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LSTC Livermore Software Technology Corp.

Volume 8, Issue 3, March 2019

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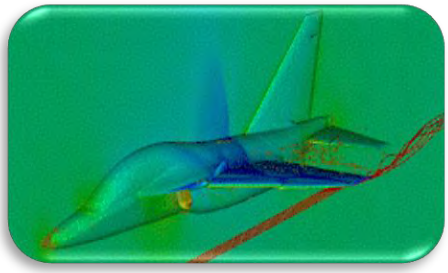
LSTC

LSTC Executive Vice President

BETA CAE



Rescale

LSTC & Shanghai Fangkun

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

FEA Information Engineering Solutions

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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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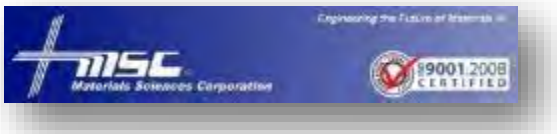
Platinum Particpants



Platinum Particpants

Table of contents

Announcements

LSTC Executive Vice President

As of March 04, 2019 Nathan Asher Hallquist has been appointed Executive Vice President of LSTC.

We are pleased to announce the appointment of Nathan Asher Hallquist to the position of Executive Vice President, effective March 4, 2019. With this appointment LSTC renews its commitment to the business model that our customers and partners have long valued and come to expect.

http://www.lstc.com/corporate/announcements

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

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

Conference Website: www.dynamore.de/conf2019

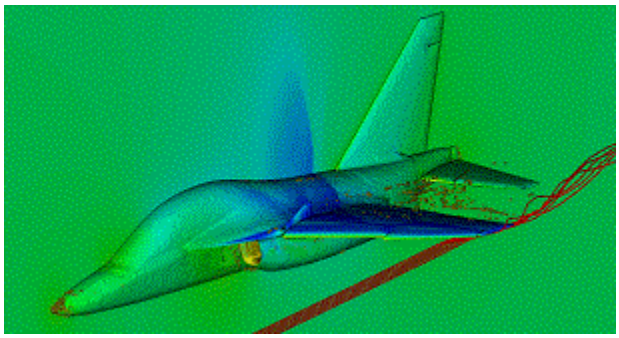
2019 China LS-DYNA Conference October 21-23, Shanghai , China

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 will invite domestic and foreign experts, developers and engineers from LSTC, and customers to share their experience and successful cases with LS-DYNA, to discuss the latest features and developments in LS-DYNA, and to explore industrial development trends. There will have pre and post-conference training classes being held on Oct. 21st, 24th and 25th.

We wholeheartedly welcome your paper submission and attendance.

Conference Website: conference.lsdyna-china.com/

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 v18.1.5 of its software suite

Apart from fixes in the detected issues, this version hosts a couple of noteworthy enhancements as well. The most important enhancements and fixes implemented are listed below.

Contents:

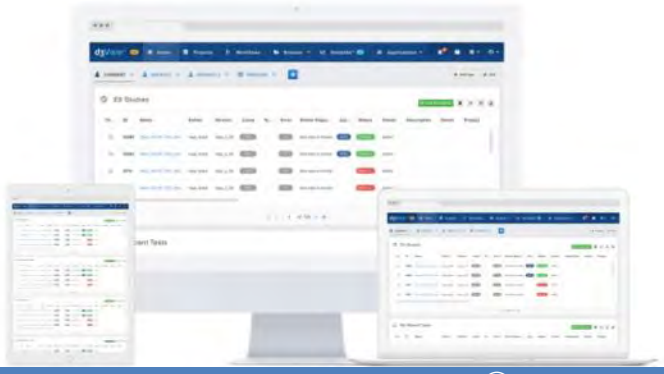
Where to download from

Customers who are served directly by BETA CAE Systems, or its subsidiaries, may download the new software, examples and documentation from their account on our server. They can access their account through the "user login" link at our web site.
Contact us if you miss your account details. The Downloads menu items give you access to the public downloads.
Customers who are served by a local business agent should contact the local support channel channel for software distribution details.

BETA CAE Systems announces the release of the new ANSA/EPILYSIS/META suite v19.1.1.

Apart from fixes in the detected issues, this version also hosts numerous noteworthy enhancements and implementations.
Enhancements and known issues resolved in ANSA
Enhancements and known issues resolved in EPILYSIS
Enhancements and known issues resolved in META
Compatibility and Supported Platforms

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

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

Experiments
Manage Safety and NVH
Compare with Simulations
Search Historical data

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

Workflows
Build and deploy workflows
Characterize materials
Model sequential impacts

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

Register now!

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

Conference Website: www.dynamore.de/conf2019

Register now for the European LS-DYNA Conference

From 14-16 May 2019 the 12th European LS-DYNA Conference will take place in Koblenz, Germany. With renowned keynote-speakers from industry and academia, approximately 200 presentations and several workshops on various topics the conference is an ideal opportunity to exchange knowledge and discuss new solution approaches with other users. Register now and take the change to talk with industry experts and learn more about the software and its applications.

Venue

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

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

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

Accommodation

A limited number of reduced rooms for conference participants can be ordered through a central hotel room booking service. Please use the booking form (pdf) on the conference website and proceed as described.

Exhibiting and sponsoring

In the accompanying exhibition, numerous hardware and software manufacturers offer an insight into the latest news and trends around LS-DYNA. If you want to contribute, please request additional exhibitor and sponsoring information.

Accompanying Seminars

As usual we offer numerous accompanying seminars in Stuttgart and Koblenz. An overview and the registration can be found here.

Participant fees

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

Contact and registration

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

Author: Christian Frech christian.frech@dynamore.de

Experiments and calibration

DYNAmore Materials characterization

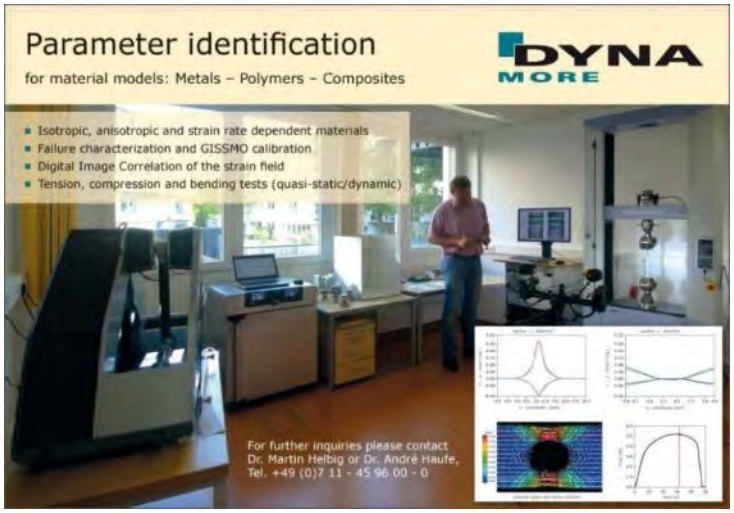
LS-DYNA material cards for polymers, metals, and composite materials.

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.

ESI Forum in India 2019

esi FORUM in India | APR 23, 2019

-----Smart Virtual Prototyping - exciting new developments and trends in the CAE World

Location: Hyatt Regency in Pune

Weikfield IT Park, Pune Nagar Road, Pune, Maharashtra 411014

Date: 23 Apr 2019

Website: https://www.esi-group.com/company/events/2019/esi-forum-india-2019

ESI India will be hosting ESI User Group Forum 2019 in Pune on 23rd April 2019. This event will bring ESI users from an array of the industries together. The theme for this year's forum is "Smart Virtual Prototyping" with presentations of exciting new developments and trends in CAE World.

This year's forum will include sessions on SMART Virtual Manufacturing & SMART Engineering for the Automotive, Aerospace, Energy and Heavy Machinery Industries. Let's Join & explore how ESI's pool of solutions can support the goal of Indian industries to get ready for the Industry of the Future. ESI's User Success Stories from the industry will be presented during this entire day on Casting, Sheet Metal Forming, Welding, Virtual Performance, Vibro-Acoustics, Virtual Reality and CFD.

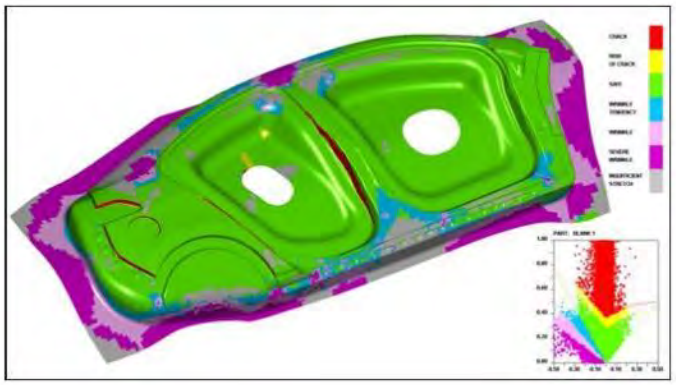
ESI India Forum 2019 will have an "Expert Panel discussion" in the evening where leaders of the industry will share their experience on "How to gear-up for Industry 4.0?"

We are inviting you to attend to this event & take the opportunity to interact & Network with ESI's Product Managers & Industry Experts. We will also extend our invitation for the evening entertainment & awards night with dinner.

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

Dynaform Modules - Blank Size Engineering

Beginning with the 3-D part geometry, BSE can quickly unfold the flanges and flatten the geometry to produce a blank outline for blank size estimation along with piece price and scrap calculation. Product feasibility and cost analysis can be thoroughly evaluated using BSE.



Part Preparation - Surface Separation
The top and bottom surfaces of a solid-model part can be separated, showing the material from both inside and outside and the mean(middle) surface can be generated automatically. There are also multiple functions to repair surface defects.

Blank Development
BSE includes an industry proven solver (MSTEP) for the accurate prediction of flat blank profiles from 3-D part geometry. Designed for cost estimators, blank predictions consider both linear bends and the material stretch that occurs during the forming process to produce the most accurate blank possible.

Nesting
The BSE module provides for 1-up, 2-up and multiple blank nesting. The material usage and fall off is calculated along with piece price. Minimum required blanking tonnage is estimated. Nesting optimization can be performed to calculate the best material utilization.

Cost Estimation Report
Automatically generate reports for cost estimation and quotation of the part material. Report output includes detailed descriptions of overall blank size, nesting configuration, pitch, coil width, material utilization, number of coils required to meet annual volume and total piece price for materials.

Feasibility Study using MSTEP
MSTEP is a one-step code which can be used for quick formability of a part. Binder, addendum and drawbeads can be simulated with pressure pads, binder and drawbead force.

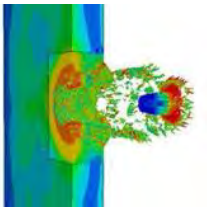
Trimline Development with MSTEP
MSTEP will quickly and easily develop the trimline throughout multiple stations.

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

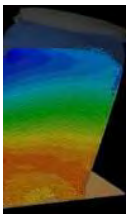
www.feantm.com

Monday 03/18/2019 - And welcome to Coffee and the shooting range. NOPE, we do not waste coffee so we are not shooting the coffee cups! So, let's head on over to YouTube and use a steel plate for those bullets, WHILE drinking the coffee from our cups! No coffee shooting allowed.



LS-DYNA bullet impact on steel plate

Monday 03/11/2019 - Today we are having Valle Dulcis chocolate with our coffee! Now, I do have plastic water barrels incase we need emergency water for the horses, WHICH brings me to the simulation of what happens if a plastic barrel full of water hits the ground? is there any chance for the barrel to survive the crash? Let's drink our coffee and watch the following simulation.



Drop of a plastic barrel_daidalos group

03/04/2019 - Now, Twining Tea, skip the scone, Cadbury chocolate AND Arup in the UK! But, sneaking my coffee in my tea cup. Today is free tea, a Chocolate AND a free webinar, courtesy of Arup!

ARUP

LS-DYNA composites modelling

Galal Mohamed

Implicit Analysis using LS-DYNA

Laura Rovira Crespo

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

Shanghai Hengstar & Enhu Technology

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

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

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

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

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

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

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

Shanghai Hengstar Technology Co., Ltd

hongsheng@hengstar.com

http://www.hengstar.com

Shanghai Enhu Technology Co., Ltd

http://www.enhu.com

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

The 2019 THUMS European Users' Meeting Friday, May 17th, 2019

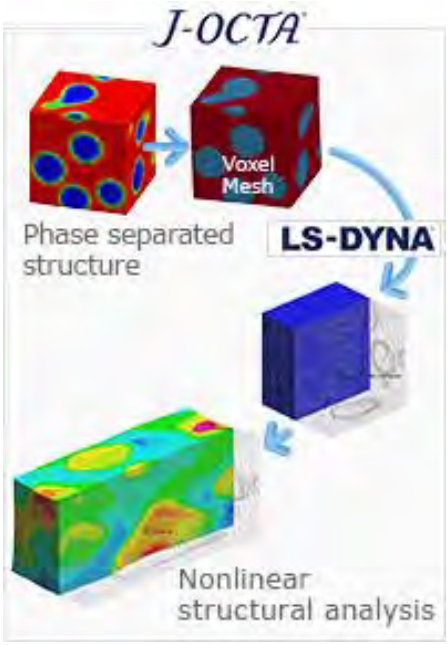
Participation:
THUMS users.
Customers who are interested in THUMS.
Venue:
Conference Center Koblenz
Koblenz Kongress - Rhein-Mosel-Halle
Julius-Wegeler-Straße 4,
56068 Koblenz, Deutschland
Contact:
Users Meeting Secretariat
JSOL Corporation, Engineering Technology Division
E-mail：event@sci.jsol.co.jp

https://www.jsol-cae.com/en/event/usersevent/2019/thums/

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

https://www.kaizenat.com/

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

Technologies Pvt. Ltd.

GROWING and MOVING!

Kaizenat had a humble beginning and started with a simple set-up in 2012. Now, we are excited to announce that we have grown big in terms of customer count, team size and revenue, which have led us to move our Bangalore office to a new premise.

Kaizenat's New Office:

The new location provides unmatched connectivity to three points of much commercial significance in Bangalore - Whitefield, MG Road, and the Airport thus reducing the long commute to the office and ensuring work-life balance.

The greatest benefits of moving:

- Dedicated in-house support team
- Sophisticated training /conference room set-up with AI Display
- Quick connect to customer location
- Dedicated automation team
- Focused and unified working environment

New Address:

Kaizenat Technologies Pvt Ltd
B-1112, Signature Tower,
Brigade Golden Triangle,
Old Madras Road,
Kattamnallur Gate,
Bangalore -560049

Contact us:

support@kaizenat.com **for more information.**

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

LSTC Executive Vice President

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We are pleased to announce the appointment of Nathan Asher Hallquist to the position of Executive Vice President, effective March 4, 2019. With this appointment LSTC renews its commitment to the business model that our customers and partners have long valued and come to expect.

Nathan has been with LSTC for many years, and his credentials make him an excellent choice on both the technical and business levels for our continued success and growth.

In this position he will support our core mission of technical excellence while offering a fresh focus on overall user experience. He believes that the two keys to our ongoing success are, first, a commitment to produce a scalable, multi-physics, analysis solver implemented within a one-code, one-model, one-license, philosophy and, secondly, a commitment to continue our unique approach to relationships with distributors, customers, alliance partners, and the broader engineering and scientific communities.

www.lstc.com

LSTC Livermore Software Technology Corp.

LS-DYNA® Advanced CFD Analysis

LS-DYNA® Incompressible CFD (ICFD) tool combines state-of-the-art numerical techniques that allow robust, scalable, and accurate simulations of fluid flows. Its ability to couple with the structural, thermal, and Discrete Element Method solvers make it an excellent option for multi-physics problems.

Applications:

- Ground vehicle aerodynamics
- Cooling analysis
- Resin Transfer Molding for manufacturing of composites
- Turbomachinery
- Fluid-Structure Interaction in the biomedical field

Features:

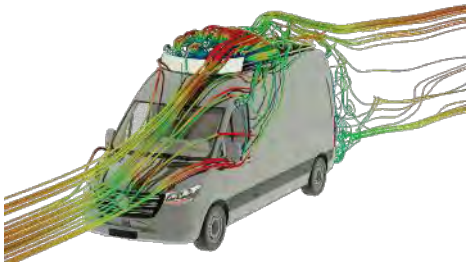
- FEM based
- Large library of RANS and LES turbulence models
- Automatic meshing and re-meshing
- Free surface flow
- Non-Newtonian flows
- Non-inertial reference frames
- Porous media models

Learn more at:

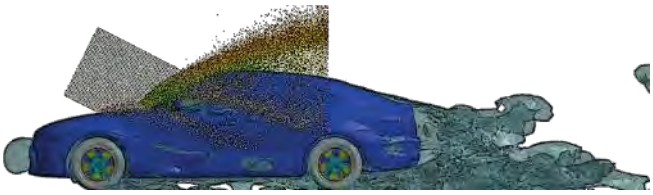
www.lstc.com/applications/icfd

YouTube:

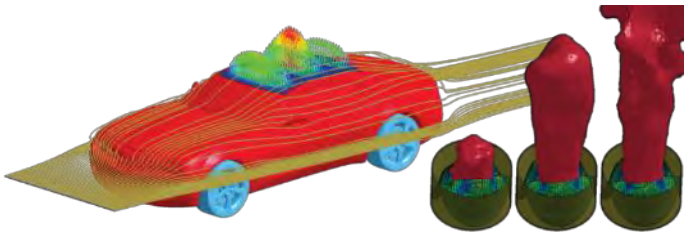
www.youtube.com/user/980LsDyna



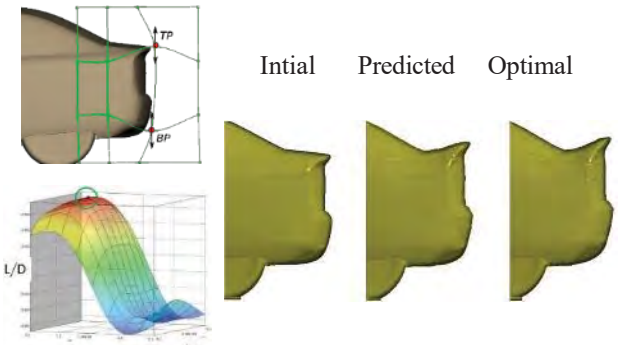
Accurate prediction of aerodynamic forces for turbulent flows



Coupling with Discrete Element Method (DEM) for water management simulations



Fluid-Structure Interaction analysis for a large number of applications including automotive and bio-medical industries



Shape optimization using ANSA® and LS-OPT®

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.

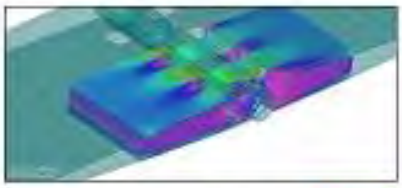
Topics Covered in this Short Course:

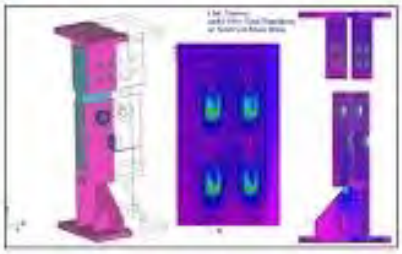
- Impact and Damage Modeling of Composites
  Application of MAT162 in Engineering and Research Problems
- Introduction to Composite Mechanics
  Introduction to Continuum Mechanics and Composite Mechanics

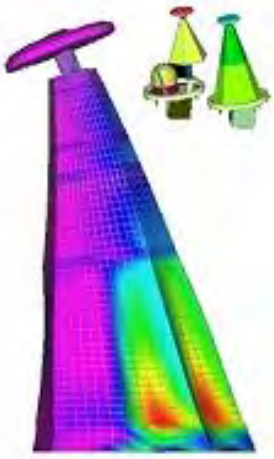
- Composite Material Models in LS-DYNA for Shell and Solid Elements
  Discussion on MAT2, MAT54, MAT59, & MAT162
- Theory and Practice in MAT162 Progressive Composite Damage Model for Unidirectional and Woven Fabric Composites
  MAT162 User Manual – Version 15A 2015
  Progressive Damage Modeling of Plain-Weave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

Oasys Suite version 16.0 now released

The Oasys Suite v16.0 includes a number of exciting new features and updates for PRIMER, D3PLOT, T/HIS, REPORTER and SHELL. Key highlights include:

PRIMER highlights:

Multiple stages can now be defined in simulation-based occupant positioning and seatsquash.
Full keyword support for R11 of LS-DYNA
Speed improvements for reading, writing and viewing models – now significantly faster for larger models
Morphing improvements – higher order morph boxes and integration with LS-OPT
Added the ability to mesh whole CAD components
New ICFD setup tool to allow easy creation of a CFD LS-DYNA analysis
Support for LS-DYNA IsoGeometric analysis models
Spotwelds and adhesive can now be created between solid parts and NURBs parts and well as shell parts
Speed improvements for model checking
New element quality checks added
New contouring options for forming analysis results, shell loading direction and element normals
Timestep information now read from the LS-DYNA output file for investigation within PRIMER along with error and warning messages

D3PLOT highlights:

New Material Attributes panel improves part-specific colour and lighting control
New capability to save and restore D3PLOT sessions
Loads can be displayed and contoured
Support for new database files and new data components added
Enhanced Measure menu
Enhanced Write menu
Support for rigid body data compression
Antialiasing

T/HIS highlights:

New capability to save and restore T/HIS sessions:
Extensive enhancements to the Curve Table
New data types and data components supported
Regression fit of data added
Block moving of curves
Antialiasing
Substantial enhancements to FAST-TCF and JavaScript functionality

REPORTER highlights:

Supports more fonts, giving you greater creative control over your reports, and allowing you to create templates that match your organisation's branding
Table and Autotable items can now be exported in Microsoft Excel format, complete with formatting (cell size, text alignment, font style, borders, colours, merged cells).
Various new functions have been added to the Item class of the JavaScript API to enable full control over Table and Autotable items. For example, it is now possible to:
Insert/delete/resize rows/columns
Merge/unmerge cells
Get/set cell properties (e.g. text, alignment, font, colour, border width)
Get/set cell conditions

Website:
https://www.oasys-software.com/dyna/news/oasys-suite-version-16-now-released/

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.

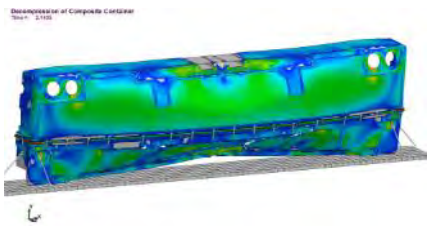
Our History

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.

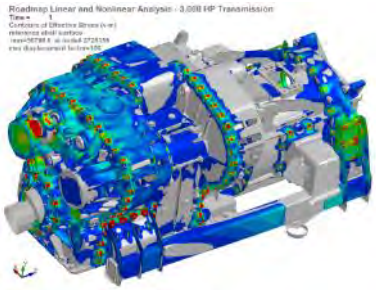
View our portfolio

FEA, CFD and LS-DYNA consulting projects

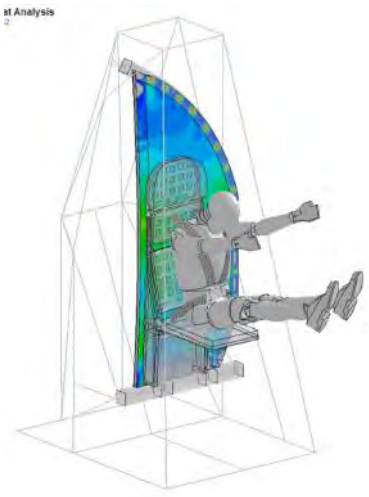
Composite Engineering



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.

Rescale Announces Strategic Partnership Offering with Siemens PLM

SAN FRANCISCO, Feb. 26, 2019

Rescale, the leader in enterprise big compute in the cloud, is pleased to announce a strategic collaboration with Siemens PLM Software. Siemens PLM Software has partnered with Rescale to enable SaaS delivery of Siemens' Simcenter™ portfolio on Rescale's ScaleX® platform. The joint offering enables customers to access compute resources on-demand from the largest HPC network in the world, as well as to take advantage of new hardware architectures as they are released. Users will be able to work entirely in the cloud if required for GUI centric processes and batch execution of multi-node solves. Additionally, this initiative will expand the amount of on-demand licensing options of Simcenter products that are currently available to a broader portion of the portfolio, including monthly GUI subscriptions and pay-per-use for solver licenses.

"Leveraging cloud infrastructure and flexible licensing models allows customers to explore their digital twin like never before, and Siemens' cloud strategy is a key enabler for their customers to get faster time to results and iterate more quickly on designs," says Joris Poort, Founder and CEO of Rescale. "Rescale is thrilled to partner with Siemens PLM Software on an initiative that brings increased innovation to customers and the broader engineering community."

Willy Bakkers, Vice President of Simulation at Siemens PLM Software stated, "The Rescale partnership helps Siemens PLM Software provide our customers with access to the most expansive and dynamic computing environment, helping customers get the most out of our advanced Simcenter simulation software solutions."

The first phase of this offering is available today for existing Siemens PLM Software customers with expanded on-demand offerings for new Siemens customers coming soon. For further information please visit http://www.rescale.com/siemens

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
Call for Paper

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 will invite domestic and foreign experts, developers and engineers from LSTC, and customers to share their experience 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 the 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, etc.

We 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

The interaction and communication between developers and end users is important to us. To promote communication between users, please submit a paper. Authors of accepted submissions will be invited to present during the Technology and Application Sessions.

(1) Application Areas

- Automotive crashworthiness
- Occupant safety and CPM airbags
- Metal forming
- Optimization
- Composites and other materials
- Robustness
- Spotwelding, bonding
- Implicit
- Pedestrian safety
- Impact, drop test
- Ballistics and penetration
- Fluid Structure Interaction and ALE
- Computational Fluid Dynamics
- CAE process integration
- Vibration, noise and fatigue
- Heat transfer
- Electro Magnetics
- DEM and SPH
- Cloud computing
- Simulation data management

Industry Fields:

- Vehicle Industry
- Aerospace
- Manufacturing Processes
- Biomechanics
- Civil Engineering
- Nuclear Engineering
- Seismic Engineering
- Ship Building/Offshore
- Transportation
- Daily consumer goods
- Locomotive
- General machinery
- Electronics

(2) Paper Submission:

Please send your one to two page abstract or full paper 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. Please write down your postal address, postcode, email address.
- Any problems about submission please contact: Elva Yu.
  Tel: 15001986675, Email: conf@lsdyna-china.com

(3) Abstract submission deadline: 20th August 2019
Notice of acceptance deadline: 1st September 2019
Full paper submission deadline: 20th September 2019

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

Prizes	Numbers of Awards	Awards
The First Prize	1	RMB5,000.00
The Second Prize	2	RMB3,000.00
The Third Prize	3	RMB2,000.00

The First Prize winner can attend the 2020 International LS-DYNA Users' Conference for free (including the round-trip ticket and hotel fee).

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.

Article courtesy of defense-aerospace

The first AC-130J has been delivered to the 4th Special Ops Sqn to replace its AC-130U Spooky, which are gradually being retired from active duty after more than 20 years of operation. (USAF photo)

4th Special Operations Squadron Receives First AC-130J Ghostrider

(Source: US Air Force; issued March 13, 2019)

HURLBURT FIELD, Fla. --- The 4th Special Operations Squadron at Hurlburt Field, is now home to Air Force Special Operations Command's newest aircraft – the Block 30 AC-130J Ghostrider gunship.

Similar to the Block 20 AC-130Js flown by the 73rd Special Operations Squadron, the Block 30 upgrade marks a major improvement in software and avionics technology over the current fleet of Block 20s.

"The Block 30 AC-130J is now our most lethal aircraft in AFSOC's inventory," said Maj. Brandon Hughes, AFSOC headquarters AC-130J requirements chief.

The new 4th SOS gunship is equipped with the precision strike package, which includes a mission management console, a robust communications suite, two electro-optical/infrared sensors, advanced fire control equipment, a precision-guided munitions delivery capability, as well as trainable 30 mm Mk 44 Bushmaster II and 105 mm M102 howitzer weapons onboard. Additional improvements include updated crew seats with added safety features and a relocation of equipment into more optimal locations.

The 4th SOS currently operates the AC-130U Spooky and has held the title as the most deployed squadron in the U.S. Air Force since 9/11.

"The men and women of the 4th SOS have been executing the close air support and air interdiction mission with one of the most feared gunships, the AC-130U, for 20 years," said Col. Michael Conley, 1st Special Operations Wing commander. "These updated capabilities provide them the most modernized gunship to date."

The Block 30 AC-130J will fulfill the same mission sets as the Spooky; however, it will cost approximately 1/3 to operate per flying hour due to the upgraded turboprop engines.

"The technology in this 5th generation gunship will ensure our combat relevance in the skies above today's battlefields and the battlefields of the future," Conley saidDéfense" which was held in Paris at the end of November, and gave a conference on the role of innovation in the FCAS project.

The Ghostrider reached initial operational capability in 2017, and the first Block 30 AC-130J will remain in a testing status for approximately one year before it becomes operationally deployable.

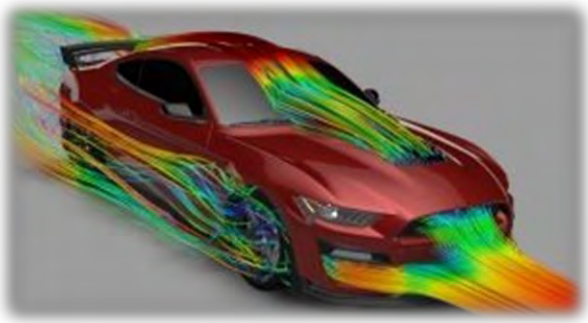
"The 4th SOS will start receiving J-qualified crewmembers in the coming months," said Lt. Col. Pete Ventres, 4th SOS commander. "The vast majority of U-model aircrews and maintainers will retrain into the AC-J to ensure we retain already-developed talent."

For now, Air Commandos with the 4th SOS will continue to operate the Spooky until it joins the AC-130H Spectres in retirement by the end of 2020.

"This is a significant milestone in our heritage and the gunship nation," Ventres said. "The AC-130J represents a leap into the future without abandoning the lessons of the past."

While technology continues to advance, the 4th SOS will keep their sights set on their main mission.

"The protection of special operations forces on the ground remains paramount," Ventres said. "The "C" in CAS stands for "Close," and when we're needed, that's where you'll find us."



Supercomputers and 3D Printing Are Secrets to All-New Mustang Shelby GT500 High Performance

DEARBORN, Mich., March 13, 2019 – When the 2020 Shelby GT500 goes on sale later this year, it will be the quickest-accelerating, most aerodynamically advanced street-legal Mustang ever, thanks to virtual testing in supercomputers and 3D printing.

Borrowing best practices from more than a century of racing, Ford Performance designers, powertrain and aerodynamics engineers functioned as a virtual racing team to test hundreds of designs both digitally and physically. They used state-of-the-art digital and additive manufacturing prototyping tools as part of a mission to make the ultimate, most advanced performance street-legal Mustang of all time.

"We created and studied designs among the engineering teams and proved out different strategies long before we built our first prototype cars," said Matt Titus, Ford Performance vehicle engineer. "Not only did this improve the effectiveness of the designs, it dramatically reduced the time it took to develop the GT500 – and the costs associated with that."

Every millimeter counts for the Mustang Shelby GT500 to deliver on downforce, braking and cooling targets. The team leveraged Ford's vast resources of advanced design simulation tools, including the Ford Performance technical center in Concord, North Carolina, and rapid 3D prototyping systems at its Advanced Manufacturing Center in Redford, Michigan. To physically validate the improving designs, Ford's wind tunnels in Michigan and Windshear rolling wind tunnel in Concord were also used.

Real-world testing still matters, so the Shelby GT500 team ran extended high-speed tests on some of the most notable racetracks across the United States – including Virginia International Raceway, NOLA Motorsports Park and GingerMan Raceway – to refine the aerodynamic designs and help the all-new Shelby GT500 deliver the fastest track times ever in a production Mustang along with improved driver control for greater confidence behind the wheel.

Delivering more than 700 horsepower using 93-octane fuel, maximizing cooling at the front is critical to the Shelby GT500's vigorous track performance, and where the team focused much of its efforts. At wide-open throttle, the cooling system needs to extract up to 230 kilowatts of heat energy, enough to heat a dozen homes. The massive front brakes reject another 100 kilowatts of heat at maximum braking, so the team utilized advanced 3D airflow modeling to maximize overall cooling while working to minimize impact on front-end lift and drag.

More than 500 3D cooling and aerodynamic designs were analyzed to maximize aero performance and cooling, with more advanced design models driven on full chassis simulators at the Ford technical center with professional racing drivers. Key modeling simulations included cooling systems, front fascia and splitter designs, along with brake ducting, rear spoiler designs and a large 6.03 square-foot louvered hood vent.

Speeding development time, the most promising designs were printed in a matter of days, not months, allowing the team to increase the fidelity of performance and aerodynamic refinement. For example, more than 10 front splitter wickers were printed and tested, some with minute modifications to perfect their design, with multiple versions of parts simultaneously sent out for track evaluation.

The team achieved maximum rear downforce of 550 pounds at 180 mph, leveraging the Mustang GT4 race-proven rear track wing to deliver the most downforce ever on a street-legal Mustang with available Carbon Fiber Track Package. An innovative new rear spoiler design, standard on the base 2020 Shelby GT500 and known by the aero team as "the swing" – a hybrid between a spoiler and a wing – is a result of the advanced simulations and prototyping process. With available Handling Package and Gurney flap installed, the swing works to deliver 379 pounds of rear downforce at 180 mph.

Keeping cool and precise on the track

High-performance cooling targets also factor into the design and virtual testing to help ensure consistent heat management and power delivery over extended sessions at the track. This includes a new performance fascia design that doubles the front opening volume and increases cooling pack airflow through six heat exchangers at top speed by 50 percent versus the existing Mustang GT350 design.

A removable rain tray further aids cooling and works to reduce underhood air pressure at high speeds, while a Shelby-specific rear diffuser helps channel under-car airflow.

A new dual-side thermostat routes coolant to a new auxiliary radiator, and a 600-watt brushless electric fan motor and performance aero fan shroud with 16 speed flaps improves cooling pack airflow while mitigating drag and front-end lift. Two new race-style oil and transmission coolers further improve powertrain cooling.

"This all-new aero design merges state-of-the-art design and materials technology with the craftsmanship of Ford racing expertise to create the most aero-capable Mustang ever," said Steve Thompson, Ford Performance vehicle dynamics engineer. "It's powerful, balanced and consistent – even over extended track runs – which works to deliver more fun and greater confidence for drivers."

The 2020 Mustang Shelby GT500 goes on sale this summer.

GT350, GT500 and Shelby are registered trademarks of Carroll Hall Shelby Trust.

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. Ford employs approximately 199,000 people worldwide. For more information regarding Ford, its products and Ford Motor Credit Company, please visit corporate.ford.com.

FEA Not To Miss

FEANTM new – Tutorial

YouTube

Tutorials
Webinars
Workshops

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
EM	LS-DYNA EM : Tutorial for Metal forming application (Part I)
Occupant	Occupant Modeling Workshops
Getting Started	Getting started With LS-DYNA (pdf)

Start your Monday with coffee or tea reading our engineering blog, at the FEA Not To Miss coffee shop.

Website: www.feantm.com

Class Showcase - Introduction to LS-TaSC®

mv@feainformation.com

Locations:
Livermore Software Technology Corp.
7374 Las Positas Rd. Livermore, CA 94551
1740 West Big Beaver Road Troy, MI 48084

Contact: classes@lstc.com
www.lstc.com/training

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Livermore Software Technology Corp.
7374 Las Positas Rd. Livermore, CA 94551
1740 West Big Beaver Road Troy, MI 48084 Contact: classes@lstc.com
www.lstc.com/training

Instructor: Imtiaz Gandikota
1 Day - $200, Students $100 w/student ID
Includes on-site continental breakfast, lunch, breaks and class notes Includes 30-day demonstration license for practice

Prerequisite: An introductory class, or equivalent knowledge in LS-DYNA is recommended

Description: This 1 day class provides an introduction to the use of the topology optimization and shape computation code (LS-TaSC) for design. It covers both theoretical concepts and practical aspects of topology optimization. The course includes workshop sessions in which the theoretical topics of the day are applied. The LS-TaSC graphical user interface is used to teach input preparation and post-processing.

Contents:
• Introduction to topology optimization using industrial examples
• LS-TaSC features
• Theory:
• Optimization formulation
• SIMP penalization
• Global and local optimization
• Design filtering
• Constrained optimization using multi-point method
• Termination criteria
• Setting up and running a simple topology optimization example
• Design parts with solids and shell elements
• Topology optimization using multiple load cases and multiple parts
• Free surface design
• Post-processing of results

LS-DYNA - Resource Links

mv@feainformation.com

LS-DYNA Multiphysics YouTube

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

FAQ LSTC

ftp.lstc.com/outgoing/support/FAQ

LS-DYNA Support Site

www.dynasupport.com

LS-OPT & LS-TaSC

www.lsoptsupport.com

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www.dynaexamples.com

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Class Directory

Directory

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

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 April/May

Introduction	
Introduction to LS-DYNA	3-4 April (T) 7-9 May 20-22 May (V)
Nonlinear Implicit Analyses	5 April (T)
Introduction to Isogeometric Analysis with LS-DYNA	27 May
Crash	
Contact Definitions	2 April (V)
Metal Forming	
Introduction to Draping Simulation with LS-DYNA	8-9 April
Metal Forming with LS-DYNA	10-12 April
Material	
Simulation of short fiber reinforced composites	1 April
Polymers/Elastomers	2-3 April
Simulation of continuous fiber reinforced composites	4-5 April
Modeling Metallic Materials	10-11 April (T)
Simulation of thermoplastics	10 April
User Materials	29 April

Conference Accompanying Seminars in Stuttgart and Koblenz, Germany

ICFD Incompressible Fluid Solver Composite Analysis	9-10 May
NVH, Frequency Domain, Fatigue	13 May (Ko)
Introduction to SPG Method for Manufacturing and Material Failure Analysis	13 May (Ko)
Resistive Heating and Battery Modeling	13 May (Ko)
Element Types & Nonlinear Aspects	17 May (Ko)
Simulation of Reinforced Composites	17 May (Ko)
Explosives Modeling for Engineers	17 May (Ko)
Concrete and Geomaterial Modeling	20-21 May
Paramter Identification with LS-OPT	22 May
Material Failure	

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

If not otherwise stated, the event location is Stuttgart, Germany. Other event locations are:
A = Aachen, Germany, Ba = Bamberg, Germany, G = Gothenburg, Sweden; L = Linköping, Sweden,
V = Versailles, France; T = Turin, Italy, Tr = Traboch, Austria, Z = Zurich, Switzerland

www.lstc.com

April 2019

Date				Location	Course Title	Days	Instructor(s)
Apr 3		Wed		*MI*	Introduction to LS-TaSC	1	I. Gandikota
Apr 4	Apr 5	Th	Fri	MI	Introduction to LS-OPT	2	I. Gandikota
Apr 8	Apr 10	Mon	Wed	MI	NVH, Fatigue, and Frequency Domain Analysis with LS-DYNA®	3	Y. Huang
Apr 25		Th		MI	CAE for Non-CAE Engineers	1	N. Karajan
Apr 29	May 1	Mon	Wed	CA	Introduction to Particle Methods in LS-DYNA®	3	B. Ren, Y.Wu, J. Xu

May 2019

Date				Location	Course Title	Days	Instructor(s)
May 2	May 3	Th	Fri	CA	Fracture, Failure, and Damage in LS-DYNA®	2	A. Tabiei
May 7		Th		MI	Nonlinear Implicit Analysis	1	N. Karajan
May 8	May 9	Wed	Th	CA	Rubber, Foam, and Viscoelastic Materials in LS-DYNA®	2	A. Tabiei
May 13	May 14	Mon	Tu	CA	Plasticity, Plastics, and Viscoplastic Materials in LS-DYNA®	2	A. Tabiei
May 14	May 17	Tu	Fri	MI	Introduction to LS-DYNA®	4	B. Aminjikarai
May 15	May 16	Wed	Th	CA	Composite Materials in LS-DYNA®	2	A. Tabiei
May 20	May 21	Mon	Tu	CA	User Defined Materials in LS-DYNA®	2	A. Tabiei
May 29	May 30	Wed	Th	MI	Comprehensive ALE and Structured-ALE Modeling Methods and Applications	2	I. Do, H. Chen

DynaS+

Complementary tools

LSTC Livermore Software Technology Corp.

OUT-06

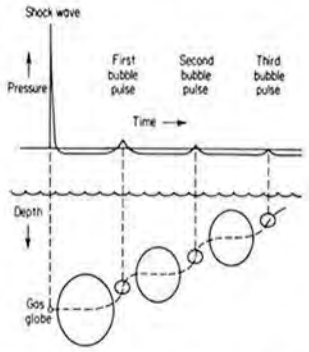
Underwater Shock Analysis with USA/LS-DYNA

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 (CAFE 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

Tel: +33 5 61 44 54 98 / Fax: +33 5 61 44 74 88 Website: www.dynasplus.com

Address: 5, avenue Didier Daurat - 31 400 TOULOUSE

A Survey of Eigen Solution Methods in LS-DYNA®

Roger Grimes, Liping Li, Eugene Vecharynski
Livermore Software Technology Corporation

Abstract

LSTC has been adding several new methods for solving a variety of eigenvalue problems in LS-DYNA. This talk will give a survey of two new methods including MCMS (our implementation of the AMLS algorithm), and an iterative based method based on the Locally Optimal Block Pre-Conditioned Conjugate Gradients Method (LOBPCG). These methods will be contrasted with our standard method of Block Shift and Invert Lanczos. We will also describe our implementation of Sectoral Symmetry, a method to vastly reduce the problem size for models with a high degree of rotational symmetry such as fan blades.

Introduction

The customer base for LSDYNA has been requesting more and more features based on the Implicit Mechanics and Implicit Linear capabilities. Historically LSDYNA has had one eigensolver which is based on the Block Shift and Invert Lanczos. To respond to customer requests we have added three new eigensolution capabilities to address special focus areas. This talk will survey and contrast the different capabilities.

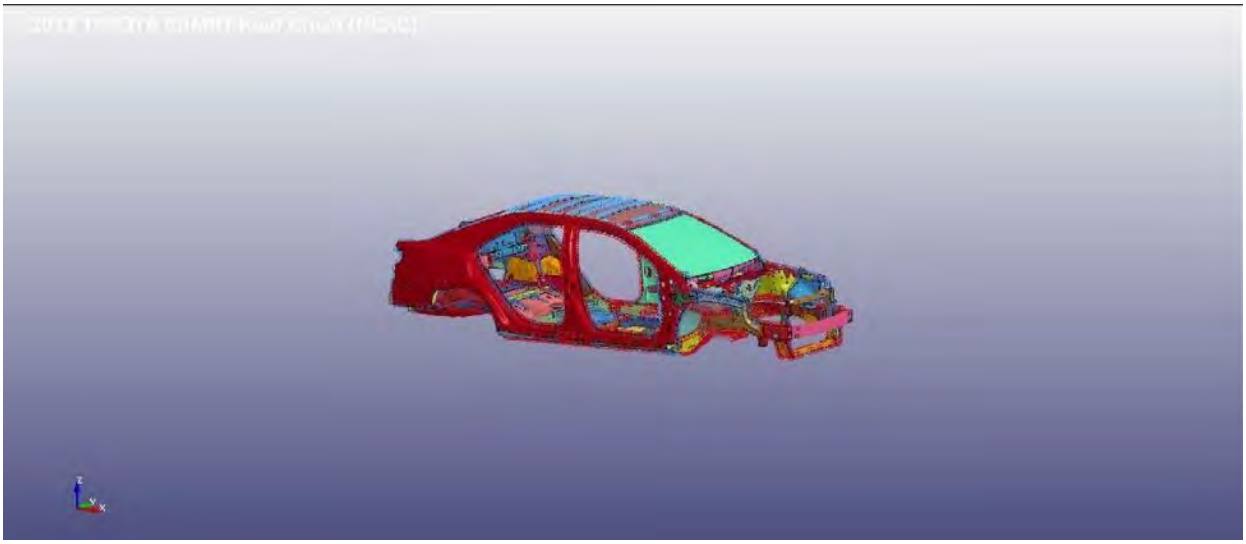
Block Shift and Invert Lanczos

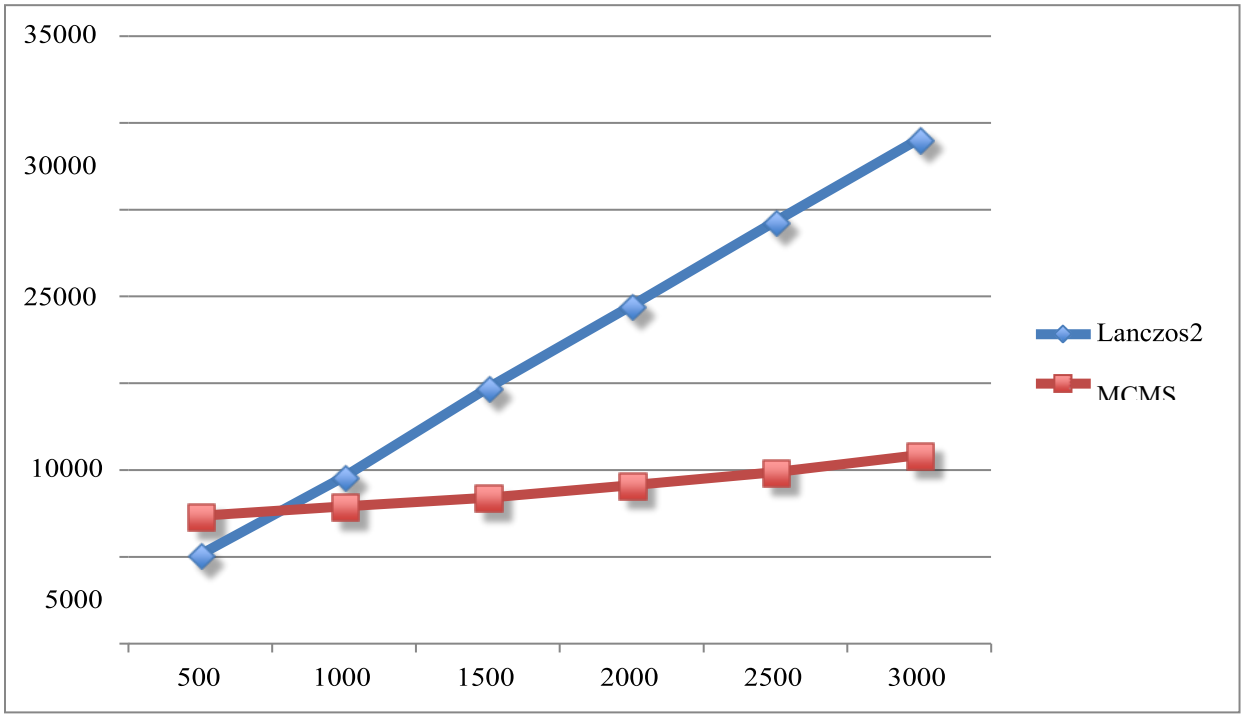
The eigensolution method based on Block Shift and Invert Lanczos has been in LSDYNA for 15+ years. It has proven to be a robust and reliable and efficient eigensolver. Lanczos computes the eigenmodes to the highest accuracy possible using numerical methods on current computers. We have both an SMP and MPP implementation. Currently it is the only eigensolver available in MPP. It should be the method of choice for computing 10 to 100s of eigenmodes or anytime accurate solutions are required. Its biggest drawback is in the area of model verification when the model has 100s of rigid body modes.

Multi-level Component Synthesis

Multi-level Component Synthesis (MCMS) is LSTC implementation of the Algebraic Multilevel Substructuring Method (AMLS). MCMS computes an approximation to the eigenmodes compared to Lanczos which is computing the eigenmodes to nearly machine precision. MCMS eigenmodes will usually have an error of 3% to 5%. AMLS, and our implementation MCMS, is best used to compute 1000 to 5000 modes. This kind of computation is usually the first step for analyses in the frequency domain. MCMS is available in Release 11 of LS971 but only in SMP. The distributed memory implementation is under design but no implementation has been started.

The following is a comparison of the SMP implementation of Lanczos and MCMS for a BIW model of the Camry model from the NCSA model.



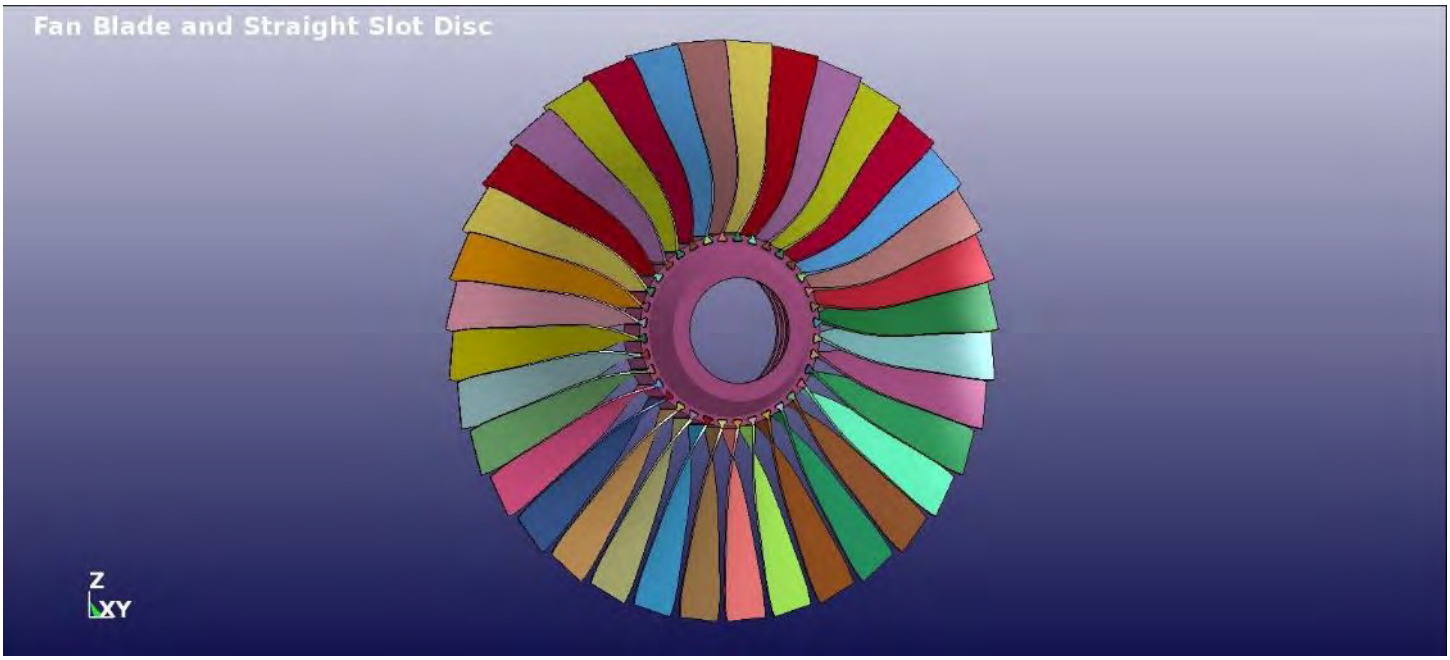


Locally Optimal Block Preconditioned Conjugate Gradient

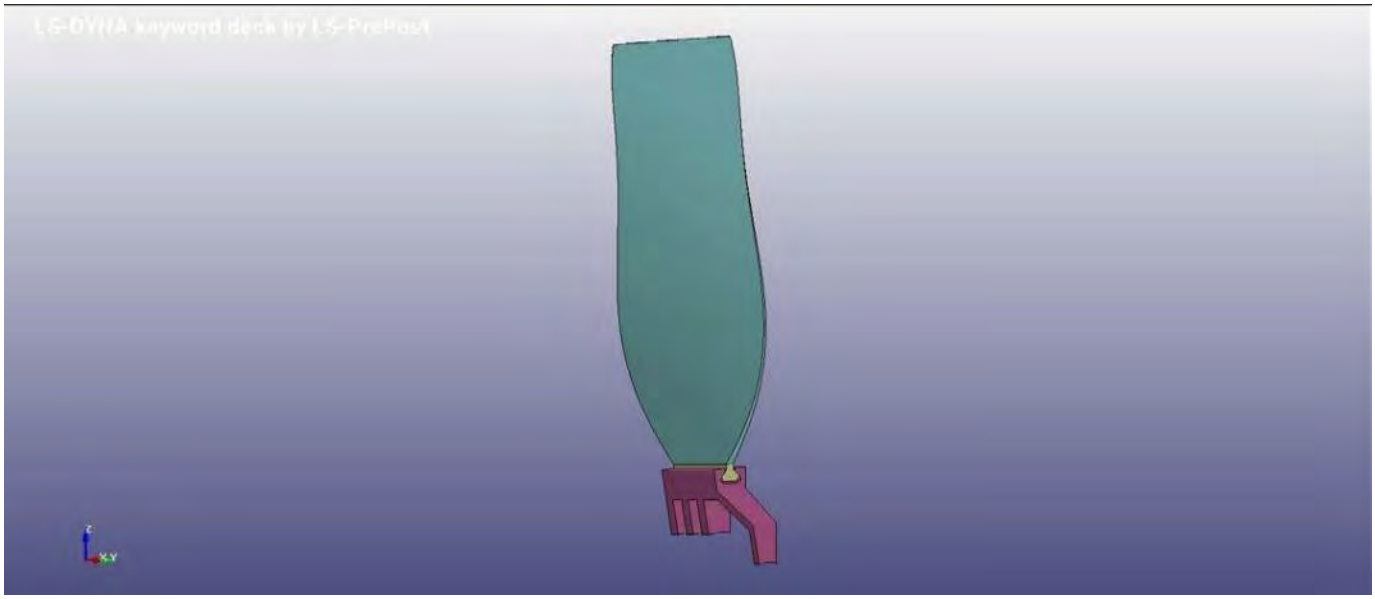
Locally Optimal Block Preconditioned Conjugate Gradient (LOBPCG) is an iterative based algorithm for computing a small number of eigenvalues for the same eigenvalue problem as Lanczos and MCMS. Instead of the direct factorization of K-σM used by Lanczos LOBPCG computes an approximate factorization of K using the Block Low Rank option in MUMPS. Because it does not perform a direct factorization it uses less computer resources than Lanczos. Our current implementation is still under development but does work well for computing a small number of eigenmodes near zero. LOBPCG requires a approximate factorization to use as a preconditioner. Our current implementation uses MUMPS and is SMP only. It is only in the development version of LS971 (that is it is not currently in Release 11). Our testing to date shows that in SMP LOBPCG scales better than Lanczos and is more efficient for computing up to 20 or 30 modes. The features of LOBPCG makes it a good choice for computing a small number of modes on a desktop workstation.

Sectoral Symmetry

Sectoral Symmetry can be used to reduce the size of the eigenmode computation for models with a large amount of rotational symmetry. Consider a model of a fan blade and hub



Instead of using the full model with 36 fan blades we can instead focus on just a single fan blade



If the analyst wants to perform a detailed study using 1 million solid elements for each fan blade plus 4 million more solid elements to represent the hub the eigensolver will need to deal with 40 million solid elements or 120 million rows in the matrices. This size problem will require a large MPP compute cluster. Instead sectoral symmetry can be used to reduce the model by 1/36. That would be approximately 1.1 million elements or 3.3 million rows. The eigenvalue problem is transformed from real symmetric to complex Hermitian but the size reduction might make this analysis possible on a capable desk side workstation. The drawback to this analysis is that you have to perform one analysis for each harmonic index to get the complete spectrum. In this case that is 1+36/2 or 19 separate analyses. LSTC implementation of Sectoral Symmetry is under development and is available in SMP in the development version of LS971. It should be noted that we are using a complex Hermitian version of LOBPCG to perform the actual eigencomputation once the matrices are formed. The MPP implementation of Sectoral Symmetry will be tied to the MPP implementation of LOBPCG. And that is dependent on the BLR methodology for the approximate factorization being available in MPP.

Summary

We have presented an overview of the three new capabilities in LSDYNA for eigenvalue computations. We highlighted MCMS capability for efficiently computing good approximations for 1000s of modes. We demonstrated LOBPCG is effective for computing a small number of eigenmodes. And we showed the new Sectoral Symmetry feature for models with a high degree of rotational symmetry.

FSI Capabilities for the CESE and Chemistry Solvers in LS-DYNA®

Kyoung-Su Im, Zen-Chan Zhang, and Grant Cook, Jr.
Livermore Software Technology Corp.

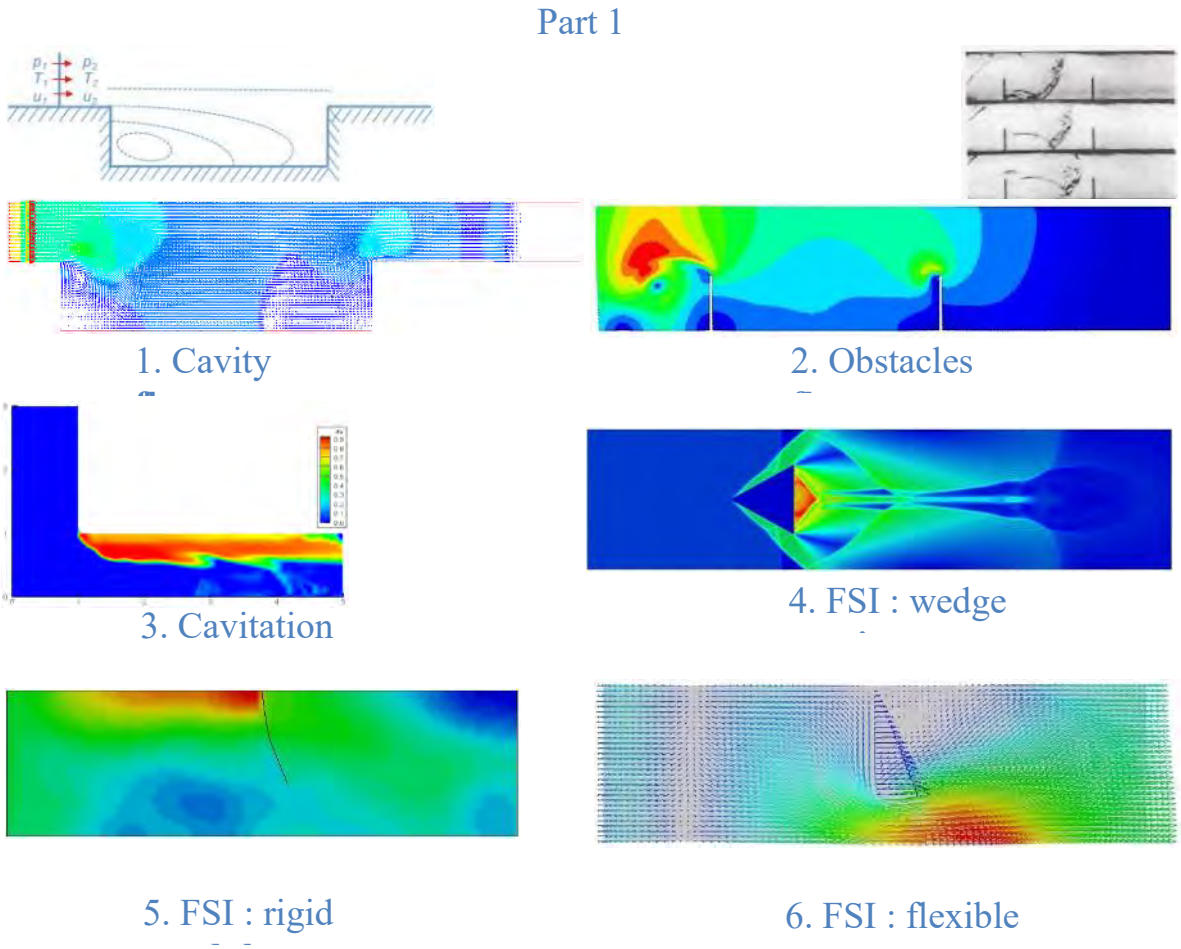
Abstract

Recently, we have developed a new class in the area of compressible flow, gaseous explosion, and FSI for users to assist from the fundamental problems to very complex high level FSI problems by using CESE and Chemistry solvers in LS-DYNA®. In this presentation, we will give a step-by-step explanation about the main goal of the class, overviews of the compressible and chemical kinetics theories,the current capabilities of solvers, and the comprehensive 10 exercise problems which consist of two parts: i) the first part covers the compressible flows, cavitation, FSI, and FSI with multi body dynamics problems, and the second part desisgined the basic concepts of chemical kinetics, closed adiabatic spatially homogeneous premixed reactors, the detonating flows, and the deformation and failures of sturctures in the nuclear containment by H_2 explosions. Each exercise problem consists of the problem descriptions, modeling methods, illustrative step by step keyword construction through animation movies, program run and the post processing. It is strongly believed that upon completing the course, users can easily not only develop the keyword files of their own models, but also achieve enough knowledge for the compressible flows, gaseous explosion with the realistic chemistry and also fluid structure interaction problems.

Introduction

This course provides for users to assist from the fundamental concepts to high level FSI applications with CESE Compressible and Chemistry solvers in LS-DYNA®. In the coure, the main goal is to provide the comprehensive and step by step learning approaches with 10 exercises. The course consists of two parts: the part 1 covers the compressible flows, cavitation, FSI, and FSI with multi body dynamics problems, and part2 covers the basic concepts of chemical kinetics, closed adiabatic spatially homogeneous premixed reactors, the detonating flows, and the deformation and failures of sturctures in the nuclear containment by H_2 explosions. Each exercise consists of the problem descriptions, modeling methods, step by step keyword construction through animation movies, running the program, and the post processing. Upon completing the course, users can easily construct not only the keywords for their own models, but also grep enough information for the compressible flows, gaseous explosion with the realistic chemistry and also fluid structure interaction problems.

Part 1 Compressible flows and FSIs

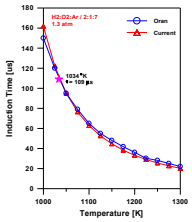


Part 1: Compressible Flows and FSIs

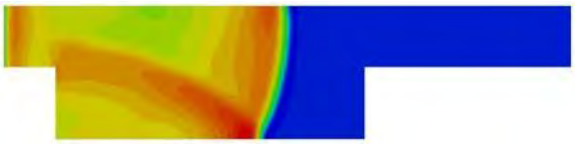
- Introduction to CESE compressible solver
- Shock moving, diffraction, and reflections in cavity and obstacle chamber
- Cavitation flow
- Moving wedge confronting shock waves
- Rigid and flexible pendulums in the flows

Part 2 Compressible flows and FSI

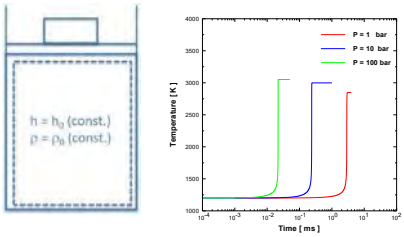
Part 2

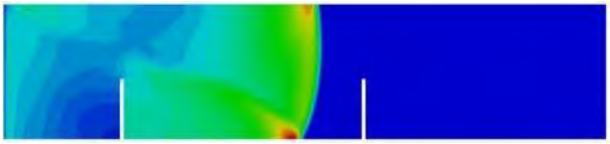


7. Const. reactors



8. Detonating flow in cavity





9. Re initiation in obstacles

10. FSI : H2 gas explosions in nuclear

Part 2: Chemically Reactive Flow and FSI

- Introduction to CHEMISTRY solver
- Basic concepts of the chemical kinetics
- Closed adiabatic spatially homogeneous premixed reactors
- Detonating flows and reinitiation

Deformation and failures of sturctures by gaseous explosions.

References

1. "Numerical Heat Transfer and Fluid Flow," by Patankar, S. V., 1980, Hemisphere.
2. "Computational Fluid Dynamics for Engineers," Vol. I by K. A. Hoffmann and S. T. Chiang, 1993, Engineering Edu. Sys.
3. “Computational Methods for Fluid Dynamics”, by Joel H. Ferziger and M. Peric, 1999, Springer-Verlag.
4. “Computational Fluid Mechanics and Heat Transfer" 2nd Edition by Anderson, Tannehill & Pletcher, 1997, Taylor and Francis, Washington D.C.
5. "Fundamental Mechanics of Fluids," 2nd ed. by Currie, I. G., 1993, McGraw Hill.

BETA
SIMULATION SOLUTIONS

BETA CAE Systems. www.beta-cae.com

BETA CAE Systems - ANSA

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

BETA CAE Systems µETA

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

Solutions for:

Process Automation - Data Management – Meshing – Durability - Crash & Safety NVH - CFD - Thermal analysis - Optimization - Powertrain
Products made of composite materials - Analysis Tools -
Maritime and Offshore Design - Aerospace engineering - Biomechanics

DatapointLabs **www.datapointlabs.com**

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

The compary meets the material property needs of CAE/FEA analysts, with a specialized product line, TestPaks®, which allow CAE analysts to easily order material testing for the calibration of over 100 different material models.

DatapointLabs maintains a world-class testing facility with expertise in physical properties of plastics, rubber, food, ceramics, and metals.

Core competencies include mechanical, thermal and flow properties of materials with a focus on precision properties for use in product development and R&D.

Engineering Design Data including material model calibrations for CAE Research Support Services, your personal expert testing laboratory Lab Facilities gives you a glimpse of our extensive test facilities Test Catalog gets you instant quotes for over 200 physical properties.

ETA – Engineering Technology Associates **www.eta.com**

etainfo@eta.com

Inventium Suite™

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

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

PreSys

Inventium's core FE modeling toolset. It is the successor to ETA's VPG/PrePost and FEMB products. PreSys offers an easy to use interface, with drop-down menus and toolbars, increased graphics speed and detailed graphics capabilities. These types of capabilities are combined with powerful, robust and accurate modeling functions.

VPG

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

DYNAFORM

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

ESI Group www.esi-group.com

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

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

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

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

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

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

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

JSOL 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

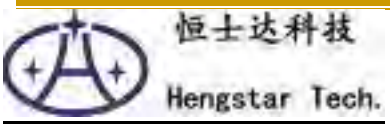
www.predictiveengineering.com

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.



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

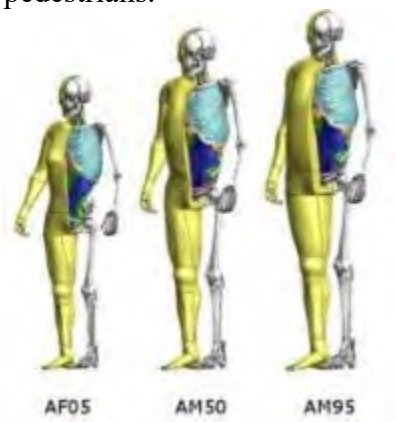
Taiwan	**SiMWARE Inc..**			
	www.simware.com.tw			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	FCM

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.

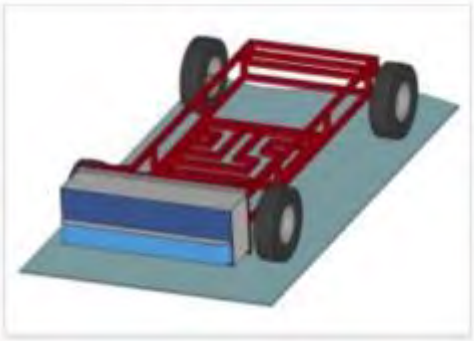
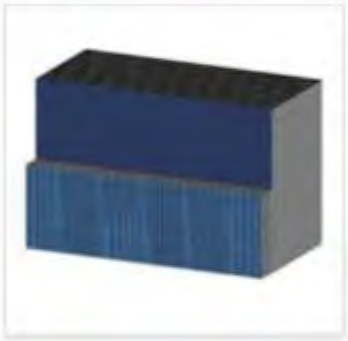
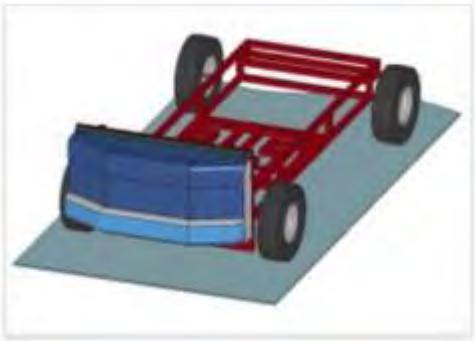
LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) models:

- 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.

Social Media

FACEBOOK

BETA CAE Systems
CADFEM
ESI Group
Lenovo

TWITTER

BETA CAE Systems
ESI Group
ETA
CADFEM
Lenovo

LINKEDIN

BETA CAE Systems
CADFEM
DYNAmore Nordic
ETA
ESI Group

YOUTUBE

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

GOOGLE+

BETA CAE Systems