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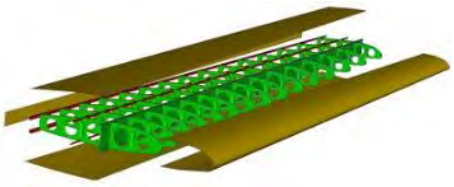
LSTC Livermore Software Technology Corp.

Volume 8, Issue 7, July 2019

www.lstc.com http://dalianfukun.com www.feapublications.com

BETA CAE



ESI Group

ETA

OASYS

16th International LS-DYNA Conference & Call for Papers

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.

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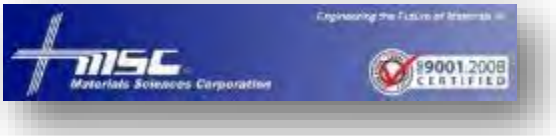
Noi Sims – noi@feainformation.com

Platinum Particpants



Platinum Particpants

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Announcements

LS-DYNA Conference 2020 & Call for Papers

The 16th International LS-DYNA Conference will open on May 31, 2020. These conferences provide a unique opportunity for LSTC developers to learn what you (those who use LS-DYNA) are interested in, and for you to comment on the directions we will be taking LS-DYNA.

Hotel: Detroit Marriott at the Renaissance Center (book by May 20)
Date: May 31 - June 2
Courses: May 31 and June 3 – 4
Abstract Submission Deadline: Oct 30, 2019
Paper Submission Deadline: Feb 15

Conference Website: http://www.lstc.com/2020

Paper Submission website: https://www.dynamore.de/en/training/conferences/upcoming/ls-dyna-2020/

2019 China LS-DYNA Conference — October 21-23, Shanghai, China

The 4th China LS-DYNA Users' Conference will be held on October 21st - 23rd, 2019 in Shanghai by LSTC and Shanghai Fangkun. LSTC will share the latest product function and development strategy during the conference. We wholeheartedly welcome your paper submission and attendance.

Conference Website: conference.lsdyna-china.com/

JSOL CAE Forum 2019 — November 6 - 8, Tokyo, Japan

JSOL Corporation is holding the "JSOL CAE Forum" to provide our users with the latest and most comprehensive simulation technologies and case studies for various JSOL CAE packages including LS-DYNA.
Venue: Tokyo Conference Center Shinagawa, 1-9-36 Konan Minato-ku Tokyo Japan
Conference Website: https://www.jsol-cae.com/en/event/usersevent/2019/caeforum/

LSTC announces the release of LS-OPT 6.0

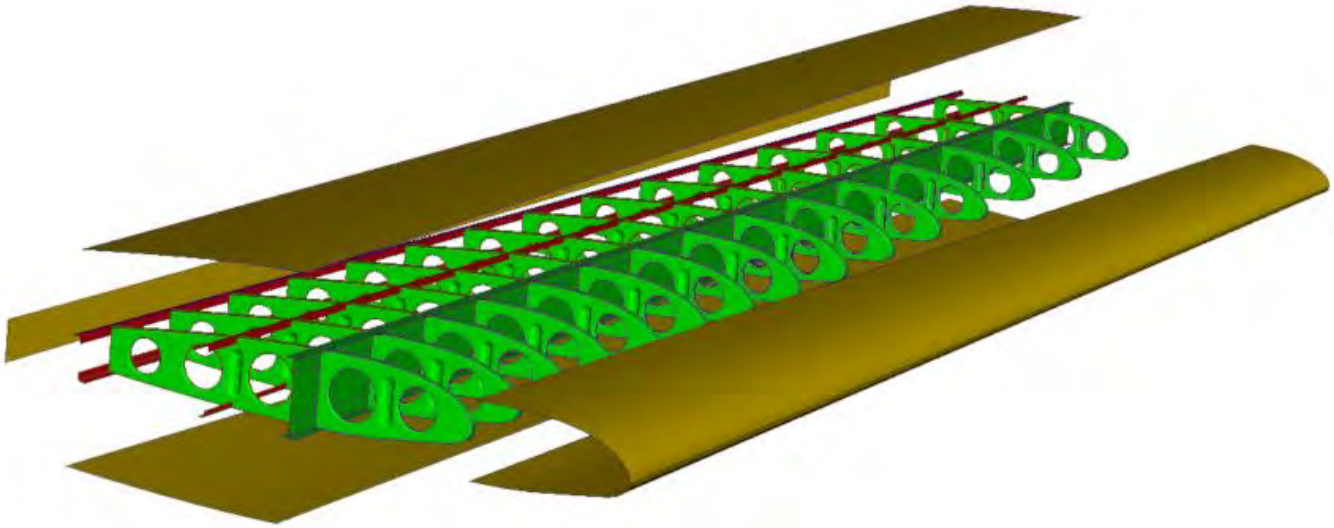
LS-OPT 6.0 is now available on LSTC ftp. Along with other new features, it introduces major developments such as classification-based constraint handling and digital image correlation.
New version download: http://ftp.lstc.com/user/ls-opt/6.0.0

2019 Journals – Q3 — *FEA Information Engineering Journal (FEAIEJ™)*

FEA Information Engineering Journal (FEAIEJ™) is a quarterly on line publication focusing on specific disciplines within Finite Element Analysis.

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…

BETA CAE Systems announces the release of the v19.1.3 of its software suite



About this release

BETA CAE Systems announces the third bug-fix release of ANSA/EPILYSIS/META v19.1.x series.

Apart from fixes in the detected issues, this version also hosts noteworthy enhancements and implementations.

Please, note the addition of 'CFD_2 layout', a new layout that appears on ANSA Launcher window. It is an alternative mode, suitable for handling large CFD model geometries, which neutralizes the highlight effect in functions such as Points > Insert, Faces > Cut, Curves > New, in order to maintain high operational performance.

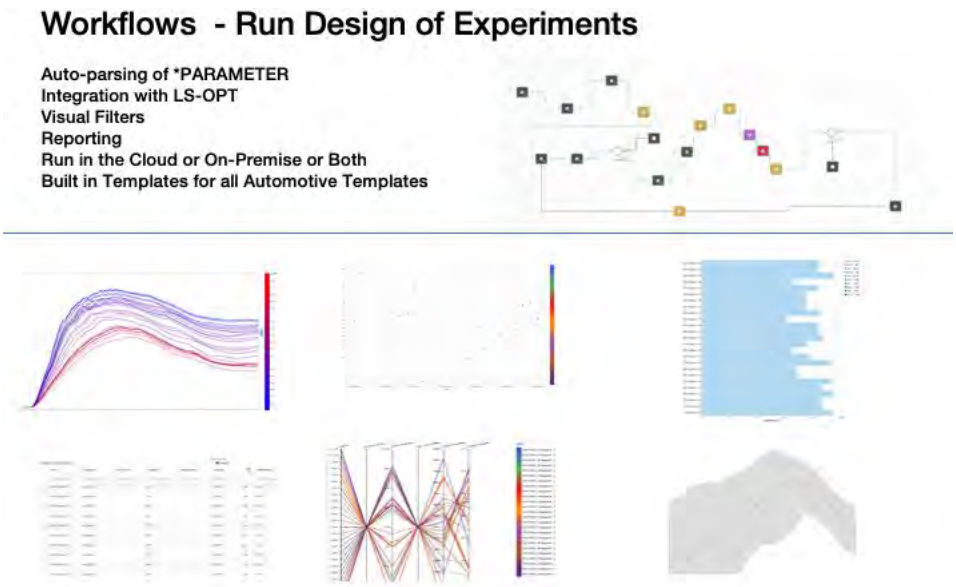
Follows a selection of the most important items:

Contents

Website: https://www.beta-cae.com/news/20190619_announcement_suite_v19.1.3.htm

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™



Turn LS-DYNA® data into decisions

HPC
Job Submission
Live Preview
Reporting and Statistics
On-premise and Cloud

LS-DYNA
Extract data from any file
Perform DOE using LS-OPT
Web-based 3D Visualization
Explicit and Implicit

Analytics
40+ Visualizers
Identify patterns in Data
Reporting to PDF/PPT

Workflows
Build and deploy workflows
Characterize materials
Model sequential impacts

Experiments
Manage Safety and NVH
Compare with Simulations
Search Historical data

Templates
400+ Math Expressions
Import from Library
Safety and NVH

http://www.d3view.com
contact marsha@lstc.com for more information

Author: Christian Frech christian.frech@dynamore.de

Experiments and calibration

DYNAmore Materials characterization

LS-DYNA material cards for polymers, metals, and composite materials.

Experiments

For many materials, the mechanical properties required for simulation are not known. Typically, a precise specification is cost-intensive and requires a considerable waiting period. In contrast, our selection of experiments, specific to certain
requirements, provides a quick, reliable basis for generating material cards for polymers, metals, and composite materials which facilitates predictability.

Our services

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

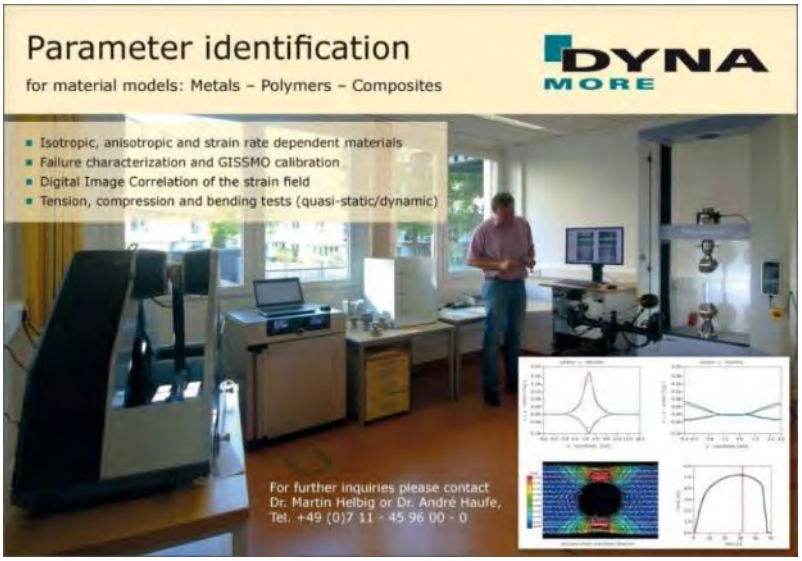
Material models and calibration

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

Our characterization spectrum includes

Deformation behaviour:
- Viscoelastic and viscoplastic
- Isotropic or anisotropic
- Tension–compression asymmetry

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



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.

Creating New Horizons for Foundries Thanks to Virtual Prototyping

ESI Showcases its Solutions at GIFA in Düsseldorf

Press Release In Paris, France on June 25, 2019

ESI Group, leading innovator in Virtual Prototyping software and services, will be at the 14th International Foundry Trade Fair – GIFA - from June 25 to 29, 2019 in Düsseldorf (Germany). Virtual Prototyping provides a credible alternative to costly and time-consuming trial and error methods and equips part manufacturers with the right solutions to adapt to a fast-evolving market. During the tradeshow, ESI will showcase its latest advances supporting the productivity of foundries in their transformation towards new markets. Its flagship casting simulation software ESI ProCAST, created

30 years ago and designed with the sole purpose of delivering premium quality castings and empowering foundries to cast and innovate with confidence, will be presented on its booth.

Disruptive trends are changing the game for foundries. For example, the rapid development of new e-mobility solutions puts an increasing pressure on foundries and other part manufacturers. Electric vehicle parts typically require new and unusual functionalities, such as integrated cooling systems for the battery housing, or may need to deliver performance into new areas, such as thermal efficiency. Facing global competition, foundries must strengthen and diversify their offering to grow within emerging market segments. They need to deliver high quality parts – meeting tolerances and requirements – and get them right the first time, decreasing scrap rates and increasing margins.

With over 40 years of experience in material physics, and decades of trusted partnership with foundries, ESI has developed software solutions dedicated to the virtual prototyping of all metalworks – from casting, stamping, welding, to additive manufacturing. Thanks to these solutions, part manufacturers are predicting defects very early in the manufacturing design process. This allows them to achieve their goals and get their parts right the first time. ESI's know-how extends beyond metal manufacturing processes. This technological edge lends ESI the ability to support foundries in addressing any technical challenge, from implementing additive manufacturing production, to predicting the behavior of parts in operational use, to maximizing productivity of their industrial operations by leveraging IoT and data analytics, or to optimizing the sequences of their manual operations using virtual reality to reduce operational risk and increase output.

Meet ESI's international team at GIFA! Hall 11 booth H39

Find out more: https://www.esi-group.com/e-mobility-creating-new-horizons-foundries

Contacts

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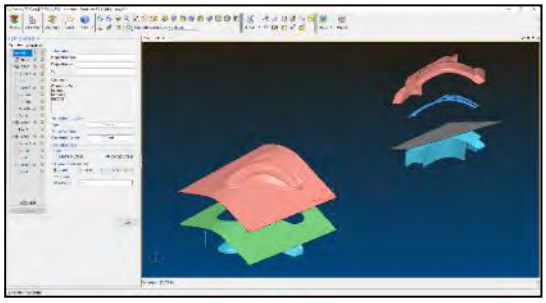
SHAN – Press *Esigroup@shan.fr* *+33 6 61 85 10 05*

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.



Prepares for the Release of DYNAFORM 6.0

ETA, Inc. (Engineering Technology Associates) is getting ready to release DYNAFORM 6.0. This new version is taking a big step forward with a upgraded graphic user interface and renewed modules.

As shown in the figure above, the new interface is CAD driven with automatic meshing, more real-estate and with less clicks needed to complete. This version was designed to be more self-explanatory for the user with a step-by-step click approach.

Additional features in this release include database manager. Database manager allows the user more flexibility to save multiple iterations or versions of a file in the same database. This will eliminate any issues when the user needs to save the file, which may have variations at different instances.

DYNAFORM 6.0 has advanced features to fix any CAD anomalies. The user has options to make CAD changes inside the software itself without having to go to any CAD tools.

We are also introducing the auto-report generator which will change the way reports and presentations were previously done. Our users can save a template and with a click of a button the report is updated for various iterations. The report generator works with Microsoft applications PowerPoint and Excel. With version 6.0 we wanted to focus on the reusability of the database, which would ultimately lead to saving time and less work for the user.

Finally, the ETA team feels DYNAFORM 6.0 will set a new benchmark in stamping and formability simulation with the ease of use, accuracy and affordability for users in the forming world.

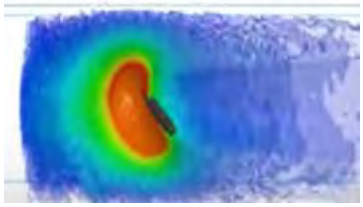
DYNAFORM 6.0 Release Event - Tuesday, August 6th at Automation Alley in Troy, Michigan

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.

Start your Monday with coffee or tea reading our engineering blog, at the FEA Not To Miss coffee shop.
Postings every Monday on what you have missed

www.feantm.com

Monday 07/15/2019 WOW - a bullet in coffee. Okay, you all knew I exaggerated. It is in water, but then it could be in tea? Anyway, let's all head to YouTube and keep the coffee out of the way of bullets.



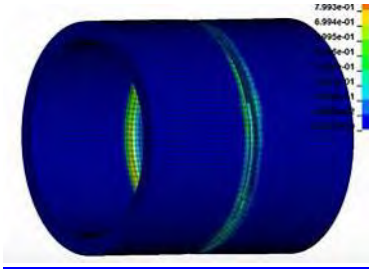
50 cal bullet in water using LS-DYNA

LS-DYNA Demo License - mv@feainformation.com

Monday 07/08/2019 As you can see below, they don't show where the coffee would be safe in a crash. Obviously the coffee would need a lid and a safe holder. I'm sure it just isn't visible BUT the driver is, so let's crash into YouTube and see what happens to the Yaris. Video

Toyota Yaris/Dodge Neon crash test simulation in LS-DYNA - by Bruno Mussulini

Monday 07/01/2019 In Tutorials I'm starting some Intro tutorials for students just starting out, wanting to start out, not doing that great starting out AND you will improve! Goal is drinking coffee and improving (now to put that to my diet - maybe I should have Intro to DIET!) Anyway, let's head over to YouTube for below, and then the Tutorial page. The section will improve, I just started the idea now.



Cutting by means of shift in LS-DYNA

The separation of the tube blank in the die without waste

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.

Euro NCAP MPDB Frontal Crash Workshop & Automotive Safety Summit 2019 Shanghai were held successfully

Shanghai Hengstar & Enhu Technology and Carhs successfully held a 3-days workshop on Euro NCAP MPDB Frontal Crash Workshop in Shanghai from July 10th to 12th 2019.

First two days, expert Volker Sandner introduced the MPDB Overview and Background, MPDB Collision Trolley , Barrier, THOR Dummy and Assessment of Collision Compatibility. All Technical Details Related to Collision Test Conditions.

On 12th July , Doctor Müller-Bechtel shown the FEA simulation of MPDB engineering development, Including the background and characteristics of MPDB working conditions, MPDB project development scores, strategies and related practical engineering cases. The theoretical explanation is combined with the actual model operation to deepen the trainee' impression and understanding of the new standards of Euro NCAP collision test.

On 15th-16th July, Shanghai Hengstar & Enhu Technology as a special sponsor, participated in the Automotive Safety Summit 2019 Shanghai , which is held by Carhs of Germany & CATARC .

The theme of this conference is "Safety Technology for Future Intelligent Electric Vehicles", The conference invited hundreds of experts from all of the world , such as Dr Michiel van Ratingen Euro NCAP, Weijing Li CATARC , Professor Qing Zhou Tsinghua University , who made thematic reports.

The conference includes international automotive safety regulations,Safety of New Energy Vehicles,The Future of Chinese Automobile Safety Regulations and Requirements,Active and Passive Safety Testing Technology,Virtual Design and Simulation,Intelligent Driving and Safety of Automatic Driving.

More than 300 experts and technicians participated in the event to discuss the latest technological progress in the field of automobile safety.

Shanghai Hengstar Technology Co., Ltd
hongsheng@hengstar.com
http://www.hengstar.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.

JSOL CAE Forum 2019

JSOL Corporation is holding the "JSOL CAE Forum" to provide our users with the latest and most comprehensive simulation technologies and case studies for various JSOL CAE packages including LS-DYNA. Until last year, we had held user's events individually for each package, like LS-DYNA & JSTAMP Forum, J-OCTA Users Conference, and Moldex3D technology exchange. In 2019, we decided to hold a comprehensive and unified event called "JSOL CAE Forum" at Shinagawa, Tokyo, from November 6 through 8. During the three-day event we will showcase a wide range of information to our structural, manufacturing, and material CAE package users all together.

We will start accepting applications in late September. A detailed program will be published on this page around the same time.

We encourage our users to take advantage of this opportunity and look forward to your attendance at the event.

JSOL Corporation

Engineering Technology Division

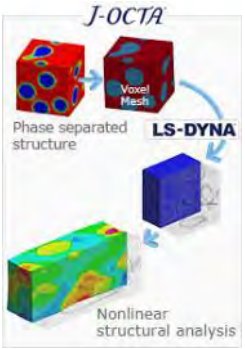
J-OCTA Feature enhancement: Finite Element Method (FEM) simulation

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.

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. We currently have office in Bangalore, Chennai, Pune and Coimbatore.

KAIZENAT Keep Improving

Turning Simulation in LS-DYNA

With the use of Simulation technology machining process of drilling have been analyzed and have shown the reliable results. The effects of the variation of drilling speed, temperature development and chip formations are shown by the results of these simulations. Important keywords to model this simulation are,

- CONTACT_AUTOMATIC_NODES_SURFACE
- BOUNDRAY_PRESCRIBED_MOTION_RIGID
- EOS_LINEAR_POLYNOMIAL
- MAT_JOHNSON_COOK
- SECTION_SPH

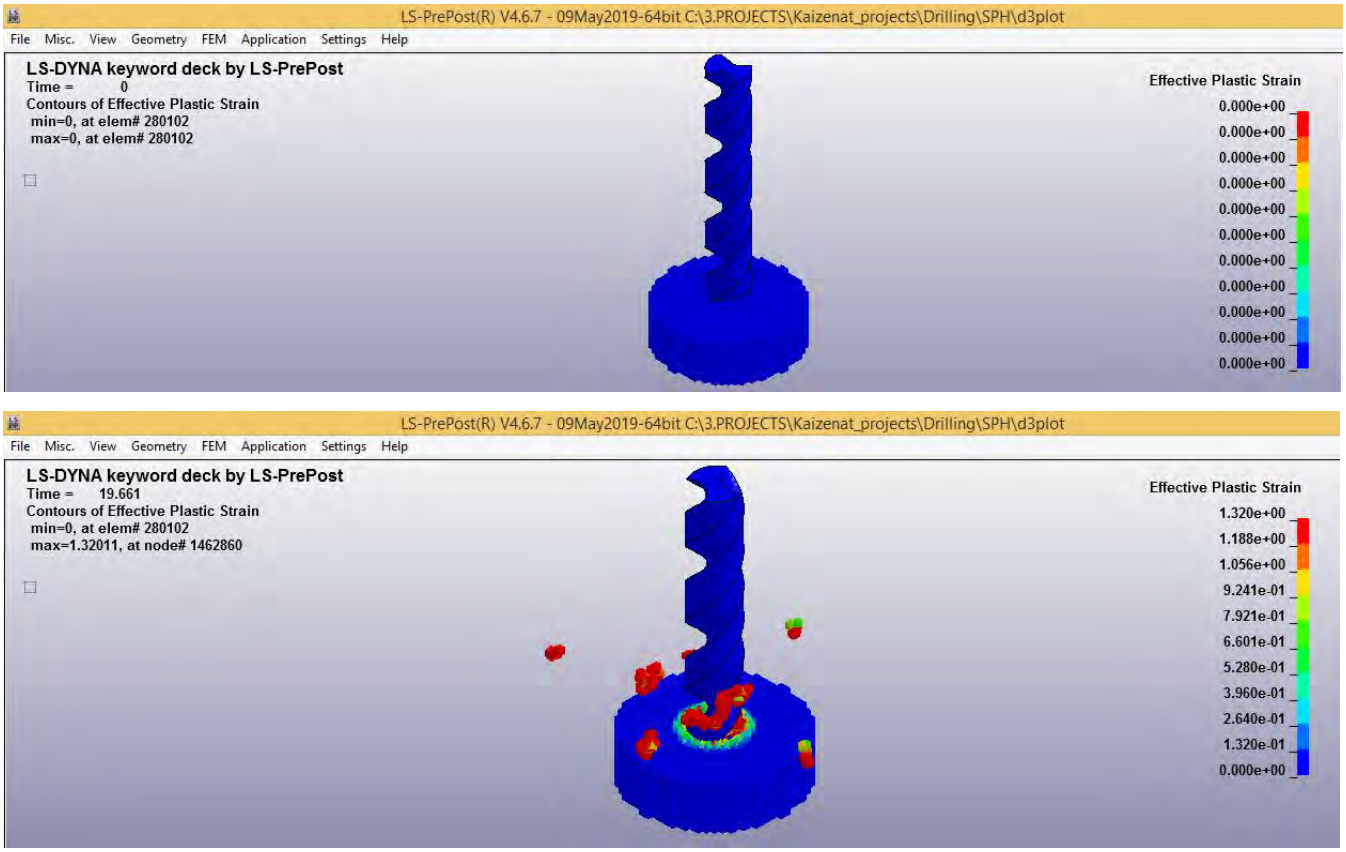


Figure: Drilling Simuaton in LS-DYNA

To know more about the simulation, please contact support@kaizenat.com

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

LS-DYNA Conference 2020 & Call for Papers

The 16th International LS-DYNA Conference will open on May 31, 2020. These conferences provide a unique opportunity for LSTC developers to learn what you (those who use LS-DYNA) are interested in, and for you to comment on the directions we will be taking LS-DYNA.

This conference will include a banquet, a reception, and an exhibition hall. The primary focus of the conference, however, will be on giving and attending presentations. With over 975 attendees in 2018, this conference is an excellent opportunity for networking. A presentation at the LS-DYNA conference will have the attention of LSTC developers, product design engineers, industry leaders, consultants, professors, researchers, students, and other interested parties.

Conference Dates

- **Sunday 5/31/2020**

  Registration, Exhibition Booths, Pre-Conference Classes, and Reception

- **Monday 6/1/2020**

  Registration, Exhibition Booths, Plenary, Keynote, Paper Presentations, and Banquet

- **Tuesday 6/2/2020**

  Registration, Exhibition Booths, Paper Presentations, and Closing

- **Wednesday-Thursday 6/3/2020-6/4/2020**

  Post-Conference Classes

At a Glance:

- **Date:** May 31 - June 2
- **Hotel:** Detroit Marriott at the Renaissance Center (book by May 20)
- **Courses:** May 31 and June 3 - 4
- **Pricing:** $650, $325 (students)
- **Contact:** conference@lstc.com
- **Registration:** Register by May 20
- **Abstract Submission Deadline:** Oct 30, 2019
- **Paper Submission Deadline:** Feb 15

***LS-DYNA Conference 2020 website*: http://www.lstc.com/2020**

16th International LS-DYNA Conference

Call for Papers

LSTC considers the technical presentations to be the most important feature of the LS-DYNA conference. Anybody wanting to make a presentation at the conference must submit a paper corresponding to what your presentation will cover. We will not accept a presentation without a paper. While we expect that most papers will fit in the categories listed below, papers outside of those topics are also welcome. If you have any questions about submitting a paper, email papers@lstc.com. Previous conference papers can be viewed here.

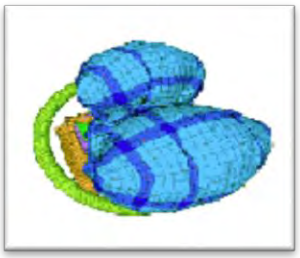
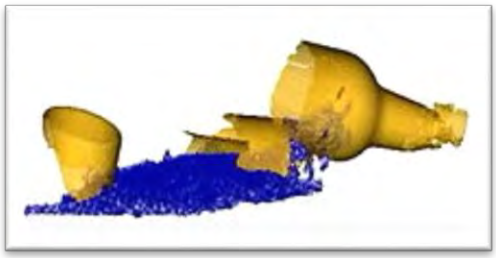
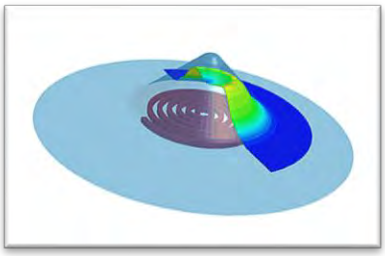
Once your paper has been accepted we will waive your registration fee (for papers having multiple co-authors only one co-author can receive this waiver). To receive this waiver you must be staying at the Marriott Detroit Renaissance Center under the group registration code "LSTC Conference." If you live locally, please contact papers@lstc.com.

Abstracts should be submitted to www.dynamore.de/paper2020 no later than October 30, 2019. Abstracts are limited 2500 characters. We will let you pick the most appropriate session for your paper, and we will do our best to accommodate your desired session. If we are not able to, we will fit your paper into one of the sessions listed below. You will be notified within a week after your submission that we have received your abstract. Papers must be submitted no later than February 15, 2020. They must be under 3000 words and must be single spaced on 8.5" X 11" paper. A Microsoft Word document will be provided to you to use as a template.

Session Categories

- Aerospace
- Automotive
- Biomedical
- Blast
- Composites
- Computing Technology
- Constitutive Modeling
- Connections
- Electromagnetics
- FSI/ALE
- ICFD
- Implicit
- Isogeometric Analysis (IGA)
- Metal Forming
- Modeling
- NVH
- Occupant Modeling
- Occupant Protection
- Optimiziation
- Post-Processing
- Simulation
- SPG
- SPH
- Thermal
- THUMS
- Topology & Optimization
- Other (please specify)

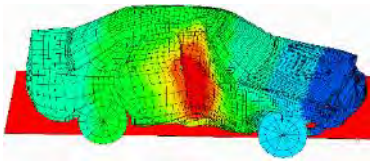
Submit abstract: https://www.dynamore.de/en/training/conferences/upcoming/ls-dyna-2020

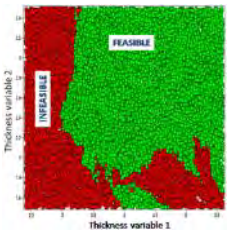
LS-OPT® NEW RELEASE VERSION 6.0

LS-OPT Version 6.0 provides major new features as follows:

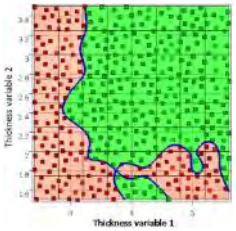
1. *Classifiers* have been introduced to provide a new constraint handling approach. In this method a decision boundary based on the pre-defined feasibility criteria is constructed in the design space that predicts whether a design is feasible or not (instead of predicting the response value itself). The support vector classification algorithm is available to approximate the boundaries. This approach is especially attractive for discontinuous or binary responses, and for handling multi-disciplinary failure/feasibility criteria.



Actual feasibility based on FE simulations

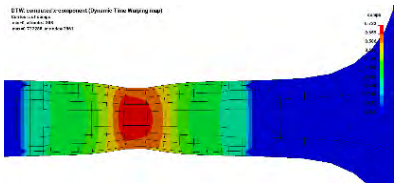


Feasibility based on classifier

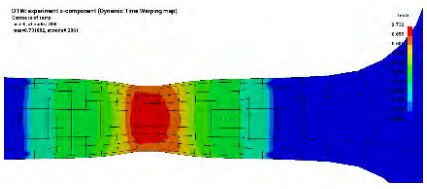


2. Parameter Estimation

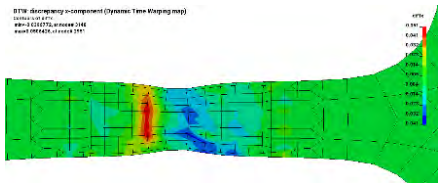
   a. *Digital Image Correlation (DIC).* Multi-point histories and crossplots (MPH) have been introduced to accommodate full-field spatial response. The MPH are defined at coordinates, e.g. from digital imaging. An interface is available for the gom/ARAMIS system and the GenEx parser has been extended for spatial data. Clustering methods and binary databases speedily handle high-volume DIC data. DIC data is mapped to the FE mesh and can be compared using LS-PrePost® selected from LS-OPT.



FEM (LS-DYNA®)



DIC mapped to FE mesh



Difference (magnified)

   b. *Similarity measures for curve comparison.* The Dynamic Time Warping (DTW) similarity measure has been added to compute the distance between any two multi-point curves for the purpose of parameter estimation. DTW addresses a deficiency to accommodate combined noise (e.g. failure models) and hysteresis.

3. *Interactive tables*. Simple static tables for design data have been enhanced to assume a more spreadsheet-like behavior. Tables, which interact with plots, now allow new design point generation in a selected region of interest as well as the simulation of newly generated points. The *point categories* feature has been enhanced while highlighting of infeasibility and interactive row sorting are possible.

4. *Stage library.* For standardization of a design problem setup, solver stages or process groups can be imported and exported to and from user-specified locations.

Efficient Global Optimization (EGO) has been added as an optimization strategy, *LS-TaSC* has been added as a solver option and the *Taguchi Method* is now available.

New version download: **http://ftp.lstc.com/user/ls-opt/6.0.0**

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.

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
July 16, 2019 | 9am-5pm
November 19, 2019 | 9am-5pm

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

Cost: In-House Class: $695 per person
Includes: Coffee, Lunch, Parking, USB with Course Content
Email Robin Mack for driving direction.

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.

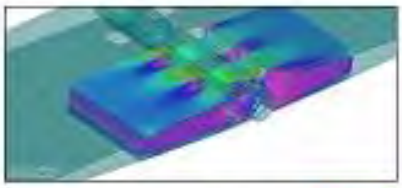
Topics Covered in this Short Course:

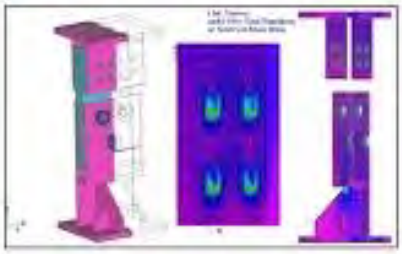
- Impact and Damage Modeling of Composites
  Application of MAT162 in Engineering and Research Problems
- Introduction to Composite Mechanics
  Introduction to Continuum Mechanics and Composite Mechanics

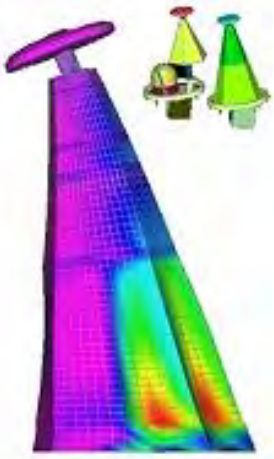
- Composite Material Models in LS-DYNA for Shell and Solid Elements
  Discussion on MAT2, MAT54, MAT59, & MAT162
- Theory and Practice in MAT162 Progressive Composite Damage Model for Unidirectional and Woven Fabric Composites
  MAT162 User Manual – Version 15A 2015
  Progressive Damage Modeling of Plain-Weave 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.

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.

New Barrier Model Released

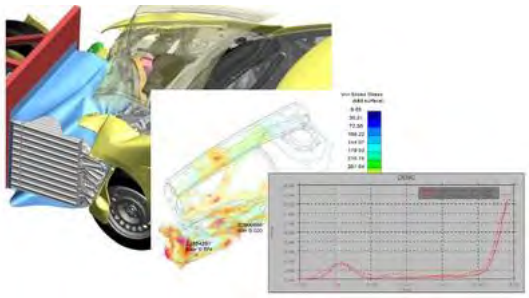
NHTSA Side and Rear Impact Barrier

Arup in collaboration with Cellbond has developed the LS-DYNA Shell model of NHTSA Side and Rear Impact Barrier.

The model is an upgrade of the already available solid model, not only showing good force-displacement correlations compared with test results but also offer a more realistic barrier deformation behaviour.

This was achieved through extensive material calibration and component/full barrier validation (facilitated by a comprehensive testing campaign).

To obtain this barrier model or for more information about a trial license contact dyna.suport@arup.com



Webinar - Oasys Post-processing: customization

This webinar demonstrates some of the customisation options available in our Oasys post-processing software.

Whether you are looking to create quality images for reports, or want to save time on setting up your model view to analyse results, attend this webinar for tips changing the appearance of your D3PLOT plots and T/HIS graphs; saving views; setting up groups to view parts of the models; and creating datums.

Clare Perryman software engineer with a PhD in Mathematics will present this webinar

12:30 PM (BST) on 15th August 2019

Please click below to register: Register Here

Predictive Engineering provides FEA and CFD consulting services, software, training and support to a broad range of companies.

FINITE ELEMENT ANALYSIS
Predictive Engineering

Who We Are

We are experienced simulation engineers that have successfully analyzed and validated hundreds and hundreds of finite element analysis (FEA) projects. With decades of experience in FEA and CFD, we know how to optimize your design to deliver every last bit of performance and to ensure that it will meet your service requirements whether in Aerospace, Marine, Energy, Automotive, Medical or in Consumer Products.

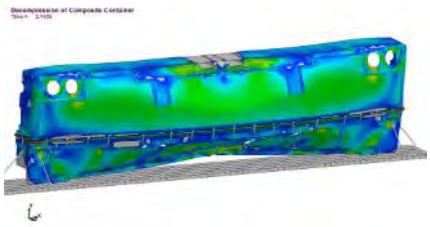
Our History

Since 1995, Predictive Engineering has continually expanded its client base. Our clients include the total spectrum from large Fortune 500 companies to start-ups looking to launch the next generation of satellites. We are also proud of work in the renewable energy fields from wind to solar. Over the years, one of our core strengths is in the vibration analysis of composite structures, aerospace electronic components and large industrial machinery. What has set us apart from the competition is our experience in the successful completion of more than 800 projects.

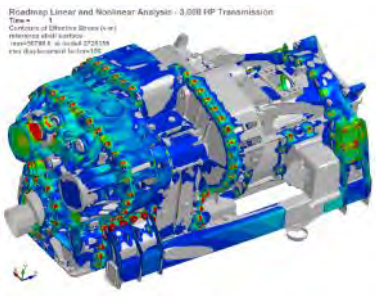
View our portfolio

FEA, CFD and LS-DYNA consulting projects

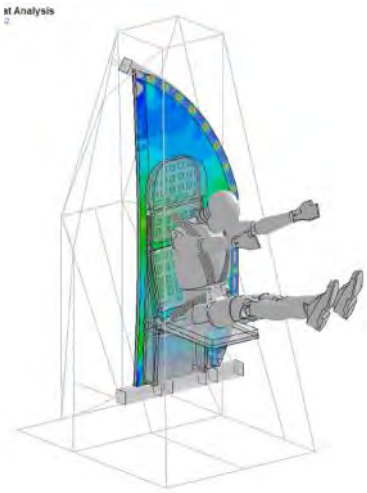
Composite Engineering



Nonlinear Dynamics



Aerospace



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.

Silicon Catalyst Further Expands In-Kind Partner Ecosystem with Rescale & S2C

Media Contacts: Tyler Smith | tyler@rescale.com

Silicon Valley, CA. – June 28, 2019 – Silicon Catalyst, the world's only incubator focused exclusively on accelerating solutions in silicon, announces the addition of Rescale and S2C as the newest In-Kind Partner (IKP) members. Silicon Catalyst continues to work with key industry players to further develop a complete value chain that economically and effectively supports the semiconductor start-ups accepted in the incubator. These startups utilize free or deeply discounted design tools and silicon MPW/shuttle runs and gain access to a world-class network of advisors, networking, marketing acumen and a path to funding needed to successfully launch their businesses.

Specific offerings from these two new IKPs include:

- Rescale: the leader in enterprise big compute in the cloud
- S2C: rapid FPGA-based prototyping and automation software

"Rescale is proud to partner with Silicon Catalyst to help enable semiconductor startups to achieve success. We support Silicon Catalyst's mission to foster new and innovative semiconductor companies who are building the future. The ability to leverage the cloud through Rescale's turnkey platform allows engineers to more easily accelerate the chip design process at better cost," stated Tyler Smith, Head of Partnerships at Rescale.

Toshio Nakama, CEO of S2C stated, "Getting silicon correct fast is critical for startups, from a cost point of view, and for rapid proof of new product concept. Prototyping silicon designs with FPGA Prototyping offers a much more affordable option for accelerated silicon design verification, and higher verification coverage, than other hardware verification technologies. Silicon Catalyst focuses exclusively on accelerating startup solutions in silicon and S2C views our joining their In-Kind Partner ecosystem as a good match with S2C's value proposition. We look forward to contributing to the success of the Silicon Catalyst Portfolio Companies."

"We are very pleased to welcome Rescale and S2C to our growing ecosystem of In-Kind Partners. The combination of cloud-based tool access from Rescale and the robust FPGA-based prototyping solution from S2C addresses the needs of the companies in our incubators and offers them expanded development options as they prepare their chip designs for tape-out and early engineering samples," stated Tarun Verma, Managing Partner at Silicon Catalyst.

About Rescale

Rescale is the leader in enterprise big compute in the cloud. Rescale empowers the world's transformative executives, IT leaders, engineers, and scientists to securely manage product innovation to be first to market. Rescale's ScaleX multi-cloud platform, built on the most powerful high-performance computing infrastructure available, seamlessly matches software applications with the best architecture in the cloud or on-premise to run

complex data processing and simulations. Rescale partners with the four largest cloud service providers and enables over 125 Global 2000 enterprise customers including four of the top five largest global automotive manufacturers and two of the top three largest global aerospace and defense companies. For more information on Rescale, visit www.rescale.com

About S2C
Founded and headquartered in San Jose, California, S2C has been successfully delivering rapid SoC prototyping solutions since 2003. S2C provides:

Rapid FPGA-based prototyping hardware and automation software
Prototype Ready™ IP, interfaces and platforms
System-level design verification and acceleration tools

With over 200 customers and more than 800 systems installed, S2C's focus is on SoC/ASIC development to reduce the SoC design cycle. Our highly qualified engineering team and customer-centric sales force understand our users' SoC development needs. S2C systems have been deployed by leaders in consumer electronics, communications, computing, image processing, data storage, research, defense, education, automotive, medical, design services, and silicon IP. S2C is headquartered in San Jose, CA with offices and distributors around the globe including the UK, Israel, China, Taiwan, Korea, and Japan. For more information, visit www.s2cinc.com

About Silicon Catalyst
It's About What's Next ® – Silicon Catalyst is the world's only incubator focused exclusively on accelerating solutions in silicon, building a coalition of in-kind and strategic partners to dramatically reduce the cost and complexity of development. Close to 300 startup companies have engaged with Silicon Catalyst since April 2015, with a total of 21 startup companies admitted to the incubator. With a world-class network of mentors to advise startups, Silicon Catalyst is helping startups address challenges moving from idea to realization. The incubator/accelerator supplies startups with a path to design tools, silicon devices, networking, access to funding and marketing acumen to successfully launch their companies' novel technology solutions. Silicon Catalyst was the recipient of the prestigious 2015 ACE Award for Start-Up Company of the Year. Visit Silicon Catalyst at www.siliconcatalyst.com

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Silicon Catalyst
Richard Curtin Managing Partner | richard@sicatalyst.com

LS-DYNA China, as the master distributor in China authorized by LSTC, is fully responsible for the sales, marketing, technical support and engineering consulting services of LS-DYNA in China.

仿坤软件 LS-DYNA China

2019 4th China LS-DYNA Users' Conference

The 4th China LS-DYNA Users' Conference will be held on October 21st - 23rd, 2019 in Shanghai. During this conference LSTC will share the details of its latest product developments as well as its road map for the future. At this conference engineers and scientists from LSTC and customers from all over the world will meet to share their experiences and successful cases with LS-DYNA, to discuss the latest features and developments in LS-DYNA, and to explore industrial development trends.

This conference aims to promote interaction and communication among developers and end users. Therefore, we call for papers with topics covered but not limited to the automotive industry, aerospace and aeronautics, electronics industry, daily consumer goods, biomechanics, locomotive, shipbuilding, civil engineering, and general machinery.

LSTC, Shanghai Fangkun Software Technology, Ltd., and Dalian Fukun Technology Development Corporation wholeheartedly welcome your paper submission and attendance.

Hosts: **Livermore Software Technology Corp. USA**
Shanghai Fangkun Software Technology, Ltd. China
Dalian Fukun Technology Development Corp. China

Date: **October 21st- 23rd, 2019**

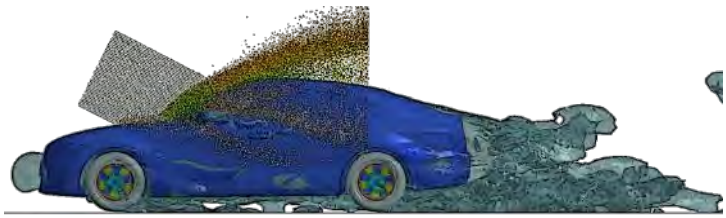
Location: **Pullman Shanghai South Hotel** (http://www.pullmzxhotel.com/)
No.1 Pubei Road, Xuhui District, Shanghai, China, 200235

Training: There will have pre and post-conference training classes being held on Oct. 21st, 24th and 25th.

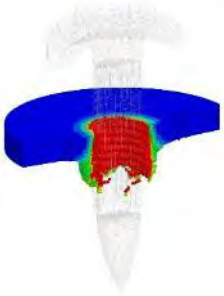
Conference Website: **http://conference.lsdyna-china.com/**

Contact us: conf@lsdyna-china.com

Call for Paper



Overview. This conference covers all topics related to LS-DYNA. At this conference our developers will review the current developments and share their plans for the future. One of the major goals of this conference is to give users a chance to provide feedback, but most of all we hope that users, and especially students, will have an enjoyable opportunity to showcase the creative things that they are doing with LS-DYNA.



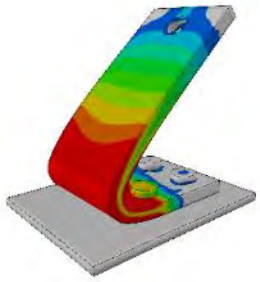
Topics. In the boxes below we list some of the topics that we expect submissions will cover. Topics not in the lists are also welcome. Authors of accepted submissions will be invited to present during the Technology and Application Sessions.

Submissions:

- **Submit abstracts to http://conference.lsdyna-china.com/.**
- Submission can be in Chinese or English. Submission of both Chinese and English versions is greatly appreciated but not mandatory.
- Elva Yu is responsible for processing submissions.

  Tel: 15001986675

  Email: conf@lsdyna-china.com



- **Abstract submission deadline — 20th August 2019**
- **Notice of acceptance deadline — 1st September 2019**
- **Full paper submission deadline — 20th September 2019**

Excellent Paper Awards. We will be giving prizes for the best papers. Award winners will be announced at the banquet on October 22nd. The best paper in English will be published in the English edition of FEA Information Engineering Journal (ISSN #2167-1273) and the best paper in Chinese will be published in the FEA Information Chinese edition.

- One first prize will be awarded. The winner will receive RMB 5,000.00 and a free trip to the 2020 international LS-DYNA Users' Conference including round-trip ticket and hotel fee.
- Two second prizes will be awarded. The winners will receive RMB 3,000.00.
- Three third prizes will be awarded. The winners will receive RMB 2,000.00.

Conference Website: http://conference.lsdyna-china.com/
Contact us: conf@lsdyna-china.com

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.

MBDA Unveils Its Vision of Future Air Systems

European missile house MBDA is working to develop a new range of weapon systems and enablers, from cruise missiles (pictured) to new versions of the MICA air-to-air family and remote carriers to equip new versions of current fighters and their successors.

LE BOURGET, France --- MBDA presents for the first time its vision of the capabilities that will lie at the heart of the next generation of European air combat systems.

As threats evolve and access denial strategies become ever more complex, with diversified effects combining surface-to-air and air-to-air assets in large scale, air superiority will need to be created on a local and temporary basis. Aircraft and air effectors will need to be able to enter denied areas, see threats before being seen, force hidden threats to uncover early enough to suppress them and to always react quicker than the adversary.

In these ever-faster operations, networked effectors will take an essential part in the combat 'cloud', exchanging tactical information and target co-ordinates in real-time with platforms and other network nodes, in order to carry out the desired operational effects. These will also have to deploy robust survivability strategies in front of highly evolving threats. The fight will not only take place between platforms but between enemy networks, and only the most agile and adaptable will win. The engagement of these networked effectors will rely on resilience to any form of aggression (eg: Electronic Warfare, Cyber) as well as on rapid decision aids able to compute complex situations.

MBDA is a key actor able to bring answers to these significant challenges, thanks to its decades long experience in supplying armament capabilities to all Europe's air combat platforms and to its in-depth understanding of operational and technological issues. This is evidenced by the concepts presented at Paris Air Show, which result from ongoing studies in its domestic nations, whether in cooperation or in the framework of individual national roadmaps.

These concepts form a coherent set of capabilities and demonstrate that MBDA can shape innovative responses for the benefit of its customers for their Future Air System projects.
These concepts cover the whole field of key domains:

- Deep Strike with cruise missiles using the most advanced options in order to penetrate and open breaches in the most efficient A2AD (Anti Access Area Denial) deployments in the future, for the benefit of friendly forces.
- Tactical Strike with stand-off, networked and compact armaments, delivering precision effects but also able to saturate enemy defences thanks to pack or swarm behaviours.

- Air-to-Air Combat with, Meteor, which today has no equivalent and will keep its lead and remain a powerful asset for next-generation fighter aircraft.
- Self-Protection with the 'Hard Kill' anti-missile system that will counter incoming missiles and so provide essential protection during 'stand-in' combat, when soft-kill counter-measures and decoys are no longer sufficient. Such a system is able to reverse the balance of power against saturating defences.
- Enablers for the penetration of adversary defences thanks to the 'Remote Carriers' that deliver multiple effects, whether lethal or non-lethal, as well as new services for munitions such as intelligence, targeting, and deception of enemy sensors.

MBDA Remote Carriers are compact, stealthy, co-operate with other armaments and platforms, and can be launched from combat or transport aircraft, or surface ships. They work as capability extenders for the platforms and the armaments that they accompany.

MBDA is the only European player in the domain of complex weapons able to master all technologies needed for the development of these concepts and their operational chain:
-- Stealthy or supersonic long-range vehicles;
-- Very compact airframes and sub-systems for high loadouts, without compromising effects and connectivity performance;

-- Networking, infrared and radio frequency sensors with data fusion and artificial intelligence for automated target identification in complex environments, threat detection, complex engagements planning, and decision aids.

As it masters these essential technologies as well as all steps in the OODA (Observation, Orientation, Decision, Action) loop, from detection and localisation to damage assessment, MBDA positions itself as the architect of this decision-action chain, which will experience significant breakthroughs in concept and doctrine.

Referring to this presentation, Éric Béranger, CEO of MBDA, stated: "MBDA's vision for future air armaments is exhaustive and ambitious, and we are ready to take on the challenge to deliver to our domestic nations the full sovereignty of their future air combat systems by taking part in the definition and development of the armaments that these systems will operate. MBDA has demonstrated that pulling together the best expertise in propulsion, guidance, connectivity and system integration have made Meteor the world best air-to-air missile, giving the pilots of European combat aircraft a decisive

operational advantage. Thanks to its decades long culture of co-operation, MBDA will be equally able to develop the next weapons that will ensure European nations can sustain their air superiority in the long term."

MBDA is the only European group capable of designing and producing missiles and missile systems that correspond to the full range of current and future operational needs of the three armed forces (land, sea and air).

With a significant presence in five European countries and within the USA, in 2018 MBDA achieved revenue of 3.2 billion euros with an order book of 17.4 billion euros. With more than 90 armed forces customers in the world, MBDA is a world leader in missiles and missile systems. MBDA is jointly owned by Airbus (37.5 %), BAE Systems (37.5 %), and Leonardo (25 %).

Volkswagen CEO Dr. Herbert Diess and Ford President and CEO Jim Hackett

Ford - Volkswagen expand their global collaboration to advance autonomous driving, electrification and better serve customers

Volkswagen to join Ford in investing in Argo AI, the autonomous vehicle platform company, at a valuation of more than $7 billion. Tie-up allows both automakers to independently integrate Argo AI's self-driving system into their own vehicles, delivering significant global scale

Ford will use Volkswagen's electric vehicle architecture and Modular Electric Toolkit (MEB) to design and build at least one high-volume fully electric vehicle in Europe for European customers starting in 2023, more efficiently advancing its promise to deliver expressive passenger cars while taking advantage of Volkswagen's scale

Ford and VW on track to develop commercial vans and medium pickups for each brand in select global markets starting in 2022; sharing development costs to generate significant synergies

The Volkswagen-Ford global alliance – which does not involve cross-ownership between the companies – is expected to create annual efficiencies for each company
NEW YORK, July 12, 2019 – Ford Motor Company and Volkswagen AG today announced they are expanding their global alliance to include electric vehicles – and will collaborate with Argo AI to introduce autonomous vehicle technology in the U.S. and Europe – positioning both companies to better serve customers while improving their competitiveness and cost and capital efficiencies.

Volkswagen CEO Dr. Herbert Diess, Ford President and CEO Jim Hackett as well as Argo AI CEO Bryan Salesky announced Volkswagen is joining Ford in investing in Argo AI, the autonomous vehicle technology platform company.

Working together with Ford and Volkswagen, Argo AI's self-driving system (SDS) is the first with commercial deployment plans for Europe and the U.S. Plus, being able to tap into both automakers' global reach, Argo AI's platform has the largest geographic deployment potential of any autonomous driving technology to date. Volkswagen and Ford independently will integrate Argo AI's SDS into purpose-built vehicles to support the distinct people and goods movement initiatives of both companies.
Argo AI's focus remains on delivering a SAE Level 4-capable SDS to be applied for ride sharing and goods delivery services in dense urban areas.

Ford and Volkswagen will have an equal stake in Argo AI, and combined, Volkswagen and Ford will own a substantial majority. The remainder will be used as an incentive pool for Argo AI employees. The full transaction is subject to regulatory approvals and closing conditions.

"While Ford and Volkswagen remain independent and fiercely competitive in the marketplace, teaming up and working with Argo AI on this important technology allows us to deliver unmatched capability, scale and geographic reach," Hackett said. "Unlocking the synergies across a range of areas allows us to showcase the power of our global alliance in this era of smart vehicles for a smart world."

Company leaders also announced Ford will become the first additional automaker to use Volkswagen's dedicated electric vehicle architecture and Modular Electric Toolkit – or MEB – to deliver a high-volume zero-emission vehicle in Europe starting in 2023.

Ford expects to deliver more than 600,000 European vehicles using the MEB architecture over six years, with a second all-new Ford model for European customers under discussion. This supports Ford's European strategy, which involves continuing to play on its strengths – including commercial vehicles, compelling crossovers and imported iconic vehicles such as Mustang and Explorer.

Volkswagen started developing its MEB architecture in 2016, investing approximately $7 billion in this platform. The car-maker is planning to use this platform to build approximately 15 million cars for the Volkswagen Group alone in the next decade.

For Ford, using Volkswagen's MEB architecture is part of its more than $11.5 billion investment in electric vehicles worldwide – and supports Ford's commitment to offer its European customers a broad range of electric vehicles while meeting its sustainability commitments.

"Looking ahead, even more customers and the environment will benefit from Volkswagen's industry-leading EV architecture. Our global alliance is beginning to demonstrate even greater promise, and we are continuing to look at other areas on which we might collaborate," Diess said. "Scaling our MEB drives down development costs for zero-emissions vehicles, allowing for a broader and faster global adoption of electric vehicles. This improves the positions of both companies through greater capital efficiency, further growth and improved competitiveness."

The alliance, which covers collaborations outside of Volkswagen and Ford's joint investments in Argo AI, does not entail cross-ownership between the two companies and is independent from the investment into Argo AI. The alliance is governed by a joint committee, which is led by Hackett and Diess and includes senior executives from both companies.

The companies also are on track to deliver medium pickup trucks for global customers, aiming to start in 2022, followed by commercial vans.

Equal Shareholders in Argo AI

Volkswagen will invest $2.6 billion in Argo AI by committing $1 billion in funding and contributing its $1.6 billion Autonomous Intelligent Driving (AID) company, which includes more than 200 employees – most of whom have been developing self-driving technology for the Volkswagen Group.

As part of the transaction, Volkswagen also will purchase Argo AI shares from Ford for $500 million over three years. Ford will invest the remaining $600 million of its previously announced $1 billion cash commitment in Argo AI.

The full transaction represents a valuation for Argo AI that totals more than $7 billion.
Both automakers see significant potential, including profitable growth by tapping new business areas tied to autonomous technology.

Argo AI plans to work closely with Ford and Volkswagen to provide the autonomous vehicle technology the automakers need to deliver fully integrated self-driving vehicles that can be manufactured at scale for safe, reliable and durable deployment in ride sharing and goods delivery services.

"Argo AI is fortunate to have a world-class team due to our clear mission and the commitment to deployment from our partners, and together with AID employees, we will have a global workforce to attract even more of the best talent," said Salesky, co-founder of Argo AI. "Plus, thanks to Ford and Volkswagen, Argo AI technology could one day reach nearly every market in North America and Europe, applied across multiple brands and to a multitude of vehicle architectures."
Based in Munich, Germany, AID will become Argo AI´s new European headquarters and will be led by AID's current CEO Karlheinz Wurm. With the addition of AID employees, Argo AI will grow from 500 to over 700 employees globally.

In addition to its global headquarters in Pittsburgh, Pa., the new location marks Argo AI's first engineering center in Europe and the fifth globally in addition to Dearborn, Mich.; Cranbury, NJ; and Palo Alto, Calif. Collaborating with Ford, Argo AI also is testing its technology in Miami and Washington, D.C., where together they plan deployment of commercial services.

Ford to Use Volkswagen's MEB Electric Vehicle Architecture for 600,000 Vehicles
Ford plans to design an all-new, MEB-platform-based EV model, which starts arriving in 2023, in Köln-Merkenich, Germany. Volkswagen will supply MEB parts and components as part of the collaboration.
Both companies also will continue to target additional areas where they can work together on electric vehicles – a key strategic priority for both companies as they drive to accelerate the transition to sustainable and affordable mobility.

The agreement with Ford is a cornerstone in Volkswagen's electric strategy, supporting the growth of the e-mobility industry and facilitating global efforts to reach the Paris 2050 Agreement.

Commercial Van and Pickup Collaboration On-Track
Ford and Volkswagen remain on track in their previously announced plan to improve their respective strengths in commercial vans and medium pickups in key global markets. The work on these vehicle lines will create significant efficiencies for each company.

Ford will engineer, source and build the previously announced medium pickup for both companies for customers in Europe, Africa, the Middle East, Asia Pacific and South America, with trucks expected to arrive in key markets as early as 2022.

For both companies, Ford intends to engineer, source and build larger commercial vans for European customers starting in 2022, and Volkswagen intends to develop, source and build a city van for sale in Europe and other select global markets.

Volkswagen and Ford have strong complementary commercial van and pickup businesses around the world, with popular models including the Ford Transit lineup and Ranger as well as the Volkswagen Transporter, Caddy and Amarok.

As both companies expect customer demand for medium pickups and commercial vans to grow globally in the next five years, collaborating on these key segments will allow better technologies and more innovation to reach their respective customers more quickly – with better plant capacity utilization.

Excerpt About Volkswagen Group - The Volkswagen Group, with its headquarters in Wolfsburg, is one of the world's leading automobile manufacturers and the largest carmaker in Europe. The Group comprises twelve brands from seven European countries: Volkswagen Passenger Cars, Audi, SEAT, ŠKODA, Bentley, Bugatti, Lamborghini, Porsche, Ducati, Volkswagen Commercial Vehicles, Scania and MAN…

Excerpt About Ford Motor Company - Ford Motor Company is a global company based in Dearborn, Michigan. The company designs, manufactures, markets and services a full line of Ford cars, trucks, SUVs, electrified vehicles and Lincoln luxury vehicles, provides financial services through Ford Motor Credit Company and is pursuing leadership positions in electrification, autonomous vehicles and mobility solutions.

Excerpt About Argo AI - Argo AI is an autonomous vehicle technology platform company based in Pittsburgh, Pennsylvania. The company is developing self-driving technology in partnership with leading automakers to provide a safer, more affordable, convenient, and accessible way to get around.

Forward Looking Statements - Statements included herein may constitute "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements are based on current expectations for future events. Actual results could differ…

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YouTube Tutorials

Webinars - Workshops

July

LS-FORM	Progressive Die PostProcessing
Oasys Primer	Oasys PRIMER v16.0 Updates
Intro	LS-DYNA Ball and Block Tutorial Part 1: Mesh and Boundary Condition Setup
Contact	LS-DYNA Analysis for Structural Mechanics: Intro to Contact

Previous Months

ICFD	New Solution Explorer in LS-PrePost to set up an LS-DYNA ICFD simulation
Oasys Post	Oasys Post Processing v16 Updates
SPH	Cutting by the SPH method in LS-DYNA
Oasys PRIMER	Tools for PrePost Pedestrian Impact Analysis
DES	Set-up of LS-DYNA DES simulations
ICFD	ICFD sloshing
CFD	Solution Explorer Dam break example
LS-RUN	How to use/setup LS-Run
LS-TaSC	LS-TaSC An introduction - Laura Crespo
EFG	LS-DYNA: Implicit element-Free Galerkin (EFG) - Cutting Simulation
SPH	Modeling Splashing and Sloshing in LS-DYNA using Smoothed Particle Hydrodynamics (SPH) - Erik Svenning
Implicit	Intro to the use of implicit analysis in LS-DYNA
Composite	Intro to LS-DYNA composites modelling
FSI	Setting up a simple FSI problem set up with ICFD-LS-DYNA

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Instructor: Paul Du Bois and Suri Bala

Sep 9	Sep 13	Mon	Fri	CA		P. DuBois, S. Bala	

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Includes: on site continental breakfasts, lunches, breaks, class dinner
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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 September/October

Introduction	
Introduction to LS-DYNA	17-19 September (Tr) 24-26 September 2-4 October (T)
Introduction to Simulation Technology	30 September
Introduction to Isogeometric Analysis with LS-DYNA	24 October
Crash	
Contact Definitions	27 September
Passive Safety	
Introduction to Passive Safety	19-20 September
Implicit Capabilities	
Implicit Analysis using LS-DYNA	16-17 September
Particle Methods	
Smoothed Particle Hydrodynamics	19-20 September
Multiphysics	
ALE and FSI	17-18 September
ICFD Incompressible Fluid Solver	17-18 October
High energy events	
Methods for Simulating Short Duration Events	8-9 October
Blast Modeling	10-11 October
Penetration Modeling	14-15 October
Optimization	
LS-OPT - Optimization & Robustness	24-26 September (V) 14-16 October

Information days and Webinars (free of charge)

Webinar: New Features in LS-DYNA	13 September
Information day: Simulation of Plastics	24 October
Information day: Composite Analysis	25 October

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; Ko = Koblenz, Germany;
L = Linköping, Sweden, V = Versailles, France; T = Turin, Italy, Tr = Traboch, Austria, Z = Zurich, Switzerland

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August 2019

Date				Location	Course Title	Days	Instructor(s)
Aug 7	Aug 8	Wed	Th	MI	Rubber, Foam, and Viscoelastic Materials in LS-DYNA®	2	A. Tabiei
Aug 12	Aug 13	Mon	Tu	MI	Plasticity, Plastics, and Viscoplastic Materials in LS-DYNA®	2	A. Tabiei
Aug 12	Aug 14	Mon	Wed	CA	ALE, Eulerian, and Fluid-Structure Interaction in LS-DYNA®	3	M. Souli
Aug 14	Aug 15	Wed	Th	MI	Composite Materials in LS-DYNA®	2	A. Tabiei
Aug 15	Aug 16	Th	Fri	CA	Smoothed Particle Hydrodynamics (SPH) in LS-DYNA®	2	M. Souli
Aug 19	Aug 20	Mon	Tu	MI	Fracture, Failure, and Damage in LS-DYNA®	2	A. Tabiei
Aug 26	Aug 27	Mon	Tu	MI	Introduction to Passive Safety	2	A. Gromer
Aug 26	Aug 29	Mon	Th	CA	Introduction to LS-DYNA®	4	A. Nair

September 2019

Date				Location	Course Title	Days	Instructor(s)
Sep 5	Sep 6	Th	Fri	MI	SPH and SPG Methods for Fluid and Solid Applications	2	J. Xu, Y. Wu
Sep 9	Sep 13	Mon	Fri	CA	Crashworthiness in LS-DYNA®(This class is 4 days of instruction; the fifth day is a half day optional workshop.)	4 + 0.5	P. DuBois, S. Bala
Sep 10	Sep 13	Tu	Fri	MI	Introduction to LS-DYNA®	4	H. Devaraj
Sep 16		Mon		CA	Overview of Contacts in LS-DYNA®	1	S. Bala
Sep 26	Sep 27	Th	Fri	MI	Occupant Simulation	2	H. Devaraj

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LSTC Livermore Software Technology Corp.

OUT-06

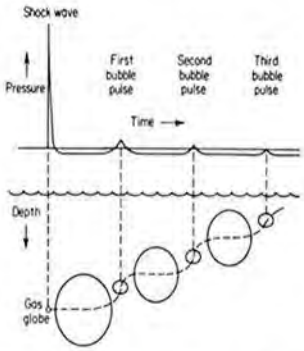
Underwater Shock Analysis with USA/LS-DYNA

Goal

Be able to run underwater explosions analysis with USA software and understand the underlying theory

Contents

1. Introduction
2. Doubly Asymptotic Approximation (DAA) Field Solver
3. Nonreflecting Boundary (NRB) Solver
4. Miscellaneous Topics
5. Optional - Cavitating Acoustic Fluid Element (CAFÉ and CASE) Field Solver



The key points of the training will be illustrated with practical exercises.

Audience

CAE Engineers / Researchers

Prerequisites

Operationnal knowledge of LS-DYNA *(Preliminary follow-up of the course **BASE-01** or **BASE-03** advised)*

Specific registration conditions submitted to the agreement of American Defence Department for USA software use

Duration

3 days

Trainers

External expert
(Tom LITTLEWOOD –LSTC)

The training being provided by an external expert, DynaS+ reserves right to cancel within the 2 weeks notice if there is not enough attendees.

Training provided in English, English course material

DynaS+ Catalogue Formation 2018 v2.0 - Réf : T/DIV/CMI/DYNAT/17/0238/2.0

Contact information:

Training Manager: **Charlotte MICHEL** E-mail: c.michel@dynasplus.com

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One-step Method for Tri-axial Carbon Fiber Reinforced Composites in LS-DYNA®

Houfu Fan[a], Danielle Zeng[b] and Xinhai Zhu[a]

a---Livermore Software and Technology Corporation, Livermore, CA, USA
b---Ford Motor Company, Dearborn, MI, USA

Abstract

In this paper, an algorithm for one-step analysis approach of carbon fiber reinforced composites modeling is introduced and successfully implemented in LS-DYNA. Local fiber rotations during the forming process of fiber reinforced composites are almost inevitable. These rotations have significant effect on the material behaviors of the composite, especially for composites with tri-axial carbon fibers embedded in. In the current work, rotation effects of the embedded fibers are considered and new implementation is capable of handling composites with tri-axial carbon fibers. The prediction ability of the algorithm is demonstrated through modeling of a double dome part with tri-axial carbon fiber composites. Good agreement is obtained in the initial composite shape prediction as compared to experimental data.

Introduction

Carbon fiber reinforced composites are drawing great attention in the automotive industry due to their lightweight, high stiffness/strength properties. Fiber reinforced composites in various fabric architectures are preformed into a designed part shape before a final compression molding of the parts. Currently, most numerical simulation methods are developed for woven composites that are fabricated with bi-axial fiber orientations. To the best of our knowledge, there is no modeling technique for composites with tri-axial fiber directions. In this paper, our previous work on bi-axial woven composites [1] is extended to model the tri-axial composites based on a one-step analysis approach. The algorithm developed for this analysis treats the matrix and fibers as different materials. Any material model in the commercial FEA software can define the matrix, while the fiber is modeled as an elastic material. The material deformation on the final formed part is obtained by using the minimum energy method. This feature has been successfully implemented in LS-DYNA and can be activated by the modified keyword: *DEFINE_FIBERS.

This paper is organized as follows. The local fiber rotation effects and the way to account for them are first discussed. After that, the keyword *DEFINE_FIBERS to defined composites with the tri-axial fibers embedded is presented. Simulations of a double dome part with tri-axial carbon fiber composites are then conducted, whose results are compared to that of the corresponding experiment.

The rotation effect

The key ingredient in modeling carbon composites with tri-axial fiber directions is the introduction of the rotation effect into our previous algorithm [1]. Without the loss of generality, a carbon-fiber reinforced composite is assumed to be discretized into a certain number of quadrilateral elements. As shown in Fig. 1, we are considering the deformation of a local representative 'fiber' within a generic quadrilateral element from its initial two-dimensional (2D, initial part) state in the original configuration to the corresponding three-dimensional (3D, final part) state in the current configuration. As shown in Fig. 1, using standard Finite Element formulation, the deformation gradient of the generic element can be obtained as $\mathbf{F_c}$. In one-step method, the 3D final part is always provided and the corresponding 2D part are to be obtained. So the unit vector $\mathbf{V_c}$ representing the direction of the generic fiber in the current configuration is given. In order to compute the internal forces due to this generic fiber, one needs to get the initial unit vector $\mathbf{V_o}$, which is proposed to be

$$\mathbf{V}_o = \frac{\mathbf{F}_c^{-1}\mathbf{V}_c}{\|\mathbf{F}_c^{-1}\mathbf{V}_c\|}$$

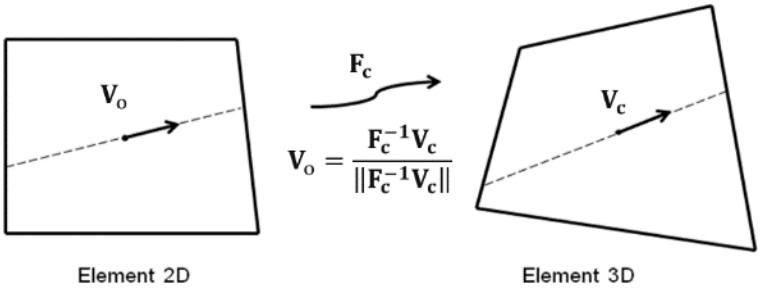


Fig 1: Mapping of a generic fiber element from the original configuration to the current configuration: $\mathbf{F_c}$ is the element deformation gradient, $\mathbf{V_c}$ and $\mathbf{V_o}$ represent the local fiber in the current and reference configuration correspondingly.

*The keyword *DEFINE_FIBERS*

In order to activate the new feature, aside from the existing keyword *CONTROL_FORMING_ONESTEP, a new keyword named *DEFINE_FIBERS is to be used, as shown below:

```
*CONTROL_FORMING_ONESTEP
      7
*DEFINE_FIBERS
$     IDF      IDP     NUMF       N1       N2      EFB      SHR    HRGLS
       1        4        3     19128    19156     &efb     -1011       0.0
$   ALPHA1   ALPHA2   ALPHA3
       0.0      60.0     120.0
$      X1       Y1       Z1       X2       Y2       Z2
      &x1      &y1      &z1      &x2      &y2      &z2
```

IDF is the unique fiber ID; IDP means the matrix part ID; NUMF denotes the number of fiber orientations; N1 and N2 are user IDs of nodes that defines the reference direction for the fiber orientations; EFB is the effective fiber stiffness (>0) or the curve ID (absolute value) that defines the effective fiber stiffness versus the normal strain; SHR is the shear stiffness (>0) or curve ID (absolute value) that defines shear stiffness versus the shear strain; HRGLS is a coefficient that helps stabilize the material behaviors at the fringe of the composite (default is 0.0); ALPHA1, ALPHA2 and ALPHA3 defines the orientation of the fibers (two or three) in degrees. Points (X1,Y1,Z1) and (X2,Y2,Z2) define the reference direction for the fiber orientations when N1 and N2 are not defined.

One-step analysis validation

We are considering the preforming of a double dome part with a tri-axial carbon fiber reinforced composite. The experimental setup is shown in Fig. 2. The lower punch and binder of a compression molding tools shall enable the forming of the specimen into a double dome shape. The upper matching mold cavity at the top is not shown in the picture and the initial flat composite are laid over the binder before the preforming process. There are generally two steps. First the upper mold goes down to the set on the binder surface to clamp the composite. Then the lower punch goes up to form the double dome part.

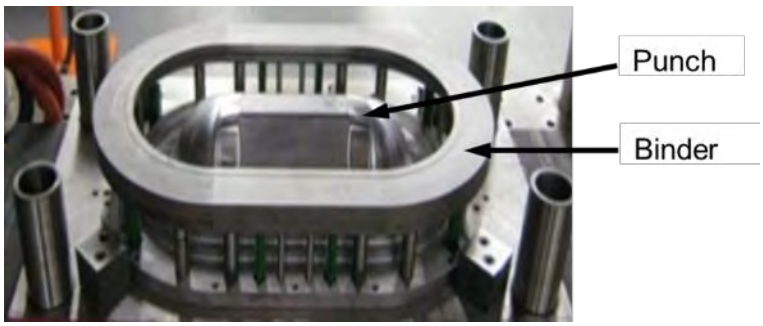
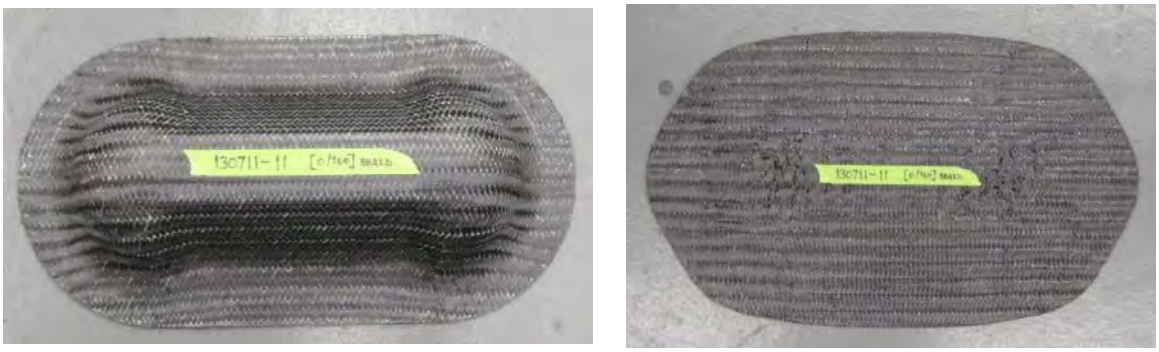


Fig 2: Experiment setup for the double dome test.

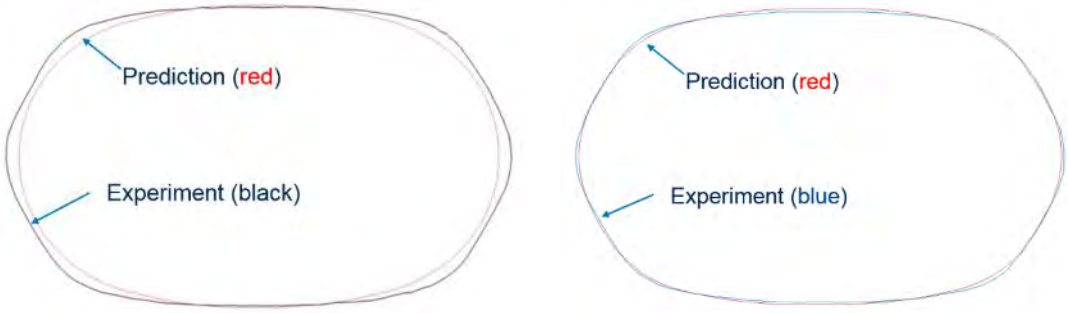
The 3D composite has an initial fiber orientation of -60/0/60 degree, with respect to the defined direction. Fig. 3(a) and (b) shows the final 3D part and initial 2D part of the preformed double dome, respectively.



(a) Final 3D part (b) Initial 2D part

Fig. 3 Results from the double dome preforming experiment.

By using the LS-DYNA one-step analysis approach, without and with the rotation effects, the predicted initial shapes of the flat composite are shown in Fig. 4. One can see that the predicted initial blank shape obtained from the method without rotation effect is some way off the experiment result (see Fig. 4(a)), while the current implementation with the rotation effect produces much better prediction (see Fig. 4(b)).



(c) No rotation effect (Original) (d) With rotation effect (Current)

(e)

Fig. 4 Predicted initial blank shapes from the one-step simulations using LS-DYNA, as compared to the corresponding experiment result.

Aside from the initial 2D shape prediction, the current method can also provide the angles between different fibers in the composite, as shown in Fig. 5.

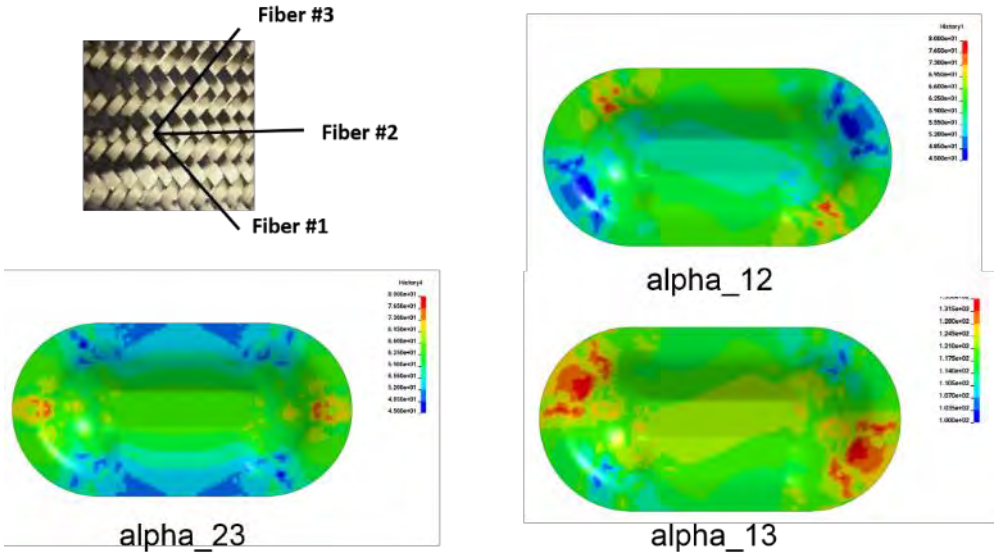


Fig 5: Contours of angles between different fibers

Conclusion:

In this work, an algorithm considering the fiber rotation effect is proposed and implemented for the one-step method in LS-DYNA. It is shown that the proposed algorithm in LS-DYNA can provide much better accuracy in predicting the initial shape for tri-axial carbon fiber reinforced composites.

Revision Information:

Revision 133462: the new feature is available, both in SMP and MPP.

Reference:

[1] Danielle Zeng, Xinhai Zhu, Li Zhang, Jeff Dahl, Houfu Fan, Development of a One-Step Analysis for Preforming of Woven Carbon Fiber Composites. 15-th International LS-DYNA Users Conference, June 10-June 12, 2018, Michigan, USA.

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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 Corporation www.jsol.co.jp/english/cae/

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. www.lstc.com

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 www.materials-sciences.com

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 www.oasys-software.com/dyna

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 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

www.oasys-software.com/dyna

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.

恒士达科技
Hengstar Tech.

Shanghai Hengstar www.hengstar.com

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..

www.lenovo.com

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.

Cloud - HPC Services - Subscription JSOL

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

www.rescale.com

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
- Pay-per-use business model means you only pay for the resources you use
- 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	
	www.complx.com.mx /		armando.toledo@complx.com.mx	
	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	
	LSTC www.lstc.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	
United States	**ESI Group N.A** **info@esi-group.com**			
	www.esi-group.com			
	PAM-STAMP			
	QuikCAST	SYSWELD	PAM-COMPOSITES	CEM One
	VA One	CFD-ACE+	ProCAST	
		Weld Planner	Visual-Environment	IC.IDO
United States	**Engineering Technology Associates – ETA**		etainfo@eta.com	
	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	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	DYNAFORM	VPG	MEDINA	
	LSTC Dummy Models		LSTC Barrier Models	
France	**DYNAmore France SAS**		sales@dynamore.eu	
	www.dynamore.eu			
	LS-DYNA, LS-PrePost	LS-OPT	Primer	DYNAFORM
	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	
	www.dynamore.de			
	PRIMER	LS-DYNA	FTSS	VisualDoc
	LS-OPT	LS-PrePost	LS-TaSC	DYNAFORM
	Primer	FEMZIP	GENESIS	Oasys Suite
	TOYOTA THUMS		LSTC Dummy & Barrier Models	

Netherlands	**Infinite Simulation Systems B.V**		j.mathijssen@infinite.nl	
	www.infinite.nl			
	ANSYS Products	CivilFem	CFX	Fluent
	LS-DYNA	LS-PrePost	LS-OPT	LS-TaSC
Russia	**Limited Liability DynaRu**		office@lsdyna.ru	
	http://lsdyna.ru/			
	LS-DYNA	LS-TaSC	LS-OPT	LS-PrePost
	LSTC Dummy Models		LSTC Barrier Models	
Spain	**DYNAmore France SAS**		sales@dynamore.eu	
	www.dynamore.eu			
	LS-DYNA, LS-OPT	LS-PrePost	Primer	DYNAFORM
	DSDM Products		LSTC Dummy Models	FEMZIP
	LSTC Barrier Models		DIGIMAT	
Sweden	**DYNAmore Nordic**		marcus.redhe@dynamore.se	
	www.dynamore.se		Oasys Suite	
	ANSA	µETA	LS-DYNA	LS-OPT
	LS-PrePost	LS-TaSC	FastFORM	DYNAform
	FormingSuite		LSTC Dummy Models	
			LSTC Barrier Models	
Switzerland	**DYNAmoreSwiss GmbH**		info@dynamore.ch	
	www.dynamore.ch			
	LS-DYNA		LS-OPT	LS-PrePost
	LS-TaSC		LSTC Dummy Models &	Barrier Models

UK	**ARUP**	dyna.sales@arup.com		
	www.oasys-software.com/dyna		TOYOTA THUMS	
	LS-DYNA		LS-OPT	LS-PrePost
	LS-TaSC		PRIMER	D3PLOT
	REPORTER	SHELL	FEMZIP	HYCRASH
	DIGIMAT	Simpleware	LSTC Dummy Models	
			LSTC Barrier Models	

China	**Shanghai Fangkun Software Technology Ltd.**		
	www.lsdyna-china.com		
	LS-DYNA	LS-TaSC	LSTC Barrier Models
	LS-PrePOST	LS-OPT	
	LSTC Dummy Models		

India	**Oasys Ltd. India**		lavendra.singh@arup.com	
	www.oasys-software.com/dyna			
	PRIMER D3PLOT	T/HIS		
		LS-OPT	LSTC Dummy Models	LS-PrePost
		LS-DYNA	LSTC Barrier Models	LS-TaSC

India	**CADFEM India**		info@cadfem.in	
	www.cadfem.in			
	ANSYS	VPS	optiSLang	
	LS-DYNA	LS-OPT	LS-PrePost	

India	**Kaizenat Technologies Pvt. Ltd**		support@kaizenat.com	
	http://kaizenat.com /			
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
	Complete LS-DYNA suite of products		LSTC Barrier Models	LS-TaSC

Distribution, Consulting

Japan	**CTC**	LS-dyna@ctc-g.co.jp		
	www.engineering-eye.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CmWAVE	

Japan	**JSOL**			
	www.jsol.co.jp/english/cae		Oasys Suite	
	JSTAMP	HYCRASH	JMAG	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	

Japan	**FUJITSU**			
	http://www.fujitsu.com/jp/solutions/business-technology/tc/sol/			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CLOUD Services	
	Inventium PreSys	ETA/DYNAFORM	Digimat	

Japan	**LANCEMORE**	info@lancemore.jp		
	www.lancemore.jp/index_en.html			
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models		

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	

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
	JSTAMP/NV	Scan IP	Scan FE	Scan CAD
	FEMZIP			

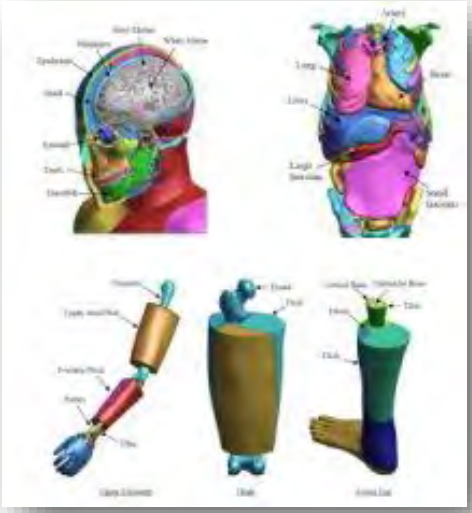
Korea	**KOSTECH**	young@kostech.co.kr		
	www.kostech.co.kr			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM
	eta/DYNAFORM	DIGIMAT	Simuform	Simpack
	AxStream	TrueGrid	FEMZIP	

Taiwan	**AgileSim Technology Corp.**			
	http://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

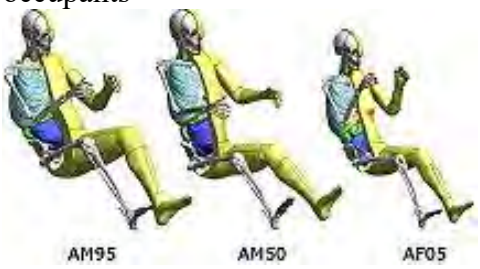
Taiwan	**SiMWARE Inc..**			
	www.simware.com.tw			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

TOYOTA - Total Human Model for Safety – THUMS

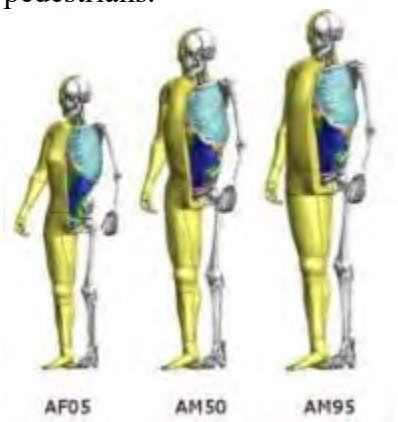


The Total Human Model for Safety, or THUMS®, is a joint development of Toyota Motor Corporation and Toyota Central R&D Labs. Unlike dummy models, which are simplified representation of humans, THUMS represents actual humans in detail, including the outer shape, but also bones, muscles, ligaments, tendons, 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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