you at the screen is the easiest way to answer your questions. Together with you, our experienced employees of DYNAmore will directly try to optimize your input decks or to solve problems in your simulation. Also very often, the questions are simply on how to model and solve a specific problem using LS-DYNA or what other modeling techniques and possibilities are offered by LS-DYNA.

Take advantage of this service, as we are certain that we can resolve many uncertainties or mis-understandings in the usage of LS-DYNA. You can simply bring along your CAD data or drawings to discuss your problem or you may also provide your data in advance. This would allow us to prepare even better for our conversation.

Please register ahead of time for the support days – ideally with a specification of the load case.

Courtesy of Adam Opel AG

Type:
  Support day
Duration:
  1/2 day
Fee:
  Free of charge
Dates:
  17 January
  14 February
  11 April
  16 May
  27 June
  19 September
  17 October
  14 November

■ SUPPORT DAY: OCCUPANT SAFETY

On the occasion of the occupant safety support days, you can bring your own LS-DYNA simulations or input decks to our headquarters in Stuttgart-Vaihingen. The support days will mainly focus on questions regarding the handling and analysis of dummy models. Experienced members of the DYNAmore staff will be available to discuss your specific needs and to find solutions to your problems. As a matter of course, questions will be dealt with on a confidential basis without any other customers being present. Please register ahead of time for these support days – ideally with a specification of the load case, such that we are able to prepare for your visit.

Exemplary questions
- How can I position a model?
- How accurate are the results?
- Do I require any prestress in the model?

- Is the model for the seat or door sufficiently refined?
- What do I have to pay attention to during postprocessing?
- Have I developed a sufficiently exact model for my restraint system?
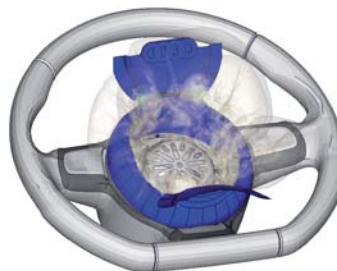
Courtesy of Autoliv B.V. & Co. KG

Type:
  Support day
Duration:
  1/2 day
Fee:
  Free of charge
Dates:
  14 March
  18 July
  19 December

■ WEBINARS – STRAIGHTFORWARD INFORMATION ON LS-DYNA

During the webinars, already established as well as new developments in LS-DYNA will be presented and their usage will be explained. On the on hand, the goal is to inform LS-DYNA users about new features and on the other hand, to provide an overview of the capabilities of LS-DYNA to interested users, who already have experience with other finite element solvers.

Particular focus will be drawn on new software versions, thereby outlining the resulting new application possibilities. Moreover, background information will be given on future developments and trends. Following this, the selection of topics for the webinars is dynamically adapted to current demands and will be announced on short notice in our newsletter as well as on our website www. dynamore.de.

Exemplary Content
- Nonlinear FE analysis with LS-DYNA
- Optimization with LS-OPT V5
- DYNAstart – Your introduction to LS-DYNA

- Presentation of new LS-DYNA releases
- Hardware: MPI, Hybrid, MPP/SMP, GPU,...
- Joining Techniques
- Material Modeling
- New element formulations
  - Meshbased: FEM, ALE, IGA
  - Mehless: CPM, EFG, SPH, DEM
- CFD and FSI
- DYNAtools for data compression, model checking, conversion, ...
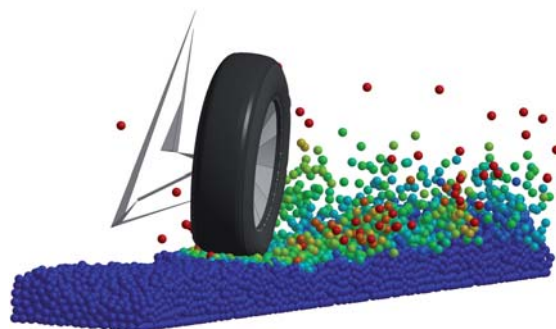
Type:
  Webinar
Duration:
  Approx. 40 - 60 min.
Fee:
  Free of charge
Dates:
  Dates will be announced in short term.

DYNAmore IT Solutions for CAx
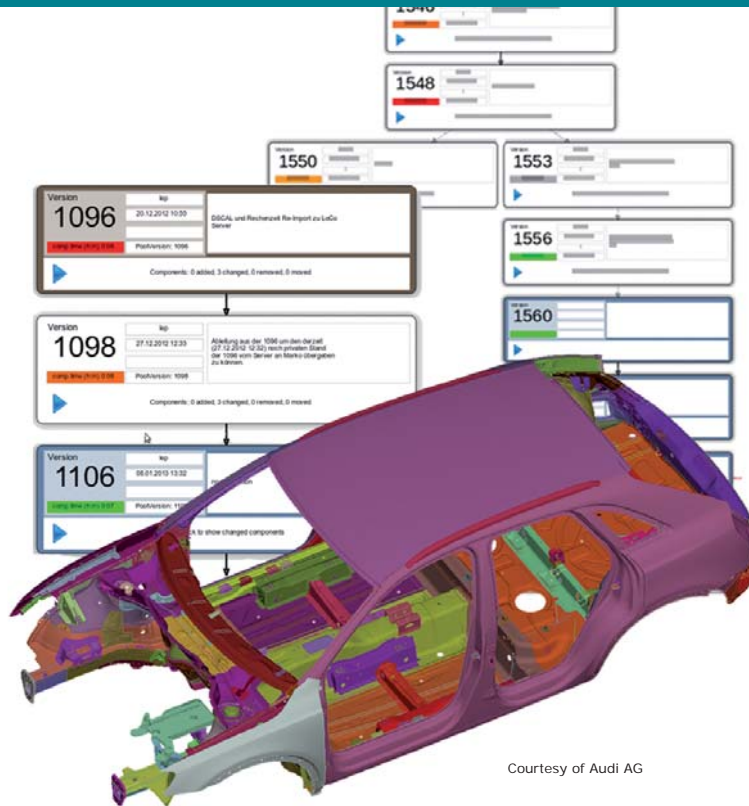
Courtesy of Audi AG

- CAx-Data management
- Process integration
- Process monitoring
- Generating reports
- IT consulting
- IT products
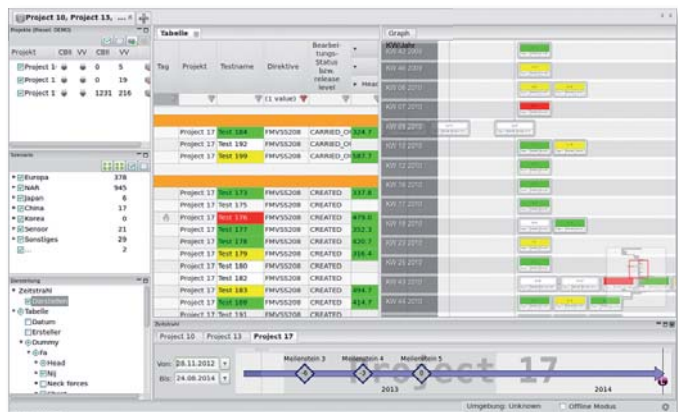
User application: Comparison simulation results vs test results

DYNAmore provides a wide range of services for developing software and integrating data management systems for virtual product development. A balanced mix of computer scientists and engineers with IT and CAE experience guarantee professional software development, making DYNAmore an ideal partner for your tasks in a CAx environment.

More information

www.dynamore.de/de/it-dienste

■ INFORMATION DAY: PROCESS AUTOMATION AND SIMULATION DATA MANAGEMENT (SDM)

Today, simulation data management (SDM) is a highly relevant topic in computer-aided engineering (CAE) of vehicles. While a few years ago, the input of a vehicle model to analyze its crashworthiness consisted of only one large file. Today, such models are constructed using modules which consist of numerous separate components. Following this, the overall input file for the finite-element solver is assembled on the basis of such model components, e.g. airbags, doors, dummies, etc. Moreover, the number of load cases that need to be investigated by simulation engineers is also constantly increasing.

Among others, the administration of these model components in a multi-user environment as well as the automated simultaneous preparation of several load cases for simulation are demanding challenges for an SDM system. The automated data flow from CAD to CAE, i.e. from the geometrical representation to meshed components, is another important subject. This also includes the demand for consistent and transparent metadata relating to the process chain CAD - Pre-SDM - assembly - simulation - post processing.

Simulation data/process management can basically be divided into three sections:

- Linking CAD-CAE, i.e. batch processing to meshing/discretization of component geometries (Pre-SDM)
- Load case compilation and input (includes) data management (assembly)
- Management of simulation results (Post-SDM)

The event will be held in cooperation with partner companies. The above-mentioned topics from process automation and simulation data management will be jointly discussed.

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  04 July
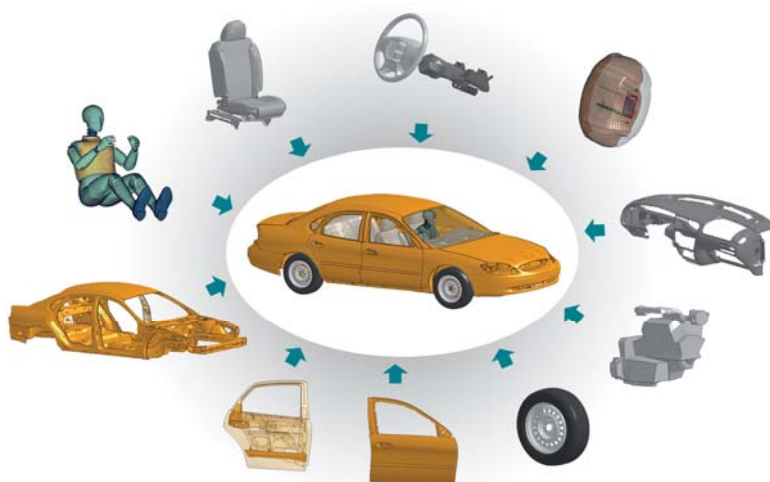
■ INFORMATION DAY: UTILIZATION OF CLOUD TECHNOLOGY FOR LS-DYNA

The idea of cloud technology is getting more and more popular in the IT world. Due to the efficient usage of available hardware resources, the IT investments can be reduced significantly. The efficient use of the soft- and hardware resources leads to a high cost saving potential for the whole IT budget in large as well as in small enterprises.

At the information event the possibilities of using cloud technology are presented. Furthermore requirements related to the usage of LS-DYNA and related products on such platforms will be discussed.

Content
- Introduction to cloud technology
- Services related to grid framework?
- How to use LS-DYNA on a grid system?
- How to achieve a good performance?
- Data integrity

Type:
  Information day
Duration:
  1/2 day
Fee:
  Free of charge
Date:
  30 April
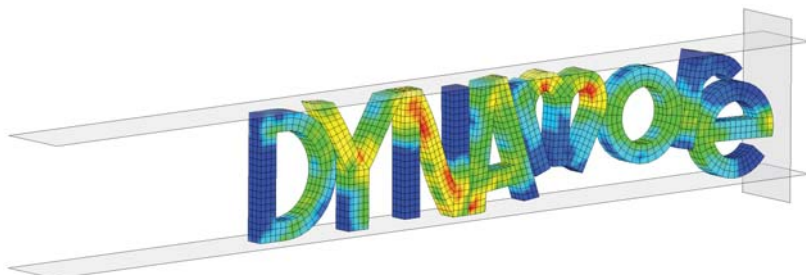
VOCATIONAL TRAININGS FOR LS-DYNA SIMULATION ENGINEERS IN VARIOUS APPLICATION AREAS

This offer gives you the chance to receive complete comprehensive instruction in your field of application. This includes training packages for certified simulation engineers in the fields of nonlinear structural mechanics (crash), occupant safety and metal forming. We would be happy to provide conceptual advice regarding comprehensive solutions for vocational trainings to become a simulation engineer using LS-DYNA. Please get in touch with us.

■ LS-DYNA FOR NONLINEAR STRUCTURAL MECHANICS (CRASH)

Professional education to become a certified simulation engineer in nonlinear structural mechanics using LS-DYNA

This package offers you an efficient option to receive comprehensive training as a nonlinear structural simulation engineer using LS-DYNA. After taking part in these seminars, you will have the necessary know-how to meet industrial requirements as a simulation engineer. On completion of all seminars within the package, you will receive a certificate declaring you a qualified LS-DYNA simulation engineer in nonlinear structural mechanics.

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

Seminars
- Introduction to LS-DYNA: Basics - 2 days
- Introduction to LS-DYNA: Advanced Topics - 1 day
- Contact Definitions in LS-DYNA - 1 day
- Joining Techniques for Crash Analysis with LS-DYNA - 2 days
- Fundamentals in Modeling Metallic Materials - 2 days

Package price: 3.540 Euro

■ LS-DYNA FOR OCCUPANT SAFETY SIMULATIONS

Professional training to become a certified simulation engineer in occupant safety simulation using LS-DYNA

With this package, you receive comprehensive training for the computational design of occupant safety systems. After attending these seminars you will have the necessary know-how to meet industrial requirements as a simulation engineer in occupant safety. On completion of all courses within the package, you will receive a certificate declaring you a qualified LS-DYNA simulation engineer in occupant safety simulation.

Seminars
- Introduction to LS-DYNA: Basics - 2 days
- Contact Definitions in LS-DYNA - 1 day
- Introduction to Passive Safety Simulation using LS-DYNA - 2 days
- LS-DYNA Dummy and Pedestrian Impactor Modeling - 1 day
- CPM for Airbag Modeling - 1 day

Package price: 3.100 Euro
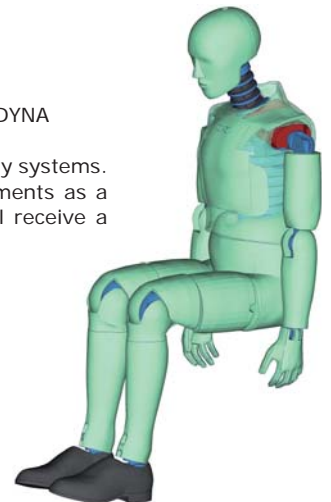
■ LS-DYNA FOR METAL FORMING

Professional training to qualify for a certified simulation engineer in metal forming using LS-DYNA and eta/DYNAFORM

After taking part in these seminars you will be able to carry out forming simulations in an industrial environment as a simulation engineer. On completion of all seminars within the package, you receive a certificate declaring you a qualified LS-DYNA simulation engineer in forming processes.

Seminars
- Introduction to LS-DYNA: Basics - 2 days
- Introduction to LS-DYNA: Advanced Topics - 1 day
- Contacts in LS-DYNA - 1 day
- Applied Forming Simulation with eta/DYNAFORM - 2 days
- Metal Forming with LS-DYNA - 2 days

Package price: 3.540 Euro

Courtesy of Volkswagen AG

USE OUR E-SERVICES ON THE WEB

DYNAlook

Search Site
☐ only in current section

home

The site presents papers from European and International LS-DYNA User Conferences and papers provided by other users. More than 1050 papers are available. The papers are accessable via the search functionality below.

Search

LS-DYNA Examples

Search Site
☐ only in current section

You are here: Home

Navigation

Metal forming

Intro by K. Weimar

Welcome to LS-DYNA Examples

The site presents approximately 200 LS-DYNA examples from various training classes. The input files and several class notes are available

Dummy Model Support

Search Site
☐ only in current section

HOME

You are here: Home

Welcome to the Dummy Model Support Site

Introduction

This site provides detailed information on dummy models for LS-DYNA. Currently, the manuals of models developed by DYNAmore are available. In the near future the models

LS-OPT Support

Search Site
☐ only in current section

HOME | EXAMPLES | DOWNLOADS | DOCUMENTS | HOWTOS

Navigation

Getting Started

Documents

Examples

Welcome to LS-OPT Support Site...

LS-OPT, the graphical optimization tool that interfaces perfectly with LS-DYNA,

LS-DYNA Support

Search Site
☐ only in current section

TUTORIALS | HOWTOS | FAQ | MANUALS | RELEASE NOTES | NEWS | LINKS

Recent Changes

History Variables for Certain Material Models

Welcome to the LS-DYNA support site

At this site you will find answers to basic and advanced questions that might occur while using LS-DYNA. Furthermore it will provide information about new releases and ongoing developments. The content will be regularly updated with answers to frequent questions related to LS-DYNA. LS-DYNAsupport will not provide information on activities of your local LS-DYNA distributor as seminars, promotions, etc. We may ask to check the local site for any kind of non-technical information.

www.dynalook.com

- Database for downloading numerous publications on LS-DYNA applications (PDF)
- Detailed search function

www.dynaexamples.com

- Comprehensive collection of examples of various LS-DYNA training seminars
- Images and animations
- LS-DYNA input decks
- Key word search
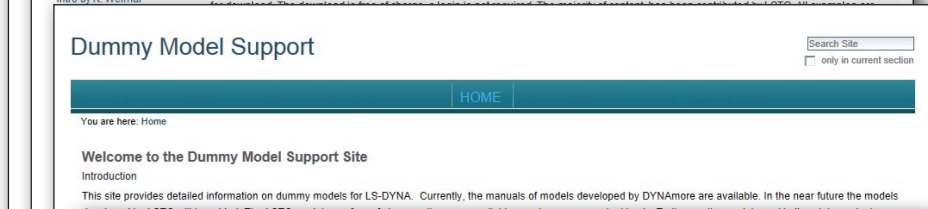
www.dummymodels.com

- Technical information about LS-DYNA dummy models
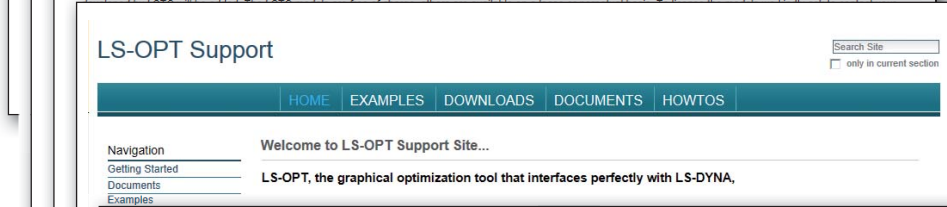
www.lsoptsupport.com

- LS-OPT support site
- General information
- Examples
- Documents
- FAQs, HowTo´s

www.dynasupport.com

- LS-DYNA support site
- Tutorials
- Release notes
- FAQs, HowTo´s

www.dynamore.de

- Description of software products and FE models
- Download area for software and documentation
- Current information and offers
- Seminar dates, booking and descriptions
- Contact addresses
- Conference information
- FE and IT services

DYNAMORE

Finite Element Solutions

DE | EN

» Personnel | » Seminars
» Contact | » Documents

Products | Sales | Services | IT Solutions | Training | Company | Downloads | News

Welcome at the DYNAmore Website

DYNAmore is dedicated to support engineers to solve non-linear mechanical problems numerically. Our tools to model and solve the problems are the finite element software LS-DYNA as solver and LS-OPT for optimization. We sell, teach, support, and co-develop the software and provide engineering services.

- LS-DYNA
- Automotive
- Crash Animation
- Forming
- Seminars 2014
- University
- Getting Started

LS-DYNA enables you to design and optimize automobile components or entire vehicles according to various crash scenarios and other requirements. Since more than 20 years car manufacturers and suppliers all over the world trust in LS-DYNA for their vehicle development process.

⚐ Example of Toyota
⚐ Example of Mercedes
⚐ Example of GM
⚐ Example of Honda

By courtesy of Dr. Ing. h.c. F. Porsche AG

LS-DYNA Forum 2014 – submit title now!

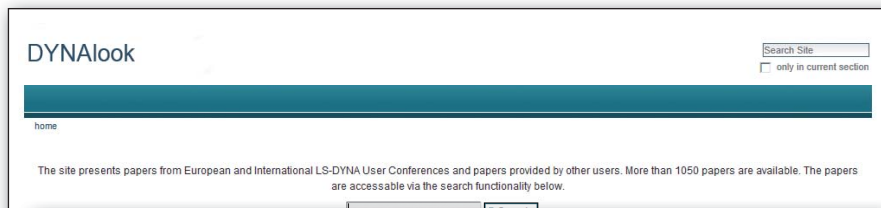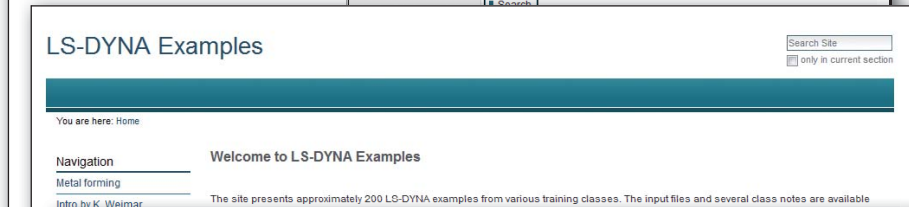The 15th LS-DYNA Forum will take place 6 - 8 October 2014 in Bamberg, Germany. We are looking forward to your attendance and to your paper submission. ...more

Integrated Optimization with ANSA-LS-OPT-META

We kindly invite you to attend the free of charge information day: Integrated Optimization with ANSA, LS-OPT and META, 24 Feb. in Stuttgart, Germany.
⚐ Flyer » Registration

Int. LS-DYNA Conference

The 13th international LS-DYNA conference will be held 8 - 10 June 2014 in Detroit, USA. We are looking very forward to meeting you in Dearborn, MI.
⚐ Conference web

A Choice of Seminars in February

Seminar: Implicit Analyses (18-19 Feb.)
⚐ Flyer » Registration
Seminar: Joining Techniques (20-21 Feb.)
⚐ Flyer » Registration

A Choice of Events in March

Info event : PRIMER - Preprocessor (11 March)
⚐ Flyer » Registration
Info event: Multiphysics (17 March)
⚐ Flyer » Registration
Seminar series: New Solvers (18-21 March)
⚐ Flyer » Registration

Seminars 2014

The new dates for 2014 are there with an extended range of seminars, information days, support days and webinars!
» Overview and registration
» Seminar brochure (German)

Seminars 🔊

» Implicit Analyses using LS-DYNA
🕒 Stuttgart, Feb. 18

» Component Connections in LS-DYNA
🕒 Stuttgart, Feb. 20

» ALE and Fluid-Structure Interaction in LS-DYNA
🕒 Stuttgart, Mar. 11

» Meshless Methods in LS-DYNA (SPH)
🕒 Stuttgart, Mar. 13

» Meshfree Methods in LS-DYNA - SPH
🕒 Stuttgart, Mar. 13

...more seminars

Information Days (at no cost) 🔊

» Integrated Optimization with ANSA, LS-OPT and META
🕒 Stuttgart, Feb. 24

» DYNAstart - Getting Started with LS-DYNA
🕒 Berlin, Feb. 26

» PRIMER as a preprocessor for LS-DYNA
🕒 Stuttgart, Mar. 11

» Current LS-DYNA Trends and Delevopments for Forming Simulations
🕒 Attendorn, Mar. 12

» DYNAstart - Getting Started with LS-DYNA
🕒 Dresden, Mar. 14

...more free events

News 🔊

» SIMVEC
🕒 Feb 10, 2014

DYNAMORE LECTURERS

Dr. Filipe Andrade
Areas of expertise:
Material modeling, FE theory
Academic studies:
Mechanical engineering

Dr.-Ing. Stefan Hartmann
Software developer LS-DYNA
Areas of expertise:
Composites, FE theory
Academic studies:
Civil engineering

B.E., M.Sc. Reuben D´Souza
Support airbags
Areas of expertise:
Occupant safety, airbag simulation
Academic studies:
Mechanical engineering

Dr.-Ing. Andre Haufe
Manager process simulation
Areas of expertise:
Material modeling, forming simulations,
joining techniques
Academic studies:
Civil engineering

Dr.-Ing. Tobias Erhart
Software developer LS-DYNA
Areas of expertise:
FE theory, material models
Academic studies:
Civil engineering

Dr. Bernd Hochholdinger
CEO DYNAmore Swiss GmbH
Area of expertise:
Thermal forming processes
Academic studies:
Civil engineering

Dipl.-Math., Dipl.-Ing. (BA) Uli Franz
CEO
Areas of expertise:
Occupant safety, dummy models
Academic studies:
Mechanical engineering, mathematics

Dr.-Ing. Nils Karajan
Manager trainings
Areas of expertise:
Multiphysics, biomechanics
Academic studies:
Civil engineering

Dr.-Ing. Dirk Freßmann
Development and support THUMS
Areas of expertise:
Human models, FSI
Academic studies:
Civil engineering

Dipl.-Ing. (FH) Daniel Kessler
Support PRIMER
Areas of expertise:
Crash, occupant safety, seats
Academic studies:
Civil engineering

Prof. Dr. rer. nat. Ulrich Göhner
Manager software solutions
Area of expertise:
Computational fluid dynamics (CFD)
Academic studies:
Mathematics

Dr.-Ing. Thomas Klöppel
Software developer LS-DYNA
Areas of expertise:
Composites, FE theory
Academic studies:
Mathematics

Dr.-Ing. Tobias Graf
Areas of expertise:
Joining techniques, material models
Academic studies:
Civil engineering

Dipl.-Ing. Markus Künzel
Support eta/DYNAFORM
Area of expertise:
Forming simulations
Academic studies:
Mechanical engineering/automotive

Dipl.-Ing. Alexander Gromer
Areas of expertise:
Occupant safety, dummy models
Academic studies:
Mechanical engineering

Dipl.-Ing. Christian Liebold
Area of expertise:
Composites
Academic studies:
Aerospace engineering

Dr.-Ing. Heiner Müllerschön
Manager competence center optimizati-
on and process integration
Areas of expertise:
Optimization, robustness analysis
Academic studies:
Civil engineering

Dr. Thomas Münz
Manager headquarters and
engineering services
Areas of expertise:
Material modeling
Academic studies:
Techno-mathematics

Prof. Dr.-Ing. Karl Schweizerhof
Technical director
Area of expertise:
FE theory
Academic studies:
Civil engineering

Dipl.-Ing. Sebastian Stahlschmidt
Manager occupant simulation
Areas of expertise:
Occupant safety, dummy models
Academic studies:
Civil engineering

Dipl.-Ing. (FH) Peter Vogel
Manager deep drawing simulations
Area of expertise:
Forming simulations
Academic studies:
Mechanical engineering

Dipl.-Math. Katharina Witowski
Software developer LS-OPT
Area of expertise:
Optimization
Academic studies:
Mathematics

EXTERNAL LECTURERS

Dipl.-Ing. Paul Du Bois
Consultant
Lecturer of the seminars:
- Crashworthiness simulation
- Blast modeling with LS-DYNA
- Penetration modeling with LS-DYNA
- Explosives modeling for engineers

Iñaki Çaldichoury
Livermore Software Technology Corporation
(LSTC) – software developer LS-DYNA
Lecturer of the seminars:
- Electromagnetism in LS-DYNA
- ICFD – Incompressible Fluid Solver
- CESE – Compressible Fluid Solver

Dr.-Ing. Markus Feucht
Daimler AG
Lecturer of the seminars:
- Joining techniques for crash analysis
- Material and failure models
  (mesh dependence/tri-axial condition)

Dr. Yun Huang
Livermore Software Technology Corporation
(LSTC) – software developer LS-DYNA
Lecturer of the seminar:
- NVH & Frequency Domain Analysis

Prof. Dr.-Ing. Stefan Kolling
Technische Hochschule Mittelhessen
Lecturer of the seminar:
- Modeling of polymers and elastomers
  in LS-DYNA

Dr.-Ing. Stefan Schwarz
Dr. Ing. h.c. F. Porsche AG
Lecturer of the seminar:
- Basics of structural optimization

Dr. Len Schwer
Schwer Engineering & Consulting
Services
Lecturer of the seminars:
- Concrete and Geomaterial Modeling
- Blast Modeling with LS-DYNA
- Penetration Modeling with LS-DYNA
- Explosives Modeling for Engineers

Prof. Mhamed Souli
University Lille / Livermore Software
Technology Corporation (LSTC) – software
developer LS-DYNA
Lecturer of the seminars:
- ALE and FSI in LS-DYNA
- Meshfree methods – SPH

Dr. Cheng-Tang Wu
Livermore Software Technology Corporation
(LSTC) – software developer LS-DYNA
Lecturer of the seminar:
- Meshfree methods – EFG

13th INTERNATIONAL LS-DYNA CONFERENCE

Type:
 Conference
Duration:
 3 days
Attendee fee:
 475 US$
Date:
 08-10 June 2014
Location:
 Dearborn, US

8 - 10 June 2014 – Dearborn, Michigan, US

The 13th international LS-DYNA conference will be held 8 - 10 June 2014 in the Adoba Hotel Dearborn, Detroit, USA.

Usually around 500 users attend the conference and more than 100 lectures are presented. User presentations will form the central part of the event. In addition, keynote presentations from re-nowned speakers from industry as well as academic research will be given and developers from LSTC will report on latest developments in LS-DYNA, LS-PrePost and LS-OPT. In an accompanying ex-hibition, delegates receive extensive information on hardware and software around LS-DYNA. In addition, numerous pre and post conference se-minars will be offered.

Adoba Hotel, Dearborn, Michigan, US

Organization
The conference will be organized by LSTC.

Location
Adoba Hotel, Dearborn, Michigan, USA

More Informationen
www.ls-dynaconferences.com

13th LS-DYNA FORUM

Type:
 Conference
Duration:
 2,5 days
Attendee fee:
 580 Euro
Date:
 06-08 October 2014
Location:
 Bamberg, Germany

6 - 8 October 2014 – Bamberg, Germany

We invite you to the German LS-DYNA Forum 2014, to be held 6 - 8 October 2014 in the Welcome Hotel Bamberg, Germany. The conference is an ideal forum for LS-DYNA and LS-OPT users to present, share and discuss experiences, to obtain information on upcoming features, and to learn more about new application areas.

Contributions from industry, research, and academia about various applications around LS-DYNA and LS-OPT will be presented. Developers from LSTC and DYNAmore will introduce you to recent developments in LS-DYNA, LS-PrePost and LS-OPT. You are cordially invited to contribute with a presentation, too.

The topics are:
- Crashworthiness
- Passenger and Pedestrian Safety
- Metal Forming
- Optimization and Robustness
- Materials (composites, polymers, …)
- Joining Techniques
- Implicit
- Impact
- Droptest
- Ballistics and Penetration
- Fluid-Structure Interaction
- Computational Fluid Dynamics (CFD)
- Heat transfer
- Electromagnetics
- Multiphysics
- Manufacturing processes
- CAE process integration
…

… from the industry areas:
- Automotive
- Aerospace
- Mechanical Engineering
- Shipbuilding/Offshore
- Transportation
- Biomechanics
- Civil Engineering
- Medical Engineering
- Packaging
- …

Hardware and Software Exhibition
In an accompanying exhibition you will receive the latest information on hardware and software related to LS-DYNA and LS-OPT.

Accompanying Seminars
Accompanying seminars will be held before and after the conference. Further information will be available on the conference website.

Venue
Welcome Hotel Bamberg, Germany

More Information
www.dynamore.de/forum2014

We will provide further details about the event in our "DYNAmore News" and on our website www.dynamore.de.

DIPLOMA AND MASTER THESES ...

...IN COLLABORATION WITH THE FOLLOWING COMPANIES:
ADAM OPEL AG, AUDI AG, DAIMLER AG AND DR. ING. H.C. F. PORSCHE AG

Are you interested in highly complex applications concerning the finite elements method?

We would be pleased to offer you a range of exciting topics for your diploma or master thesis related to current developments in the latest FE technologies using LS-DYNA. Especially in the field of crashworthiness simulations, LS-DYNA is one of the world's leading FE programs and used for this purpose by many leading automotive manufacturers. As a result of the close collaboration between DYNAmore GmbH and Adam Opel AG, Audi AG, Daimler AG and Dr. Ing. h.c. F. Porsche AG, challenging tasks are constantly arising. Exemplary topics could address:

- Material modeling of composites, foams, plastics, layers of adhesive
- Modeling of joining techniques
- Simulation of welding processes
- Simulation of sheet metal and bulk forming processes
- Hot forming taking into account phase transitions
- Extensions for human models
- 3d skeletal muscle modeling in biomechanics
- Modeling of coupled multiphysic problems
- Fluid-structure interaction
- Particle mechanics
- Comparison of new simulation methods
- Optimization and robustness analysis with LS-OPT (optimization software)
- Software development for process integration
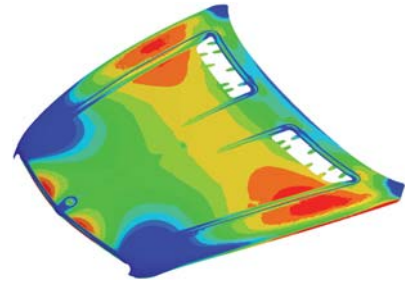
Courtesy of Daimler AG

The preparation of the thesis will be in collaboration with DYNAmore GmbH and the above mentioned companies. Please get in touch with Dr. Thomas Münz (DYNAmore), Tel: +49 (0) 7 11 - 45 96 00 - 10, E-Mail: thomas.muenz@dynamore.de.

www.dynamore.de

Advertisement

FEMZIP – COMPRESSION OF LS-DYNA RESULTS

- The data compression tool FEMZIP reduces the cost for archiving data, storage and data management.
- FEMZIP is able to read the plot files and to build a compressed version of the results that can be up to 10 times smaller.
- FEMZIP exploits the internal data structure of the result files.
- Compressed data can be directly loaded by various postprocessors.

Archive Size
If the simulation data are compressed, only a small fraction of storage is required. Storage and backup capacities can store more simulation results. Hence, investments into higher storage and archive capacities can be minimized.

Data Transfer Times
Transferring simulation results across computer networks can be very time consuming. Transmission speeds are limited by the available network bandwidth. Since compressed simulation results require significantly less storage, they can be transferred in a fraction of the time required for transferring uncompressed results.

Data Loading Times
Reading data into postprocessors can be a time consuming task as well. If data storage is provided through centralized file servers, compressed data can be read in directly into postprocessors significantly quicker due to the faster data transfer. In some cases load times can even be improved when reading from a local hard drive.

Decompression
The original data formats could be retrieved by using the open decompression tool FEMUNZIP.

Test License
We are pleased to offer you a free test license to evaluate FEMZIP.

www.dynamore.de/femzip

ABOUT DYNAMORE

DYNAmore GmbH – Gesellschaft für FEM-Ingenieurdienstleistungen – is your contact partner for consulting, training, support and sales services concerning the finite element software LS-DYNA. The product portfolio consists of LS-DYNA, LS-OPT, LS-PrePost, GENESIS, additional complementary programs as well as numerous FE models for crash simulations (dummies, barriers, pedestrians, human models, etc.).

Our range of services is completed by secured and qualified support for all application fields, various seminars as well as FEM calculation services and general consulting on the subject of structural dynamics. We are one of the top addresses for pilot and development projects concerned with the simulation of nonlinear dynamic problems. The services provided by DYNAmore GmbH also include software development for finite element solver technology and simulation data management as well as consulting and support for modern, massively parallel computer systems.

LS-DYNA – one solution for many nonlinear problems

LS-DYNA is one of the world's leading finite elements software systems for the numerical simulation of highly-complex, nonlinear dynamic processes, such as

- Crash
- Occupant safety
- Metal forming
- Impact and drop tests
- Snap-though buckling
- Penetration problems
- Fluid structure interaction
- Thermo-mechanical coupling
- Explosion

The program is intensively used in the automotive, aircraft and aerospace industries. Further areas of application include bio-mechanics, shipbuilding, locomotive construction, civil engineering, defense industry and consumer goods industry. A wide range of problems can be solved by LS-DYNA simply using standard PC.

LS-PrePost – definition and evaluation of simulations

LS-PrePost is a pre- and postprocessor which can be used to modify input decks and to visualize results computed by LS-DYNA. An intuitive graphical user interface simplifies its use. Options for handling and visualizing LS-DYNA input decks are available to help you prepare input data.

LS-OPT – optimization / robustness analysis of nonlinear systems

LS-OPT combines optimization algorithms with an optimization environment which automatically generates and analyzes variants and visualizes the obtained results. The program is designed for nonlinear problems and can include LS-DYNA as well as other solvers to enable multidisciplinary optimization. LS-OPT is not only used for optimization purposes but also for robustness analyses.

FEMZIP

This software allows to drastically reduce the storage size of simulation results, thus enabling the results to be viewed, sent and archived faster.

GENESIS – optimization software for large linear systems

GENESIS is a software system for optimizing topologies and designs. As a distributor, we provide the complete product portfolio of the manufacturer Vanderplaats R&D for customers in Europe. This is a supplement to the optimization solution LS-OPT for linear systems.

Validated FE models for standard load cases

FE models

In vehicle assessment, tests are carried out under comparable conditions. To successfully achieve this, accurately specified barriers and dummies are used for testing. DYNAmore develops and distributes FE models for such test pieces.

Dummy models

To compute occupant values, DYNAmore develops the following models for the automotive industry (PDB): Eurosid-1, USSID, ES-2, ES-2re, BioRID-2 and WorldSID. The portfolio is completed by models developed by the hardware dummy manufacturer Humanetics and by LSTC.

Pedestrian safety models
We supply impactor models from various manufacturers for assessing pedestrian safety during vehicle collisions.

Barrier models
The impact on the structure of a vehicle is often due to a barrier. We supply finite element models for all standard barriers, which are developed by our partners Arup and LSTC or within the scope of a working group by Daimler, Dr. Ing. h.c. F. Porsche, Lasso and Peng.

Human models
Besides the dummy models, there is also the option of using human models to investigate vehicle safety. The models distributed by DYNAmore are developed in Japan by Toyota.

Simulating forming processes

Metal forming in LS-DYNA
With LS-DYNA, DYNAmore provides a solution to meet high accuracy requirements in the computation of sheet metal and pipe forming. Quite a few automotive and supplier companies investigate the manufacturability and springback of a component using LS-DYNA before constructing a tool. Main applications include deepdrawing, stretch-forming, pipe bending, hydroforming and thermal deep drawing.

eta/DYNAFORM
An integrated pre- and postprocessor system for forming processes is combined in eta/DYNAFORM. In a user environment, eta/DYNAFORM combines mesh generation, the computation of binder forces, binder closing, deep drawing simulation, trimming processes, the computation of springback and multistep processes.

Simulation services

The staff at DYNAmore has a wealth of experience in computing nonlinear problems. We see ourselves as a suitable contact partner for:

- Nonlinear statics and dynamics
- Crash analysis
- Developing dummy models
- Component tests
- Passive safety, pedestrian safety
- Metal forming
- Implicit analyses using LS-DYNA
- Optimization, robustness analyses
- Flow simulation
- Fluid-structure interaction
- ...

Software development

SDM and process integration
At our offices in Dresden and Ingolstadt, we develop software for our customers who are principally active in the automotive industry. We specialize in customer-specific software solutions in CAE data management (SDM), process integration, process automation and optimization.

Development in LS-DYNA
DYNAmore is an experienced contact partner regarding the development of new features in LS-DYNA. Together with our customers, we integrate failure models into material laws, develop interfaces, create material models for foams and integrate new element technologies.

Development of DYNAtools and additional software
DYNAmore supplies a wide range of additional tools which facilitate working with LS-DYNA and LS-OPT. The tools are developed in close cooperation with the automotive manufacturers Audi, Daimler, Dr. Ing. h.c. F. Porsche and Adam Opel.

Support – Consulting – Sales – Training Courses

Products
All products mentioned are used and further developed by DYNAmore in day-to-day project work. This enables us to provide highly practice-related advice on your tasks. According to your

Portfolio

- Software solutions
- Method development
- Support and consulting
- Calculation services
- IT solutions for CAx process and data management
- Training courses and information events
- Conferences

Facts

- 66 employees in Germany
- 22 employees working in our subsidiaries in Sweden, Switzerland and Italy
- Our customers include over 150 industrial companies and more than 100 universities in Germany, Austria, Switzerland, Italy, Spain, Portugal, Benelux, Turkey, Czech Republic, Slovenia, Poland and Rumania, who all together use well over 50,000 LS-DYNA licenses. We also take care of numerous companies outside Europe, e.g. USA, Japan, China, India, Brazil, Korea, Australia and Malaysia, which primarily use our dummy models.
- Our headquarters are in Stuttgart/Vaihingen in Germany. We have other offices near Wolfsburg, in Ingolstadt, in Dresden, in Berlin, in Zurich (CH) and in Torino (I) as well as on five customer premises.
- The founders of DYNAmore have been working in the field of the nonlinear finite element method since the beginning of the Eighties. DYNAmore has gained experience from numerous car crash and development projects and possesses expertise acknowledged both by industry and universities. The staff at DYNAmore is also actively involved in the further development of the programs LS-DYNA and LS-OPT.
- A distinguishing feature of the company is our good, long-term customer relationships. Our references range from large-scale companies to engineering offices.

requirements, you receive a tailormade package comprising anything from software licensing right up to the handover of component responsibility by DYNAmore.

Support
The software you obtain from us is supported by highly experienced members of staff. You can contact each individual expert directly on the phone anytime. We also provide in-house support on request.

Test license
You can test any of our products free of charge. You then decide to rent the software, buy it or use it via a web portal. All standard platforms are supported.

Training courses
Besides offering numerous seminars on the various areas of application of LS-DYNA and LS-OPT, DYNAmore also holds other seminars concerned with pre- and postprocessing topics. All seminars can be aligned individually to company requirements and can also be held at your company premises if required.

Events
In order to promote the exchange of information, DYNAmore regularly organizes events such as user meetings, information days and webinars on a range of different subjects.

Information

You can find out more about DYNAmore and LS-DYNA on our website www.dynamore.de.

ORGANIZATION

Seminar locations

Unless otherwise stated, events are held in our headquarters in Stuttgart, Germany:

- Industriestr. 2, D-70565 Stuttgart, Germany
  Tel: +49 (0)711 - 45 96 00 - 0

Other seminar locations:

- Office Dresden
  Pohlandstraße 19, D-01309 Dresden
  Tel: +49 (0)351 - 31 20 02 - 0
- Office Ingolstadt
  Donaustr. 7, D-85049 Ingolstadt
  Tel: +49 (0)841 - 12 60 48 - 34
- Office Berlin
  Stralauer Platz 34, D-10243 Berlin
  Tel: +49 (0)30 - 20 68 79 10
- DYNAmore Swiss GmbH
  Technoparkstrasse 1, CH-8005 Zurich, Switzerland
  Tel: +41 (0)44 - 6 33 61 62
- DYNAmore Nordic AB
  Brigadgatan 14, SE-587 58 Linköping, Sweden
  Tel: +46 (0)13 - 23 66 80
- DYNAmore Nordic AB
  Office Göteborg
  Lindholmspiren 3, S-417 56 Göteborg, Sweden
  Tel.:   +46 (0)31 - 3 01 23 80
- DYNAmore Italia S.r.l.
  Piazza Castello 139, 10122 Torino, Italy
  Tel.:   +39 335 - 1 57 05 24
- 4a engineering GmbH (partner in Austria)
  Industriepark, A-8772 Traboch, Austria
  Tel: +43 (0)38 42 - 4 51 06 - 6 00

Seminars on request / in-house seminars

All courses can be individually compiled. We would be also happy to consider your special requirements. For example, the contents of seminars can be adapted to your company's specific needs, or alternatively the course can be held parallel to a project selected by you. We are also pleased to give seminars on your premises. Please get in touch with us.

Seminar fees

See seminar description. All seminar fees quoted are per participant and seminar and do not include statutory value-added tax. Seminar fees are due on application and include seminar documents, drinks during breaks and lunch.

Reductions

We give a 50 % reduction to members of universities and public research institutions. Students may attend the seminars free of charge if there are vacancies (please show your enrolment certificate).

Course times

Seminars: 9:00 - 17:00 (unless otherwise indicated).
Information days: usually 13:30 - approx. 17:00.

Speakers

Seminars are only given by experienced experts.

Language

Unless otherwise stated, all seminars will be given either in German or English language on an on-demand basis. Please indicate your preferred language during registration.

Cancellation of a seminar by a participant

Up to one week before the start of the seminar: no charge
Up to two days before the start of the seminar: 50 %
Non-attendance: complete seminar fee
Substitute participants will be accepted.

Cancellation of a seminar by the organizer

If less than four applications without reduction were received, we reserve the right to cancel a seminar. In such a case, all participants who have applied for the course will be notified at the latest one week before commencement of the seminar.

Registration

Please apply either using the registration form on Page 53-55 or online under www.dynamore.de or just send us an email to seminars@dynamore.de. You will be sent a registration confirmation as well as information regarding directions and hotels. Please note, that all seminars and the seminar language will be confirmed separately.

Data protection and competition law declaration of consent

With your registration you allow us the use and the processing of your data for the seminar organization and for promotional purposes. You may at any time revoke these commitments. For this, please contact DYNAmore GmbH by fax, telephone or in writing.

Further information

Seminars on the Internet
You will find current information and new developments concerning LS-DYNA on our website www.dynamore.de. There, you may also find up-to-date details about our seminars, information days and webinars as well as additional or modifications to dates and further information events.

Newsletter
If you would like to be informed by email about current events and new developments in the LS-DYNA world, we would be happy to send you our "DYNAmore News". To register, please send us an email to infomail@dynamore.de.

Contact partner

Organization
Carina Ernigkeit, Ulrike Kraus
Tel: +49 (0)711 - 45 96 00 - 0
seminar@dynamore.de

Course Advisor
Dr. Nils Karajan
Tel: +49 (0)711 - 45 96 00 - 22
nik@dynamore.de

DYNAmore HEADQUARTERS

DYNAmore GmbH
Headquarters
Industriestr. 2
D-70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
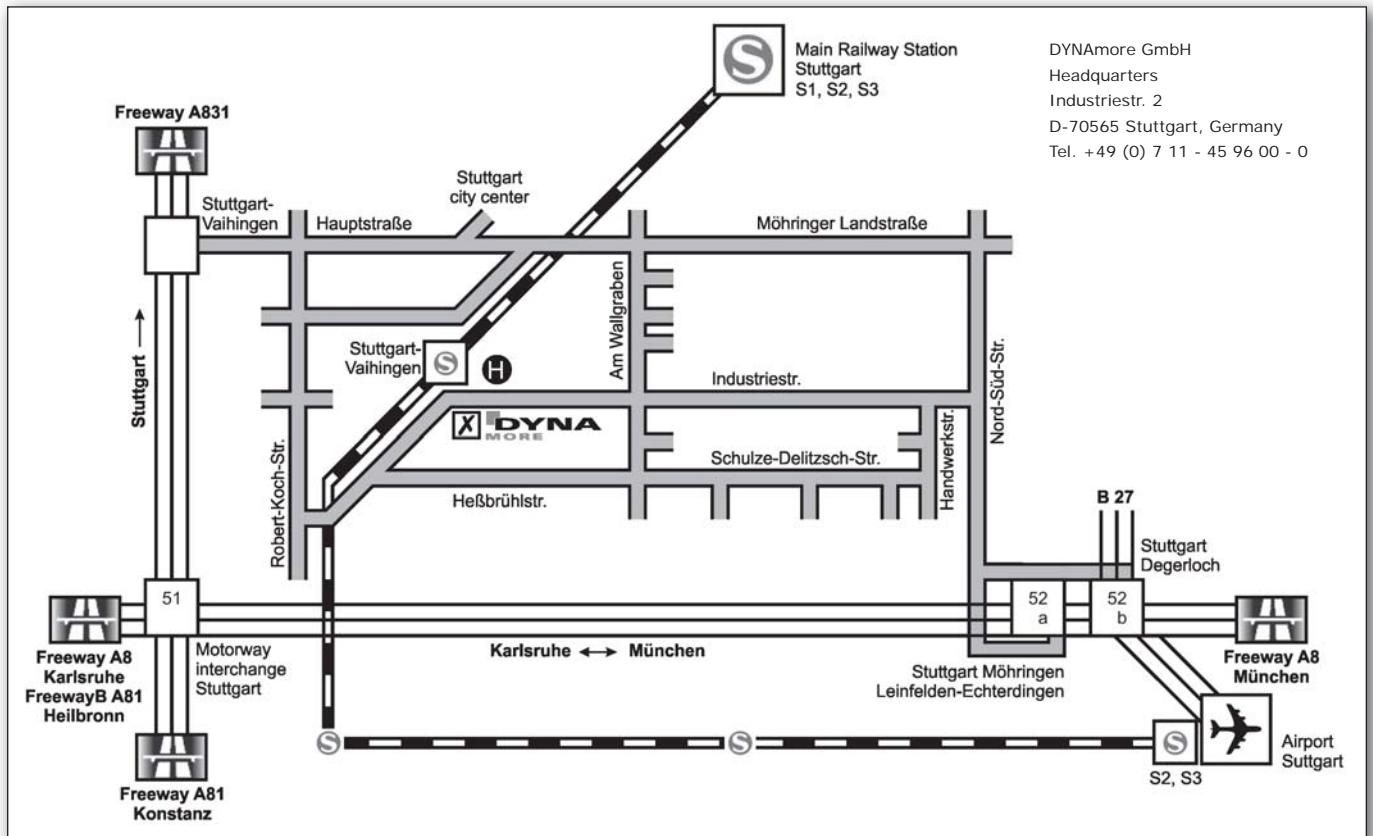
Arriving by car

From the direction of Munich
Take the freeway A8 to Stuttgart, exiting at Möhringen/Degerloch/LE-Leinfelden. Follow signposts marked Möhringen/LE-Echterdingen, Industriegebiet Vaihingen/Möhringen. The DYNAmore headquarters are located opposite the train (S-Bahn) station.

From the direction of Frankfurt/Karlsruhe/Heilbronn/Singen
Take the freeway A8 towards Munich (München), exit at Möhringen/Vaihingen/LE-Leinfelden. Follow signposts marked Industriegebiet Vaihingen/Möhringen. The DYNAmore headquarters are located opposite the tram station.

Arriving by public transport

Stuttgart Airport
Take the train (S-Bahn) "S2" in the direction of Schorndorf or the S-Bahn "S3" in the direction of Backnang and alight in either case at the stop marked Stuttgart-Vaihingen. The DYNAmore headquarters are located opposite the train station.

Stuttgart Main Railway Station
Take the train (S-Bahn) "S1" in the direction of Herrenberg or the S-Bahn "S2" or "S3" in the direction of the airport and alight at the stop marked Stuttgart-Vaihingen. The DYNAmore headquarters are located opposite the train station.

More information about the S-Bahn timetable can be found under: www.vvs.de

DYNAmore Headquarters

PLEASE COMPLETE AND FAX IT TO FAX-NO. +49 (0)711 - 45 96 00 - 29

Address for window envelope

DYNAmore GmbH
Industriestr. 2
D-70565 Stuttgart
Germany

I hereby place an order for the following LS-DYNA version:

❏ **DYNAstart Personal (private)**

DYNAstart Personal is the LS-DYNA introductory package from DYNAmore. It comprises the following features:

- License for LS-DYNA, LS-PrePost, LS-OPT

- Operable using Windows/Linux

- Model size limited to 10,000 elements

- No composites

- No MPP possibilities

- 1st month, telephone support hotline

- 11 further months, email support

  Annual rental fee: 90 Euro *

❏ **DYNAlab (research, teaching)**

- License for LS-DYNA (any number of processors), LS-PrePost, LS-OPT

- Support

- Only for research and teaching purposes - rental per institute

  Annual rental fee: 1,000 Euro *

❏ **DYNAstart Professional (industry)**

- License for LS-DYNA, LS-PrePost, LS-OPT

- Support

  Annual rental fee: 5,000 Euro *

Sender

Company / University: _____

Dept. / Institute: _____

Title, first/last name: _____

Street: _____

ZIP code, town/city: _____

Tel: _____

Fax: _____

E-Mail: _____

Date, signature: _____

* Prices do not include statutory value-added tax. Subject to exchange rate fluctuations USD/Euro.

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DYNAmore GmbH
Industriestr. 2
D-70565 Stuttgart
Germany

I hereby register for the following seminar/information day/support day:

INTRODUCTION
- ❑ Introduction to LS-DYNA
  Optional: ❑ Basics (days 1 and 2)
  ❑ Advanced Topics (day 3)
- ❑ Introduction to LS-PrePost
- ❑ Information day: DYNAstart

BASICS/THEORY
- ❑ Element Types and Nonlinear Aspects
- ❑ User Interfaces in LS-DYNA
- ❑ Information day: Verification and Validation

CRASHWORTHINESS
- ❑ Crashworthiness Simulation
- ❑ Contact Definitions
- ❑ Joining Techniques for Crash Analysis
- ❑ Failure of Fiber-Reinforced Polymer Components
- ❑ Information day: Simulation of Drop Tests

DEFENSE
- ❑ Blast Modeling
- ❑ Penetration Modeling
- ❑ Explosives Modeling for Engineers

PASSIVE SAFETY
- ❑ Introduction to Passive Safety Simulation
- ❑ Dummy/Pedestrian Impactor Modeling
- ❑ CPM for Airbag Modeling
- ❑ Information day: Dummy Models
- ❑ Information day: Human Models

METAL FORMING/PROCESS SIMULATION
- ❑ Forming Simulation with eta/DYNAFORM
- ❑ Metal Forming with LS-DYNA
- ❑ Hot Forming with LS-DYNA
- ❑ Information day: Forming Trends
- ❑ Information day: E.magn./Thermom. Forming

MATERIALS
- ❑ Fundamentals of Modeling Metallic Materials
- ❑ Damage and Failure Models
- ❑ Parameter Identification with LS-OPT
- ❑ User Materials in LS-DYNA
- ❑ Modeling Polymers and Elastomers
- ❑ Concrete and Geomaterial Modeling
- ❑ Introduction to Composite Modeling
- ❑ Information day: Composite Analysis
- ❑ Information day: Simulation of Plastics
- ❑ Information day: Material Characterisation

IMPLICIT CAPABILITIES
- ❑ Implicit Analysis with LS-DYNA
- ❑ Information day: LS-DYNA/Implicit
- ❑ NVH and Frequency Domain Analysis
- ❑ Information day: Acoustics/NVH

MULTIPHYSICS/NEW METHODS
- ❑ ALE and Fluid-Structure Interaction
- ❑ Meshless Methods - EFG
- ❑ Meshless Methods - SPH
- ❑ Electromagnetism
- ❑ ICFD - Incompressible Fluid Solver
- ❑ CESE - Compressible Fluid Solver
- ❑ Information day: Multiphysics

BIOMECHANICS
- ❑ Information day: Biomechanics
- ❑ 3D Image Segmentation and Meshing

OPTIMIZATION
- ❑ Information day: Optimization/DOE/Robustness
- ❑ Basics of Structural Optimization
- ❑ LS-OPT – Optimization and Robustness
  Optional: ❑ days 1 and 2
  ❑ day 3
- ❑ Structural Optimization with GENESIS
- ❑ Information day: ANSA, LS-OPT and META

CIVIL ENGINEERING
- ❑ Information day: Civil Engineering Applications

PRE- AND POSTPROCESSING
- ❑ Introduction to PRIMER
- ❑ Information day: PRIMER
- ❑ Pre- und Postprocessing with
  ❑ ANSA ❑ METApost ❑ HyperWorks
  ❑ MEDINA Interface/MIDAS

SUPPORT
- ❑ Support Day: LS-DYNA
- ❑ Support Day: Occupant Safety

CAE/IT
- ❑ Information day: Process Autom./SDM
- ❑ Information day: Cloud for LS-DYNA

Date (please specify): _____

All seminars are available in English language on demand and need to be confirmed.
Please indicate your preferred language ❑ German ❑ English

Sender

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E-Mail: _____

Date, signature: _____

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SCAN THIS PAGE AND SEND IT VIA E-MAIL TO SEMINAR@DYNAMORE.DE

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D-70565 Stuttgart
Germany

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- ❏ Electromagnetism
- ❏ ICFD - Incompressible Fluid Solver
- ❏ CESE - Compressible Fluid Solver
- ❏ Information day: Multiphysics

BIOMECHANICS
- ❏ Information day: Biomechanics
- ❏ 3D Image Segmentation and Meshing

OPTIMIZATION
- ❏ Information day: Optimization/DOE/Robustness
- ❏ Basics of Structural Optimization
- ❏ LS-OPT – Optimization and Robustness
  - Optional: ❏ days 1 and 2
    - ❏ day 3
- ❏ Structural Optimization with GENESIS
- ❏ Information day: ANSA, LS-OPT and META

CIVIL ENGINEERING
- ❏ Information day: Civil Engineering Applications

PRE- AND POSTPROCESSING
- ❏ Introduction to PRIMER
- ❏ Information day: PRIMER
- ❏ Pre- und Postprocessing with
  - ❏ ANSA ❏ METApost ❏ HyperWorks
  - ❏ MEDINA Interface/MIDAS

SUPPORT
- ❏ Support Day: LS-DYNA
- ❏ Support Day: Occupant Safety

CAE/IT
- ❏ Information day: Process Autom./SDM
- ❏ Information day: Cloud for LS-DYNA

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