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ANSYS LST

Issue 1, January 2020

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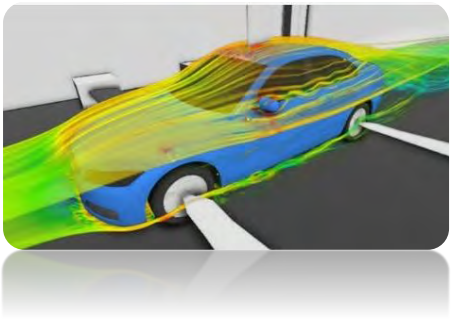
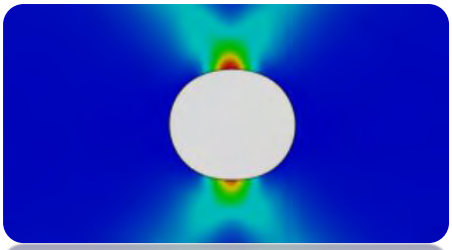
ANSYS

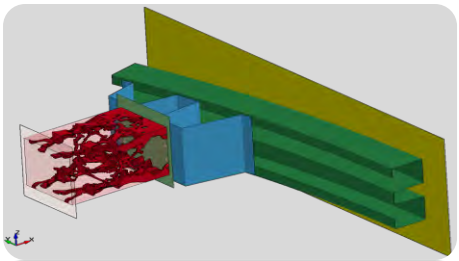
BETA CAE Systems



DYNAmore GmbH



LST - LS-TaSC



16th International LS-DYNA® Conference

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The focus is engineering technical solutions/information.

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Simplified and Traditional Chinese

The focus is engineering technical solutions/information.

Livermore Software Technology, an ANSYS company

Development of LS-DYNA, LS-PrePost, LS-OPT,
LS-TaSC (Topology), Dummy & Barrier models and
Tire models for use in various industries.

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Platinum Particpants

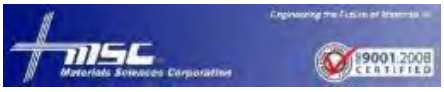


Table of contents

About ANSYS, Inc.

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where ANSYS software played a critical role in its creation. ANSYS is the global leader in engineering simulation. Through our strategy of Pervasive Engineering Simulation, we help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and create products limited only by imagination. Founded in 1970, ANSYS is headquartered south of Pittsburgh, Pennsylvania, U.S.A., Visit www.ansys.com for more information.

Published on December 27, 2019 by Shawn Wasserman
ANSYS LS-DYNA, ANSYS Mechanical, ANSYS Workbench, Automotive

What is Emobility and How Do Engineers Design Electronic Cars?

Emobility refers to the use of electrified vehicles for transportation purposes. It could be a vehicle that is fully or partly electric, like a hybrid.

“Emobility has become a trend that is on the rise,” says Sandeep Sovani, director of industry marketing at ANSYS. “In major cities, you can spot an electric or hybrid every ride. The trend is fueled by many factors including clean energy, petrol costs and climate change fears.”

People, governments, automotive companies and the general community are jumping on board —as evidenced by growing incentives like specialized parking spots, tax breaks and vehicle options.

Electric vehicle incentives are proof of the emobility trend.

But what are the engineering challenges preventing electric cars from overtaking transportation systems?

What are the Biggest Barriers to Emobility?

The biggest challenges to emobility are energy storage, charging and cost.

"If we look at a car today, we expect it to have two important features that are often taken for granted. One, that it will drive about 400 miles before refueling. And two, that we can charge it at any gas station in about 5 minutes," says Sovani.

Energy storage and battery charging are some of the biggest emoblity challenges.

Currently, electric vehicle battery technology can't accommodate these expectations, especially in cold climates that affect performance.

Additionally, most electric cars are luxury items. Considering the costs and travel limitations, it's no wonder why they haven't dominated the market.

However, not all is lost. Engineers need to find solutions to these challenges for electric cars to become dominant.

"The majority of consumers don't care what fuel goes into a car," predicts Sovani. "You give it the fuel it needs to meet the range and recharging expectations. Once engineers develop electric solutions to meet these expectations, gasoline and diesel will be phased out."

Are There Signs that Electric Vehicle Battery Technology Will Gain Popularity?

The electric car has gained the public interest a few times throughout history. However, it has yet to dominate the market despite a modern concept being introduced in the 90s and Tesla's announcement of its electric sportscar in 2006. Currently, they are a niche option, popular enough that major publications, like U.S. News & World Report, see fit to rank the top models available.

The Volkswagen I.D. R Electric car is breaking speed records around the world.

However, electric cars have entered into the racing world in a big way. The Volkswagen ID. R Electric car has recently broken records at Pikes Peak and Nürburgring Nordschleife. Sovani points out that on

these tracks the battery-powered vehicle had a few benefits when compared to traditional internal combustion engines.

First, its electric powertrain doesn't need oxygen to operate. So, it can maintain top efficiency in the high altitude of Pikes Peak. Second, the battery only needed to run for the 8-minutes to complete the course. So, engineers could use a lighter battery by pushing it to its thermal and energy capacity limits.

"Pikes Peak was a big victory for emobility. The previous record was broken by nearly a minute, which is an incredible feat given that teams usually struggle to improve these records by a few seconds. It is fascinating," says Sovani. "This raises the profile of electric vehicles in the public eye. There is no one reason people buy electric, but I think this will be one of the things they think about when they do."

Marco Oswald, technical account manager for Continental at ANSYS says, "motorsports are an extreme example of an electric powertrain. Original equipment manufacturers (OEMs) and Tier 1 suppliers are working on mass market technology to bridge internal combustion engines and electric cars. Systems simulations can help to optimize these vehicles for cost, power and efficiency."

How to Design an Electric Powertrain

Systems simulations are some of the most important tools to designing optimal electric powertrains.

"Recently, we saw a shift from automotive engineers optimizing components to optimizing systems and system integrations," says Oswald. "Users realize that they have to consider each component as a part of a system and all the multiphysics that entails."

For instance, by modeling their race car's system, and how it reacts to the track, Volkswagen Motorsports was able to optimize its electric car for Pikes Peak without overengineering the weight of the battery.

Systems simulations are crucial to designing optimal electric powertrains.

However, the design criteria of electric vehicles on racetracks are not the same as those on public roads. For instance, consumer grade batteries will need to last 10- to 15-years, travel hundreds of miles per charge and hundreds of thousands of miles per lifecycle. A far cry from the 8 minutes at Pikes Peak.

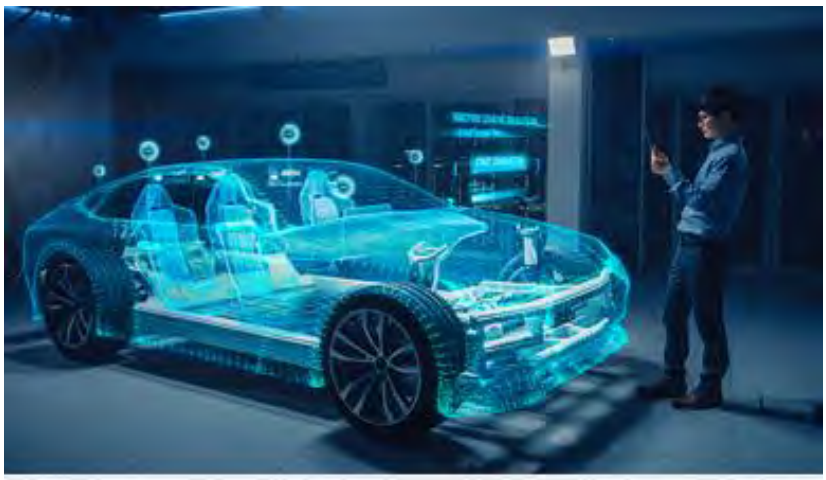
Even though the goals have changed, systems simulation can still be applied to the design of commercial cars. Instead of optimizing the systems to an 8-minute racetrack, engineers can optimize the car to the duty cycle it will experience over its lifespan.

To gain insights into the duty cycle of a car, engineers will need to turn to digital twins. Wolfram Schloter, enterprise account manager for Continental at ANSYS, elaborates: "Systems simulation is one step away from twin building. Here you can make observations on how a system will behave and compare it to how it is used in the real world."

Through the digital twin, engineers can gather information on a car's performance and loads. From there, they can plug that data into systems simulations to gain insights into everything from maintenance cycles to further design improvements.

Are Companies Taking the Steps They Need to Design for Emobility?

To successfully design cars for emobility, companies need to focus on systems engineering. Otherwise, they will be limited to time-consuming and expensive physical prototypes.



An engineer works to optimize a battery system. But to optimize this subsystem in the context of the whole, engineers will need systems simulations or expensive physical prototypes.

Batteries and brakes are complex systems to begin with. Once you realize they are subsystems of the electric powertrain, they become even more complicated.

Oswald says, "Using systems simulation, we can model what happens to each subsystem under different scenarios, weather and driving conditions. You can then gain insights into how the whole system will behave when they all run together."

Despite the potentials of systems simulation, some companies are struggling to keep up with this new design philosophy.

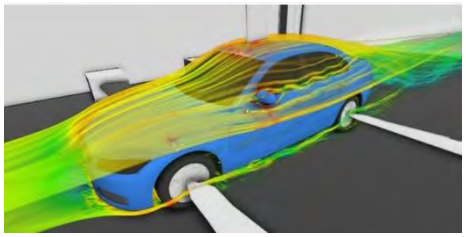
He adds, "Many are still business as usual. If they remain this way, they won't be competitive. Their time to market will increase while the competition will get faster. That competition will also be able to optimize every system of their product under several conditions. That can't be done by optimizing on a part-by-part basis. By integrating systems simulation into the design cycle, companies can reduce iteration loops to save time and money."

Schloter agrees, stating,"When engineers see the effects of using systems simulation for the first time, they are convinced. The main reason companies employ it is to get ahead of their competition."

To learn how to simulate emobility battery systems, watch the webinar: VW Motorsport Presents: Battery Simulation - An Essential Technology for the ID. R at Nürburgring and the Record at Pikes Peak.

Or visit ANSYS at CES. Learn more at: discover how simulation speeds development at CES.

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 v20.1.0 of its software suite

December 27, 2019

BETA CAE Systems announces the release of version 20.1.0 of its software suite with solutions for every stage of the product development process.

The v20.1.0 paves the way for more efficient process streamline and acceleration, as it successfully embraces noteworthy enhancements in the lately introduced functionality of v20x series, coupled with distinctive new features.

Some key points about the new tools and the noticeable software features of this version are highlighted below.

New tools & Highlights

ANSA: Towards an even more efficient model build-up process, ANSA v20.1.0 expands the already introduced Standard Parts Library concept, embracing the notion of Fasteners' automatic recognition, handling and modeling through Features Manager. Version 20.1.0 invites you to delve further into the core of BETA products by introducing new features , such as the User Defined Quality Criteria, and the enrichment of the Virtual Reality implementation with Morphing and Optimization functionality.

EPILYSIS: EPILYSIS, comes with extended functionality for SOL200 Multidisciplinary Optimization. It expands Topology Optimization capabilities with MAC-based mode-tracking, as well as Density Filtering Method and Maximum Member Size (TVMAX).
Further enhancing interoperability and interaction with other simulation software, ANSA users can now create various representations of Reduced Order Models from large scale FEM models, using EPILYSIS (or META), and then export them for use in 3rd party multi-body dynamics and control system software.

META: META goes a long way in the Graphics area, providing enhancements not only in the field of visualization, but also in the speed performance. The new version augments the Virtual Reality experience via new features, such as Voice Commands, and upgrades in existing features related to model manipulation and handling, such as Explode and Teleport.

Noteworthy performance improvement in METADB files and dedicated toolbars for NVH analysis are amongst the new tools and features that add value to our post-processing solutions. Same time, new classes supplement the creation, modification and deletion of data from Report and Spreadsheets. Coupled with a new META script API, these developments offer less memory consumption and faster execution.

KOMVOS: Following its distribution as a stand-alone application, this version, amongst other developments, brings a new layout to display DM relationships increasing efficiency in core operations, and performance in all user scenarios.

RETOMO: The introduction of Python support in RETOMO enables the acceleration of even the most

demanding and time-consuming image and mesh processing actions, and makes possible the training and application of Artificial Intelligence via a Python script.
Not to be missed, the significant performance improvement for large projects, as part image manipulation and loading of large meshes take place now much faster.

For more details about the new software features, enhancements and corrections please, refer to the Release Notes document.

Graphic Requirements

Upon v20.1.0, the minimum graphic requirements for ANSA and META are:
AMD or NVIDIA GPU with at least 1GB of video memory and OpenGL 3.3 support.

In case of unsupported hardware in Windows or Linux, ANSA and META will automatically fallback to software rendering using Mesa LLVM rasterizer pipeline. Additionally, Mesa can be manually activated.

For more details please refer to the Release Notes document.

New Documentation

Best practices: Working with fastener library.

Compatibility and Supported Platforms

ANSA files saved by all the first and second point releases of a major version are compatible to each other. New major versions can read files saved by previous ones but not vice versa.

META Project files saved from version 20.1.0 are compatible and can be opened by META version 20.0.0 or later. To be readable by META versions earlier than v20.0.0 or v16.0.0, they have to be saved selecting the option "Version 16.0.0" or "Version <16.0.0".

Support for Mac OS has been discontinued.

Support for 32-bit platform has been discontinued for all operating systems.

Download

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 for software distribution details.

What to download

All files required for the installation of this version reside in the folder named "BETA_CAE_Systems_v20.1.0" and are dated as of December 27, 2019. These files should replace any pre-releases or other files downloaded prior to that date.

The distribution of this version of our pre- and post-processing suite is packaged in one, single, unified installation file, that invokes the respective installer and guides the procedure for the installation of the required components.

For the installation of the software on each platform type, the.sh installer file residing in the folder with respective platform name, for Linux or the respective .msi installer file for Windows, have to be downloaded.

In addition to the above, optionally, the META Viewer is available to be downloaded for each supported platform.

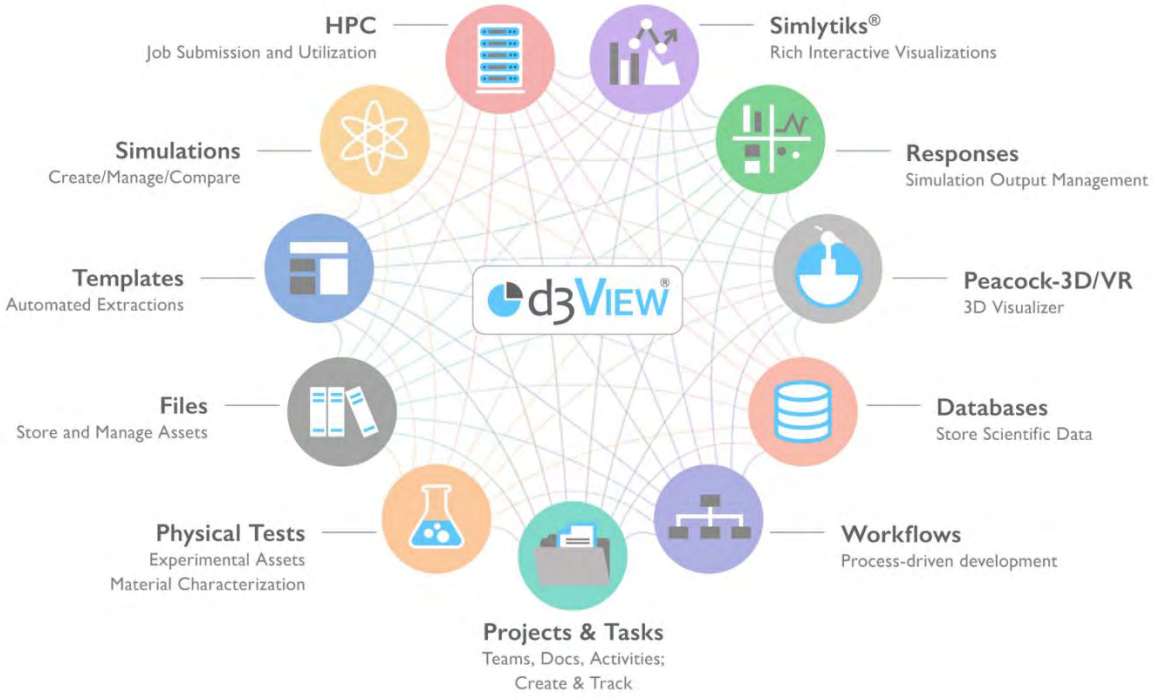
The tutorials and the example files reside in the folder named "TUTORIALS". This folder includes the complete package of the tutorials and example files, and a package with only the updated ones.

The Abaqus libraries required for the post-processing of Abaqus .odb files are included in the installation package and can be optionally unpacked.

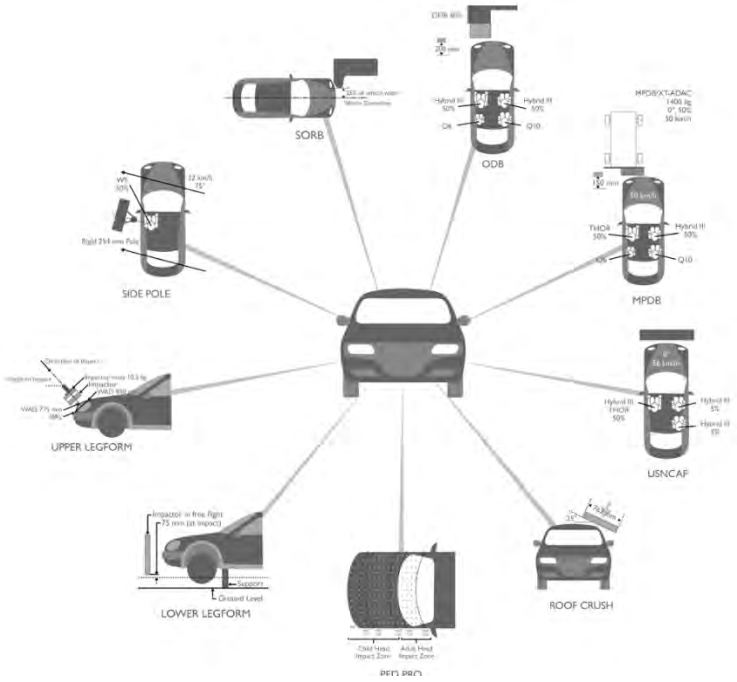
Earlier software releases are also available in the sub-directory called "old" or in a folder named after the product and version number.

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 Platform Components



d3VIEW Built-In Automotive Templates



www.d3view.com.

For more information email info@d3view.com

Author: Christian Frech christian.frech@dynamore.de

Announcement and Call for Papers

16th German LS-DYNA Forum
October 7 - 9 2020, Ulm, Germany

Conference Website: www.dynamore.de/forum2020-e

Call for Papers
we kindly invite you to participate at the16th German LS-DYNA Forum and encourage you to actively contribute to the conference agenda by submitting a presentation about your experience with LS-DYNA, LS-OPT or LS-TaSC. Participation without a presentation is also worthwhile to exchange your knowledge and discuss new solution approaches with other users.

Besides presentations from users, there will be also selected keynote lectures of renowned speakers from industry and universities as well as developer presentations. The popular workshops on various topics will also be continued.

We hope that we have stimulated your interest and are looking forward to receiving your abstract and to seeing you in Ulm.

Conference languages
German and English

Venue
Maritim Hotel and Conference Center Ulm

Address:
Maritim Hotel
& Congress
Centrum Ulm

Basteistraße 40
D-89073 Ulm
Germany

Directions
Ulm can be reached easily via the airports Frankfurt, Munich and Stuttgart. From the airports are connections with the train ICE.

Abstract submission
Please submit your abstract (maximum length 2,500 characters) by E-Mail to forum@dynamore.de or online at: www.dynamore.de/abstract2020-e

Please note: A full paper is not required, only a 2-page extended abstract.

Important Dates
Abstract submission: 29 May 2020 Author notification: 3 July 2020
Two-page abstract: 7 September 2020

Participant fees
Industry speaker: 400 Euro
Academic speaker: 300 Euro
Industry: 575 Euro[1)] / 625 Euro
Academic: 380 Euro[1)] / 430 Euro
[1)] Registration before 26 June 2020. All plus VAT.

Exhibiting and sponsoring
Please request further information.

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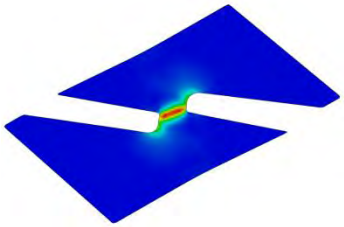
Author: Christian Frech christian.frech@dynamore.de

Material Competence Center moves into new premises

Material Competence Center
Access to high-quality material data down to the failure and fracture range is critical for the predictive capability of simulation calculations, enabling the identification of all necessary model parameters and ultimately the successful calibration of material models. To this end, DYNAmore has in recent years advanced the data acquisition from experiments and the efficient parameterization of material models and recently bundled the competences of our employees with the move to new premises and the creation of a Material Competence Center in Leinfelden-Echterdingen near Stuttgart, Germany, at one location.



Service
The aim of the LS-DYNA Material Competence Center is to offer the entire engineering service from a single source, starting with the execution of the test up to the delivery of a material card adapted for the special customer application. We coordinate the test planning and combine this know-how with DYNAmore's many years of experience in the field of LS-DYNA material models in order to apply methods for efficient parameter identification. In case of special applications, e.g. high dynamics or thermos-mechanically coupled investigations, we cooperate with well-known material laboratories regarding the experimental scope. In addition to the provision of material cards for common and established materials, we also offer the identification of parameters of the numerous extended and more complex material models of LS-DYNA.

Areas of expertise

- Metallic materials up to failure prediction (GISSMO, eGISSMO, DIEM, etc.)
- Polymers and composites (non-reinforced, short fiber-reinforced, continuous fiber-reinforced)
- Elastomers
- Glass (float, thermally or chemically tempered) and ceramic materials
- Connection technology (punctiform, linear, flat) Metallic materials up to failure prediction (GISSMO, eGISSMO, DIEM, etc.)
- Polymers and composites (non-reinforced, short fiber-reinforced, continuous fiber-reinforced)
- - Elastomers
- - Glass (float, thermally or chemically tempered) and ceramic materials
- - Connection technology (punctiform, linear, flat)

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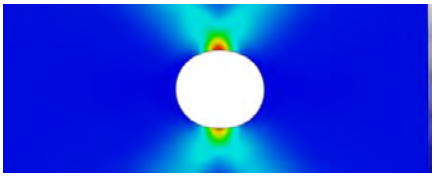

Registration for Open Day on 30 January 2020

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.

Farasis Energy Breaks Through the Electric Vehicle Market Thanks to ESI's Virtual Prototyping

Date: 6 Jan 2020 Location Paris, France

ESI Group, leading innovator in Virtual Prototyping software and services for manufacturing industries, helped Farasis Energy, a Chinese-American battery provider, win in recordbreaking time, a call for tenders made by a premium German automotive OEM. Thanks to ESI's expertise, the reliability of the virtual prototype of the new Farasis battery model was decisive in a "zero real prototype" procedure, stipulating the elimination of any physical prototype.

The move of the automotive industry toward electrification is seemingly unstoppable. Manufacturers are announcing aggressive plans for Electric Vehicle (EV) production, and the International Energy Agency says the number of EVs will grow from 3 to 125 million by 2030. So, it's no wonder that new players are entering the market, breaking the traditional rules of product design – new players like lithium-ion battery maker Farasis Energy. Looking to collect wins in this fast-growing market, the team at Farasis relied on ESI's expertise to prove to a major German car maker that they were the best supplier – based solely on a virtual prototype. This collaboration around ESI's Virtual Performance Solution (VPS) allowed to virtualize and secure the behavior of the battery in vibration or vehicle crash situations.

Dr. Matt Klein, Advanced R&D Director at Farasis Energy, emphasized the key role ESI played in this project: "Half-way through the bidding process, the manufacturer actually decided to remove the physical prototype step – they would make their decision based on the virtual prototype. In just 8 months, we went from limited Virtual Prototyping capability to winning those bids. The head of the whole program conducting the bidding process went out of his way to tell us that the mechanical simulation was an instrumental part in helping us get the design approved. We could not have done that without ESI. Our partnership with ESI is truly strategic in bringing our simulation capabilities to a global leading standard."

Two fundamental elements differentiated ESI's VPS in this project:

- The reliability of the results, eliminating the need for a real prototype verification, as a result of the consideration of complex physical phenomenon inside the battery.
- The integration level of different virtual vibration and crash tests in one solution, allowing iteration loops and quick decisions.

Farasis relied on ESI's proven knowledge of the automotive industry and ability to provide real results, virtually, thanks to virtual prototyping. The capability to build a global model, covering several engineering disciplines, led to a highly efficient workflow and ultimately a cost-effective solution for Farasis.

About Farasis

Farasis Energy, Inc. created in California in 2002 is a company specialized in the conception and distribution of batteries. Present in China (headquarters), in the Silicon Valley (R&D center), and in Europe, the Group is one of the world leaders in his sector. Farasis' ambition is to position itself as a pivot to better meet the challenges of its industrial clients: saving time to market and the costs of production while maintaining a high level of reliability and safety.

ESI and Farasis will jointly showcase their expertise and partnership at the CES 2020 in Las Vegas. Meet them in ESI Booth: LVCC, Automotive Section - North Hall, booth #9020

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About ESI Group

ESI Group is 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. Coupled with the latest technologies, Virtual Prototyping is now anchored in the wider concept of the Product Performance Lifecycle™, which addresses the operational performance of a product during its entire lifecycle, from launch to disposal. The creation of a Hybrid Twin™, leveraging simulation, physics and data analytics, enables manufacturers to deliver smarter and connected products, to predict product performance and to anticipate maintenance needs.

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

DYNAFORM is a simulation software solution, which allows organizations to bypass soft tooling, reducing overall tryout time, lowering costs, increasing productivity & providing complete confidence in die system design. It also allows for the evaluation of alternative and unconventional designs & materials.

ACP OpDesign

A performance-driven, holistic product design development method, which is based on design optimization. ACP incorporates the use of multiple CAE tools to generate an optimal design solution. 3G Optimization is employed and allows engineers to design a concept model using a holistic design approach. It incorporates material types and its properties (Grade and Gauges), Geometry (Shape) and manufacturing processes for the optimum weight and performance.

VPG Suite

VPG Suite software provides powerful tool sets that allow the user to quickly and efficiently setup system level models to evaluate vehicle chassis, suspension and body structure of a vehicle under actual proving ground loading conditions.

ETA

Established in 1983, ETA's expertise in creating product design & development solutions from concept to product, along with supplying research and innovation using CAE, CAD and optimization tools - Durability, Vehicle Dynamics, NVH, Crash/Safety, Die System Structure and Manufacturing Processes. While proactive in the creation and implementation of new technology and software, ETA's products include; ACP OpDesign™, DYNAFORM™, PreSys® and VPG Suite™.

Season's Greetings from ETA

As we close out 2019, The ETA team would like to thank everyone for their continued support, and we look forward to sharing more exciting news on our expanded product portfolio in 2020.

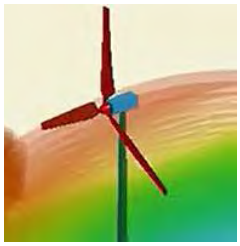
Season's Greetings – Wishing you a vibrant holiday season and a new year filled with peace and prosperity.

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 01/13/2020 - I know, your question is will my to go coffee cups stand up to a wind turbine. Of course they will! NOT! We'll call saying that they will stand up to a wind turbine using LS-DYNA a marketing stretch of the truth! But, now we'll all book on over to YouTube.



Wind turbine simulation using LS-DYNA

Monday 01/06/2020 - We start January off with SNOW! Okay, I'm in California, so for me it's rain. BUT, most of you will be having coffee with a side of snowball. So, that brings me to what your car feels in the snow.

LS-DYNA CFD: Driver Benchmark plus DEM particles, study of snow deposition on vehicle

- - Benchmark model designed by TUM, Inst For Aerodynamics and solved with the ICFD LS-DYNA module

Monday 12/30/2019 - Coffee Le LEGO Week. I love these LEGO simulations, slinky, toys, planes. WAIT - it seems I love all of them with coffee. And we are also heading to 2020 Coffee Year!

LEGO BUGATTI Chiron (42083) crash at 46kmh against 40% offset barrier

Simulation with LS-DYNA for 130ms real time.

Shanghai Hengstar & Enhu Technology sells and supports LST'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.

Online Workshop on the GISSMO Model for Fracture Prediction

Shanghai Enhu & Hengstar Technology organized an open online workshop for the CAE engineers about "The GISSMO Model for Fracture Prediction" on Jan 10th, 2020. The purpose of this workshop was to help better understand the GISSMO model and its applications. The content of this workshop included engineering approach for instability failure, failure criterion for plane stress, and generalized incremental stress state dependent damage model. Besides, identification of the GISSMO damage parameters using LS-OPT was introduced.

More than 40 CAE engineers attend this online workshop. After presentation and discussion, all attendees agree that the workshop was held timely and successfully.

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

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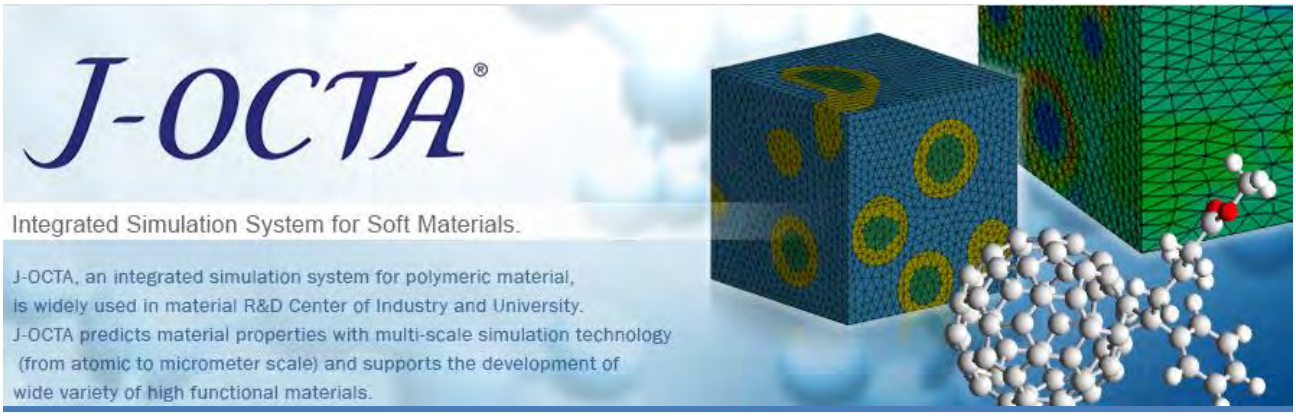
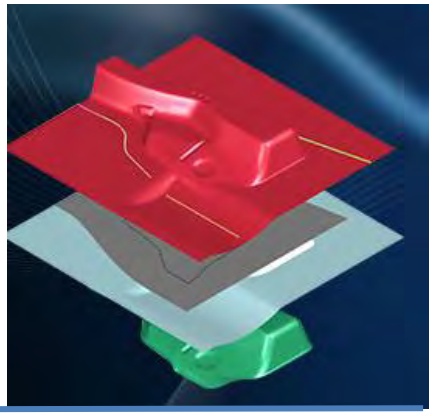
JSOL supports industries with the simulation technology of state-of-the-art. Supporting customers with providing a variety of solutions from software development to technical support, consulting, in CAE (Computer Aided Engineering) field. Sales, Support, Training.



Support tool design and process design for forming

Integrated forming simulation system JSTAMP

Sheet metal forming Simulation



JSTAMP@

- Dieface Design Support
- Blankline/trim line development
- Crack, wrinkle, and springback prediction
- CAD output of SB-compensated tool
- Material database as standard equipment

J-Composites partners - Dec 09, 2019 NEW

Mitsubishi Chemical Corporation: Cooperation in standard material database for Form Modeler

Toray Industries, Inc.: Cooperation in standard material database for Form Modeler

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.

Cybertruck Armour Glass window Simulation

The **Tesla Cybertruck** is an all-electric battery-powered light commercial vehicle. Cybertruck is built with an exterior shell made for ultimate durability and passenger protection. Starting with a nearly impenetrable exoskeleton, every component is designed for superior strength and endurance, from Ultra-Hard 30X Cold-Rolled stainless-steel structural skin to Tesla armor glass.

Tesla Armour Glass: Ultra-strong glass and polymer-layered composite can absorb and redirect impact force for improved performance and damage tolerance. Using **LS-DYNA the impact of a steel ball being thrown at one of the Cybertruck Armour glass windows is simulated.**

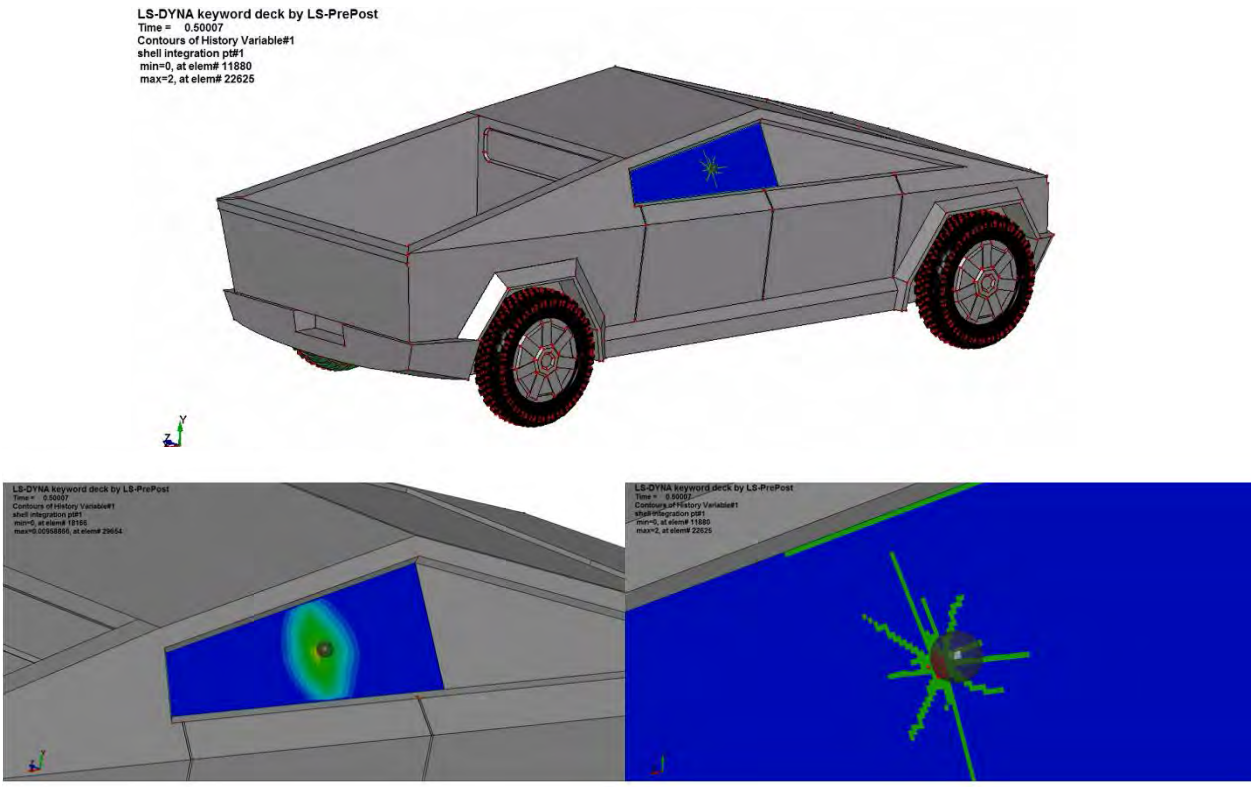


Figure: **Crack Propagation on the Armor Glass Window**

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

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

16th International LS-DYNA Conference 2020

ANSYS LST

The 16th International LS-DYNA Conference is scheduled to start on the 31st of May, 2020. These conferences are a tradition at LST, LLC. They provide a unique opportunity for LST, LLC developers to meet with customers and for everyone in the LST, LLC community to showcase what they've been doing. This conference includes a banquet, a reception, and an exhibition hall. The primary focus of the conference is the technical presentations. With over 975 attendees in 2018, this conference is an excellent opportunity for networking. A presentation at the LS-DYNA conference will have the attention of LST, LLC developers, product design engineers, industry leaders, consultants, professors, researchers, students, and other interested parties.

Conference Dates

- **Sunday 5/31/2020**

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

- **Monday 6/1/2020**

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

- **Tuesday 6/2/2020**

  Registration, Exhibition Booths, Paper Presentations, and Closing

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

  Registration for Post-Conference Classes

At a Glance:

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

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

16th International LS-DYNA Conference

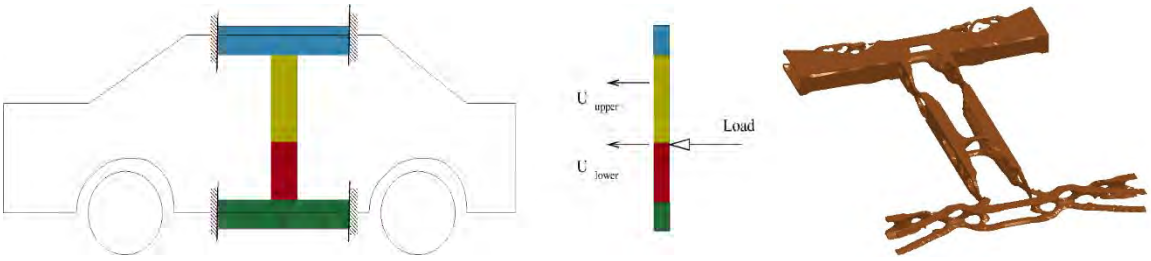


LS-TaSC New Release Version 4.1

LS-TaSC Version 4.1 provides new features as follows:

Extended Frequency Capabilities: Frequency constraints have been implemented for a single eigenvalue load case. The eigen mode tracking feature is available for frequency constraints. A typic design of maximizing fundamental eigenfrequency with one or more frequency constraints on the target eigen modes (e.g. first bending/torsion mode) can be addressed. *Solid elements* including linear hexahedrons, pentahedral and tetrahedral, and *CONSTRAINED_NODAL_RIGID_BODY keyword, are supported for frequency design.

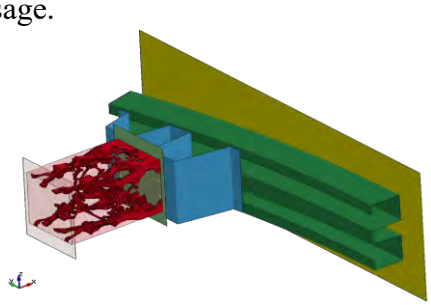
***Multidisciplinary Design Optimization*:** Projected Subgradient Method in co-operation with the multipoint scheme and spatial kernels [Ref. 1 – 3] is developed as the main solver to address constrained multidisciplinary topology optimization problems in combination with crash, NVH, and statics load cases. This solver is motivated for a high performance of computing huge models with more than 10 million elements.



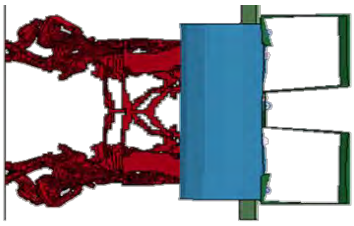
Simplified side impact design problem

Final design of B-pillar

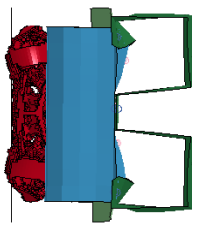
Animation of the design iterations is available to display the iterative designs and be saved in different formats. Iterative design data of optimization history plots are allowed to be exported for further usage.



Final design of crash box



Deformation at t=12 ms



Deformation at t=20 ms

References:

[1]Roux W, Yi GL, and Gandikota I, Implementation of projected sub-gradient method in LS-TaSC. 15th International LS-DYNA User's Conference, Jun 10-12, 2018, Detroit.

[2]Gandikota I, Yi GL, and Roux W, Crashworthiness and lightweight optimization of an automotive crash box using LS-TaSC. FEA Information Engineering Solutions, 2019.

[3]Roux W, Yi GL, and Gandikota I, A spatial kernel for topology optimization. Computer Methods in Applied Mechanics and Engineering, 361: 112794, 2020.

New version download: http://ftp.lstc.com/user/ls-tasc/v4.1/

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

2020 Workshops

Webinar Course Dates
March 10, 2020
July 14, 2020
November 17, 2020

In House Course Dates
March 11, 2020
July 15, 2020
November 18, 2020

Cost:
In-House Class: $695 per person
Includes: Coffee, Lunch, Parking, USB with Course Content

email Corinne Hamed 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 Corinne Hamed your full name, and if you're attending in house or web conference.

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.

Registration open for the Annual UK Oasys LS-DYNA Users' Meeting

Monday, 30th March 2020

Please join us for the 17th Oasys LS-DYNA Users' Meeting, being held at the Ashorne Hill conference center in Warwickshire, UK.

We are excited to announce some of the new features in the Oasys LS-DYNA Environment that will be demonstrated at this event:

- A new user interface for Oasys software
- Improved speed and performance
- A more integrated suite of products
- More expert tools and functionality
- LS-DYNA news and developments

We look forward to seeing you at our event! Please register here.

SIMBIO-M conference

June 18th -19th 2020 in Turin, Italy

Papers deadline: February 28th 2020

Hosted by Dr Christophe Bastien (Coventry University), Dr Alessandro Scattina (POLITO), Dr Michel Behr (IFSTTAR), Prof Kambiz Kayvantash (CADLM);

This conference is aiming at introducing new technologies, advances and tools in the fields of Biomechanics and Biomedical engineering. Focus is on research and in particular introduction of young researchers into the applications world.

SIMBIO-M website and brochure

Webinars 2020

Oasys and LS-DYNA team offers several free webinars

These are delivered by our software experts and provide opportunity to listen and ask questions from the comfort of your own desk.

Next upcoming webinars:

- 4th February ICFD an introduction
- 4th March LS-OPT part 2
- 1 April Oasys Post: customization
- 7 May Advanced LS-DYNA Implicit

To view past and future webinars click here.

Subscribe to Oasys LS-DYNA YouTube channel and follow our group on LinkedIn

Please check out our Oasys LS-DYNA YouTube channel and follow our group on LinkedIn to stay in touch!

Predictive Engineering

www.predictiveengineering.com

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.

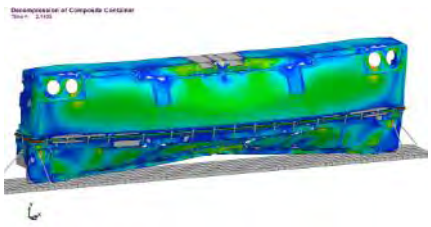
Our History

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.

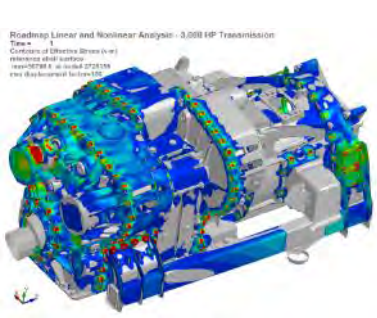
View our portfolio

FEA, CFD and LS-DYNA consulting projects

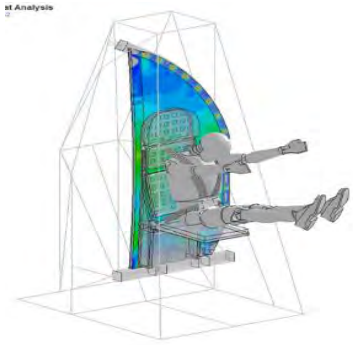
Composite Engineering



Nonlinear Dynamics



Aerospace



LS-DYNA Training

Predictive Engineering is a finite element analysis consultancy based in Portland, Oregon with over 15 years of LS-DYNA consulting experience. We have leveraged this experience to provide a unique LS-DYNA training class that is focused on the mechanical analysis of highly nonlinear systems (e.g., impact analysis, burst containment, drop test, bird-strike, progressive failure of composites, high-deformation analysis of polymers and foams or fluid-structure interaction using DEM / SPH / CFD).

UPCOMING LS-DYNA TRAINING COURSE

LS-DYNA Analysis for Structural Mechanics
Explicit, Nonlinear, Large Deformation Analysis for Structural Mechanics
Duration: 5 days
When: May 11 - 15, 2020
Where: Portland, Oregon, USA
Read more online and Register

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.

Four Ways to Digitally Transform with HPC in the Cloud

December 5, 2019 | Fanny Tréheux

The cloud revolution has begun, and High Performance Computing (HPC) is next. As cloud computing rapidly becomes better, faster, and cheaper than on-premises, no workload will be left untouched, and companies will need to adopt it to remain competitive over the next decade and beyond.

So what is the cloud transformation in HPC? Why are on-premises HPC systems not enough anymore?

LESSON ONE: Cloud computing drives agility, faster innovation, and just-in-time procurement

Cloud computing is the best way to rapidly deliver new compute power to meet demand. For companies to stay competitive, they must embrace broad technology trends and innovation.

Usage of computation is accelerating as companies penetrate new markets and personalize the consumer experience while also balancing stricter regulation. Figure 1 is showing a threefold increase in compute demand over three years for one application alone at a Top 5 automotive supplier. The peak demand reached double the capacity available on-premise in the last year. To date, buying on-premises compute has been the answer, but this is rapidly changing.

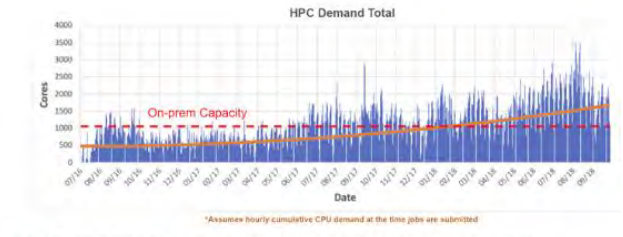


Figure 1 – *HPC demand for crash simulation at an automotive company over three years*

First, best-in-class companies embrace accelerating innovation by unlocking how rapidly new users can access capacity. Rather than strictly restricting or prioritizing access to on-premises resources based on limited capacity, cloud scale and availability make it possible to open HPC to new audiences and scenarios. Engineers and scientists are able to run higher fidelity analysis and more simulations, reducing defects or warranty issues and winning more contracts. Timely access to compute would also enable engineers to explore new ways of innovation. Engineering departments must quickly adopt new methods, tools, and technology, and IT needs to empower them rather than limit them.

Second, cloud capacity can be deployed faster and with more agility than on-premises compute. Legacy provisioning purchases on-premise hardware as a depreciated capital expense, restricted by how long it takes to secure capital in tight markets. This also creates risk that hardware needs stay static over the lifetime of the hardware: five years is an infinite time period in today's evolving competitive marketplace. In contrast, leading-edge organizations have embraced the cloud to drive business transformation. By transforming Capex to Opex, companies can rapidly shift procurement and learning cycles to weeks instead of years. As illustrated in figure 2, shifting to paying cloud computing expenses per job rapidly pays off in a short period of time. By continually refreshing compute architecture and riding innovation curves in hardware performance gains, organizations like this can avoid long and costly RFPs and minimize risk by enabling rapid iteration.

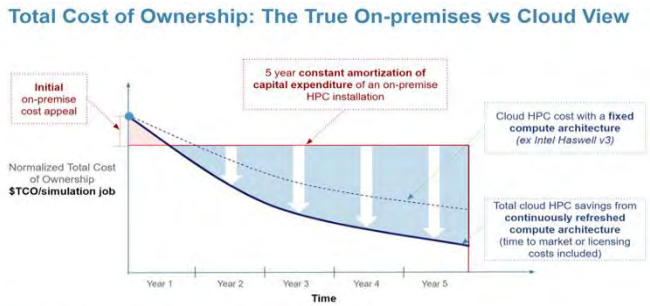


Figure 2 – *Capex versus Opex cost comparison per simulation job over 5 years*

Cloud-based HPC is a best practice to deliver new value to the business unit in a span of weeks instead of lagging by years, scaling on demand just when the business needs it.

LESSON TWO: Cloud HPC data is shared more easily with mainstream business workflows

Companies need to better understand the possibilities to innovate. A key objective of the digitization effort is to harvest data to more quickly surface information that matters to different stakeholders. In contrast with legacy on-premises HPC systems that may be disconnected from other business practices, cloud HPC data and metadata are shared more easily. By missing this trend, IT organizations miss the opportunity to capture precious engineering information (e.g model size, procedure, project, and key results). With access to data from HPC workloads, other IT administrators and engineering leaders can make more informed decisions and continuously take action that drive efficiencies. For example, this allows team to apply techniques like artificial intelligence to HPC metadata so they can be fueled with more automation and optimization. A user could, for instance, quickly retrieve a past job with similar attributes, therefore eliminating analysis rework. It is also essential to capture HPC information in relation to the application or even the model used to put the data in its full context. This historic HPC workload data could then generate recommendations for which compute architecture offers the best cost-performance based on how models are sized or which application are used.

LESSON THREE: Full stack cloud HPC platform provides a fully extensible and traceable experience

The managed cloud experience can provide a fully engineered experience that can integrate with the entire enterprise stack. Traceability is essential for company to measure trade off and manage uncertainty. Since every modeled behavior is built in differing systems, HPC applications and underlying hardware environments are diverse and fragmented. This makes it hard for IT and engineering teams to drive a consistent end-to-end traceability across the entire engineering or scientific process and linking their disparate tools together. Moreover, an engineer or scientist often uses more than one application in their toolchain to perform modeling, analysis, data regression, and post-processing visualization. With traditional HPC, those processes are captured through complex submission scripts often written by the user, which makes it difficult to maintain and update consistently, and connect to the rest of the enterprise over time. With cloud HPC, each step of the process are tied to a specific hardware and software stack optimized for best speed up. Cloud tiered storage also tailors storage to how the process flow is executed to optimize performance. This approach allows company to move up a level of abstraction, by formulating HPC workloads to meet the underlying hardware capabilities while reducing considerably the amount of manual scripting required. In addition, cloud HPC has built-in APIs and other services to extend to internal resources such as PLM or other cloud application such as IOT platforms. It brings together new and legacy technologies to enable agile change management while maintaining optionality to integrate future technology.

LESSON FOUR: Cloud computing enables 'as a service' economy for HPC

HPC enables a robust partner ecosystem for co-innovation. Just as the cloud has unlocked n-squared value networks in social media, transportation, media and supply chains, cloud HPC will fundamentally change collaboration. Today's organizations have engineering centers and customers distributed across the world and the complexity of the supply chain is increasing. HPC has to facilitate teamwork at different locations, bring compute resources close to each user and overcome the challenges of data fragmentation and data gravity.

Digital transformation is driven by the power of the partner ecosystem. IDC predicts that "by 2021, 82% of revenues from digital transformation business models will be ecosystem enabled." On-premise HPC architectures are more isolated systems and are not as well designed to enable efficient information exchange across external collaborators. In contrast, cloud was built for sharing and collaborating across organizational boundaries. Cloud computing infrastructure unlocks new possibilities for HPC use cases with which an on-premise system cannot keep pace. For example, manufacturing companies are now adopting a model-centric approach of engineering called Model-Based System Engineering (MBSE) in an effort to increase focus in managing and connecting the digital thread. The system-level model becomes the single source of truth to perform rapid trade of study. It is connected to component behavior models that might come from internal departments, but also external suppliers. Cloud computing provides the abstraction layer to enable the computation of the MBSE toolchain while protecting the IPs between the OEM and suppliers (see figure 3).

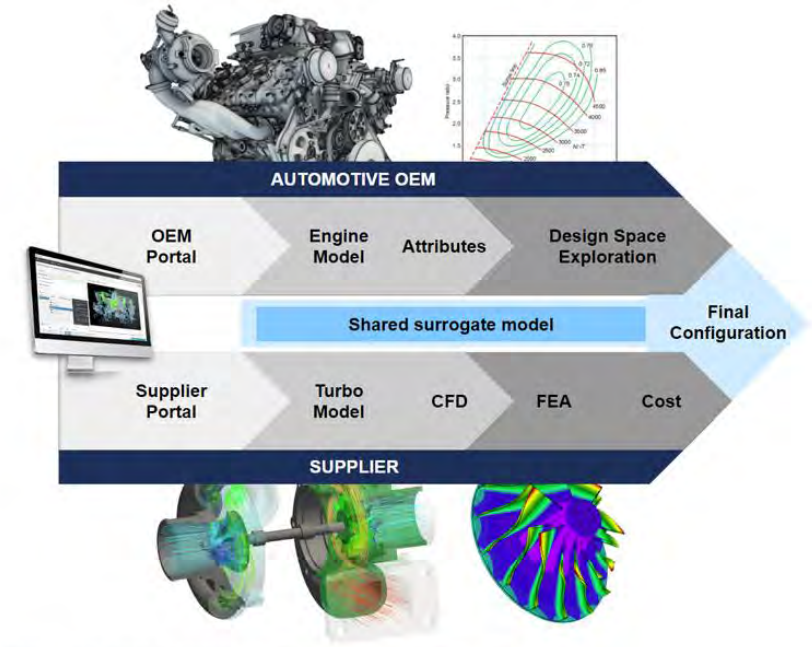


Figure 3 – *OEM supplied collaborative approach of Model Based System Engineering*

This method enables OEM to iterate much faster on the design across the entire supply chain. This is also a first step toward building a digital twin to tap into new revenue sources and offer new experiences to customers. The digital twin enriches the MBSE model with data from an external ecosystem such as sensors placed on physical assets. That opens opportunities for in-service predictive maintenance and other insights. The openness and decentralization of HPC architecture are key to evolving toward the 'as a service' economy and offer a better customer and partnership experience.

How to get started?

The first step toward the digital journey is to craft a clear vision center around productivity gains and new revenue sources that HPC in the cloud can enable. What area in your business could benefit from more computational speed, extensibility and collaboration?

Change management should also not be overlooked. HPC administrators need to consider the migration path to the cloud and its governance.

Rescale streamlines the HPC transition to the cloud with its ScaleX platform: a modern SaaS framework that scales to enterprise levels and supports thousands of simultaneous users and compute intensive workloads. Together with our pool of experts that strive to make engineers and scientists more productive in the cloud, Rescale helps organizations accelerate their digital maturity.

Read in website

LS-DYNA China, as the master distributor in China authorized by LST, an Ansys company, 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

About Shanghai Fangkun Software Technology Ltd.

Shanghai Fangkun Software Technology Ltd. was authorized by former Livermore Software Technology Corporation (LSTC, now LST, an ANSYS company) as the domestic master distributor of LS-DYNA
software. Shanghai Fangkun is fully responsible for domestic sales, marketing, technical support. By integrating and managing a wide range of resources such as LS-DYNA agents and partners, Shanghai Fangkun is focused on providing strong technical support for domestic LS-DYNA users, and help customers to use LS-DYNA software for product design and development effectively.

Contacts:

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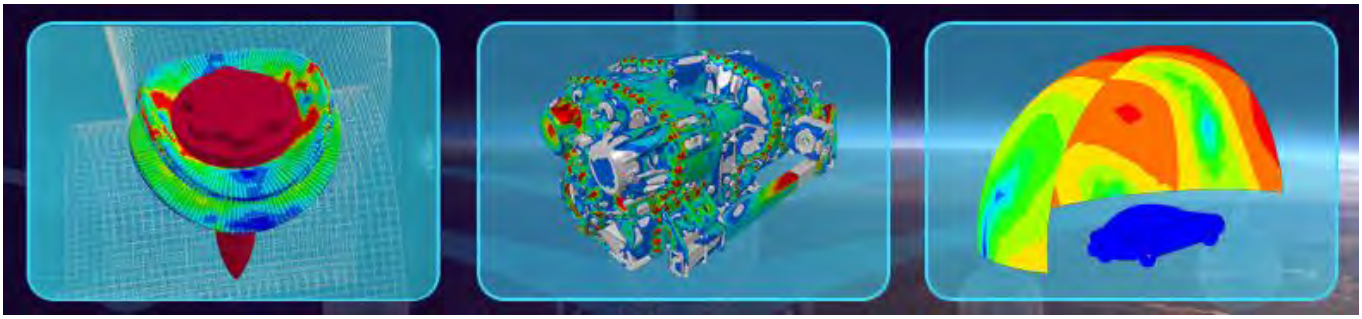
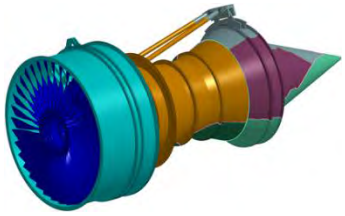
Tel.: 021-61261195 4008533856

Email: sales@lsdyna-china.com

Website: www.lsdyna-china.com





LS-DYNA Basic Training
2020/2/20-21

Dear LS-DYNA Users,

To help users to better understand LS-DYNA software and use LS-DYNA more efficiently, Shanghai Fangkun will organize a LS-DYNA basic training on 20th to 21st, Feb in Shanghai. We welcome those who are interested to attend this course.

- **Host:** Shanghai Fangkun Software Technology Ltd.
- **Date:** 20th to 21st, Feb., 2020
- **City:** Shanghai
- **Attendees:** 20 - 30
- **Form of instruction:** Classroom
- **Language:** Mandarin
- **Course Fee:** RMB 3,000 for each person (including electronic class material and lunch, not including hotel and transportation fees)
- **Certificate:** All participates will receive a course completion certificate issued by Shanghai Fangkun Software Technology Ltd.

Instructor

Li Yong, technical support engineer of Shanghai Fangkun Software Technology Ltd.
Graduated in vehicle engineering from Xiamen University of Technology. Li was engaged in CAE analysis in vehicle industry since 2015, mainly responsible for crashworthiness and lightweight design of vehicle structure.

Contents

1.Introduction to LS-DYNA
2.The Keyword Deck and the User's Manual
3.Element Formulations
4.Choosing a Material Model
5.Applying Load and Initial Conditions
6.Boundary Conditions
7.Specification of Contact
8.Control Cards
9.Output and Databases
10.Timestep and CPU Time
11.Hourglassing
12.Specifying Connections
13.Applying Damping
14.Abnormal Terminations and Assessment of Results
15Exercises

Contact: Elva Yu Tel.: 18221209107, 021-61261195
Email: Training@lsdyna-china.com

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- 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.

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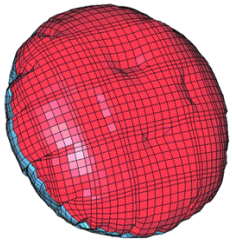
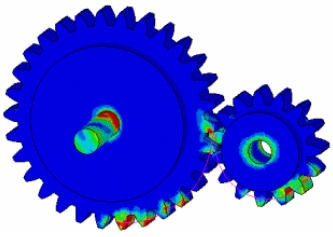


2020 Jeep® Gladiator: North American Truck of the Year

Berj Alexanian , Todd Goyer

- Jeep® Gladiator earns North American Truck of the Year title in its debut year
- Winner voted on by 50 expert jurors from print, television, digital outlets and radio from across the United States and Canada

January 13, 2020 , Auburn Hills, Mich. - The all-new Jeep® Gladiator – the most capable midsize truck ever - has been named the 2020 North American Truck of the Year by a panel of automotive experts. The award is unique and considered by many to be one of the world's most prestigious based on its diverse mix of 50 automotive journalists from the United States and Canada who serve as the voting jurors.

The winners were announced at a news conference today at the TCF Center in Detroit.

"The Jeep Gladiator is not only the world's most capable midsize pickup, it's now the North American Truck of the Year as well," said Jim Morrison, Head of Jeep Brand – FCA North America. "This honor is a testament to our customers who demand the very best and the Gladiator delivers with all of the 4x4 capability and versatility expected of a Jeep vehicle."

The organization's awards are independent and unique because instead of being given by a single publication, website, radio or television station, they are selected by a jury of automotive journalists representing diverse media outlets from the United States and Canada.

Jurors evaluate the finalists based on segment leadership, innovation, design, safety, handling, driver satisfaction and value for the dollar. The process, which started in June 2019 by determining a list of eligible vehicles, includes three rounds of voting.

This is the 26th year of the awards. Gladiator earns the North American Truck of the Year title in its debut year.

NACTOY

The NACTOY awards recognize the most outstanding new vehicles of the year. These vehicles are benchmarks in their segments based on factors including innovation, design, safety, handling, driver satisfaction and value for the dollar. The organization gives out three awards. They are: "North American Car of the Year," "North American Utility of the Year," and "North American Truck of the Year." The awards are unique because — instead of being given by a single publication, website, radio or television station — they are given by an independent jury of automotive journalists from the United States and Canada.

All-new 2020 Jeep Gladiator

The all-new 2020 Jeep Gladiator, engineered from the ground up to be the most off-road capable midsize truck ever, builds on a rich heritage of tough, dependable Jeep trucks with an unmatched combination of rugged utility, authentic Jeep design, open-air freedom, clever functionality and versatility and best-in-class towing and 4x4 payload.

Equipped with the proven 3.6-liter Pentastar V-6 engine and a versatile cargo box, Gladiator is built to handle the demands of an active lifestyle while delivering an open-air driving experience in a design that is unmistakably Jeep. Combining traditional Jeep attributes with strong truck credentials, the Jeep Gladiator is a unique vehicle capable of taking passengers and cargo anywhere. A multitude of technology features, such as Apple CarPlay and Android Auto, and safety features, such as Blind-spot Monitoring and Rear Cross Path detection, adaptive cruise control and Forward Collision Warning-Plus, further Gladiator's appeal.

All Gladiator models are Trail Rated with a badge indicating that the vehicle is designed to perform in a variety of challenging off-road conditions identified by five key consumer-oriented performance categories: traction, ground clearance, maneuverability, articulation and water fording. Gladiator Rubicon models are equipped with signature red tow hooks, Rock-Trac® 4x4 system, featuring a two-speed transfer case with a 4:1 low-range gear ratio, front and rear heavy-duty Dana 44 axles, Tru-Lok® electric front- and rear-axle lockers, segment-exclusive electronic sway bar disconnect, cab and bed rock rails and standard 33-inch Falken Wildpeak All-Terrain off-road tires.

About Jeep Brand

Built on more than 75 years of legendary heritage, Jeep is the authentic SUV with class-leading capability, craftsmanship and versatility for people who seek extraordinary journeys. The Jeep brand delivers an open invitation to live life to the fullest by offering a full line of vehicles that continue to provide owners with a sense of security to handle any journey with confidence.

The Jeep vehicle lineup consists of the Cherokee, Compass, Gladiator, Grand Cherokee, Renegade and Wrangler. To meet consumer demand around the world, all Jeep models sold outside North America are available in both left- and right-hand drive configurations and with gasoline and diesel powertrain options. Jeep is part of the portfolio of brands offered by global automaker Fiat Chrysler Automobiles. For more information regarding FCA (NYSE: FCAU/ MTA: FCA), please visit www.fcagroup.com.

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LS-DYNA - Resource Links

LS-DYNA Multiphysics YouTube

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

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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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www.dynalook.com

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www.dummymodels.com

LSTC ATD MODELS

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OASYS	www.oasys-software.com/training-courses
Predictive Engineering	www.predictiveengineering.com/support-and-training/ls-dyna-training

Training - Dynamore

Author: Christian Frech christian.frech@dynamore.de

Seminars 2020

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Selection of trainings for February/March

Introduction	
Introduction to LS-DYNA	11-13 February 24-26 March 31 March -2 April (Z)
Introduction to LS-PrePost	10 February 23 March 30 March (Z)
Basics/Theory	
User Interfaces	3 February
Crash	
Crash Analysis	17-20 March 24-27 March (G)
Joining Techniques in LS-DYNA	9-10 March
Failure of Fiber-Reinforced Polymers	16 March
Introduction to contact definitions in LS-DYNA	30 March (V)
Passive Safety	
Dummy/Pedestrian Impactor Modeling	4 February
Introduction to Passive Safety	12-13 March
CMP Airbag Modeling	27 March
Material	
Material Failure	23-24 March (T)
Implicit Capabilities	
Implicit Analysis using LS-DYNA	11-12 March

Information days (free of charge)

New Features in LS-DYNA	18 March (T)
Optimization with ANSA, LS-OPT and META	23 March

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

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February 2020

Date		Location	Course Title	Instructor(s)
Feb 4	Feb 5	***MI***	Passive Safety	A. Gromer
Feb 5	Feb 6	CA	Comprehensive LS-DYNA® ALE and S-ALE Applications Seminar	I. Do, H. Chen
Feb 10		***MI***	CAE for Non-CAE Engineers	N. Karajan
Feb 11	Feb 2	***MI***	Implicit Analysis in LS-DYNA®	N. Karajan
Feb 18	Feb 19	CA	Methods & Modeling Techniques: Pre-requisites for Blast and Penetration	P. Du Bois, L. Schwer
Feb 20	Feb 21	CA	Blast Modeling with LS-DYNA®	P. Du Bois, L. Schwer
Feb 24		CA	Explosives Modeling for Engineers	P. Du Bois, L. Schwer
Feb 24		***MI***	Overview of Contacts in LS-DYNA®	S. Bala
Feb 25		***MI***	Material Characterization for Metals, Polymers, & Foams	S. Bala
Feb 25	Feb 26	CA	Penetration Modeling with LS-DYNA®	P. Du Bois, L. Schwer
Feb 27	Feb 28	***MI***	Occupant Simulation in LS-DYNA®	H. Devaraj

March 2020

Date		Location	Course Title	Instructor(s)
Mar 2	Mar 4	***CA***	ALE, Eulerian, & Fluid-Structure Interaction in LS-DYNA®	M. Souli
Mar 5	Mar 6	***CA***	Smoothed Partical Hydrodynamics (SPH) in LS-DYNA®	M. Souli
Mar 10	Mar 13	***MI***	Introduction to LS-DYNA®	R. Chivukula
Mar 16		***CA***	Verification & Validation in LS-DYNA®	A. Tabiei
Mar 16	Mar 17	***MI***	Airbag Modeling in LS-DYNA®	A. Nair
Mar 17	Mar 20	***CA***	Introduction to LS-DYNA®	A. Tabiei

LS-DYNA® Linear Solver Development — Element validation of constrained and bushing elements

Zhe Cui[1], Yun Huang[1], Allen T. Li[2]

[1]Livermore Software Technology, an ANSYS Company

[2]Ford Motor Company

Abstract: This paper is part of LS-DYNA's linear solver development on validating of constrained and bushing elements between NASTRAN and LS-DYNA.

In this paper, the constrained elements and bushing elements are investigated. The constrained elements include both rigid (RBE2, etc.) and interpolation elements (RBE3, etc.), which are very popularly used elements. The bushing (generalized spring and damper) elements consist of the CBUSH and CBUSH1D. Several benchmark examples are studied to perform cross-validation of the Constrained and bushing elements in LS-DYNA and NASTRAN, in different types of analysis such as static, normal mode and SSD analysis.

The validation shows that there is a good match for the constrained elements and bushing elements in most cases, between LS-DYNA and NASTRAN. This paper can provide guidance for the users who need to translate their FEM models between NASTRAN and LS-DYNA.

Keywords: LS-DYNA, linear solver, constrained elements, bushing elements

1. Constrained elements

The constrained elements include both rigid and interpolation elements, which consist of RBAR, RBE1, RBE2, RROD, RTRPLT, RBE3, and RSPLINE. In this paper, the RBE2 and RBE3, which are the most commonly used of constrained elements are investigated. The RBE2 and RBE3 elements are all mainly based on a linear displacement relationship, not an elastic relationship. They are not dictated by stiffness, mass or force. They all follow the small displacement theory. The RBE2 and RBE3 elements have different definitions for dependent and independent nodes or grid points. The stiffness, mass and loads at the dependent degree-of freedoms are transferred to the independent degree-of-freedoms.

The RBE2 is a rigid body connected to an arbitrary number of grid points. The independent degrees-of-freedom are the six components of motion at a single grid point. The dependent degrees-of-freedom at the other grid points all have the same user-selected component numbers. The RBE3 defines a constraint relation in which the motion at a "reference" grid point is the least square weighted average of the motions at other grid points. The element is useful for loads and masses from a "reference" grid point to a set of grid points.

In LS-DYNA, the corresponded keyword to RBE2 is ***CONSTRAINED_NODAL_RIGID_BODY**, which defines a nodal rigid body consisting of the defined nodes. The first card is shown in Figure 1; the 2nd card is used for SPC option; and the 3th-5th card are used for INERTIA option; the 6th card is required if a local coordinate system is used to specify the inertia tensor when the INERTIA option is set.

Card 1	1	2	3	4	5	6	7	8
Variable	PID	CID	NSID	PNODE	IPRT	DRFLAG	RRFLAG	
Type	I	I	I	I	I	I	I	
Default	none	none	none	0	0	0	0	

Figure1. The keyword format (1st card) of ***CONSTRAINED_NODAL_RIGID_BODY**

The ***CONSTRAINED_INTERPOLATION** is doing the same feature as RBE3 in LS-DYNA, which defines an interpolation constraint. With this constraint type, the motion of a single dependent node is interpolated from the motion of a set of independent nodes. This option is useful for the redistribution of a load applied to the dependent node by the surrounding independent nodes. This load may be a translational force or a rotational moment. This keyword is typically used to model shell-brick and beam-brick interfaces.

Figure 2 shows the input parameters of ***CONSTRAINED_ INTERPOLATION**. The card 2 is used to define independent node card sets.

Card 1	1	2	3	4	5	6	7	8
Variable	ICID	DNID	DDOF	CIDD	ITYP			
Type	I	I	I	I	I			
Default	0	0	123456	optional	0			

Card 2	1	2	3	4	5	6	7	8
Variable	INID	IDOF	TWGHTX	TWGHTY	TWGHTZ	RWGHTX	RWGHTY	RWGHTZ
Type	I	I	F	F	F	F	F	F
Default	0	123456	1.0	TWGHTX	TWGHTX	TWGHTX	TWGHTX	TWGHTX

Figure2. The keyword format of ***CONSTRAINED_ INTERPOLATION**

A simple HAT section model as shown in Figure 3 is used to do the validation. There are totally 12,614 nodes and 12,046 shell elements and 30 solid elements in this model.

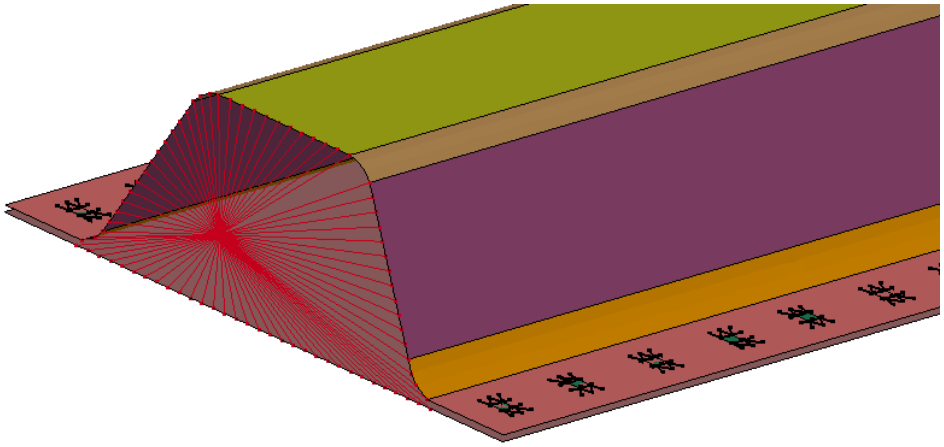

Figure 3. The HAT section model

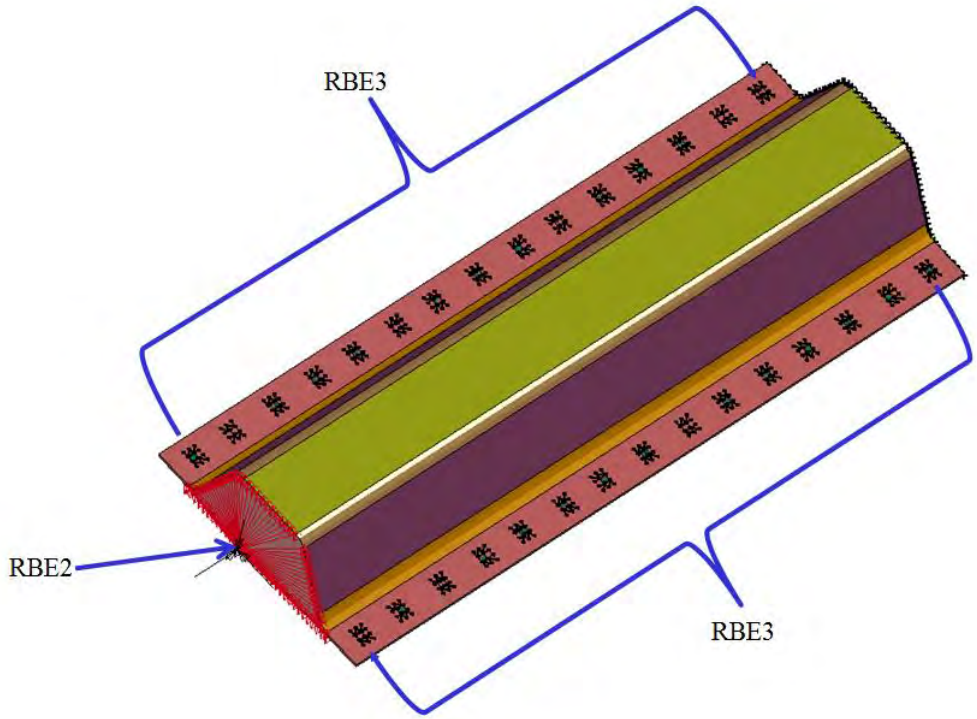

Figure4. The HAT section model with both RBE2 and RBE3 elements

Figure 4 shows the HAT section model with both RBE2 and RBE3 elements. Four load cases are investigated. The first 3 cases are static analysis where a nodal force of 100 N is applied to the structure at X, Y and Z direction separately in each case. The displacement of node 101 is calculated by NASTRAN and LS-DYNA and the results are compared. The 4th case is about normal mode analysis. The first 10 modes are computed for comparison. One can see from Table 1 that the results by the two codes match very well.

Table1. The comparison of hybrid RBE2 and RBE3 elements case

Load case ID	Displacement (mm)	NASTRAN	LS-DYNA	Diff
101	X	3.751E-06	3.750E-06	0.024%
102	Y	1.039E-04	1.038E-04	0.078%
103	Z	-4.798E-04	-4.795E-04	-0.049%
201	Mode # (Hz)			
	1	263.72	263.72	0.001%
	2	420.49	420.24	0.059%
	3	495.03	494.84	0.038%
	4	548.38	548.55	0.030%
	5	603.25	603.19	0.010%
	6	722.84	723.30	0.064%
	7	763.12	763.26	0.019%
	8	907.38	907.64	0.029%
	9	916.79	916.73	0.006%
	10	979.52	979.85	0.034%

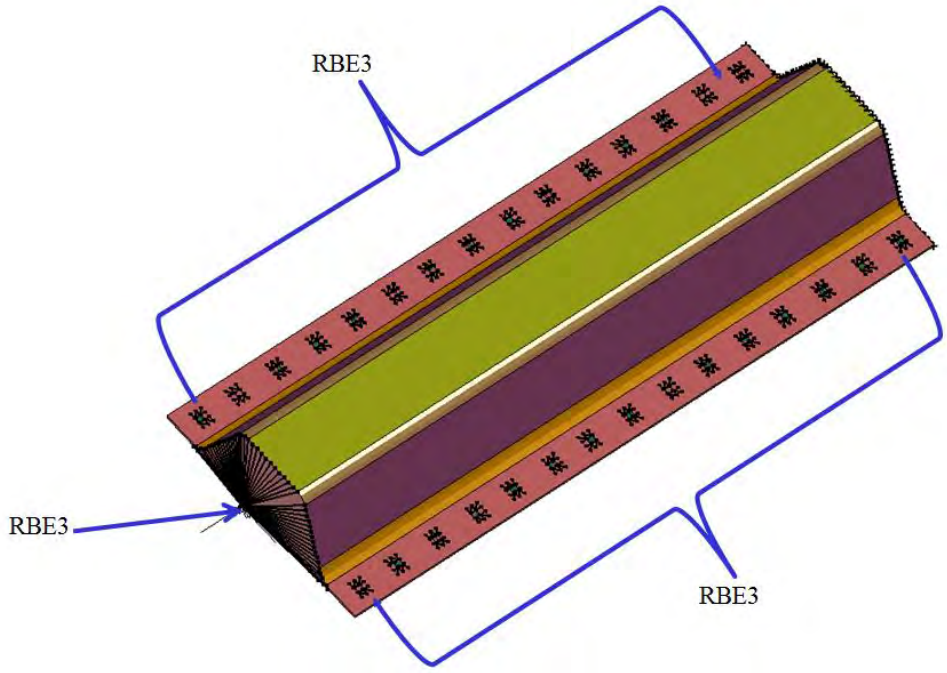

Figure5. The HAT section model with RBE3 element

Figure 5 shows the HAT section model with RBE3 element. Again, there are 4 load cases investigated. The first 3 cases are static analysis where a nodal force of 100 N is applied to the structure at X, Y and Z direction separately in each case. The displacement of node 101 is calculated by NASTRAN and LS-DYNA and the results are compared. The 4th case is about normal mode analysis. The first 10 modes are computed for comparison. One can still see from Table 2 that the results by the two codes match very well.

Table2. The comparison of RBE3 elements case

Load case ID	Displacement (mm)	NASTRAN	LS-DYNA	Diff
101	X	3.778E-06	3.777E-06	0.010%
102	Y	1.564E-04	1.564E-04	0.012%
103	Z	-8.420E-04	-8.425E-04	-0.059%
201	Mode # (Hz)			
	1	254.63	254.64	0.003%
	2	414.81	414.52	0.069%
	3	447.25	447.33	0.016%
	4	448.79	448.65	0.031%
	5	503.95	503.68	0.054%
	6	624.02	623.87	0.024%
	7	673.75	674.07	0.047%
	8	710.67	710.92	0.035%
	9	785.10	785.17	0.009%
	10	900.46	900.39	0.007%

2. Bushing elements in SSD analysis

The bushing (generalized spring and damper) elements consist of the following: CBUSH and CBUSH1D.

The CBUSH is a structural scalar element connecting two non-coincident grid points, or two coincident grid points, or one grid point with an associated PBUSH entry. This combination is valid for any structural solution sequence. In modal frequency response, the basis vectors (system modes) will be computed only once in the analysis and will be based on nominal values of the scalar frequency dependent springs. In general, any change in their stiffness due to frequency will have little impact on the overall contribution to the structural modes. The stiffness matrix for the CBUSH element takes the diagonal form in the element system.

The BUSH1D is a one dimensional version of the BUSH element, which is defined with the CBUSH1D and a PBUSH1D entry. The user may define several spring or damping values on the PBUSH1D property entry. It is assumed that springs and dampers work in parallel. The element force is the sum of all springs and dampers. The BUSH1D element has axial stiffness and axial damping. The element includes the effects of large deformation. The elastic forces and the damping forces follow the deformation of the element axis if there is no element coordinate system defined. The forces stay fixed in the x-direction of the element coordinate system if the user defines such a system. Arbitrary nonlinear force-displacement and force velocity functions are defined with tables and equations. A special input format is provided to model shock absorbers.

In LS-DYNA, there are three material models with damping, which can be applied in frequency domain SSD analysis. These damping materials are very useful to model viscous damping or local damping in frequency domain SSD analysis. The material type 66 (***MAT_LINEAR_ELASTIC_DISCRETE_BEAM**) is defined for simulating the effects of a linear elastic beam by using six springs each acting about one of the six local degrees-of-freedom. The two nodes defining a beam may be coincident to give a zero length b beam, or offset to give a finite length beam. It can be used with discrete beam element type 6 in frequency domain SSD analysis. The material type 74 (***MAT_ELASTIC_SPRING_DISCRETE_BEAM**) permits elastic springs with damping to be combined and represented with a discrete beam element type 6. Linear stiffness and damping coefficients can be defined, and, for nonlinear behavior, a force versus deflection and force versus rate curves can be used. The material type S02 (***MAT_DAMPER_VISCOUS**) for discrete elements (***ELEMENT_DISCRETE**) provides a linear translational or rotational damper located between two nodes. Only one degree of freedom is then connected.

The ***MAT_66** (***MAT_LINEAR_ELASTIC_DISCRETE_BEAM**) corresponds to NASTRAN's CBUSH element; the ***MAT_74** (***MAT_ELASTIC_SPRING_DISCRETE_BEAM**) and ***MAT_S02** (***MAT_DAMPER_VISCOUS**) correspond to NASTRAN's CBUSH1D element, which can be used to model viscous local damping in frequency response analysis.

To active the material damping in frequency domain SSD analysis, two flags in the keyword input files are required. First, one needs to set "DMPFLG" equal to 1 in the keyword ***FREQUENCY_DOMAIN_SSD** (Figure 6) to use local damping. Second, the "EVDUMP" should be smaller than 0 (e.g. -1) in the keyword ***CONTROL_IMPLICIT_EIGENVALUE** (Figure 7) to request output of eigenvalues and eigenvectors using a binary format.

Card 2	1	2	3	4	5	6	7	8
Variable	DAMP	LCDAM	LCTYP	DMPMAS	DMPSTF	DMPFLG		
Type	F	I	I	F	F	I		
Default	0.0	0	0	0.0	0.0	0		

Figure6. Card 2 of ***FREQUENCY_DOMAIN_SSD**

Card 2	1	2	3	4	5	6	7	8
Variable	ISOLID	IBEAM	ISHELL	ITSHELL	MSTRES	EVDUMP	MSTRSCL	
Type	I	I	I	I	I	I	F	
Default	0	0	0	0	0	0	0.001	

Figure7. Card 2 of ***CONTROL_IMPLICIT_EIGENVALUE**

A simple beam model with attached damper at one end is used for the cross-validation between LS-DYNA and NASTRAN. Figure 8 shows the finite element model of the beam with the damper.

The frequency response analysis, which is the SSD in LS-DYNA and SOL 111 in NASTRAN are performed on this model. Three cases with different damper models are investigated.

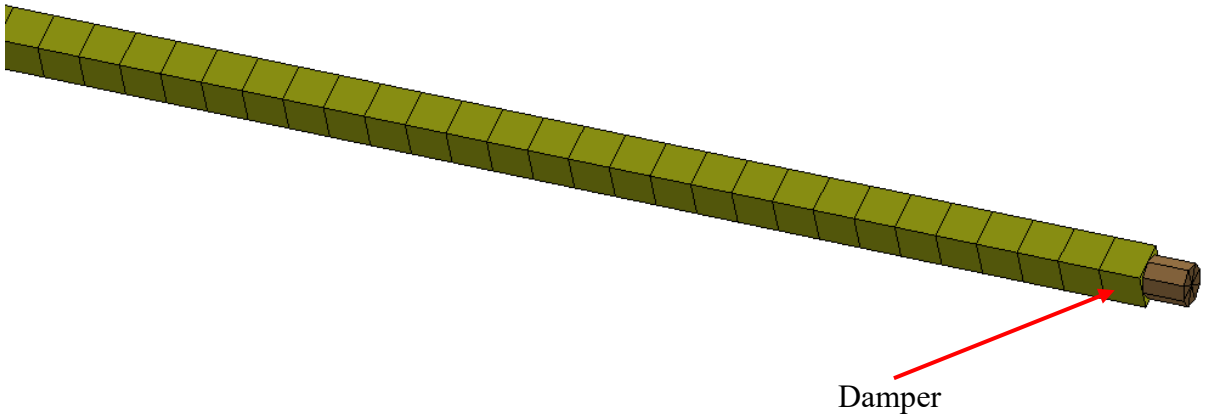

Figure8. A simple beam model with an attached damper

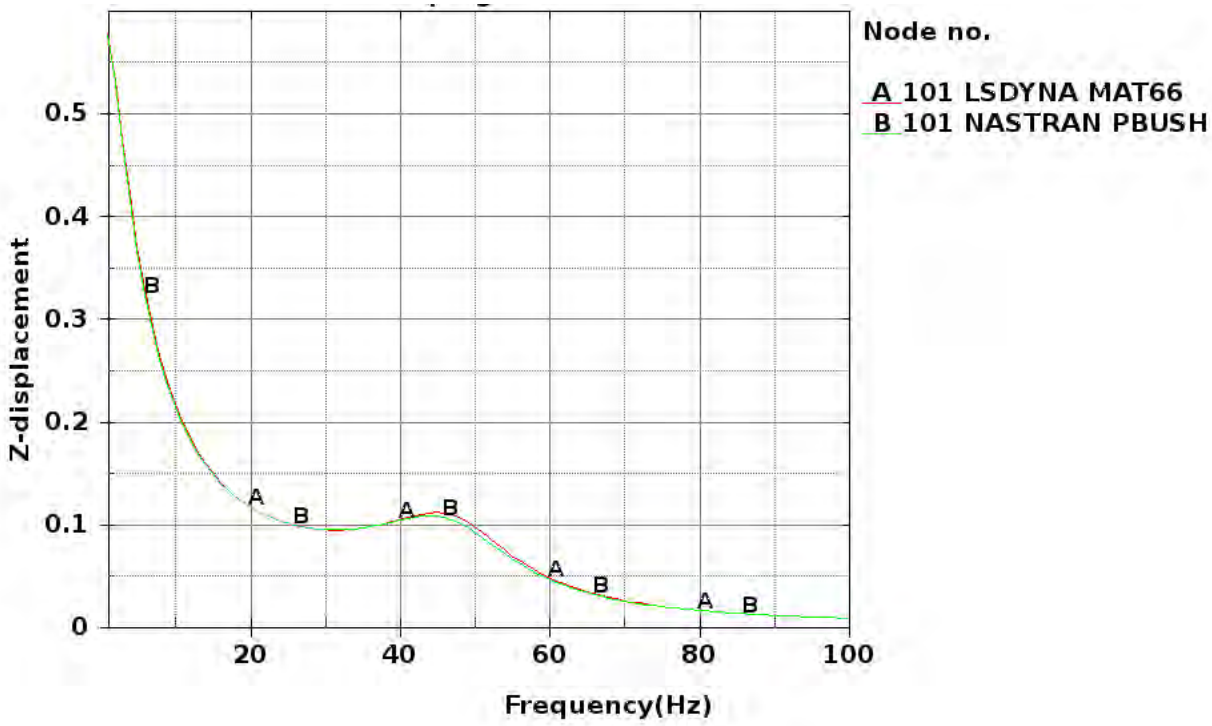

Figure9. Z displacement comparison

Figure 9 shows the Z displacement results at node 101. MAT66 is used in LS-DYNA and PBUSH is used in NASTRAN. One can see that there is a very good match between LS-DYNA and NASTRAN. Figure 10 shows the Z displacement results at node 101, for which MAT74 and MATS02 are used in LS-DYNA and PBUSH1D is used in NASTRAN. One can see that the results by LS-DYNA and NASTRAN match very well.

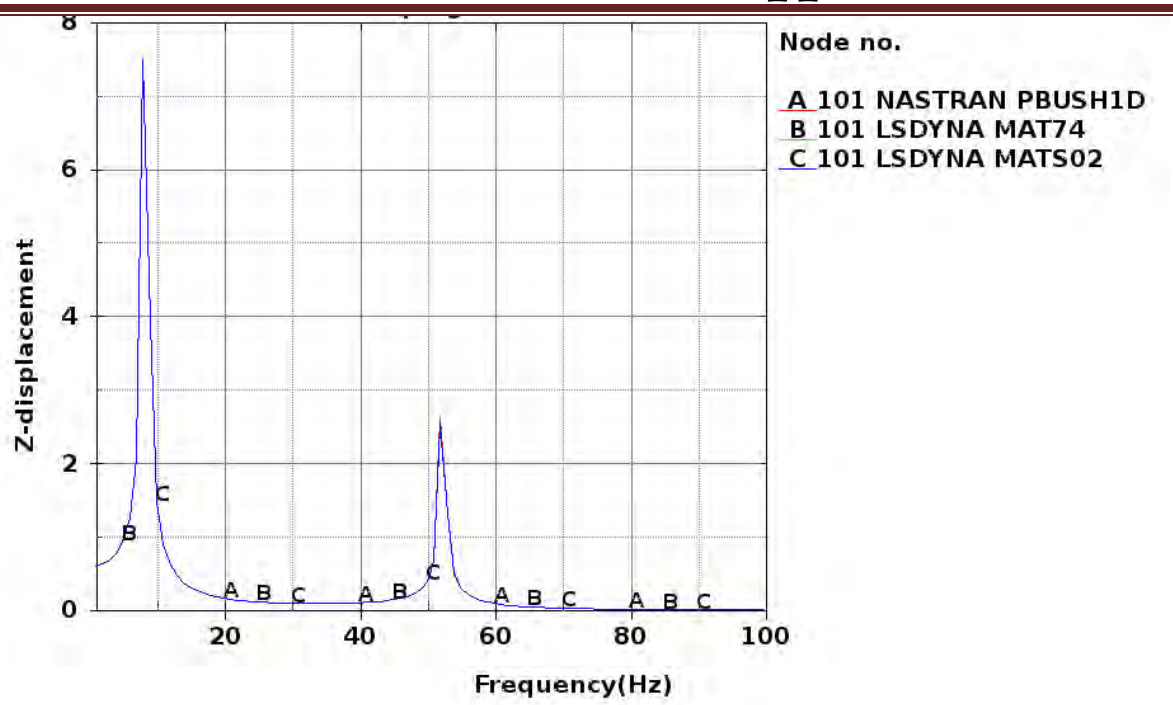

Figure10. Z displacement comparison

3. Summary

In this paper, two commonly used constrained elements: RBE2 and RBE3, and bushing elements in NASTRAN are investigated. For RBE2, its corresponding keyword in LS-DYNA is

CONSTRAINED_NODAL_RIGID_BODY**. For RBE3, its corresponding keyword in LS-DYNA is *CONSTRAINED_INTERPOLATION. For the bushing elements, one can also find corresponding material models in LS-DYNA. For CBUSH element, the corresponding material model in LS-DYNA is ***MAT_66** (MAT_LINEAR_ELASTIC_DISCRETE_BEAM**). For CBUSH1D element, the corresponding material models in LS-DYNA are ***MAT_74** (***MAT_ELASTIC_SPRING_DISCRETE_BEAM**) and ***MAT_S02** (***MAT_DAMPER_VISCOUS**).

As demonstrated by the examples, a good match between the results by LS-DYNA and NASTRAN for the constrained elements and bushing elements can be reached. Cross-validations of more element types will be performed in the future.

4. References

1.LS-DYNA Keyword User Manual, Livermore Software Technology Corporation, 2017.

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 LST, an ANSYS company to provide an integrated solution in the field of optimization.

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

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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.

LST

Livermore Software Technology, an ANSYS Company
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 LST, an ANSYS company. 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.

LST, AN ANSYS COMPANY 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.

LST, AN ANSYS COMPANY Barrier Models

LSTC offers several Offset Deformable Barrier (ODB) and Movable Deformable Barrier (MDB) model.

Material Sciences Corporation www.materials-sciences.com

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

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

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

MSC/LS-DYNA Composite Software and Database -

Fact Sheet: http://www.materials-sciences.com/dyna-factsheet.pdf

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

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

Oasys Ltd. LS-DYNA Environment www.oasys-software.com/dyna

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

Oasys PRIMER

Key benefits:

- Pre-Processor created specifically for LS-DYNA®
- Compatible with the latest version of LS-DYNA®
- Maintains the integrity of data
- Over 6000 checks and warnings – many auto-fixable
- Specialist tools for occupant positioning, seatbelt fitting and seat squashing (including setting up pre-simulations)
- Many features for model modification, such as part replace
- Ability to position and depenetrate impactors at multiple locations and produce many input decks automatically (e.g. pedestrian impact, interior head impact)
- Contact penetration checking and fixing
- Connection feature for creation and management of connection entities.
- Support for Volume III keywords and large format/long labels
- Powerful scripting capabilities allowing the user to create custom features and processes

www.oasys-software.com/dyna

Oasys D3PLOT

Key benefits:

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

www.predictiveengineering.com

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

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

Our History

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

恒士达科技
Hengstar Tech.

Shanghai Hengstar www.hengstar.com

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

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

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

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

Consulting

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

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

Cloud - HPC Services - Subscription RESCALE

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.

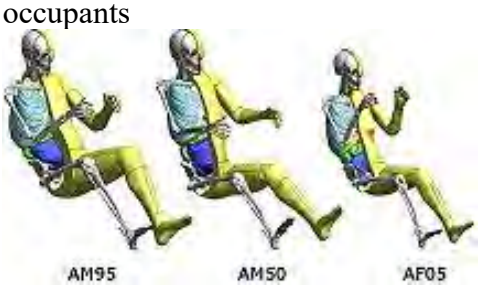
Key collaboration capabilities:

- 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

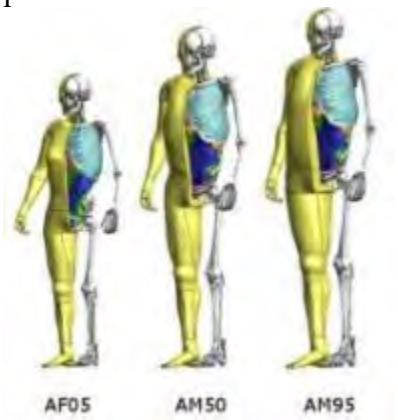
TOYOTA - Total Human Model for Safety – THUMS

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.

LST, An ANSYS Company – Dummy Models

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

LST, An ANSYS Company – 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

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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