BETA CAE

ESI Group
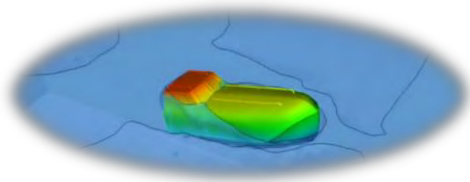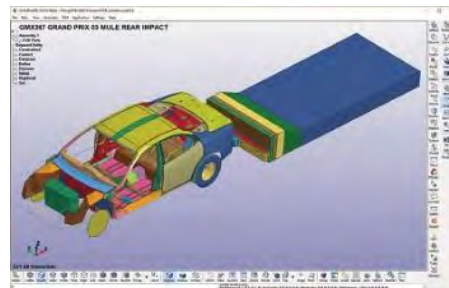

Dynamore
European LS-DYNA Conference 2019

LSTC
LS-PrePost

New Platinum Participant: **Kaizenat Technologies Pvt Ltd (KTPL)**

FEA Information Engineering Solutions

www.feapublications.com

The focus is engineering technical solutions/information.

FEA Information China Engineering Solutions

www.feainformation.com.cn

Simplified and Traditional Chinese

The focus is engineering technical solutions/information.

LSTC - Livermore Software Technology Corp.

Development of LS-DYNA, LS-PrePost, LS-OPT,

LS-TaSC (Topology), and LSTC's Dummy &

Barrier models for use in various industries.

www.lstc.com

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To be removed from the FEA News send an email - subject "Remove" to news@feainformation.com

If you have any questions, suggestions or recommended changes, please contact us.

Editor and Contact: Marsha Victory - mv@feainformation.com
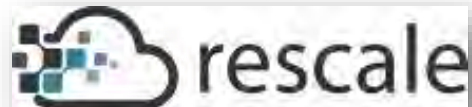
Yanhua Zhao - yanhua@feainformation.com

Noi Sims – noi@feainformation.com

Platinum Particpants

BETA SIMULATION SOLUTIONS

DYNAMORE

eta

esi get it right®

JSOL

恒士达科技 Hengstar Tech.

MSC Materials Sciences Corporation — Engineering the Future of Materials — ISO 9001:2008 CERTIFIED

Oasys The Software House of Arup

FINITE ELEMENT ANALYSIS **Predictive Engineering**

rescale

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DatapointLabs

KAIZENAT — Keep Improving

LANCEMORE

TERRABYTE Co.,Ltd.
Customer Satisfaction by Computer Solution & Computer Simulation

仿坤软件 LS-DYNA China

DLFK

DELL

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Announcements

New Platinum Participants:

Kaizenat Technologies Pvt Ltd (KTPL)

KAIZENAT Technologies Pvt Ltd is the leading solution provider for complex engineering applications and is founded on Feb 2012 by Dr. Ramesh Venkatesan, who carries 19 years of LS-DYNA expertise. KAIZENAT sells, supports, trains LS-DYNA customers in India. Currently office is in Bangalore, Chennai, Pune and Coimbatore.

LSTC Releases LS-PrePost4.6

Livermore Software and Technology Company (LSTC), Livermore, CA has recently released LS-PrePost4.6. This release is ready-to-use and can be download from LSTC ftp site.

Highlighted new features: Support creation of reduced d3plot database (Same format as d3plot); Improving rendering speed of element based fringe; Chain multiple models with history data plot; Improving ICFD and NVH applications.

12th European LS-DYNA Conference Announcement and Call for Papers: May 14 - 16 2019, Koblenz, Germany

Conference Website: www.dynamore.de/conf2019

We kindly invite all users of LS-DYNA, LS-OPT, and LS-TaSC to take advantage of this fantastic opportunity to showcase their work. The conference is your chance to talk with industry experts, catch up with colleagues and enjoy time exploring new ideas. In addition, attendees can meet with exhibitors to learn about the latest hardware and software trends as well as additional services relating to the finite element solver LS-DYNA, the optimization codes LS-OPT and LS-TaSC, and the pre- and postprocessor LS-PrePost. Training courses and workshops will take place in the week before, during and after the conference.

BETA CAE Systems announces the release of the v18.1.4 of its software suite
December 3, 2018

This version is addressed to those who have not yet migrated to the v19.x.
With this release, the v18.1x branch receives further enhancements and corrections on identified issues.

BETA CAE Systems

Developing CAE software systems for all simulation disciplines. Products: ANSA pre-processor/ EPILYSIS solver and META post-processor suite, and SPDRM, the simulation-process-data-and-resources manager, for a range of industries, incl. the automotive, railway vehicles, aerospace, motorsports, chemical processes engineering, energy, electronics…
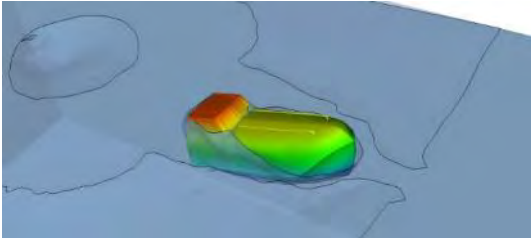
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Progressive Composite Damage Modeling in LS-DYNA (MAT162 & Others)

Bazle Z. (Gama) Haque, Ph.D.
Senior Scientist, University of Delaware Center for Composite Materials (UD-CCM)
Assistant Professor of Mechanical Engineering, University of Delaware, Newark, DE 19716
P: (302) 690-4741 | E: bzhaque@udel.edu

2019 Workshops:
Webinar Course Dates
March 12, 2019 | 9am-5pm
July 16, 2019 | 9am-5pm
November 19, 2019 | 9am-5pm

In House Course Dates
March 13, 2019 | 9am-5pm
July 17, 2019 | 9am-5pm
November 20, 2019 | 9am-5pm

Cost:
In-House Class: $695 per person
Includes: Coffee, Lunch, Parking,
CD with Course Content
[*Driving Directions* | Center for Composite Materials]

Web Conference: $695 per person
Includes: CD with Course Content

Description

Progressive damage modeling of composites under low velocity impact, and high velocity impact is of interest to many applications including car crash, impact on pressure vessels, perforation and penetration of thin and thick section composites. This course will provide a comparison between available composite models in LS-DYNA for shell and solid elements, e.g., MAT2, MAT54, MAT59, & MAT162. Among these material models, rate dependent progressive composite damage model MAT162 is considered as the state of the art. This short course will include the theory and practice of MAT162 composite damage model with applications to low and intermediate impact velocities, understanding the LS-DYNA programming parameters related to impact-contact, damage evolution, perforation and penetration of thin- and thick-section composites. Printed copies of all lecture

notes will be provided along with a CD containing all example LS-DYNA keyword input decks used in this short course.

Topics Covered in this Short Course:
Impact and Damage Modeling of Composites
Application of MAT162 in Engineering and Research Problems

Introduction to Composite Mechanics
Introduction to Continuum Mechanics and Composite Mechanics

Composite Material Models in LS-DYNA for Shell and Solid Elements
Discussion on MAT2, MAT54, MAT59, & MAT162

Theory and Practice in MAT162 Progressive Composite Damage Model for Unidirectional and Woven Fabric Composites
MAT162 User Manual – Version 15A 2015
Progressive Damage Modeling of Plain-Weave Composites using LS-Dyna Composite Damage Model

MAT162
Unit Single Element Analysis

Comparison between Different LS-DYNA Composite Models
Sphere Impact on Composite SHELL & SOLID Plates

Low Velocity Impact and Compression after Impact Applications
Modeling the Low Velocity Impact and Compression after Impact Experiments on Composites Using MAT162 in LS-DYNA

Perforation Mechanics of 2-D Membrane and Thin Composites

Penetration Mechanics of Composites and Soft-Laminates

Introduction to LS-DYNA (Document Only)

To register, email *Robin Mack* your full name, and if you're attending in house or web conference.

d3VIEW is a data to decision platform that provides out-of-the box data extraction, transformation and interactive visualizations. Using d3VIEW, you can visualize, mine and analyze the data quickly to enable faster and better decisions.

d3VIEW is a data to decision platform that provides out-of-the box data extraction, transformation and interactive visualizations.

Using d3VIEW, you can visualize, mine and analyze the data quickly to enable faster and better decisions.

Overview - d3View can integrate with any High Performance Computing (HPC) systems to submit and track jobs, perform complex data transformations using a rich library of templates that can help turn data to information, help visualize thousands of data using rich powerful visualizations, export to reports to share and collaborate.

HPC Interactions - Using the HPC application, you can submit and track simulation or non-simulation jobs that require compute resources…

Visualize your Data   - View your data using extensive library of visualizations to understand your information and to help you make decisions quickly….

Introducing Peacock beta   - View your 3D data using our native Multi-threaded GPU-Powered Visualizer….

Track Key Performance Targets and Indexes
Define and track key performance targets across simulations and tests to help you identify your design performance…

Design of Experiments (DOE) Data Visualizer - Viewing data from your DOE runs can be challenging when running simulations on the cloud or on-premise HPC system..

Experimental Data   - d3VIEW's data to decision framework supports storing, organizing and visualization of experimental data…

DYNAmore GmbH

Author: Christian Frech christian.frech@dynamore.de

Announcement and Call for Papers

12th European LS-DYNA Conference
May 14 - 16 2019, Koblenz, Germany

Conference Website: www.dynamore.de/conf2019

Call for Papers

We kindly invite all users of LS-DYNA, LS-OPT, and LS-TaSC to take advantage of this fantastic opportunity to showcase their work. The conference is your chance to talk with industry experts, catch up with colleagues and enjoy time exploring new ideas. In addition, attendees can meet with exhibitors to learn about the latest hardware and software trends as well as additional services relating to the finite element solver LS-DYNA, the optimization codes LS-OPT and LS-TaSC, and the pre- and postprocessor LS-PrePost. Training courses and workshops will take place in the week before, during and after the conference.

Venue

The Upper Middle Rhine Valley is one of the largest and oldest cultural landscapes in Europe and is the epitome of Rhine Romanticism. UNESCO acknowledged the wide variety and beauty of the Middle Rhine by making it a world heritage site in 2002.

Koblenz can be reached easily via Frankfurt and Düsseldorf International Airport.

Address:
Koblenz Kongress - Rhein-Mosel-Halle
Julius-Wegeler-Straße 4
56068 Koblenz, Germany
www.koblenz-kongress.de/

Abstract submission

Please submit your abstract (maximum length 2,500 characters) by E-Mail to conf@dynamore.de or online at:
https://www.dynamore.de/conf2019

Extended

Important Dates

Abstract submission: 18 February 2019 Author notification: 27 February 2019
Final paper deadline: 27 March 2019

Participant fees

Industry speaker: 420 Euro
Academic speaker: 360 Euro
Industry: 640 Euro[1] / 690 Euro
Academic: 490 Euro[1] / 540 Euro
[1] Registration before 1 April 2019. All plus VAT.

Exhibiting and sponsoring

Please request further information.

Contact

DYNAmore GmbH
Industriestr. 2, D-70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
E-Mail:conference@dynamore.de
www.dynamore.de/conf2019

A leading innovator in Virtual Prototyping software and services. Specialist in material physics, ESI has developed a unique proficiency in helping industrial manufacturers replace physical prototypes by virtual prototypes, allowing them to virtually manufacture, assemble, test and pre-certify their future products.

New Software Version of ESI

Visual-Environment v14.5 Released

ESI Visual-Environment is an open Computer-Aided Engineering (CAE) platform that addresses the simulation needs of multiple domains across major industries. It includes a comprehensive modeling tool to generate quality meshes on complex geometries for various engineering problems from Virtual Manufacturing to Virtual Performance: Heat Treatment, Welding, Casting, Flow, Crash, Safety, NVH (Noise, Vibration & Harshness), Electromagnetics, Fluid Dynamics (CFD), and more. An interactive post-processing module caters to the requirements of the CAE community through its multi-page / multi-plot environment.

Furthermore, a software development toolkit integrated inside Visual-Environment allows user to customize and extend this open architecture through process templates and macros. Visual-Environment incorporates the finest engineering knowledge & best practices with a process-oriented approach suited to the needs of a shop-floor user or a savvy software user alike.
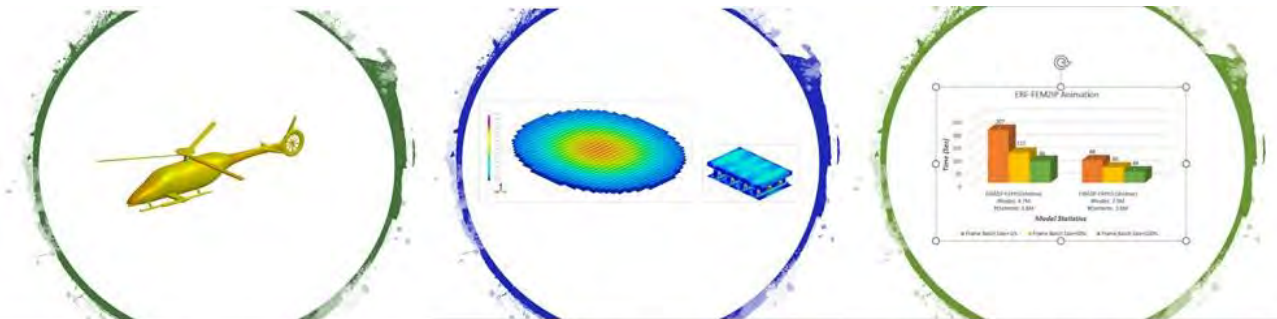
Visual-CFD: Demonstration of Overset Capabilities   Visual-CEM: Airborne Array Antennas   Visual-Viewer: Animation Performance Improvements

Release Highlights across Visual-Environment platform

- Stress-relief involved by Heat Treatment Process now simulated in Visual-AM, the new module for Additive Manufacturing.
- Sub Assembly Management enabled through dedicated automatic file and model management tools in Visual-Assembly.
- Optimization of wrapping (insulation) scheme for the investment casting process has been developed for Visual-Cast.
- Visual-CEM supports model symmetry & thin wires as well as very large array antennas, known as AESA antennas (Active Electronically Scanned Array antennas widely used in Aeronautics & Defense).
- Overset is the new and smart way of modeling relative movement between different objects in Visual-CFD. Different components will be meshed separately, then merged and solved together. The result from one set of mesh will be interpolated to other at boundary.

- Visual-Crash DYNA is enhanced to retain the location of user comments as they are, on import and export of LS-DYNA keyword file.
- Visual-Crash PAM enables advanced simulation-based dummy positioning in its Dummy Integration Workflow and provides improvements for the 2D Seat Belt Routing. ESI Input Checker is now fully integrated.
- Visual-Heat Treatment provides solution for heat treatment 3D machining chaining simulation.
- Visual-Mesh improved its CAD Import capabilities and provides productivity gain in casting through improved CAD Assembly functionalities. In welding, user experience better usability and functionality through improved remeshing.
- In Visual-RTM the deformation of core material during injection is now taken into account.
- Visual-Seat enhances early design with automated workflows and dedicated processes.
- In Visual-Systems a Co-Simulation Export dialog box is introduced to export customized FMU.
- Visual-SYSTUS comes with a Regulatory Analysis Application enabling users to perform RCCM/ASME analysis and to post-treat all the results from a basic to an advanced user mode.
- Visual-Viewer supports new functionalities for Multi Spectrum (e.g. visualize different results on various parts in the model). It also provides improved animation performance of ERF-FEMZIP files by using frame batch loading.
- Visual-Weld introduces new Nistche contact formulation for 3D welding and heat treatment models.

ESI is continuously expanding the capabilities of Visual-Environment to support new physics in CAE, enabling customers to work with different physics in a single simulation environment, with the ability to virtually build and test a full Virtual Prototype, all around a single core model, delivering tremendous gains in productivity and accuracy.

ESI's customer portal myESI is available for all ESI customers to access updated product information, tips & tricks, training information, and selected software downloads.

For additional product information, please feel free to visit our website, contact any of the local ESI subsidiaries or contact Andrea Gittens, Product Marketing Manager for ESI Visual-Environment.

For more ESI news, visit www.esi-group.com/press

Season's Greeting

ETA has impacted the design and development of numerous products - autos, trains, aircraft, household appliances, and consumer electronics. By enabling engineers to simulate the behavior of these products during manufacture or during their use, ETA has been involved in making these products safer, more durable, lighter weight, and less expensive to develop.

Dynaform Modules - Die Evaluation Module

Since most tooling designs are done in a CAD environment, DYNAFORM's D-Eval Module was specially created to support and analyze CAD based tooling and engineering designs.

A CAE solution, D-Eval is tailored to support engineers in the early stages of the product design cycle. It allows engineers to take manufacturability into consideration early in the design process, ahead of the tooling stage.

D-Eval includes the INCSolver, which allows engineers to generate reliable formability results in a reasonable response time.
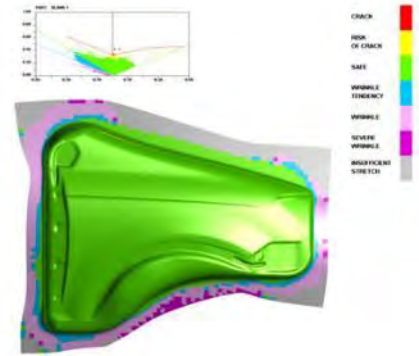
D-Eval Provides CAE Tools for "What If" Studies:

- Tipping Adjustments
- Binder Generation & Modifications
- Morphing
- Drawbead Layout
- Line Bead & Geometry Bead Conversion

- Addendum Modifications
- Die Design Modifications
- CAM Trim Evaluation
- Trim Line Checks

INCSolver

The D-Eval Module Includes the INCSolver, which is a nonlinear transient dynamic finite element program. It was developed solely for the purpose of simulating sheet metal forming processes.

Using Shared Memory Processing (SMP), users can take advantage of the multiple-CPUs, Multiple-Cores and Multiple-Threads of the latest Windows computing platform. This allows for quick and reliable results. For most cases with a 4-core CPU, results can be generated in just minutes.

The INC Solver works well with non-connected mesh generated from non-conforming CAD surfaces. This solution is most suitable for CAD engineers and directly interfaces with all major CAD systems. In addition, the INCSolver's features and functions are excellent for early stage tooling evaluation and are very simple to learn and use.

Streamlined interface for common die face engineering applications including:

- Gravity Load & Binder Wrap Simulation
- Crush Forming Simulation
- Single Action Simulation
- Double Action Simulation
- Tailor-welded Blank
- Trimming & Lancing Function

FEA Not To Miss, is a weekly internet blog on helpful videos, tutorials and other Not To Miss important internet postings. Plus, a monthly email blog.

Welcome to Monday - grab a cup of coffee, tea or protein drink and join me for FEA Not To Miss Monday

Postings every Monday on what you have missed

www.feantm.com

12/17/18 - Since my take out orders want coffee delivered by drones AND I can have horse meds right to the farm house, I say let's go for it! GO ANSYS! Therefore, this week we shall have coffee called Cafe Au Pilz - a combination of all different flavors, and then some.

Simulating Drones for Deliveries with ANSYS

In this video ANSYS tools solve engineering challenges during the UAV delivery process.

12/10/18 - Abstract Coffee Au Coco! below looks like swirling milk? Clouds? Cream mixing in coffee? A dam breaking holding back coffee? I have no clue BUT it is CFD and LS-DYNA and that is the important part (so is the coffee)

This is an animation of LS-DYNA CFD: Dam break and impact on elastic obstacle - FSI Validation problem using automatic mesh adaptivity.

2/03/18 - One wonders about the fluid velocity through my Keurig maker? NO? Okay, I agree that is a bit odd even for me SO I will go watch the fluid velocity as it drips into my coffee cup.
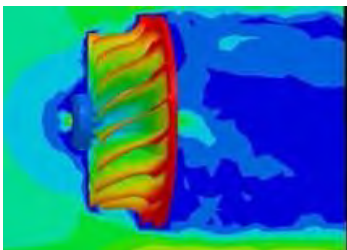
This is an animation of The flow simulations for impeller turbine using LS-DYNA (ICFD) - Kaizenat India distributor

Shanghai Hengstar & Enhu Technology sells and supports LSTC's suite of products and other software solutions. These provide the Chinese automotive industry a simulation environment designed and ready multidisciplinary engineering needs, and provide a CAD/CAE/CAM service platform to enhance and optimize the product design and therefore the product quality and manufacture.

Shanghai Hengstar & Enhu Technology

Sub-distributor and CAD/CAE/CAM consulting in China, especially for FEA needs for engineers, professors, students, consultants.

Contact us for our LS-DYNA training courses and CAD/CAE/CAM consulting service, such as

- Crashworthiness Simulation with LS-DYNA
- Restraint System Design with Using LS-DYNA
- LS-DYNA MPP
- Airbag Simulation with CPM
- LS-OPT with LS-DYNA

Our classes are given by experts from LSTC USA, domestic OEMs, Germany, Japan, etc. These courses help CAE engineers to effectively use CAE tools such as LS-DYNA to improve car safety and quality, and therefore to enhance the capability of product design and innovation.

Consulting - Besides solver specific software sales, distribution and support activities, we offer associated CAD/CAE/CAM consulting services to the Chinese automotive market.

Solutions - Our software solutions provide the Chinese automotive industry, educational institutions, and other companies a mature suite of tools - powerful and expandable simulation environment designed and ready for future multidisciplinary CAE engineering needs.

Shanghai Hengstar provides engineering CAD/CAE/CAM services, consulting and training that combine analysis and simulation using Finite Element Methods such as LS-DYNA.

Shanghai Hengstar Technology Co., Ltd

hongsheng@hengstar.com

http://www.hengstar.com

Shanghai Enhu Technology Co., Ltd

http://www.enhu.com

JSOL supports industries with the simulation technology of state-of-the-art. Supporting customers with providing a variety of solutions from software development to technical support, consulting, in CAE (Computer Aided Engineering) field. Sales, Support, Training.

J-OCTA
MultiScale Simulation Software for Soft Materials

J-OCTA, an integrated simulation system for polymeric material, is widely used in material R&D Center of Industry and University J-OCTA predicts material properties with multi-scale simulation technology, from atomic to micrometer scale, and supports the development of wide variety of highly functional materials.

JSOL Corporation
Engineering Business Division
Product : J-OCTA

http://www.j-octa.com/?cd=mail

J-OCTA Feature enhancement: Finite Element Method (FEM) simulation

Interface for LS-DYNA supports large-deformation simulation

Recently, it is in high demand to estimate and evaluate the behavior during large deformation of micro-structured composites which contain phase separation and filler, by performing simulations. Existing FEM engine of J-OCTA, "MUFFIN-Elastica" is for elastic simulation and is specialized for the behavior during a small deformation.

To extend its applicability to FEM simulation, the updated J-OCTA 4.1 version will provide the interface for a multi-purpose nonlinear structural analysis engine "LS-DYNA".

The phase-separated structure computed by "COGNAC or "SUSHI" can be output as a mesh data for LS-DYNA simulation. After the user specifies the material properties for each component and deformation (boundary) condition, LS-DYNA simulation can be started from J-OCTA directly. As a material model being appropriate for nonlinear structural simulation, materials including elastoplastic, viscoelastic, and hyperplastic such as rubber are available for use.

From version 4.1, J-OCTA can deal a large-deformation FEM calculation of a multi-phase structure which contains phase separation and filler dispersed structure.
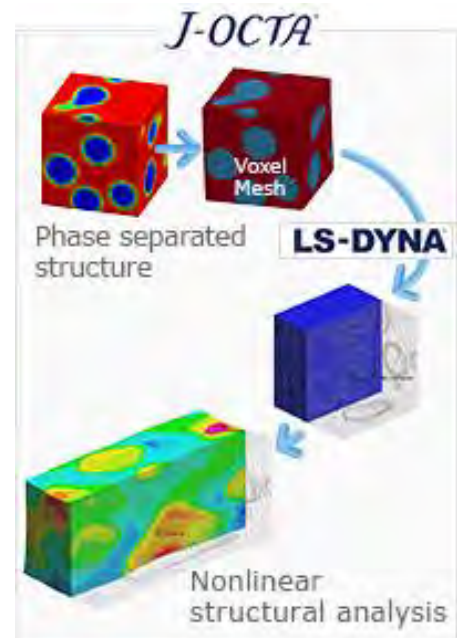
Example Case Study: Nonlinear Mechanical Properties of Composites

The phase-separated structure of a resin material (e.g., polypropylene) which is popular in the automobile industry varies depending on the type and the content ratio of the additive substance. It results in the different material properties. In this case study, you can find an example of the J-OCTA and LS-DYNA coupling analysis of mesoscale simulation that considers the phase-separated structure of a polymer.

KAIZENAT

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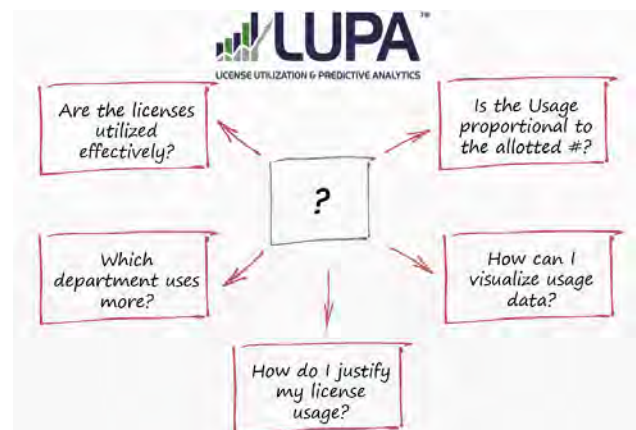
KAIZENAT Keep Improving **Technologies Pvt. Ltd.**

Kaizenat's Offering:

- **LSTC Business**
  Sales | Support | Training
- **Product Development**
  CAE Products | Android Apps | Customization
- **Urban transport (Eco)**
  Solar & Electric Vehicle
- **Go Green**
  Farmers <-> Consumers on a direct Platform

Kaizenat's Tools around LS-DYNA:

Kaizen-DYNA is a mobile and web based to help LS-DYNA users across the world.

This powerful application helps LS-DYNA users across the world to stay connected and help each other by sharing their knowledge.

The key feature of this application is QUERY and RESPONSE.

LUPA is a License Utilization and Predictive Analytics platform that helps engineers, Managers & IT-Dept to visualize the usage analytics and take business decisions accordingly.

It's Predictive Analytics capability helps business leaders to forecast their license utilization for the coming years and plan for the investments accordingly.

Contact us @ support@kaizenat.com for more information.

A team of engineers, mathematicians, & computer scientists develop LS-DYNA, LS-PrePost, LS-OPT, LS-TaSC, and LSTC's Dummy & Barrier models.

LS-PrePost® an Advanced Pre- and Post-processor

LS-PrePost® is an advanced pre- and post-processor developed for LS-DYNA®. It is fully multi-platform with support for Windows, Linux and Mac OSX. LS-PrePost is based on the OpenGL rendering engine with a design that is both efficient and intuitive. It is delivered with LS-DYNA without additional cost and may be installed on multiple platforms. License keys are not needed.

Geometry and Meshing Includes

- A geometry engine which allows the creation and modification of curves, surfaces, and solid objects. Also included are tools to heal and simplify the geometry model
- An automatic surface meshing tool
- An automatic 3-Dimension(3D) tetrahedron meshing module
- Various methods to create a mesh by dragging, spinning, offsetting, and sweeping
- The construction of middle surface shells from 3D Solids

## Pre- and Post-Processing Capabilities

- Complete LS-DYNA Keyword management
- Tools to create and modify LS-DYNA entities
- General model setup for NVH (Noise, Vibration and Harshness), Implicit, and Thermal Analyses
- Tools to measure FEA data like distance, area, angle, volume, etc.
- Section cuts for better visualization in complicated models
- Comprehensive time history plotting for the d3plot, ASCII history, and BINOUT databases
- Time history plotting for user defined data
- Particle and Discrete element visualization
- CFD model and result visualization

Other General Functions

- Tools to display, reverse, and auto reverse the normal vector directions of Shells, Segments, Thick Shells, and Cohesive Elements
- Printing of High Definition pictures in a choice of formats
- Movie creation for animation sequences
- Commands, Macros and a Scripting Command Language (SCL) for automated Pre- and Post-Processing

Applications

- Airbag folding
- Comprehensive model checking including contact initial penetration check
- Dummy positioning
- Metal forming process setup
- Seatbelt fitting

LS-PrePost Pre- and Post-Processig

LS-DYNA Geometry and Meshing

ICFD Post-Processing
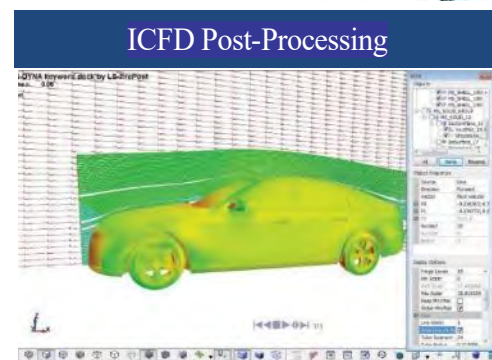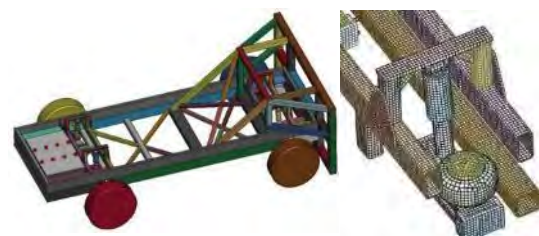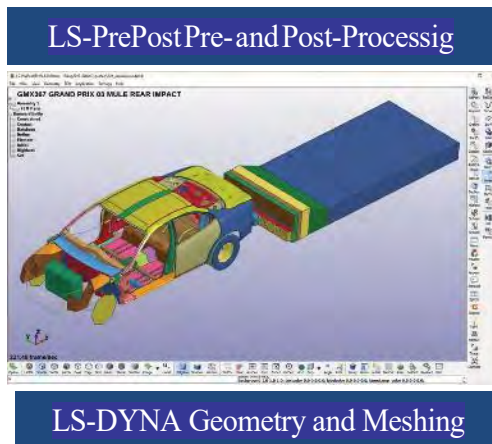
Providing engineering services to the composites industry since 1970. During this time, we have participated in numerous programs that demonstrate our ability to perform advanced composite design, analysis and testing; provide overall program management; work in a team environment; and transition new product development to the military and commercial sectors.

MAT162 is a material model for use in LS-DYNA that may be used to simulate the onset and progression of damage in unidirectional and orthotropic fabric composite continua due to 3D stress fields. This failure model can be used to effectively simulate fiber dominated failures, matrix damage, and includes a stress-based delamination failure criterion.

Simulation Movie

Penetration and Perforation of Moderately Thick Composites

Examples are located at   www.ccm.udel.edu/software/mat162/examples/
- Example 1: Sphere Impact on a Composite Laminate
- Example 2: Sphere Impact on a Perfectly Clamped Composite Plate
- Example 3: Sphere Impact on Elliptical Carbon/Epoxy Tube

High Velocity Impact of Square Plate using MAT161/162
www.youtube.com/watch?v=NgjncjfLKGw

Engineering Services

MSC brings a long-range perspective to its engineering services clients. We understand the history of our core technologies, and can project likely new developments, and seek to provide innovation. A keen appreciation of the materials and structures state-of-the-art gives us the ability to create a development roadmap that efficiently reaches the clients goal, while taking full advantage of what already exists. We have an unusually broad exposure to materials applications; we have been involved with everything from infrastructure applications to spacecraft. This broad perspective allows us to draw on approaches and trends in one application area, and apply it to another. This helps our clients avoid pitfalls, and make exceptionally rapid technological progress. The same broad reach allows us the opportunity to interact with, and evaluate a wide range of suppliers.
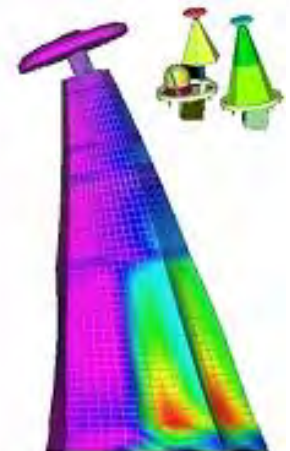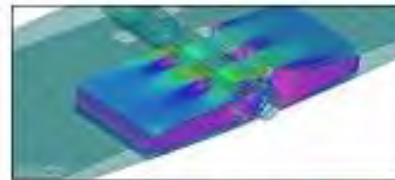
Oasys Ltd is the software house of Arup and distributor of the LS-DYNA software in the UK, India and China. We develop the Oasys Suite of pre- and post-processing software for use with LS-DYNA.

Oasys Post-Processing V15 Update

Jac Cross, Arup Associate and developer of the Oasys Post Processing software presents this free webinar, which describes and demonstrates some of the new and updated features in the latest Oasys D3PLOT, T/HIS, and REPORTER v15.0 release.

Please click below to view the webinar recording:
VIEW RECORDING

Oasys 15 Highlights New features in version 15

The following bullet points summarise the key updates which have been implemented and are now available in each of our Oasys version 15 programs.

This version of Oasys PRIMER includes:
- Support for LS-DYNA R10 keywords
- Improved model read and write speed with about 60% and 70% of the time to read and write respectively compared to V14
- A new link capability is integrated into PRIMER to use the post-processing tools D3PLOT & T/HIS
- A new combined Dummy Positioning and Seatsquash tool to automatically create simulation based LS-DYNA positioning models
- New options for the orientation and alignment of spotwelds created in PRIMER
- A new mechanism type "Coupler" has been added to handle rotation against rotation or rotation against translation or translation against translation
- Improved ability to read more ANSA comments and convert them into PRIMER mechanisms

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Free Introduction to LS-DYNA Training Course 21-23 January 2019

Arup office in Solihull, UK

The spaces will be reserved on a first come first served basis.

We expect this to be popular. Please register soon to guarantee your place on this course.

Keep an eye out for the scheduled training courses in 2019 on our website!

Predictive Engineering provides finite element analysis consulting services, software, training and support to a broad range of engineering companies across North America. We strive to exceed client expectations for accuracy, timeliness and knowledge transfer. Our process is both cost-effective and collaborative, ensuring all clients are reference clients.

CFD Analysis of CRRC's LACMTA Heavy-Rail Rapid Transient Vehicle

This has been an on-going project for our CFD consulting services team during most of 2018. As we all know, there is nothing like a "site visit" to meet your fellow engineers and see hardware. In early September, Drs. Laird and Hearn visited the CRRC Changchun Railway Vehicles Co., Ltd in Changchun, China. This is a cooperative project where Predictive has partnered with Hengstar Technology, Shanghai, China. The project work requires a complete flow and thermal analysis of Los Angeles County Metropolitan Transportation Authority (LACMTA) new passenger transit vehicle. The CFD requirements are a notch above normal specifications with tight controls on air flow volume, maximum velocity and distribution. Thermal analysis looks at vehicle cool down on hot days (transient thermal with solar radiation and lots of internal heat generation) and also thermal management within the electronics and motor drive bay at bogie level. All simulation work will be validated against vehicle mock-ups.
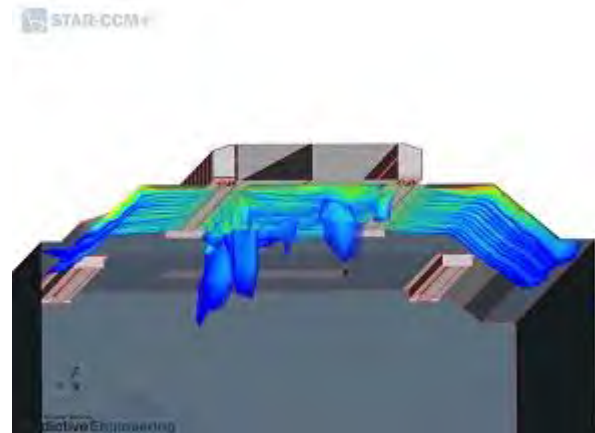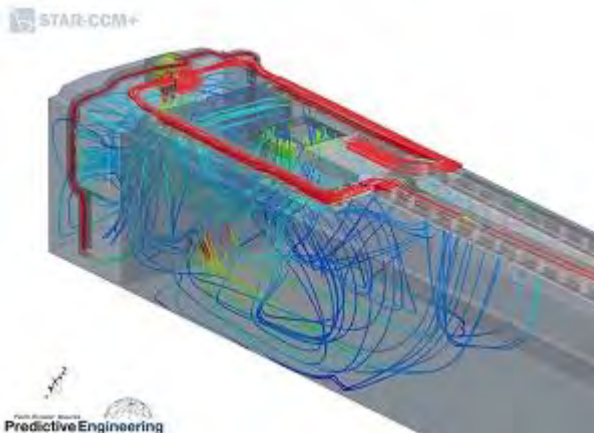
Offering industry-leading software platforms and hardware infrastructure for companies to perform scientific and engineering simulations. Providing simulation platforms that empower engineers, scientists, developers, and CIO and IT professionals to design innovative products, develop robust applications, and transform IT into unified, agile environments.

Finally, Hard Numbers for How Much HPC is Worth
Thomas Helmonds - November 28, 2018

Here at Rescale, we care very much about the cost and value of HPC. It was a major topic in our previous blog post "Addressing the Cloud Cynic." So, we thought we'd back up some of our claims with the cliff notes from a key analyst's study. In June 2018, Hyperion Research updated their global HPC study that used close to 700 different case studies over a 3 year period to help calculate the impact of HPC on enterprises. It breaks down the return on research and returns on investment associated with capital expenditures on HPC. The following information is focused on data extrapolated from the key industries that Rescale focuses on: Academic, Defense, Government, Life Sciences, Manufacturing, Oil and Gas, Telecomm, and Transportation.

The Data:
– The average revenue earned per dollar spent on HPC is $332.80.
    –– The 3 highest are Transportation, Government, and Oil and Gas at $1804.00, $1205.00, and $416.00, respectively.
    –– The 3 lowest are Academic, Defense, and Manufacturing at $9.20, $75.00, and $83.00, respectively.
– The average profit earned per dollar spent on HPC is $40.60.
    –– The 3 highest are Government, Oil, and Gas, and Academics at $112.00, $53.00, and $44.00, respectively.
    –– The 3 lowest are Defense, Transportation, and Manufacturing at $5.30, $15.60, and $20.20, respectively.
– The average cost of innovation required $11M in HPC usage.
    –– The key drivers of HPC use are scientific breakthroughs and support research programs at $76M and $27M, respectively.
    –– Those two types of innovation create a strong HPC market in Companies and Academics, not Government sectors.

Key Takeaways:

– The data is heavily influenced by the outliers.
  — Average revenue generated, excluding the top 2 highest outliers (Transportation and Government), is equal to $159/dollar spent on HPC.
  — Average profit generated, excluding the top and bottom outliers (Government and Defense), is equal to $34/ dollar spent on HPC.

– Government and Oil and Energy have seen the largest return on HPC in both revenue and profit.
  — Interestingly, Transportation companies that utilized HPC were the largest revenue earners, but the second smallest profit earners.
  — Companies engaged in innovations in scientific breakthrough and support research programs are strong drivers of HPC usage.

Understanding the impact and value of HPC on your organization is not as easy as applying industry metrics to your company. The true cost of ownership and practical application for HPC requires a deep dive into organizational needs and inefficiencies; however, these market statistics prove that HPC has had a positive impact on all organization and should be considered for every organization.

*The statistics provided were calculated from a subgroup of the overall data that represents Rescales' target markets. The full study can be viewed in the link provided.

Joseph, Conway, and Norton. (2018, June 1). Economic Models For Financial ROI And Innovation From HPC Investments. Retrieved from: https://www.hpcuserforum.com/ROI/

Financial Impact of HPC on Each Industry

Industry	Average Revenue per $ spent on HPC	Average Profit or Cost Saving per $ spent on HPC
Academic	$9.20	$44.30
Defense	$75.00	$5.30
Government	$1205.70	$112.00
Life Sciences	$160.00	$40.90
Manufacturing	$83.00	$20.20
O&G	$416.00	$53.70
Telecomm	$210.70	$30.40
Transportation	$1804.30	$15.60

This article was written by Thomas Helmonds.

CAE software sale & customer support, initial launch-up support, periodic on-site support. Engineering Services.   Timely solutions, rapid problem set up, expert analysis . material property test Tension test, compression test, high-speed tension test and viscoelasticitiy test for plastic, rubber or foam materials. We verify the material property by LS-DYNA calculations before delivery.

CAE consulting - Software selection, CAE software sale & customer support , initial launch-up support, periodic on-site support.

Engineering Services - Timely solutions, rapid problem set up, expert analysis - all with our Engineering Services. Terrabyte can provide you with a complete solution to your problem; can provide you all the tools for you to obtain the solution, or offer any intermediate level of support and software.

FE analysis
- LS-DYNA is a general-purpose FE program capable of simulating complex real world problems. It is used by the automobile, aerospace, construction, military, manufacturing and bioengineering industries.
- ACS SASSI is a state-of-the-art highly specialized finite element computer code for performing 3D nonlinear soil-structure interaction analyses for shallow, embedded, deeply embedded and buried structures under coherent and incoherent earthquake ground motions.

CFD analysis
- AMI CFD software calculates aerodynamics, hydrodynamics, propulsion and aero elasticity which covers from concept design stage of aerocraft to detailed design, test flight and accident analysis.

EM analysis
- JMAG is a comprehensive software suite for electromechanical equipment design and development. Powerful simulation and analysis technologies provide a new standard in performance and quality for product design.

Metal sheet
- JSTAMP is an integrated forming simulation system for virtual tool shop based on IT environment. JSTAMP is widely used in many companies, mainly automobile companies and suppliers, electronics, and steel/iron companies in Japan.

Pre/ Post
- **PreSys** is an engineering simulation solution for FE model development. It offers an intuitive user interface with many streamlined functions, allowing fewer operation steps with a minimum amount of data entry.
- **JVISION** - Multipurpose pre/post-processor for FE solver. It has tight interface with LS-DYNA. Users can obtain both load reduction for analysis work and model quality improvements.

Biomechanics
- **The AnyBody Modeling System™** is a software system for simulating the mechanics of the live human body working in concert with its environment.

LS-DYNA China Presented at 2018 National Conference on Solid Mechanics

The 2018 National Conference on Solid Mechanics was held in Harbin from November 23 to 25, 2018, which brought together more than 2000 experts, scholars and graduate students from over 120 colleges and universities in China. LS-DYNA China, as the only CAE software provider among the exhibitors, grabbed the attention of extensive exhibition professionals.

LS-DYNA has been widely used in China. At the site, customers have visited our booth to learn about the latest developments in software, especially in its breakthrough in the field of multi-physics in recent years, particularly in the implicit analysis, SALE fluid structure interaction, EFG meshfree method, ICFD (incompressible fluid and fluid structure interaction) analysis, CESE high-speed compressible fluid simulation, and Peri-Dynamic algorithms.

Many users are very interested in the training plan for the next year and the annual conference of LS-DYNA which will be held in October 2019. The related information will be announced recently. LS-DYNA users are welcomed to various activities organized by Shanghai Fangkun (LS-DYNA China).

Website: http://www.lsdyna-china.com   **Sales Email**: sales@lsdyna-china.com
Technical support Email: support@lsdyna-china.com   **Phone:** 400 853 3856 021-61261195

Leonardo: Italian National Fire Corps Awards Contract for Three AW139 Helicopters
http://www.defense-aerospace.com

The Italian Fire Service's €45 million contract for three AW139s includes an option for 12 additional helicopters, and brings to 56 the number of AW139s ordered by Italian government agencies. (Leonardo photo)

ROME --- In a move to enhance its emergency multirole airborne capabilities to more effectively counter the ever-increasing risks of firefighting duties, the Italian National Fire Corps (Vigili del Fuoco) has signed a contract for the supply of three AW139 intermediate twin engine helicopters.

The order, valued at around €45 million, also includes integrated logistic support and training for pilots and technicians, and encompasses an option for 12 additional helicopters. Deliveries of the three new aircraft are expected to start shortly and to be completed in 2019.

Over 816,000 rescue operations occur every year countering fires across Europe, including many in Italy this year. In order to better face these challenges, the Italian National Fire Corps, part of the department of firefighters, public rescue and civil defence within the Ministry of the Interior, is acquiring the world's best rescue helicopter capable to also carry out maritime and mountain Search and Rescue (SAR), medical rescue, and disaster relief/civil protection. The AW139 has been selected by the customer following a competitive tender launched in 2017.

The 7-tonne AW139s of the Italian National Fire Corps are expected to progressively replace their AB412s helicopters which have been in service for decades. The new aircraft of the Italian National Fire Corps will feature a wide range of mission equipment, including an external rescue hoist, cargo hook with Bambi bucket provision, weather radar, multi-band and satellite communication systems, high definition Forward Looking Infra-Red / Low Light TV (FLIR/LLTV) system, Leonardo's high definition mission console with digital recorder, high definition down link, Leonardo's Optical Proximity LiDAR System (OPLS), Night Vision Goggle (NVG) capability, new generation Trakka searchlight, emergency floatation system and external life rafts, external loudspeaker, medical rack and bubble windows.

The AW139 design incorporates a large spacious cabin accessed by two sliding doors, powerful engines that deliver class leading performance and safety, making it the aircraft of choice in its weight class. Excellent one engine inoperative capability ensures the aircraft can accomplish the most demanding missions while maintaining the ability to fly away safely in the rare event of an engine failure.

The cockpit features the latest technology including fully integrated avionics, a 4-axis digital Automatic Flight Control System with dedicated SAR modes and large flat panel colour displays - reducing pilot workload and allowing the crew to concentrate on the mission.

Note to editors on the AW139 helicopter :

The AW139 has also been selected by and is in service with the Italy's Customs and Border Protection Service, State Police, Coast Guard and Air Force. The various Italian Government agencies operating the AW139 are able to benefit from shared logistics, training and support systems.

This latest selection by the Italian National Fire Corps brings the total number of AW139s chosen by all of these Italian Government operators to 56, covering a wide scope of public utility roles including law enforcement and homeland security, patrol, special operations, search and rescue, command and control, government/VVIP transport, disaster relief and training.

Many law enforcement, maritime/border patrol and security agencies from countries around the world, including Italy, the UK, USA, Japan, Republic of Korea, Malaysia, Sweden, Spain, Estonia, The Netherlands, Brazil, and UAE, have selected or are already operating the AW139 to fulfil their requirements. Over 270 customers from around 70 nations have already ordered over 1100 AW139s, more than 900 of which are in service, confirming itself as the bestselling aircraft in its category

Real life safety: the Mercedes-Benz EQC and safety: Proven to be safe

Stuttgart. The new Mercedes-Benz EQC (combined power consumption: 22.2 kWh/100 km; combined CO2 emissions: 0 g/km, provisional figures)[1] is also a genuine Mercedes when it comes to passive safety. In addition to the usual, extensive programme of crash tests, the brand applies stringent safety standards to the battery and all component parts carrying electrical current. In many cases these standards exceed legal requirements.

Mercedes-Benz's extensive experience of high-voltage drive systems has led to a special safety concept. The EQC's accident safety was validated at the Mercedes-Benz technology centre for vehicle safety (TFS), the most advanced crash test centre in the world. Here vehicles, including prototypes with large electric batteries, have been tested under harsh crash conditions. The result is a whole array of constructive measures which deliver the EQC's high level of crash safety:

·A new subframe surrounds the drive components located in the front section, and this unit is supported by the usual mounting points.

·The battery is surrounded by a robust frame with an integral crash structure. Deformation elements are installed between the frame and the battery, and these are able to absorb additional forces in the event of a severe side impact.

·A battery guard in the front area of the battery is able to prevent the energy storage unit from being pierced by foreign objects.

·

·The high-voltage system can also be shut down automatically in a crash, depending on its severity. A distinction is made between a reversible and an irreversible cut-off. When it is shut down the voltage in the high-voltage system outside of the battery reduces to below the safety-relevant voltage limit in a very short time.

·Another feature of the comprehensive high-voltage safety concept is that the charging process is automatically curtailed if an impact is detected when stationary at a quick-charging station (DC charging). There are also shutdown points where emergency teams can deactivate the high-voltage system manually.

·In addition to assessing the occupant values during a crash, the battery's accident safety was also tested at the development centre of Deutsche ACCUMOTIVE, a wholly-owned Daimler subsidiary. Test criteria included the battery's behaviour under impact and when penetrated by foreign bodies, with overheating and overloading also simulated

Beyond the structural safety and the battery protection concept, the model's specially adapted restraint systems are particularly important for the occupants in the event of an accident.

- ·Three-point seat belts with pyrotechnical belt tensioners and belt force limiters are installed for the driver, front passenger and passengers on the outer rear seats (normal three-point seat belt in the centre at the rear).
- ·i-Size (Europe) and ISOFIX (other countries) child seat attachment points for securely attaching appropriate child seats on the outer rear seats
- ·Window airbags in the roof area between the A, B and C-pillars for the head area of the driver, front passenger and passengers on the outer rear seats
- ·Combined thorax/pelvis side impact airbags for driver and front passenger. Additional optional side impact airbags for the outer rear seats.
- ·Airbags for driver and front passenger in the event of a severe frontal impact, with dual-stage, time-delayed deployment on the passenger side
- ·Knee airbag for the driver

Numerous measures help to ensure that when Mercedes-Benz vehicles suffer an accident, consequential damage is reduced and rescue of the occupants is assisted. As soon as a protective system (e.g. belt tensioner and airbag) is triggered, an emergency call or a service call is made or a breakdown is detected, the following measures can be initiated depending on the accident type and severity:

- ·Automatic activation of Mercedes-Benz emergency call to notify emergency services of the location and emergency situation and initiate rescue.
- ·Shutdown of the high-voltage system
- ·Activation of the hazard warning system to warn other road users
- ·Interior lighting switched on
- ·Front side windows lowered for ventilation in the event of airbag deployment
- ·Central locking system unlocked
- ·Lifting of the electrically adjustable steering column
- ·Notification of a detected breakdown or accident situation to Car-to-X communication and to the Mercedes-Benz service centre
- ·A rescue sticker provides a direct link to the vehicle's rescue data sheet. Corresponding stickers are affixed to the charging flap and to the opposite B-pillar of the vehicle for this purpose. In the aftermath of an accident, rescue services can scan the QR code with a smartphone or tablet PC for fast and reliable access to the rescue data sheet for the specific vehicle concerned, thus facilitating rescue operations.
- ·Alongside the rescue data sheets, the Rescue Assist App for smartphones and tablets also has three-dimensional views of the vehicle – now also offline in case there is no mobile network available at the accident scene.

LS-Run 1.0 tutorial on YouTube -
A video that explains how to use and setup LS-Run. LS-Run is a program that starts and schedules LS-DYNA simulations when using Windows. You can run both mpp and smp simulations on your laptop, on a remote computer (Linux or Windows), or on a Windows HPC server.

New: LS-Run for LS-PrePost - With the new software "LS-Run" simulations can be started in a simplified job list (queuing system) using either MPP or SMP versions of LS-DYNA on computers running Windows or Linux.

LSTC WinSuite – a complete solution for the Windows platform pdf

With the release of LS-DYNA R10, a new installer called WinSuite has been released for Windows. This installer contains a complete environment for running the major products from LSTC; LS-DYNA, LS-PrePost, LS-OPT and LS-TaSC. It also includes the new program LS-Run which can act as a control center when running LS-DYNA. WinSuite contains everything needed to get started using LS-DYNA on Windows including self-study tutorials and support for queuing up jobs on the local computer.

For LSTC WinSuite download information, please contact gunther@lstc.com or your local distributor.

LS-DYNA Tools -DYNAmore

Tool sets that facilitate the work with LS-DYNA. The tools are written in Perl or Fortran and compiled for common operating systems. An evaluation and the usage in production are free of charge for our customers and others on request. The majority of tools are made available by courtesy of Daimler, Porsche and Opel.

KAIZENAT dynaLUPA License utilization & Predictive Analytics

- •Total Number of licenses used
- •Comparison of YOY, MOM usage,
- •Number of hours delayed/wasted in queue
- •Justifying number of license requirement
- •Forecast usage pattern based on current usage pattern
- •User with highest utilization in a department
- •User with lowest utilization in a department
- •Track license usage/user & Forecast and allocate

Contact support@kaizenat.com for more information

Guest Showcase LS-DYNA OnLine Training

mv@feainformation.com

http://lsdyna-online.com - OnLine training by Ala Tabiei

Training courses offered online using GO TO MEETING. Each of these courses are 16 hours course (some with workshops). The 16 hours courses are exactly the same ones given at LSTC by the instructor. The workshops, also the same as what is given at LSTC by the instructor are with instructor support. Customers who need courses which are not listed on the website are encouraged to contact lsdyna-online to discuss any additional desired courses. In addition, customers with 3 students and more can request a course at their desired dates.

The website has tutorials, full course descriptions and information you need to be an attendee of courses on line. Additionally, there is a YouTube Channel for your convenience to watch how the training courses will work https://www.youtube.com/watch?v=k-CfYyhBzc8&version=3

2019 Courses will be posted soon on the website.

 Lecture & Workshop will start at 10:00 am Eastern Time or 9:00 am, USA depending on the course to accommodate the different time zones.

Cost is per student.

Among the classes offered are:
- Introduction to LS-DYNA
- Composites in LS-DYNA
- Contact in LS-DYNA
- Fracture, Damage & Failure
- Fluid Structure Interaction

Contact: courses@lsdyna-online.com
        or call: 513-331-9139

LS-DYNA - Resource Links

LS-DYNA   Multiphysics   YouTube

https://www.youtube.com/user/980LsDyna

FAQ   LSTC

ftp.lstc.com/outgoing/support/FAQ

LS-DYNA Support Site

www.dynasupport.com

LS-OPT & LS-TaSC

www.lsoptsupport.com

LS-DYNA   EXAMPLES

www.dynaexamples.com

LS-DYNA   CONFERENCE   PUBLICATIONS

www.dynalook.com

ATD –DUMMY   MODELS

www.dummymodels.com

LSTC   ATD   MODELS

www.lstc.com/models   www.lstc.com/products/models/mailinglist

AEROSPACE   WORKING   GROUP

http://awg.lstc.com

LS-DYNA YAHOO Group

http://tech.groups.yahoo.com/group/LS-DYNA

mv@feainformation.com

www.fujitsu.com/jp

www.infinite.nl

www.dynamax-inc.com

www.dynasplus.com

www.beta-cae.com

www.dynamore.de
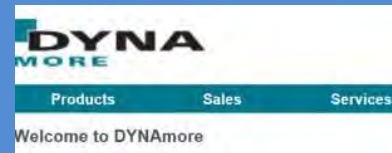
www.materials-sciences.com

www.kaizenat.com

www.eta.com
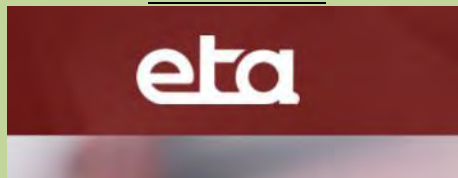
www.lancemore.jp/index_en.html

Training - Webinars

Participant's Training Classes

Webinars

Info Days

Class Directory

Directory

Arup	www.oasys-software.com/dyna/en/training
BETA CAE Systems	www.beta-cae.com/training.htm
DYNAmore	www.dynamore.de/en/training/seminars
Dynardo	http://www.dynardo.de/en/wost.html
ESI-Group	https://myesi.esi-group.com/trainings/schedules
ETA	www.eta.com
KOSTECH	www.kostech.co.kr/
LSTC - (corporate)	www.lstc.com/training
LS-DYNA OnLine - (Al Tabiei)	www.LSDYNA-ONLINE.COM
OASYS	www.oasys-software.com/training-courses/
Predictive Engineering	www.predictiveengineering.com/support-and-training/ls-dyna-training

Training - Dynamore

Author: Christian Frech christian.frech@dynamore.de

Seminars 2019
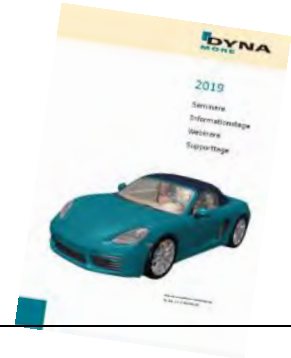
Visit the website for complete overview and registration www.dynamore.de/seminars

Selection of trainings for January/February

Introduction
Introduction to LS-DYNA	29-31 January (V)
	12-14 February
Introduction to Simulation Technology	7 February
Introduction to LS-PrePost	11 February

Basics/Theory
User Interfaces	4 February

Crash
Crash Analysis	5-8 February (G)
Failure of Fiber-Reinforced Polymers	14 February
Joining Techniques in LS-DYNA	25 February

Metal Forming
Hot Forming with LS-DYNA	22 January
Applied Forming Simulation with eta/DYNAFORM	24 January

Particle Methods
Smoothed Particle Hydrodynamics	26-27 February

Multiphysics
ALE and FSI	28 February

Information days (free of charge)
Process Automation/SDM	25 February

We hope that our offer will meet your needs and are looking forward to welcoming you at one of the events.

If not otherwise stated, the event location is Stuttgart, Germany. Other event locations are:
A = Aachen, Germany, Ba = Bamberg, Germany, G = Gothenburg, Sweden; L = Linköping, Sweden,
V = Versailles, France; T = Turin, Italy, Tr = Traboch, Austria, Z = Zurich, Switzerland
We hope that our offer will meet your needs and are looking forward to welcoming you at one of the events.

Training - LSTC

January 2019

Date		Location	Coures Title	Days	Instructor(s)
Jan 22-25	Tues-Fri	*MI*	**Introduction to LS-DYNA®**	4	R. Chivukula
Jan 28	Mon	CA	**Discrete Elements in LS-DYNA®**	1	H. Teng

February 2019

Date		Location	Coures Title	Days	Instructor(s)
Feb 11-12	Mon-Tues	*MI*	**Airbag Folding**	2	R. Chivukula
Feb 13-14	Wed-Thurs	*MI*	**Airbag Modeling in LS-DYNA®**	2	A. Nair
Feb 20	Wed	*MI*	**Introduction to LS-PrePost**	1	P. Ho, Q. Yan
Feb 25	Mon	*MI*	**Overview of Contacts in LS-DYNA®**	1	S. Bala
Feb 26	Tues	*MI*	**Material Characterization for Metals, Polymers and Foams**	1	S. Bala
Feb 04-06	Mon-Wed	CA	**ALE, Eulerian & Fluid-Structure Interaction in LS-DYNA®**	3	M. Souli
Feb 07- 08	Thurs-Fri	CA	**Smoothed Particle Hydrodynamics (SPH) in LS-DYNA®**	2	M. Souli

Rapid Simulations of Welding and AM using LS-DYNA® and LS-PrePost®

Mikael Schill
DYNAmore Nordic AB, Linköping, Sweden
Anders Jernberg
DYNAmore Nordic AB, Linköping, Sweden
Anders Bernhardsson
DYNAmore Nordic AB, Linköping, Sweden

Abstract

Simulation of the welding process in LS-DYNA has been continuously improving the recent years. The functionality in terms of solvers, materials, heat source and preprocessing GUI have been continuously expanded. One of the issues that remains to be solved is the sometimes quite long simulation times. The solution time of a welding simulation depends largely on the length and speed of the weld. This is especially true in Additive Manufacturing (AM) applications where the length of the weld can be very long. To remedy this problem, a dumping methodology is presented. The methodology still uses a thermo-mechanical approach, but the weld energy is dumped in the complete weld rather than applied incrementally. This paper presents the methodology in detail together with examples and comparisons in both welding and AM applications.

Introduction

The functionality for simulating welding in LS-DYNA has been a focus for development for the last few years. The development has resulted in tailored material models like *MAT_CWM, *MAT_UHS and lately also *MAT_GENERALIZED_PHASECHANGE see Klöppel [1]. Also, the heat source modeling has been in focus and now the user can benefit from several heat source shapes and also sub-cycling and user-controlled integration of the heat source for increased speed and accuracy, see Schill et al. [2]. The methodology for the welding simulations has been used in e.g. Schill et al. [3] and Caro [4], where the simulation results also were compared to experiments. The preprocessing of a welding process containing several welds can be very challenging. In order to help the user, a GUI is implemented into LS-PrePost. The basics of the GUI and simulation methodology will briefly be explained in this paper. A more in-depth description can be found in Schill et al. [2]. The main focus of the GUI is to enable the user to easily switch welding order, boundary conditions and define weld paths.

So far, the development focus has been on simulating welding by using an incremental movement of the heat source. This means that the complete weld path of the heat source is simulated. Thus, for multi pass welds or long welds the simulations can be very time consuming. Additive Manufacturing (AM) resembles welding in many ways. Especially if Laser Metal Deposition (LMD) is considered. In this case, the welding paths can be very long even for small parts. In order to simulate long weld paths or AM within reasonable time frames, some kind of simplification has to be made. One way to speed up the simulation is to use a thermal dumping technique. This type of method involves dumping the thermal energy from the weld source in one or a limited number of steps. The incremental heat source movement simulation is then bypassed, and the simulation time is reduced to the cooling simulation. The time saving for using this type of method is thus considerable. The accuracy is of course affected, and the user must be aware of the assumptions made and the effects of using such a method.

This paper presents the basics of simulating welding in LS-DYNA in terms of material, heat source and solver options followed by the basics of the GUI in LS-PrePost. The next section contains the description of a thermal dumping method. Its theoretical basis and limitations is discussed and the corresponding realization in

LS-DYNA is explained. The thermal dumping is implemented as a heat source option in LS-PrePost and this is also presented. To verify the technique, a simple T-joint welding example and LMD additive manufacturing example is shown.

Simulation of welding in LS-DYNA

Welding simulations makes use of the multiphysics capabilities of LS-DYNA. The thermal solver is used for the heat source that heats up the material while the thermal strains and stresses are calculated in the mechanical solver. The solution of the problem can be made either using a coupled or an uncoupled approach. The type of solution is chosen by the parameter SOLN on the *CONTROL_SOLUTION keyword. A coupled approach means that the thermal and mechanical solvers are run at the same time exchanging information. The solution in LS-DYNA is done using a staggered approach where the solvers have different time steps and the thermal or mechanical state is assumed to be constant within a timestep. The solution is coupled in such a sense that the thermal problem affects the mechanical and vice versa. The problem can also be solved using an un-coupled approach. In this case, the thermal problem is run first and then the mechanical problem is run using the results from the thermal solver as an input using the keyword *LOAD_THERMAL_D3PLOT. In this case, the thermal problem affects the mechanical problem but not the other way around. Welding simulations are often run using the un-coupled approach to simplify the problem. This is usually a good approximation if the mechanical solution does not drastically change the thermal problem due to e.g. contacts or similar.

Material Any thermo mechanical material model can be used for welding, but there are three different material models that are tailored for simulation of welding, namely *MAT_CWM, *MAT_UHS and *MAT_GENERALIZED_PHASECHANGE. The simplest one is the *MAT_CWM which contains the basic features for modeling a welding material. All elastic and plastic input parameters are temperature dependent and it is possible to activate the material at a user specified temperature. This temperature is used to distinguish between three different material states, see Lindström [5].

> *Ghost:* Material has very low elastic properties and heat conduction. The material will not be activated during the simulation. This is the material of a later welding stage.
> *Liquid:* This state is ghost material from the beginning with ghost properties. However, at a specific user defined temperature it will be activated and given the material properties of that temperature.
> *Solid:* This material is already activated in a previous welding stage.

Apart from the ghost properties, *MAT_CWM also has anneal functionality where the history variables are cancelled out above a user specified temperature. This is useful for modeling the stresses in the heat affected zone. *MAT_UHS_STEEL and *MAT_GENERALIZED_PHASECHANGE are phase kinetic models where the former is used to model the growth of bainite, ferrite, pearlite and martensite during cooling and austenization during heating, see Åkerström et al. [6] and [7], For full control over the phase kinetics, the *MAT_GENERALIZED_PHASECHANGE offers up to 24 different phases where the user can choose freely from a set of phase transformation laws to describe phase changes between the different constituents. The *MAT_CWM material model has a thermal counterpart in *MAT_CWM_THERMAL where the material can be activated in the same manner. The mechanical and the thermal models are uncoupled, so they can be combined with any other thermos-mechanical material model.

Heat source One other crucial part of modeling the welding process is the heat source. The keyword in

LS-DYNA used for this purpose is *BOUNDARY_THERMAL_WELD TRAJECTORY. In its current state, it offers three different types of heat source, namely the double ellipsoid, the conical and the double conical. The user must input appropriate measures of the heat source geometry to match welding tests and etched weld cross section cuts. The keyword also hosts the movement of the heat source which can be described by a number of methods. The most common being a string of nodes described by a *SET_NODE. The orientation of the heat source can also be described by a string of nodes or as normal to a segment set. It should be noted that the heat source is implemented in the thermal solver. Thus, it is possible to use it in a thermal only simulation without any need to activate the mechanical solver.

Due to the incremental nature of the heat source, the choice of time step size is in reality bound by the velocity of the weld torch and the element size. If the heat source is moved too far in one timestep, the heating becomes local instead of uniform which results in a hourglass type of deformation. To remedy this, a subcycling of the heat source is implemented and the heat is integrated along the weld path during one timestep. This makes the user freer to choose a timestep although a too large timestep will of course affect the accuracy. The number of subcycling steps during one timestep is controlled by the NCYC parameter.

Accurate integration of the applied heat is activated by setting a negative number of on the power input.
LS-DYNA then calculates the applied power and adjusts it to fit the theoretical. This makes the solution less sensitive to coarse meshes. The integration is done by integration cells and the user can set the side length of the integration cells by the DISC parameter. If chosen wisely, this can be used to decrease the simulation time without significantly affecting the accuracy.

LS-PrePost Welding GUI

Setting up a welding simulation can be a challenging task. Especially if the model contains several welds and the user is faced with a task to vary the welding and corresponding clamping order. The welding GUI inside LS-PrePost is implemented to target this setup, see Figure 1.
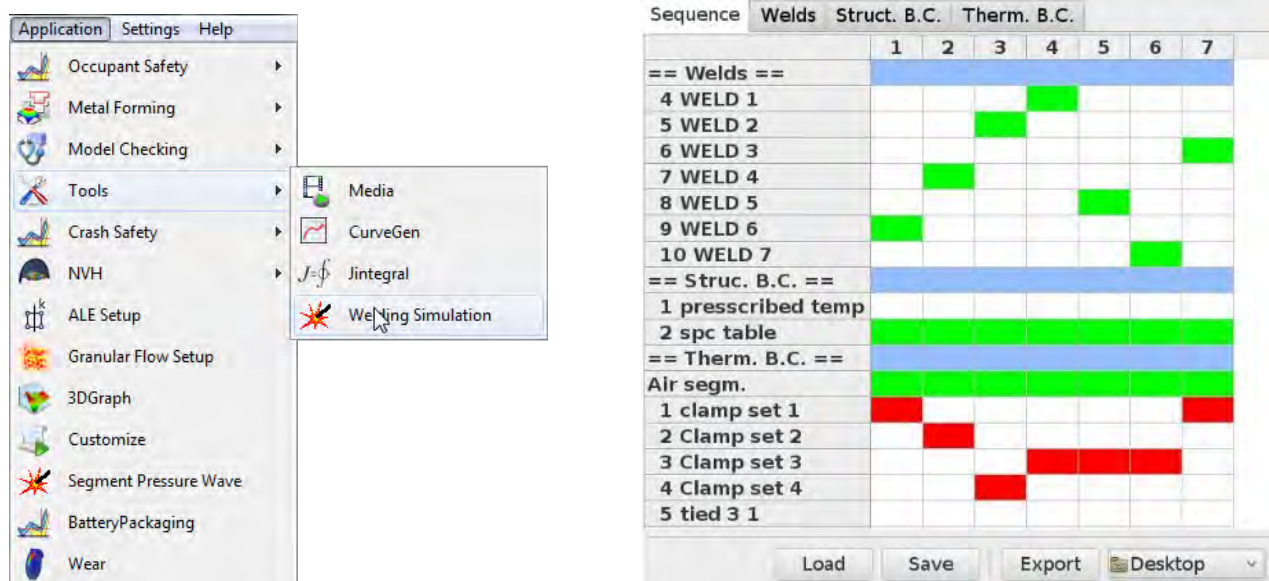

Figure 1: LS-PrePost welding GUI application and process window

The main window is the process window where the welding order and corresponding clamping is chosen. To further guide the user, the color of the button is green if the welding or clamping is set up correctly or red if further input is needed. Each weld has its corresponding welding setup, path, and orientation path. For a more in-depth description see Schill et al. [2].

A novel implementation into the GUI is the possibility to run the simulation in an uncoupled or thermal only setup. The user then checks either of the boxes found in the weld setup window, see Figure 2. If uncoupled is chosen, the GUI outputs a thermal only and mechanical only simulation version of each welding and cooling step which must be run in consecutive order starting with the thermal followed by the mechanical simulation.
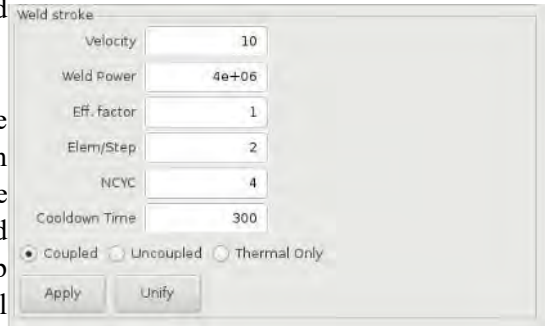

Figure 2: Possibility to run either coupled, uncoupled or thermal simulation setup

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Conclusions

The welding functionalities in LS-DYNA has been continuously improved over the recent years. This regards both LS-DYNA and also LS-PrePost where a GUI has been implemented to aid the user in setting up and modifying this type of simulations. The focus has been on incremental simulations where development has been done in terms of new material models and heat source modeling. However, incremental welding simulations can be quite time consuming for long or many weld passes. Instead of incrementally heating up the weld with a moving heat source it is assumed that an equal amount of energy can be deposited in just one step. This methodology is known as thermal dumping. This is true if it can be assumed that the deformations and stresses that occur during the heating does not affect the solution. Thus, the stresses and deformation evolve during the cooling of the weld. Still, the simulation can be thermo-mechanical. It is then possible to apply the same temperature history in both types of simulations. This allows for the user to modify the welding parameters directly instead of having to go through a calibration step. The obvious benefit of the thermal dumping technique is that since the energy is applied in one step, the simulation time is not affected by the weld length.

This is a huge benefit for welding large structures or AM simulations where the weld pass length could be substantial. The method presented in this paper is based on a volumetric heat loading of the weld with equal amount of heat input as the incremental weld. The simulation is divided into a heating step and a cooling step. Since it is assumed that the heating does not affect the mechanical solution, this step is done only using only the thermal solver. This step is followed by a cooling step where the thermal strains are activated. The methodology has been added to the welding GUI in LS-PrePost where the user now can choose to run a weld pass either incrementally or using thermal dumping.

BETA CAE Systems.   **www.beta-cae.com**

BETA CAE Systems - ANSA

BETA CAE Systems µETA

An advanced multidisciplinary CAE pre-processing tool that provides all the necessary functionality for full-model build up, from CAD data to ready-to-run solver input file, in a single integrated environment. ANSA is a full product modeler for LS-DYNA, with integrated Data Management and Process Automation. ANSA can also be directly coupled with LS-OPT of LSTC to provide an integrated solution in the field of optimization.

Is a multi-purpose post-processor meeting diverging needs from various CAE disciplines. It owes its success to its impressive performance, innovative features and capabilities of interaction between animations, plots, videos, reports and other objects. It offers extensive support and handling of LS-DYNA 2D and 3D results, including those compressed with SCAI's FEMZIP software.

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Testing over 1000 materials per year for a wide range of physical properties, DatapointLabs is a center of excellence providing global support to industries engaged in new product development and R&D.

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Inventium Suite™

Inventium Suite™ is an enterprise-level CAE software solution, enabling concept to product. Inventium's first set of tools will be released soon, in the form of an advanced Pre & Post processor, called PreSys.

Inventium's unified and streamlined product architecture will provide users access to all of the suite's software tools. By design, its products will offer a high performance modeling and post-processing system, while providing a robust path for the integration of new tools and third party applications.

PreSys

Inventium's core FE modeling toolset. It is the successor to ETA's VPG/PrePost and FEMB products. PreSys offers an easy to use interface, with drop-down menus and toolbars,

increased graphics speed and detailed graphics capabilities. These types of capabilities are combined with powerful, robust and accurate modeling functions.

VPG

Advanced systems analysis package. VPG delivers a unique set of tools which allow engineers to create and visualize, through its modules-- structure, safety, drop test, and blast analyses.

DYNAFORM

Complete Die System Simulation Solution. The most accurate die analysis solution available today. Its formability simulation creates a "virtual tryout", predicting forming problems such as cracking, wrinkling, thinning and spring-back before any physical tooling is produced

ESI Group

Visual-Environment is an integrative simulation platform for simulation tools operating either concurrently or standalone for various solver. Comprehensive and integrated solutions for meshing, pre/post processing, process automation and simulation data management are available within same environment enabling seamless execution and automation of tedious workflows. This very open and versatile environment simplifies the work of CAE engineers across the enterprise by facilitating collaboration and data sharing leading to increase of productivity.

Visual-Crash DYNA provides advanced preprocessing functionality for LS-DYNA users, e.g. fast iteration and rapid model revision processes, from data input to visualization for crashworthiness simulation and design. It ensures quick model browsing, advanced mesh editing capabilities and rapid graphical assembly of system models. Visual-Crash DYNA allows graphical creation, modification and deletion of LS-DYNA entities. It comprises tools for checking model quality and simulation parameters prior to launching calculations with the solver. These tools help in correcting errors and fine-tuning the model and simulation before submitting it to the solver, thus saving time and resources.
Several high productivity tools such as advanced dummy positioning, seat morphing, belt fitting and airbag folder are provided in **Visual-Safe,** a dedicated application to safety utilities.

Visual-Mesh is a complete meshing tool supporting CAD import, 1D/2D/3D meshing and editing for linear and quadratic meshes. It supports all meshing capabilities, like shell and solid automesh, batch meshing, topo mesh, layer mesh, etc. A convenient Meshing Process guides you to mesh the given CAD component or full vehicle automatically.

Visual-Viewer built on a multi-page/multi-plot environment, enables data grouping into pages and plots. The application allows creation of any number of pages with up to 16 windows on a single page. These windows can be plot, animation, video, model or drawing block windows. Visual-Viewer performs automated tasks and generates customized reports and thereby increasing engineers' productivity.

Visual-Process provides a whole suite of generic templates based on LS-DYNA solver (et altera). It enables seamless and interactive process automation through customizable LS-DYNA based templates for automated CAE workflows.

All generic process templates are easily accessible within the unique framework of Visual-Environment and can be customized upon request and based on customer's needs.

Visual*DSS* is a framework for Simulation Data and Process Management which connects with Visual-Environment and supports product engineering teams, irrespective of their geographic location, to make correct and realistic decisions throughout the virtual prototyping phase. Visual*DSS* supports seamless connection with various CAD/PLM systems to extract the data required for building virtual tests as well as building and chaining several virtual tests upstream and downstream to achieve an integrated process. It enables the capture, storage and reuse of enterprise knowledge and best practices, as well as the automation of repetitive and cumbersome tasks in a virtual prototyping process, the propagation of engineering changes or design changes from one domain to another.

JSOL

JSOL Corporation

HYCRASH

Easy-to-use one step solver, for Stamping-Crash Coupled Analysis. HYCRASH only requires the panels' geometry to calculate manufacturing process effect, geometry of die are not necessary. Additionally, as this is target to usage of crash/strength analysis, even forming analysis data is not needed. If only crash/strength analysis data exists and panel ids is defined. HYCRASH extract panels to calculate it's strain, thickness, and map them to the original data.

JSTAMP/NV

As an integrated press forming simulation system for virtual tool shop the JSTAMP/NV meets the various industrial needs from the areas of automobile, electronics, iron and steel, etc. The JSTAMP/NV gives satisfaction to engineers, reliability to products, and robustness to tool shop via the advanced technology of the JSOL Corporation.

JMAG

JMAG uses the latest techniques to accurately model complex geometries, material properties, and thermal and structural phenomena associated with electromagnetic fields. With its excellent analysis capabilities, JMAG assists your manufacturing process

Livermore Software Technology Corp.   <ins>**www.lstc.com**</ins>

LS-DYNA

A general-purpose finite element program capable of simulating complex real world problems. It is used by the automobile, aerospace, construction, military, manufacturing, and bioengineering industries. LS-DYNA is optimized for shared and distributed memory Unix, Linux, and Windows based, platforms, and it is fully QA'd by LSTC. The code's origins lie in highly nonlinear, transient dynamic finite element analysis using explicit time integration.

LS-PrePost: An advanced pre and post-processor that is delivered free with LS-DYNA. The user interface is designed to be both efficient and intuitive. LS-PrePost runs on Windows, Linux, and Macs utilizing OpenGL graphics to achieve fast rendering and XY plotting.

LS-OPT: LS-OPT is a standalone Design Optimization and Probabilistic Analysis package with an interface to LS-DYNA. The graphical preprocessor LS-OPTui facilitates

definition of the design input and the creation of a command file while the postprocessor provides output such as approximation accuracy, optimization convergence, tradeoff curves, anthill plots and the relative importance of design variables.

LS-TaSC: A Topology and Shape Computation tool. Developed for engineering analysts who need to optimize structures, LS-TaSC works with both the implicit and explicit solvers of LS-DYNA. LS-TaSC handles topology optimization of large non-linear problems, involving dynamic loads and contact conditions.

LSTC Dummy Models:

Anthropomorphic Test Devices (ATDs), as known as "crash test dummies", are life-size mannequins equipped with sensors that measure forces, moments, displacements, and accelerations.

LSTC Barrier Models: LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) model.
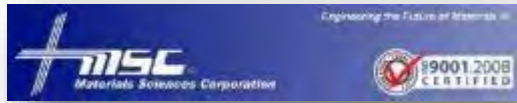
Material Sciences Corporation

Materials Sciences Corporation has provided engineering services to the composites industry since 1970. During this time, we have participated in numerous programs that demonstrate our ability to: perform advanced composite design, analysis and testing; provide overall program management; work in a team environment; and transition new product development to the military and commercial sectors. MSC's corporate mission has expanded beyond basic research and development now to include transitioning its proprietary technologies from the research lab into innovative new products. This commitment is demonstrated through increased staffing and a more than 3-fold expansion of facilities to allow in-house manufacturing and testing of advanced composite materials and structures

Materials Sciences Corporation (MSC) MAT161/162 - enhanced features have been added to the Dynamic Composite Simulator module of LS-DYNA.

This enhancement to LS-DYNA, known as MAT161/162, enables the most effective and accurate dynamic progressive failure modeling of composite structures to enable the most effective and accurate dynamic progressive

failure modeling of composite structures currently available.

MSC/LS-DYNA Composite Software and Database -
  Fact Sheet: http://www.materials-sciences.com/dyna-factsheet.pdf

- MSC and LSTC have joined forces in developing this powerful composite dynamic analysis code.
- For the first time, users will have the enhanced ability to simulate explicit dynamic engineering problems for composite structures.
- The integration of this module, known as 'MAT 161', into LS-DYNA allows users to account for progressive damage of various fiber, matrix and interply delamination failure modes.
- Implementing this code will result in the ability to optimize the design of composite structures, with significantly improved survivability under various blast and ballistic threats.

MSC's LS-DYNA module can be used to characterize a variety of composite structures in numerous applications—such as this composite hull under blast

Oasys Ltd. LS-DYNA Environment

The Oasys Suite of software is exclusively written for LS-DYNA® and is used worldwide by many of the largest LS-DYNA® customers. The suite comprises of:

Oasys PRIMER

Key benefits:
- Pre-Processor created specifically for LS-DYNA®
- Compatible with the latest version of LS-DYNA®
- Maintains the integrity of data
- Over 6000 checks and warnings – many auto-fixable
- Specialist tools for occupant positioning, seatbelt fitting and seat squashing (including setting up pre-simulations)
- Many features for model modification, such as part replace
- Ability to position and depenetrate impactors at multiple locations and produce many input decks

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automatically (e.g. pedestrian impact, interior head impact)
- Contact penetration checking and fixing
- Connection feature for creation and management of connection entities.
- Support for Volume III keywords and large format/long labels
- Powerful scripting capabilities allowing the user to create custom features and processes

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Oasys D3PLOT

Key benefits:
- Powerful 3D visualization post-processor created specifically for LS-DYNA®
- Fast, high quality graphics
- Easy, in-depth access to LS-DYNA® results
- Scripting capabilities allowing the user to speed up post-processing, as well as creating user defined data components

www.predictiveengineering.com

Predictive Engineering provides finite element analysis consulting services, software, training and support to a broad range of engineering companies across North America. We strive to exceed client expectations for accuracy, timeliness and knowledge transfer. Our process is both cost-effective and collaborative, ensuring all clients are reference clients.

Our mission is to be honest brokers of information in our consulting services and the software we represent.

Our History

Since 1995, Predictive Engineering has continually expanded its client base. Our clients include many large organizations and industry leaders such as SpaceX, Nike, General Electric, Navistar, FLIR Systems, Sierra Nevada Corp, Georgia-Pacific, Intel, Messier-Dowty and more. Over the years, Predictive Engineering has successfully completed more than 800 projects, and has set itself apart on its strong FEA, CFD and LS-DYNA consulting services.
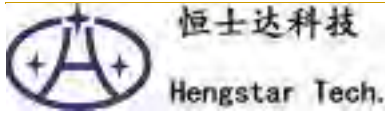
Shanghai Hengstar

Center of Excellence: Hengstar Technology is the first LS-DYNA training center of excellence in China. As part of its expanding commitment to helping CAE engineers in China, Hengstar Technology will continue to organize high level training courses, seminars, workshops, forums etc., and will also continue to support CAE events such as: China CAE Annual Conference; China Conference of Automotive Safety Technology; International Forum of Automotive Traffic Safety in China; LS-DYNA China users conference etc.

On Site Training: Hengstar Technology also provides customer customized training programs on-site at the company facility. Training is tailored for customer needs using LS-DYNA such as material test and input keyword preparing; CAE process automation with customized script program; Simulation result correlation with the test result; Special topics with new LS-DYNA features etc..

Distribution & Support: Hengstar distributes and supports LS-DYNA, LS-OPT, LS-Prepost, LS-TaSC, LSTC FEA Models; Hongsheng Lu, previously was directly employed by LSTC before opening his distributorship in China for LSTC software. Hongsheng visits LSTC often to keep update on the latest software features.

Hengstar also distributes and supports d3View; Genesis, Visual DOC, ELSDYNA; Visual-Crash Dyna, Visual-Process, Visual-Environment; EnkiBonnet; and DynaX & MadyX etc.

Consulting

As a consulting company, Hengstar focuses on LS-DYNA applications such as crash and safety, durability, bird strike, stamping, forging, concrete structures, drop analysis, blast response, penetration etc with using LS-DYNA's advanced methods: FEA, ALE, SPH, EFG, DEM, ICFD, EM, CSEC..

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Lenovo is a USD 39 billion personal and enterprise technology company, serving customers in more than 160 countries.

Dedicated to building exceptionally engineered PCs, mobile Internet devices and servers spanning entry through supercomputers, Lenovo has built its business on product innovation, a highly efficient global supply chain and strong strategic execution. The company develops, manufactures and markets reliable, high-quality, secure and easy-to-use technology products and services.

Lenovo acquired IBM's x86 server business in 2014. With this acquisition, Lenovo added award-winning System x enterprise server ortfolio along with HPC and CAE expertise.

Lenovo Attains Status as Largest Global Provider of Top500 SuperComputers

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Contact:　JSOL Corporation Engineering Technology Division <cae-info@sci.jsol.co.jp>

**Cloud computing services
for
JSOL Corporation LS-DYNA users in Japan**

**JSOL Corporation is cooperating with chosen
cloud computing services**

JSOL Corporation, a Japanese LS-DYNA distributor for Japanese LS-DYNA customers.

LS-DYNA customers in industries / academia / consultancies are facing increased needs for additional LS-DYNA cores

In calculations of optimization, robustness, statistical analysis, we find that an increase in cores of LS-DYNA are needed, for short term extra projects or cores.

JSOL Corporation is cooperating with some cloud computing services for JSOL's LS-DYNA users and willing to provide short term license.

This service is offered to customers using Cloud License fee schedule, the additional fee is less expensive than purchasing yearly license.

The following services are available (only in Japanese). HPC OnLine:

NEC Solution Innovators, Ltd. - http://jpn.nec.com/manufacture/machinery/hpc_online/

Focus - Foundation for Computational Science
http://www.j-focus.or.jp

Platform Computation Cloud - CreDist.Inc.

PLEXUS CAE
Information Services International-Dentsu, Ltd. (ISID) https://portal.plexusplm.com/plexus-cae/

SCSK Corporation - http://www.scsk.jp/product/keyword/keyword07.html

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Rescale: Cloud Simulation Platform

The Power of Simulation Innovation

We believe in the power of innovation. Engineering and science designs and ideas are limitless. So why should your hardware and software be limited? You shouldn't have to choose between expanding your simulations or saving time and budget.

Using the power of cloud technology combined with LS-DYNA allows you to:
· Accelerate complex simulations and fully explore the design space
· Optimize the analysis process with hourly software and hardware resources
· Leverage agile IT resources to provide flexibility and scalability

True On-Demand, Global Infrastructure

Teams are no longer in one location, country, or even continent. However, company data centers are often in one place, and everyone must connect in, regardless of office. For engineers across different regions, this can cause connection issues, wasted time, and product delays.

Rescale has strategic/technology partnerships with infrastructure and software providers to offer the following:
· Largest global hardware footprint – GPUs, Xeon Phi, InfiniBand
· Customizable configurations to meet every simulation demand
· Worldwide resource access provides industry-leading tools to every team
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· True on-demand resources – no more queues

ScaleX Enterprise: Transform IT, Empower Engineers, Unleash Innovation

The ScaleX Enterprise simulation platform provides scalability and flexibility to companies while offering enterprise IT and management teams the opportunity to expand and empower their organizations.

Rescale Cloud Simulation Platform   www.rescale.com

ScaleX Enterprise allows enterprise companies to stay at the leading edge of computing technology while maximizing product design and accelerating the time to market by providing:
· Collaboration tools
· Administrative control
· API/Scheduler integration
· On-premise HPC integration

Industry-Leading Security
Rescale has built proprietary, industry-leading security solutions into the platform, meeting the needs of customers in the most demanding and competitive industries and markets.
· Manage engineering teams with user authentication and administrative controls
· Data is secure every step of the way with end-to-end data encryption
· Jobs run on isolated, kernel-encrypted, private clusters
· Data centers include biometric entry authentication
· Platforms routinely submit to independent external security audits

Rescale maintains key relationships to provide LS-DYNA on demand on a global scale. If you have a need to accelerate the simulation process and be an innovative leader, contact Rescale or the following partners to begin running LS-DYNA on Rescale's industry-leading cloud simulation platform.

LSTC   - DYNAmore GmbH   JSOL Corporation

Rescale, Inc. - 1-855-737-2253 (1-855-RESCALE) - info@rescale.com

 944 Market St. #300, San Francisco, CA 94102 USA

ESI Cloud Based Virtual Engineering Solutions   www.esi-group.com

ESI Cloud offers designers and engineers cloud-based computer aided engineering (CAE) solutions across physics and engineering disciplines.

ESI Cloud combines ESI's industry tested virtual engineering solutions integrated onto ESI's Cloud Platform with browser based modeling,

With ESI Cloud users can choose from two basic usage models:
- An end-to-end SaaS model: Where modeling, multi-physics solving, results visualization and collaboration are conducted in the cloud through a web browser.
- A Hybrid model: Where modeling is done on desktop with solve, visualization and collaboration done in the cloud through a web browser.

Virtual Performance Solution:

ESI Cloud offers ESI's flagship Virtual Performance Solution (VPS) for multi-domain performance simulation as a hybrid offering on its cloud platform. With this offering, users can harness the power of Virtual Performance Solution, leading multi-domain CAE solution for virtual engineering of crash, safety, comfort, NVH (noise, vibration and harshness), acoustics, stiffness and durability.

In this hybrid model, users utilize VPS on their desktop for modeling including geometry, meshing and simulation set up. ESI Cloud is then used for high performance computing with an integrated visualization and real time collaboration offering through a web browser.

The benefits of VPS hybrid on ESI Cloud include:
- Running large concurrent simulations on demand
- On demand access to scalable and secured cloud HPC resources
- Three tiered security strategy for your data
- Visualization of large simulation data sets
- Real-time browser based visualization and collaboration
- Time and cost reduction for data transfer between cloud and desktop environments
- Support, consulting and training services with ESI's engineering teams

VPS On Demand

ESI Cloud features the Virtual Performance Solution (VPS) enabling engineers to analyze and test products, components, parts or material used in different engineering domains including crash and high velocity impact, occupant safety, NVH and interior acoustics, static and dynamic load cases. The solution enables VPS users to overcome hardware limitations and to drastically reduce their simulation time by running on demand very large concurrent simulations that take advantage of the flexible nature of cloud computing.

Key solution capabilities:

- Access to various physics for multi-domain optimization
- Flexible hybrid model from desktop to cloud computing
- On demand provisioning of hardware resources
- Distributed parallel processing using MPI (Message Passing Interface) protocol
- Distributed parallel computing with 10 Gb/s high speed interconnects

Result visualization

ESI Cloud deploys both client-side and server-side rendering technologies. This enables the full interactivity needed during the simulation workflow along with the ability to handle large data generated for 3D result visualization in the browser, removing the need for time consuming data transfers. Additionally ESI Cloud visualization engine enables the comparisons of different results through a multiple window user interface design.

Key result visualization capabilities:

- CPU or GPU based client and server side rendering
- Mobility with desktop like performance through the browser
- 2D/3D VPS contour plots and animations
- Custom multi-window system for 2D plots and 3D contours
- Zooming, panning, rotating, and sectioning of multiple windows

Collaboration

To enable real time multi-user and multi company collaboration, ESI Cloud offers extensive synchronous and asynchronous collaboration capabilities. Several users can view the same project, interact with the same model results, pass control from one to another. Any markups, discussions or annotations can be archived for future reference or be assigned as tasks to other members of the team.

Key collaboration capabilities:

- Data, workflow or project asynchronous collaboration
- Multi-user, browser based collaboration for CAD, geometry, mesh and results models
- Real-time design review with notes, annotations and images archiving and retrieval
- Email invite to non ESI Cloud users for real time collaboration

Distribution, Consulting

Canada	**Metal Forming Analysis Corp MFAC**	galb@mfac.com	
	www.mfac.com		
	LS-DYNA	LS-OPT	LS-PrePost LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG
	eta/DYNAFORM	INVENTIUM/PreSys	

Mexico	**COMPLX**	Armando Toledo
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	LS-DYNA LS-OPT	LS-PrePost
		LS-TAsc Barrier/Dummy Models

United States	**DYNAMAX**	sales@dynamax-inc.com	
	www.dynamax-inc.com		
	LS-DYNA	LS-OPT	LS-PrePost LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	

United States	**Livermore Software Technology Corp**	sales@lstc.com	
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	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS

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	www.eta.com		
	INVENTIUM/PreSy	NISA	VPG LS-DYNA
	LS-OPT	DYNAform	

United States	**Predictive Engineering**	info@predictiveengineering.com

www.predictiveengineering.com

LS-DYNA   LS-OPT   LS-PrePost   LS-TaSC

LSTC Barrier Models   LSTC Dummy Models

Distributor for Siemens PLM Software at www.AppliedCAx.com (FEMAP, NX Nastran, STAR CCM+, NX CAD/CAM/CAE)

France	**DynaS+**	v.lapoujade@dynasplus.com

www.dynasplus.com   Oasys Suite

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DYNAFORM   VPG   MEDINA

LSTC Dummy Models   LSTC Barrier Models

France	**DYNAmore France SAS**	sales@dynamore.eu

www.dynamore.eu

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    LS-PrePost

DSDM Products   LSTC Dummy Models   FEMZIP

LSTC Barrier Models   DIGIMAT

Germany	**CADFEM GmbH**	lsdyna@cadfem.de

www.cadfem.de

ANSYS   LS-DYNA   optiSLang

                 AnyBody

ANSYS/LS-DYNA

Germany	**DYNAmore GmbH**	uli.franz@dynamore.de

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Primer   FEMZIP   GENESIS   Oasys Suite

TOYOTA THUMS   LSTC Dummy & Barrier Models

Distribution, Consulting

Netherlands	**Infinite Simulation Systems B.V**		j.mathijssen@infinite.nl	
	www.infinite.nl			
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Russia	**Limited Liability DynaRu**		office@lsdyna.ru	
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Spain	**DYNAmore France SAS**		sales@dynamore.eu	
	www.dynamore.eu			
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Sweden	**DYNAmore Nordic**		marcus.redhe@dynamore.se	
	www.dynamore.se		Oasys Suite	
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	LS-PrePost	LS-TaSC	FastFORM	DYNAform
	FormingSuite		LSTC Dummy Models	
			LSTC Barrier Models	

Switzerland	**DYNAmoreSwiss GmbH**		info@dynamore.ch	
	www.dynamore.ch			
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	LS-TaSC		LSTC Dummy Models & Barrier Models	

Distribution, Consulting

UK **ARUP** dyna.sales@arup.com

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REPORTER SHELL FEMZIP HYCRASH

DIGIMAT Simpleware LSTC Dummy Models

LSTC Barrier Models

China **Shanghai Fangkun Software Technology Ltd.**

www.lsdyna-china.com

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LSTC Dummy Models

India **Oasys Ltd. India** lavendra.singh@arup.com

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LS-DYNA LS-OPT LS-PrePost

India **Kaizenat Technologies Pvt. Ltd** support@kaizenat.com

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Japan	JSOL			
	www.jsol.co.jp/english/cae		Oasys Suite	
	JSTAMP	HYCRASH	JMAG	
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Japan	FUJITSU			
	http://www.fujitsu.com/jp/solutions/business-technology/tc/sol/			
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	Inventium PreSys	ETA/DYNAFORM	Digimat	

Japan	LANCEMORE	info@lancemore.jp		
	www.lancemore.jp/index_en.html			
	Consulting			
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Japan	Terrabyte	English:		
	www.terrabyte.co.jp	www.terrabyte.co.jp/english/index.htm		
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	AnyBody	

Distribution, Consulting

Korea	**THEME**	wschung7@gmail.com		
	www.lsdyna.co.kr		Oasys Suite	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	Planets
	eta/DYNAFORM	FormingSuite	Simblow	TrueGRID
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Korea	**KOSTECH**	young@kostech.co.kr		
	www.kostech.co.kr			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM
	eta/DYNAFORM	DIGIMAT	Simuform	Simpack
	AxStream	TrueGrid	FEMZIP	

Taiwan	**AgileSim Technology Corp.**			
	www.agilesim.com.tw			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

Taiwan	**Flotrend**			
	www.flotrend.com.tw			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

Taiwan	**SiMWARE Inc..**			
	www.simware.com.tw			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

TOYOTA - Total Human Model for Safety – THUMS
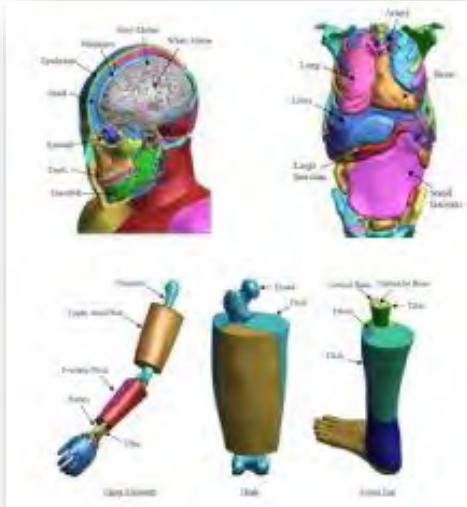
The Total Human Model for Safety, or THUMS®, is a joint development of Toyota Motor Corporation and Toyota Central R&D Labs. Unlike dummy models, which are simplified representation of humans, THUMS represents actual humans in detail, including the outer shape, but also bones, muscles, ligaments, tendons, and internal organs. Therefore, THUMS can be used in automotive crash simulations to identify safety problems and find their solutions.

Each of the different sized models is available as sitting model to represent vehicle occupants

and as standing model to represent pedestrians.

The internal organs were modeled based on high resolution CT-scans.

THUMS is limited to civilian use and may under no circumstances be used in military applications.

LSTC is the US distributor for THUMS. Commercial and academic licenses are available.

For information please contact: THUMS@lstc.com

THUMS®, is a registered trademark of Toyota Central R&D Labs.

LSTC – Dummy Models

LSTC Crash Test Dummies (ATD)

Meeting the need of their LS-DYNA users for an affordable crash test dummy (ATD), LSTC offers the LSTC developed dummies at no cost to LS-DYNA users.

LSTC continues development on the LSTC Dummy models with the help and support of their customers. Some of the models are joint developments with their partners.

 e-mail to: atds@lstc.com

Models completed and available
 (in at least an alpha version)
- Hybrid III Rigid-FE Adults
- Hybrid III 50th percentile FAST
- Hybrid III 5th percentile detailed
- Hybrid III 50th percentile detailed
- Hybrid III 50th percentile standing
- EuroSID 2
- EuroSID 2re
- SID-IIs Revision D
- USSID
- Free Motion Headform
- Pedestrian Legform Impactors

Models In Development
- Hybrid III 95th percentile detailed
- Hybrid III 3-year-old
- Hybrid II
- WorldSID 50th percentile
- THOR NT FAST
- Ejection Mitigation Headform

Planned Models
- FAA Hybrid III
- FAST version of THOR NT
- FAST version of EuroSID 2
- FAST version of EuroSID 2re
- Pedestrian Headforms
- Q-Series Child Dummies
- FLEX-PLI

LSTC – Barrier Models

Meeting the need of their LS-DYNA users for affordable barrier models, LSTC offers the LSTC developed barrier models at no cost to LS-DYNA users.

LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) models:

- ODB modeled with shell elements
- ODB modeled with solid elements
- ODB modeled with a combination of shell and solid elements

- MDB according to FMVSS 214 modeled with shell elements
- MDB according to FMVSS 214 modeled with solid elements

- MDB according to ECE R-95 modeled with shell elements

- AE-MDB modeled with shell elements

- IIHS MDB modeled with shell elements
- IIHS MDB modeled with solid elements
- RCAR bumper barrier

- RMDB modeled with shell and solid elements

LSTC ODB and MDB models are developed to correlate to several tests provided by our customers. These tests are proprietary data and are not currently available to the public.

All current models can be obtained through our webpage in the LSTC Models download section or through your LS-DYNA distributor.

To submit questions, suggestions, or feedback about LSTC's models, please send an e-mail to: atds@lstc.com. Also, please contact us if you would like to help improve these models by sharing test data.

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ESI Group

YOUTUBE

YOUTUBE Channel	WebSite URL
BETA CAE Systems	www.beta-cae.com
CADFEM	www.cadfem.de
ESI Group	www.esi-group.com
ETA	www.eta.com
Lancemore	www.lancemore.jp/index_en.html
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