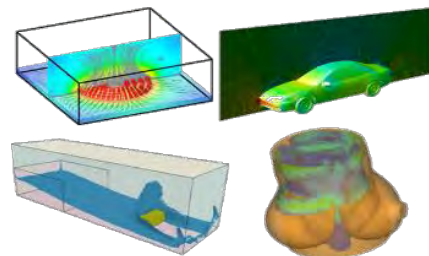**ANSYS**

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The focus is engineering technical solutions/information.

FEA Information China Engineering Solutions

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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.

www.lstc.com

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

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

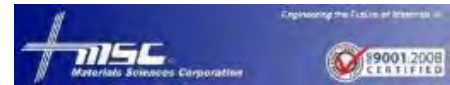**Editor and Contact: Yanhua Zhao - news@feainformation.com**

Platinum Particpants

BETA SIMULATION SOLUTIONS

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DatapointLabs

恒士达科技 Hengstar Tech.

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FINITE ELEMENT ANALYSIS Predictive Engineering

DELL

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

仿坤软件 LS-DYNA China

Table of contents

Announcements

We have decided to continue the publication of FEA Information solution and the newsletter, with the next issue arriving in January 2021.

We sincerely thank all of our participants and readers over the 20 years of this publication. We hope you continue to support us.

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.

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Ansys Website   **Ansys Blog**

/Ansys

Ansys Blog

Accelerating Automotive CFD Simulations with High-Performance Computing

Automotive external aerodynamics simulations require a high level of accuracy in a short amount of time. Because of the large, complex geometries and domain size needed, pre-processing and solving time can be significant.

Ansys has been making great progress in accelerating the pre-processing and solving time for these types of simulations. Ansys Fluent has added new features and capabilities to generate a high-quality mesh quickly and efficiently, including:

- Task-based workflows for clean and dirty computer-aided design (CAD) geometries.
- Automation and customization.
- New meshing topologies.
- Highly scalable parallel meshing.

Ansys is also delivering significant high-performance computing (HPC) enhancements with each new release of Fluent to reduce the time it takes to arrive at reliable solutions.

Accelerating Pre-Processing

Fluent offers two different workflows that help accelerate meshing by organizing the process into a user-friendly, task-based workflow: A watertight geometry workflow for clean CAD and a fault-tolerant meshing workflow for dirty CAD.

Both workflows offer relevant choices and options, but also have the flexibility to be customized.

Best practices are embedded into each task in the form of default values. Advanced users can easily check a box to reveal more options. You can also automate the process, using a Python-based journal file for batch meshing.

Fluent also offers a new mesh topology, known as Mosaic Poly-Hexcore. Mosaic technology enables polyhedral connections between disparate mesh types. Mosaic Poly-Hexcore is the first to employ this technology. It is a combination of hexahedral, isotropic poly prism and mosaic polyhedral elements.

Because the core volume mesh is generated using hexahedral elements, the same grid resolution results in a total face-count reduction. This delivers faster compute times with lower memory and disk space requirements.

Volume meshing can be accelerated even more by using Fluent's parallel meshing capabilities. Fluent has the ability to generate over 10 million cells per minute when running on 256 cores.

Reducing Time to Reliable Solutions with HPC

To enable fast and accurate simulations, Ansys delivers significant HPC enhancements with each new release of Fluent. One important development area is related to sliding mesh applications. They are increasingly being used to accurately simulate aerodynamic drag of a vehicle with rotating wheels, power losses in geared transmissions and the aeroacoustics of an automotive blower, for example.
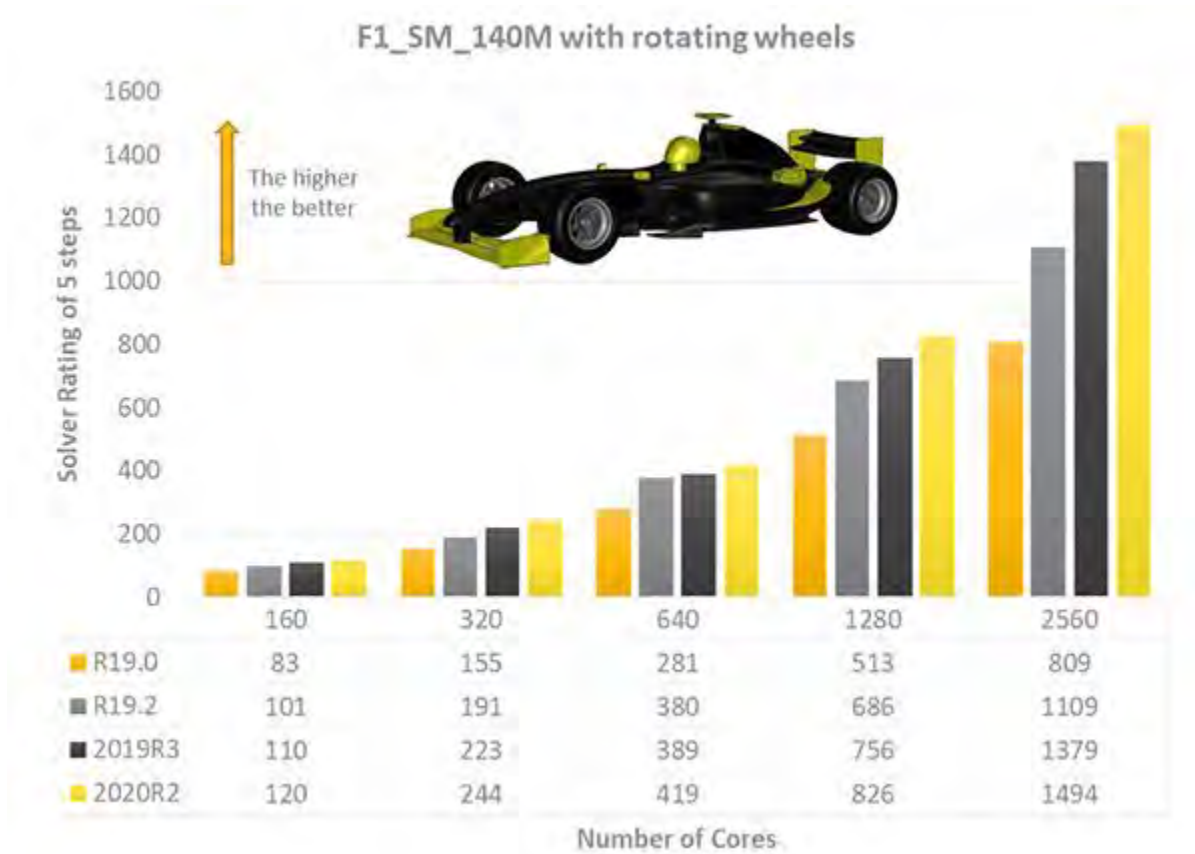

F1_SM_140M with rotating wheels

Number of Cores	160	320	640	1280	2560
R19.0	83	155	281	513	809
R19.2	101	191	380	686	1109
2019R3	110	223	389	756	1379
2020R2	120	244	419	826	1494

Ansys 2020 R2 has enabled a 61% speedup vs. Release 19.0 for a 140-million cell Formula One car simulation on 1,280 CPU cores.

Because sliding mesh applications are typically less efficient in terms of parallel processing, Ansys has steadily removed the bottlenecks to parallel scalability of complex models. The intersection algorithms have been improved, the mesh update overhead has been reduced and the data exchange strategies have been enhanced, among other improvements. In the current release, Ansys 2020 R2, this has enabled a 61% speedup — with respect to Release 19.0 — for a 140-million cell Formula One car simulation on 1,280 CPU cores.

Because hardware and software improvements go hand in hand, Fluent is optimized for the latest hardware technologies including those of Ansys HPC partners like Hewlett Packard Enterprise and Intel. For example,

Ansys and Intel worked together to build a new smoother and optimize it for Intel® Xeon® Scalable processors.

Ansys and Intel worked together to build a new smoother and optimize it for Intel® Xeon® Scalable processors to help reduce long simulation times. The testing showed that this produces a performance boost of 12 to 19%. If you would like to know more, download the "Run Your Ansys Fluent Simulations at Top Speed" white paper.

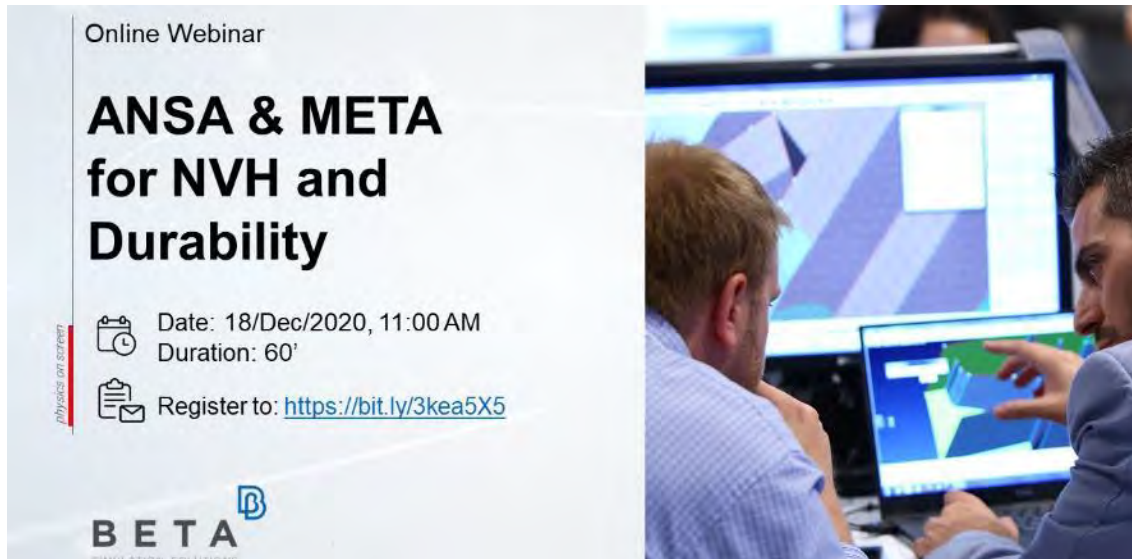Thanks to these and other HPC enhancements with each new release, you can solve smaller models and higher-fidelity models more quickly.

Register for our upcoming webinar, "How Aston Martin Red Bull Racing delivers winning CFD with Partners Ansys and HPE," to learn how Aston Martin Red Bull Racing is using Fluent with HPC solutions from Hewlett Packard Enterprise to increase their success on the track.

Read from website

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…

Online Webinar: ANSA and META for NVH and Durability

(Registration link: https://bit.ly/3kea5X5)

BETA CAE Systems India would like to invite you to a free NVH & Durability webinar on 18th December 2020 at 11:00 am. The webinar will be for an hour duration, covering an insight into state-of-the-art method of pre and post processing NVH simulations.

All managers, engineers, and any interested technical staff can attend this Webinar on ANSA and META for NVH & Durability application.

ANSA is a standard and robust solution for NVH & Durability pre-processing tasks that addresses the industry needs for process efficiency and simulation results reliability. It constitutes a complete platform covering equally and at the highest level of all pre-processing activities from CAD input to the output of a ready-to-run model. It efficiently supports all popular codes used at your facility.

META brings a new dimension to the NVH & Durability post-processing by successfully

addressing the bottlenecks and constraints involved. It's optimized performance for graphics & memory usage along with a broad range of features and calculation options, makes it an efficient environment for handling results from all popular solvers, as well as real-life test data and can even be integrated in optimization processes for NVH & Durability post-processing requirements.

About "B-webinars"

Beyond the numerous videos that we release every week, which allow you to enhance your knowledge upon demand, this is a new series of live webinar events.
The events comprise talks, presentations and demos, on topics related to the use and deployment of BETA software for solving demanding problems in computational engineering.
You are all welcomed to enjoy the webinars and take the most out of it by deepening your knowledge and broaden your horizons.
Learn more: https://www.beta-cae.com/training.htm#live_webinars

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Author: Christian Frech christian.frech@dynamore.de

Save the date!

13th European LS-DYNA Conference
October 5-6, 2021, Ulm, Germany

Conference Website: www.dynamore.de/en/conf2021

Invitation

We very much hope for a normalization of the situation and that we will be able to welcome the LS-DYNA users personally at a conference again next fall. We kindly invite all users of LS-DYNA, LS-OPT, and LS-TaSC to the 13th European LS-DYNA Conference at October 5-6, 2021 in Ulm, Germany. As usually the conference will be a great opportunity to talk with industry experts, catch up with colleagues and enjoy time exploring new ideas. In addition, attendees can meet with exhibitors to learn about the latest hardware and software trends as well as additional services relating to the finite element solver LS-DYNA, the optimization codes LS-OPT and LS-TaSC, and the pre- and postprocessor LS-PrePost. Training courses and workshops will also take place in the week before, during and after the conference.

Venue

The Congress Centrum Ulm is located directly on the river Danube. The city is best known for its cathedral, the highest church tower in the world and for being the birthplace of Albert Einstein.

Ulm is located directly on the A7 and A8 motorways and can be easily reached from Stuttgart and Munich airports.

Address:
Basteistraße 40
89073 Ulm
Telefon: +49 731 922990
Telefax: +49 731 9229930
www.ulm-messe.de

Abstract submission

Please submit your abstract (maximum length 2,500 characters) by E-Mail to conf@dynamore.de or online at:
www.dynamore.de/en/2021-abstract

Important Dates

Abstract submission: May 28, 2021
Author notification: July 9, 2021
Paper submission: September 3, 2021
Conference date: October 5-6, 2021

Participant fees

Industry speaker: 420 Euro

Academic speaker: 360 Euro

Industry: 640 Euro[1] / 690 Euro

Academic: 490 Euro[1] / 540 Euro

[1] Registration before 30 June 2021. All plus VAT.

Exhibiting and sponsoring

Please request further information.

Contact

DYNAmore GmbH
Industriestr. 2, D-70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
E-Mail:conference@dynamore.de
www.dynamore.de/en/conf2021

Author: Christian Frech christian.frech@dynamore.de

Webinars and Video-Seminars 2021

Online trainings from January to March

Webinars LS-DYNA Compact

Introduction to LS-PrePost	11-12 January
Introduction to LS-DYNA	13-15 January
Simulation of fiber-reinforced plastics	18-20 January
Simulation of thermoplastics	21-22 January
Implicit Analysis using LS-DYNA	25-26 January
Modeling Metallic Materials	8-9 February
Element Types & Nonlinear Aspects	22-24 February
Damage and Failure	22-23 February
Introduction to Isogeometric Analysis with LS-DYNA	1-2 March
Advanced Damage Modeling - Orthotropic Materials	8-9 March
Introduction to SPG Method for Manufacturing and Material Failure Analysis	15-16 March
User Interfaces in LS-DYNA	18 March
Electromagnetism in LS-DYNA	22-23 March
Resistive Heating and Battery Modeling	24 March
Introduction to Simulation Data and Process Management in LoCo	29-30 March
User Materials	31 March

Video Seminars

Introduction to LS-DYNA online	anytime
Crashworthiness Simulation with LS-DYNA	anytime
Modeling Metallic Materials	anytime
LS-OPT - Optimization	anytime
LS-OPT - Robustness	anytime

Visit our website for complete overview and registration www.dynamore.de/en/seminars

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eSi
get it right®

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.

Dirisolar Reclaims the Sky with Its Ecological Airship

An aircraft for cargo and passenger use with unlimited flight time, 100% carbon-free flights, and 90% of components made from recycled material... Where do we sign up?

Wednesday, December 9, 2020 By Natasha Baccari

According to the [Center for Biological Diversity](#), if the aviation industry were a country, it would place sixth in greenhouse gas emissions, between Japan and Germany. Aircraft manufacturers around the world are striving to reduce fuel consumption, and new incumbents are reimagining the possibilities of air mobility altogether. With the COVID-19 pandemic drastically reducing air travel, companies like Dirisolar are ever more committed to reinventing how people travel!

A glimpse into the history of flight

From kites to hydrogen balloons and airplanes to helicopters, there has always been intrigue in the concept of flight. But something we don't often hear about is airships. What is an airship and why don't we hear about them anymore?

The history of airships and the adventure of free human flight began on November 21, 1783, in France with physicist Pilâtre de Rozier and the Marquis d'Arlandes, who flew a "hot-air balloon" over Paris for 9 km. Technology continued to develop into a hard-shell and in 1910, the first commercial airship company began flying passengers in airships. Unfortunately, this was short-lived. The Hindenburg hydrogen airship caught fire and crashed in New Jersey in 1937, marking the end of airships for commercial passenger transport. That was until a man by the name of Philippe Tixier had a dream of continuing his grandfather's legacy of flying airships and devoted his life to transforming the aeronautics industry.

The next generation of airships

Mr. Tixier founded the Dirisolar Company in 2009. In 2012, it signed partnerships to produce the first manned solar airship, which is planned for flight in 2023. Dirisolar's solar-powered airship is part of an ecological approach to the transportation of the future. It offers multiple usages – from passenger and cargo transport to scientific explorations and ground observations – and its maneuverability, its ability to land on the ground without any external assistance, paired with its unlimited flight time, make it attractive to almost all sectors.

The structural arrangement of the DS 900. Courtesy of Dirisolar.

Dirisolar airships are designed, first and foremost, to ensure the safety of passengers and to fulfill eco-tourism expectations.

So, what makes this aircraft so unique? The entire craft is suspended in the air by helium, powered by solar panels - offering 100% carbon-free flights – and is completely autonomous. Its fully electric engine propels it in silence, registering at only 47 decibels.

Additionally, a whopping 90% of the airship's components are made from recycled material! The startup is also designing a production process that will limit carbon emissions.
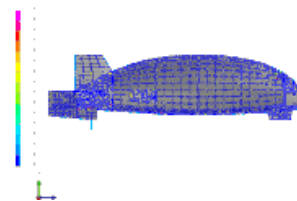
Tackling the challenges of a novel aircraft

But the thing that makes the Dirisolar even more unique is its rigid hull and front cabin, which also happen to be the same things that made it a challenge to build.

Weight, size, and a thin envelope – things you worry about when mailing a letter or building a solar-powered airship? Maybe both!

Finding the compromise between weight and strength is critical for any aircraft. The vessel must be strong enough to withstand wind and other forces acting on it during flight and continue to do so over the course of the craft's lifetime. For the Dirisolar, measuring 50 meters long, 12 meters high, and 15m wide, weighing in at roughly 1 300 kg empty, and only being able to withstand 40km/hour winds, weight optimization is crucial for production. Additionally, the Dirisolar team needs to understand how the airship will respond to meteorological and areological disturbances it would face in the air, which cannot be predicted or reproduced in a wind tunnel.

Last but certainly not least, we come to the craft's landing technique. A vessel of this size, weight, and design would require a group of 20 to help it land safely. But because this craft is intended for tourist flights, happening several times a day, that's impossible – can you imagine having a crew of 20 waiting for each flight to land?! Luckily, Dirisolar already had developed a technique that would allow for them to safely land the aircraft without any external assistance, but with a price tag of 8 million euros for the first flight, there was zero room for error. Dirisolar needed to ensure that, with this technique, their first real prototype would also be their last.

Stress on the Dirisolar in flight at 50 km/h

Virtual Prototyping becomes indispensable to Dirisolar's first flight

After meeting via the aeronautic simulation world, Dirisolar began its relationship with ESI Group in 2014. They started using ESI's solutions to conduct performance tests and to evaluate aerodynamic forces.

Flow around the Dirisolar landed

Dirisolar began using simulation in the design and pre-certification phases to execute linear and non-linear mechanical calculations and simulate critical design aspects. Access to advanced simulations and calculations enabled them to design the airship and study all of its possible load cases, without ever relying on a real prototype.

That's the most beautiful and unique thing about Virtual Prototyping – you can take your wildest, 8 M € ideas and bring them to life without spending even a fraction of that!
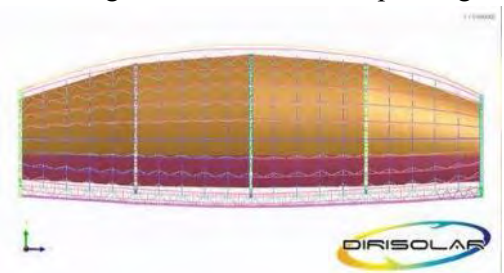
Through the use of Virtual Prototyping, they were able to analyze aerodynamic forces and wind resistance up to 135km/hour. This ensured the all-weather maneuverability of the craft and validated its ability to land without any external assistance. Harnessing Virtual Prototyping during the design phase allowed Dirisolar to quickly investigate an incredible number of variants, and correct errors expeditiously.

Tanks filling up with Helium

ESI's engineers worked closely with the team to fully understand their challenge and to help them work smarter instead of harder. And with an introduction to the ESI VPS Cloud Computing solution, Dirisolar avoided investing in HPC servers, directing all the startup's effort in the "what", not the "how".

"Virtual Prototyping helps us anticipate the behavior of the physical aircraft: it is the only solution that optimizes time and costs." Philippe Tixier / Founder & CEO, Dirisolar

Aiming to get it right the first time

The team at Dirisolar is bringing their dream to fruition, via simulation, which has proved essential because it's imperative to get it right the first time. For their passionate engineers who have dedicated years of their lives to this ground-breaking project, the confidence in knowing that the results are accurate gives them a peace of mind they couldn't put a price tag on.

Discussions between Dirisolar and the European Aircraft Safety Agency (EASA) are underway. Ultimately, they will use the simulation results to certify the aircraft, enabling it to be mass-produced and marketed.

Dirisolar plans to first target tourist flights and then diversify their offerings towards other applications, such as forest fire prevention, anti-poaching, pipeline surveillance, and more.

Dirisolar, we can't wait to see your name in the sky!

Learn more about Dirisolar and their fundraising efforts. For more information visit Virtual Performance Solution; Fluid Dynamics.

Read from website

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.

ETA Inc., Engineering Technology Associates Announces DYNAmore as Master Distributor in Europe

TROY, Michigan (USA) /STUTTGART, Germany – September 8, 2020 –
ETA Inc. (Engineering Technology Associates), an engineering and software innovator with over 37 years in the automotive engineering community, has signed a master distribution agreement with DYNAmore GmbH. DYNAmore is one of the largest distributors of LS-DYNA simulation software worldwide.

"I highly appreciate to further strengthen our long-standing and very good cooperation with ETA and to coordinate the distribution of Dynaform throughout Europe. Together we are well positioned to meet the increasing demands on deep drawing, hydroforming and tube bending simulations."
Ulrich Franz, Managing Director, DYNAmore GmbH

'It is my pleasure to welcome DYNAmore, our long time Dynaform partner and German distributor as our new Master Distributor for Dynaform in the European Union. I am pleased by DYNAmore's business expansion, as they increase their presence in new growth markets across Europe.'
– Dr. Akbar Farahani, CEO & President, ETA Inc.

ETA and DYNAmore have been the most prominent LS-DYNA distributors for over 25 years. This new partnership will bring both companies closer, strengthen the software sales and support to the end-customer and showcase a unified market expansion to European OEMs' and suppliers.

ETA and DYNAmore are committed to creating a powerful virtual presence with webinars, online support and training for customers during the current pandemic and beyond.

DYNAmore will lead the following efforts:
- Supporting customers with the 6th generation of Dynaform
- Providing assistance to European sub-distributors
- Delivering consistent, streamlined communication for software sales and support throughout Europe

For further information on ETA, please visit eta.com
For further information on DYNAmore, please visit www.dynamore.de/en.

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Postings every Monday on what you have missed

www.feantm.com

12/14/2020   Who asked for a pinball machine for Xmas? If you didn't then you should. And if you did then below will be of interest if you want to be like the song Pinball Wizard. Old old song!

Self-controlling pinball simulation using LS-DYNA

in this neat pinball simulation by DYNAmore Nordic, prescribed motions are applied to the flippers as the ball, modelled with a Discrete Element Sphere, comes into contact with some segments above the respective flipper.

12/07/2020   I did try to find an FEA simulation on how to make me follow through on my 2021 New Year Resolution I am thinking to do - NONE!I am thinking of bottling my to go coffee so we need to watch bottle caps!

LS-DYNA simulation of a LS-TaSC optimized bottle opener in action.

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 of GISSMO failure theory and application in LS-DYNA

Shanghai Hengstar Technology & Ansys/Lst will jointly organize a Web Training of the GISSMO failure theory and application in LS-DYNA on Dec 17 2020.

Contents:

(1) Basic theory of GISSMO

(2) Failure curve and instability curve

(3) Stress triaxiality

(4) Mesh dependence

(5) Parameter identification of the GISSMO model

Instructor：

Xiaobin Feng (senior engineer)

Xiaobin Feng has a master's degree in mechanics and more than 5 years' working experience. At present, he is mainly responsible for the performance test and simulation calibration of metal/non-metallic materials, including the tensile test calibration and material failure (GISSMO) simulation calibration under different strain rates. At the same time, he also participated in the drop analysis of electronic products, simulation analysis and optimization of the whole vehicle of the railway train industry, etc.

Duration and Style: (3 hours web training)   **Time**: Dec 17 2020 (9:00AM-12:00AM) **Language:** Mandarin

Contact: Xixi Fei   Tell: 021-61630122 mobile:13524954631 Email:Training@hengstar.com
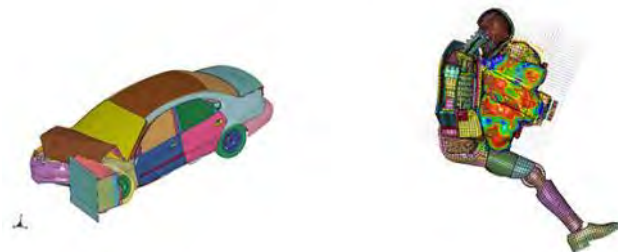
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JSOL supports industries with the simulation technology of state-of-the-art. Supporting customers with providing a variety of solutions from software development to technical support, consulting, in CAE (Computer Aided Engineering) field. Sales, Support, Training.

General-Purpose Nonlinear Analysis Program
Simulating Complex Real World Problems

General-purpose finite element program
LS-DYNA®

- Material models: metal, rubber, resin and composite, and more
- From a desktop PC to a supercomputer
- Cutting-edge technologies: time development, spatial discretization
- Application: crash, strength, forming analysis

LS-DYNA Features

LS-DYNA opens the nonlinear world

The phenomena adopted for developing product designs are becoming increasingly complex: automotive crashes, metal forming, forging, large deformations of rubber materials, and failure of plastic parts. CAE simulation is now an essential tool for attaining a complex and high-quality design in various industries. LS-DYNA was originally introduced by Dr. John O. Hallquist at the Lawrence Livermore National Laboratory in the 1970s. In the late 1980s, Livermore Software Technology, LLC (LST, LLC) was founded to develop LS-DYNA as a commercial code. LST, LLC has been committed to developing LS-DYNA for solving nonlinear problems more precisely and stably. LS-DYNA is now known worldwide as one of the best nonlinear solvers and is used in both the academic and the industrial worlds.

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.

LUPA

LST, an ANSYS Company

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

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

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

Geometry and Meshing Includes

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

Applications

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

Pre- and Post-Processing Capabilities

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

Other General Functions

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

LS-PrePost new release version 4.8

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

A few highlighted items in LS-PrePost 4.8:

1. Fringe Binout data – data in Binout branches like ELOUT, NODOUT, TPRINT now can be fringed on an input keyword file (without deformation) or d3plot files. (see C1.png)
2. Greatly improved graphic rendering for SPH particle tracing. (C2.png)
3. Better split windows configurations, XY graphs can also be posted in split windows panels along with models (C3.png)
4. Support NVH Panel Contribution Analysis. (C4.png)
5. SCL (Scripting Command Language) now support Python in addition to the C-like language.

LS-PrePost 4.8 can be download from:
https://ftp.lstc.com/anonymous/outgoing/lsprepost/4.8/

C1

C2

C3

C4

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.

Bottom photos courtesy of TPI Composites, Inc. (left) and Seemann Composites, Inc. (right)

Engineering Services

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

Oasys Ltd is the software house of Arup and distributor of the LS-DYNA software in the UK, India and China. We develop the Oasys Suite of pre- and post-processing software for use with LS-DYNA.

Webinar to watch again
Oasys PRIMER - Mesh modifications tools

In this webinar, we will be looking at the powerful meshing tools that are built into the latest release of Oasys PRIMER. We will cover some fundamentals such as creating, splitting and reviewing meshes as well as some more advanced features such as holes, swages and the tet mesher.

View here

Webinar to watch again
Oasys REPORTER - Integration

Learn how to use Oasys REPORTER to accelerate your LS-DYNA post-processing. REPORTER is now seamlessly integrated with the Oasys Suite, so you can quickly add images and key results data directly into reports, for sharing with your team

View here

We would like to take this opportunity to send a huge ***thank you*** to Yanhua, Marsha and everyone else behind the scenes at FEA News and LST for the many years of knowledge sharing and support to the LS-DYNA community.

The Oasys LS-DYNA newsletter will continue next year, and we welcome all Oasys and LS-DYNA users to subscribe here.

As we approach the end of a challenging year the Oasys team at Arup wish a happy holidays to all and look forward to working with you in a brighter 2021.

Season's Greetings from Arup

It's 50 years since our founder, Sir Ove Arup, gave his Key Speech setting
out the core values of our firm and the importance of what he termed 'the humanitarian attitude'.
This year, more than ever, these values guide us as we seek to support our clients, partners
and members. Together we shape a better world.

Wishing you safe and happy holidays.

ARUP

We shape a better world | www.arup.com

Predictive Engineering

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

Predictive Engineering – Western States ANSYS LS-DYNA Distributor – Your Free Coffee Cup is On Its Way!

LS-DYNA has been one of Predictive's core analysis tools pretty much since we got started in

For now, let's talk about those free coffee cups. Predictive is now the western states distributor of ANSYS LS-DYNA and provides complete sales, training and services for ANSYS LS-DYNA clients in this region. It is a continuation of our prior setup with LSTC (now ANSYS LST) with the addition of Predictive's ability to offer ANSYS Workbench with LS-DYNA and other ANSYS software tools. So where's my free coffee cup? If you are a current Predictive ANSYS LS-DYNA client, we'll be shipping'em out to you at the end of February and for our new client's – just send us an email or give us a call.

1995. It is an amazing numerical workhorse from the basic linear mechanics (think ANSYS or Nastran) to simulating well nigh the impossible. At least that is the way I feel at times when the model is not solving and spitting out arcane error messages and I'm basically questioning my sanity for accepting this project from hell that has a deadline at the end of the week. Which brings me to my favorite project management image – "trough of despair followed by wiggles of false hope then crash of ineptitude and finally the promised land" but I'll leave that for another blog.

View our portfolio

FEA, CFD and LS-DYNA consulting projects

Contact:

Address:
2512 SE 25th Ave
Suite 205
Portland, Oregon 97202
USA

Phone:
503-206-5571
Fax: 866-215-1220
E-mail:
sales@predictiveengineering.com

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.

Platform Updates and Software Release Notes – December 2020

December 145, 2020, Jolie Hales
Automotive, English, Product Info & Tutorials

Rescale now works with more than 600 applications.

Here are a few **recent highlights**:

SCM ADF 2019 & 2020 – ADF, which **stands** for Amsterdam Density Functional, is a computational chemistry program particularly strong in understanding and predicting structure, reactivity (catalysis), and spectra of molecules. Learn more here.

AutoForm TubeXpert R9.0.0.4 – AutoForm **TubeXpert** is an easy-to-use and highly intuitive software solution for rapid tool design and simulation of tube bending, forming and hydroforming processes. Learn more here.

Siemens Simcenter STAR-CCM+ 15.06.007 – Simcenter STAR-CCM+ is a complete multiphysics solution for the simulation of products and designs operating under real-world conditions. Learn more here.

TopOpt – TopOpt is an acronym for Topology Optimization — a joined research effort between DTU Mechanical Engineering and DTU Compute with the aim of promoting theoretical extensions and practical applications of the topology optimization method.   TopOpt is MATLAB-based code utilized in multiple load-cases, alternative mesh-independency schemes, passive areas, etc. Learn more here.

Our full software catalog is available here.

Interested in learning more or about application availability? CONTACT AN EXPERT

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.

Shanghai Fangkun Software Technology Ltd

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

Based on the strong technical support and developing capability from ANSYS Inc, Shanghai Fangkun attracts a group of top LS-DYNA application engineers and commit to provide LS-DYNA technical support in the automotive industry, electronics industry, rock-soil, aerospace, general machinery and other industries. Shanghai Fangkun devotes to providing all products of LSTC including LS-DYNA, LS-OPT, LS-PREPOST, LS-TASC and LSTC FEA models (dummies model, pedestrian model, etc).

In the meantime, Shanghai Fangkun also relies on strong technical support of ANSYS Inc and will focus on secondary development and process customization of LS-DYNA and its application process. In view of domestic users customization requirement, Shanghai Fangkun will concentrate on customizing custom interface based on LS-PREPOST processing platform, to adjust, standardize and analyzes specific process, improve the efficiency in application, reduce human error, accumulate experience of engineering application, improve customer R&D and competition capabilities.

Shanghai Fangkun will keep mission firmly in mind, devote to improving user satisfaction of LS-DYNA and providing high-quality technical support and engineering consulting services for users.

Contacts
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Postcode: 201102 **Tel:** 4008533856 021-61261195
Sales Email: sales@lsdyna-china.com **Technical Support Email:** support@lsdyna-china.com

LS-DYNA Training Plan in 2021

Shanghai Fangkun has successfully held several series of LS-DYNA related webinars and training courses in 2020 and received much attention and feedback. Now Shanghai Fangkun release the training plan for 2021 as shown in the following table. Please follow us official Wechat "LSDYNA" to get latest information. All LS-DYNA users and those who interested in are welcome to attend. If you have any questions, please contact email training@lsdyna-China.com, **or dial 021-61261195, 4008533856.**

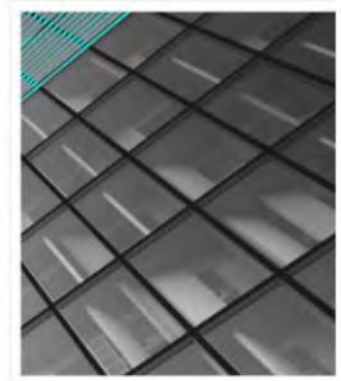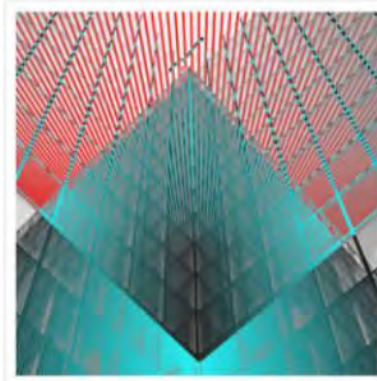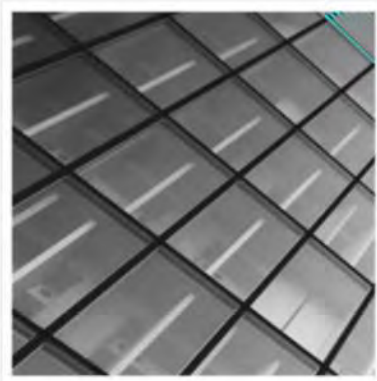| Date	Topic	Duration
Jan.	LS-DYNA Basic Training	2 days
Feb.	Introduction to LS-PrePost	4-8 hours
Feb.	Introduction to LS-Form & Stamp forming	4-8 hours
Mar	Crash & Safety analysis in LS-DYNA	2 days
Mar	Introduction to LS-Form & Stamp forming	4-8 hours
Apr	GISSMO failure model theory and application of LS-DYNA	4-8 hours
Apr	Simulation of battery crush and nail penetration in multiphysical field with LS-DYNA	4-8 hours
May	Concrete material model in LS-DYNA	2-4 hours
May	Introduction to S-ALE	4-8 hours
Jun	Drop analysis in LS-DYNA	4-8 hours
Jun	Introduction to Contact in LS-DYNA	4-8 hours
Jul	Introduction to EM in LS-DYNA	4-8 hours
Jul	Introduction to LS-OPT	4-8 hours
Aug	ICFD analysis in LS-DYNA	2-4 hours
Aug	LS-DYNA Basic Training	4-8 hours
Sep	Implicit analysis in LS-DYNA	4-8 hours
Sep	CESE analysis in LS-DYNA	2-4 hours
Oct	LS-DYNA application in constranit system	4-8 hours
Oct	Meshfree,SPG and Advanced finite element analysis in LS-DYNA	4-8 hours
Nov	LS-DYNA composite material model training	4-8 hours
Nov	LS-DYNA Thermal-structural-Coupling Analysis	4-8 hours
Dec	LS-DYNA Welding Analysis	4-8 hours
Dec	NVH, Frequency domain and fatigue in LS-DYNA	4-8 hours

Shanghai Fangkun Software Technology Ltd. was authorized by ANSYS Inc as the domestic master distributor of LS-DYNA software and will keep mission firmly in mind, devote to improving user satisfaction of LS-DYNA and providing high-quality technical support and engineering consulting services for users.

Founded in 2013, Simu-K is born from the vision of an engineer and an entrepreneur. The primary objective is to allow companies in Quebec and internationally to have access to expertise in digital simulation adapted to their needs.

Address 275 Main Street St-Nazaire-du-Lac-St-Jean, Quebec Canada, G0W 2V0	General informations *Email:* info@simu-k.com	Direction *President : Michael Page* *Email:* michael.page@simu-k.com *Phone:* +1-418-376-7468

Impact protection structure with SPH element : https://youtu.be/k7gqMkqwC3s	
Electro-thermal-mechanical simulation with element erosion : https://youtu.be/_UFwEiqUpYg	
Protective structure for tank failure with SPH fluid : https://youtu.be/4II-qMqI1Rc	
DEM-Structure interaction with impact : https://youtu.be/d-QRNKQfcqM	

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

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

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

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

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

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

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

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

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

New 2021 Jeep® Wrangler 4xe Named Hybrid Technology Solution of the Year by AutoTech Breakthrough Awards Program

Dec 4, 2020 | Nick Cappa; Kristin Starnes

- Wrangler 4xe boasts 375 horsepower, 470 lb.-ft. of torque and delivers up to 25 miles of pure electric operation for daily commutes with no range anxiety

- 2021 Jeep® Wrangler 4xe is the natural evolution of nearly 80 years of Jeep capability leadership

- Wrangler 4xe retains the Jeep Wrangler's Trail Rated running gear: solid front and rear axles, full-time 4x4 two-speed transfer case, fully articulating suspension and 30 inches of water fording capability

- Jeep 4xe vehicles provide new levels of efficiency, performance and capability, on and off the road

December 4, 2020 , Auburn Hills, Mich. - The 2021 Jeep® Wrangler 4xe plug-in hybrid has been named Hybrid Technology Solution of the Year by the AutoTech Breakthrough Awards program.

4xe is Jeep's global name for its plug-in hybrid electric vehicle technology. Delivering up to 25 miles of nearly silent, zero-emission, electric-only propulsion, the new 2021 Jeep Wrangler 4xe is commuter friendly as an all-electric daily driver without range anxiety. It also is the most capable and eco-friendly off-road Jeep vehicle – combined with the open-air freedom that only Jeep Wrangler offers.

"The Jeep Wrangler 4xe reaches a new audience by creatively mixing advanced propulsion with a staple in the off-road world," said Bryan Vaughn, President of AutoTech Breakthrough Awards. "It is this combination of technology without sacrificing the core capabilities of the Wrangler that has earned the vehicle our Hybrid Technology Solution of the Year award."

The most advanced Wrangler powertrain combines a high-tech, 2.0-liter four-cylinder turbocharged engine with two electric motors, a high-voltage battery pack and TorqueFlite eight-speed automatic transmission. Torque from the electric motors in the Wrangler 4xe arrives instantly on demand from the driver. The powertrain also delivers fuel-saving, seamless, stop-start operation of the engine.

Jeep Wrangler 4xe maximizes efficiency with an estimated 50 miles per gallon equivalent (MPGe). With 375 horsepower, 470 lb.-ft. of torque, a 0-60 mph time of just 6.0 seconds and total driving range of nearly 400 miles, the 2021 Jeep Wrangler 4xe delivers performance, benchmark off-road capability and an electric vehicle lifestyle.

Drivers can tailor the hybrid powertrain to best suit each trip with the E Selec mode buttons on the instrument panel. Hybrid, the default mode, blends power from the engine and electric motors. Electric prioritizes EV operation until the battery reaches its minimum charge, while eSave prioritizes propulsion from the engine, saving the battery charge for later use.

Trail Rated is a necessary component for all Jeep Wranglers. The 4xe is equipped with solid front and rear axles, full-time 4x4 two-speed transfer case, fully articulating suspension and 30 inches of water fording capability. All Wrangler 4xe power modes are available when the drivetrain is shifted to 4Lo. The seamless integration of electric power into the 4x4 drivetrain elevates the Wrangler 4xe to new levels of off-road performance.

The Jeep Wrangler 4xe will be sold globally and assembled at the FCA Toledo Assembly Complex in Toledo, Ohio.

AutoTech Breakthrough

Part of Tech Breakthrough, a leading market intelligence and recognition platform for global technology innovation and leadership, the AutoTech Breakthrough Awards program is devoted to honoring excellence in automotive technologies, services, companies and products. The AutoTech Breakthrough Awards program provides a forum for public recognition around the achievements of AutoTech companies and solutions in categories, including Connected Car, Electric Vehicles, Engine Tech, Automotive CyberSecurity, Sensor

Technology, Traffic Tech, Vehicle Telematics and more. For more information, visit https://autotechbreakthrough.com/.

 Jeep Brand

Built on nearly 80 years of legendary heritage, Jeep is the authentic SUV with 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.

Follow Jeep and FCA news and video on:

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Instagram: www.instagram.com/jeep or www.instagram.com/FiatChrysler_NA
Twitter: www.twitter.com/jeep or www.twitter.com/FiatChrysler_NA
YouTube: www.youtube.com/thejeepchannel or www.youtube.com/fcanorthamerica

Read from website

LS-DYNA - Resource Links

LS-DYNA   Multiphysics   YouTube

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

FAQ   LSTC

   ftp.lstc.com/outgoing/support/FAQ

LS-DYNA Support Site

   www.dynasupport.com

LS-OPT & LS-TaSC

   www.lsoptsupport.com

LS-DYNA   EXAMPLES

   www.dynaexamples.com

LS-DYNA   CONFERENCE   PUBLICATIONS

   www.dynalook.com

ATD –DUMMY   MODELS

   www.dummymodels.com

LSTC   ATD   MODELS

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

AEROSPACE WORKING GROUP

   http://awg.lstc.com

Training - Webinars

Participant's Training Classes

Webinars

Info Days

Class Directory

Directory

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

LS-DYNA Online Training

LS-DYNA LIVE ONLINE TRAINING & CONSULTING SERVICES

Lsdyna online was created by the LSTC instructor after 25 years of teaching various LS-DYNA courses for LSTC nationally and internationally (more than 20 countries). The online company was established in 2012 and we have been providing many live interactive courses to many companies and organizations. We do consulting work in addition to instructions. Here are some courses, for full list see our webpage.

1. Introduction to LS-DYNA (2 days @ $800) December 11-12	**13. Plasticity, Plastics, & Visco-Plasticity (2 day @ $1000)** November 2-3
2. Composites in LS-DYNA (2 days @ $1000) October 1-2	**14. Penetration Using LS-DYNA (2 days @ $1000)** June 15-16
4. Fracture, Damage, & Failure (2 days @ $1000) October 5-6	**15. Composite Materials (1 day @ $500)** October 30
5. Fluid Structure Interaction (2 days @ $1000) September 29-30	**16. Blast using LS-DYNA (2 days @ $1000)** November 5-6
6. Material Models Tests to Simulation (2 days @ $1000) October 8-9	**17. Introduction to LS-PREPOST (1 day @ $500)** November 4
3. Contact in LS-DYNA (2 days @ $1000) October 12-13	**18. Advance LS-PREPOST (1 day @ 500)** email us for dates

About Tabiei

Dr. Al Tabiei has been a consultant on the use of large scale finite element simulation for more than 25 years to more than 80 large and small companies and government labs in the US and abroad. He was the director of the Center of Excellence in DYNA3D Analysis at the University of Cincinnati (1997-2001). He has more than 150 journal, refereed reports, and conferences papers
He lectured at nearly 20 countries. He also did code development for LSTC. The instructor has developed and implemented many material models in LS-DYNA. Composite Shell element for composite materials and various other development in the code. He was consultant to the US government for several years on the use of simulation for home land security problems. He has served as a Subject Matter Expert (SME) for the government for more than 20 years. He was also on a NASA team for the return to the moon program to investigate different landing scenarios (2006-2010).

Acoustic radiated power and radiation efficiency calculation with LS-DYNA®

Yun Huang, Zhe Cui

Livermore Software Technology, an ANSYS company

Abstract

The keyword `*FREQUENCY_DOMAIN_SSD` *in LS-DYNA® not only provides convenient solution for steady state vibration analysis for structures, but also raises the possibility for acoustic simulation. For example, it can be combined with acoustic boundary element method (keyword* `*FREQUENCY_DOMAIN_ACOUSTIC_BEM`*) or acoustic finite element method (keyword* `*FREQUENCY_DOMAIN_ACOUSTIC_FEM`*), to compute the acoustic pressure and sound pressure level for vibro-acoustic problems. In addition, with the option ERP for this keyword, one can perform ERP (Equivalent Radiated Power) analysis to get a quick solution for radiated noise, based on the plane wave assumption for the acoustic waves.*

A new parameter RADEFF has been added to the keyword `*FREQUENCY_DOMAIN_SSD_ERP` *to run acoustic radiated power computation for baffled plates, and also computes the radiation efficiency.*

With some examples, this paper explains the difference between the ERP (equivalent radiated power) and ARP (acoustic radiated power), and shows how to use this new parameter to compute the acoustic radiated power and radiation efficiency for vibrating structures.

Introduction

Starting from R7 of 971 version, a keyword `*FREQUENCY_DOMAIN_SSD` has been introduced in LS-DYNA to run steady state dynamic analysis. It provides vibration response due to harmonic loading in frequency domain. This provides also possibility for some other simulations, for example, acoustic computation. Usually engineers and researchers use finite element method or boundary element method to run acoustic or vibro-acoustic simulation. These methods require explicit finite element or boundary element mesh for the acoustic domain. A complex variable equation system is established and solved for each excitation frequency. As a comparison, the SSD based acoustic approach is much simpler as it does not require any acoustic elements. Based on the vibration results from SSD, one can compute the acoustic intensity on the surface of structures, with some assumptions. Then with an integral on the elements on the surface, one can get estimated radiated acoustic power from the structure. This paper introduces three methods to compute the radiated acoustic power based on SSD: 1) ERP; 2) ERP with corrected radiation efficiency at lower frequencies; and 3) Using Rayleigh Integral.

Review of the theory for computation of acoustic power

The acoustic intensity is defined as

$$I(r_P) = \text{Re}\big[p(r_P) \cdot v_n(r_P)^*\big] / 2 \quad (1)$$

where $p(r_P)$ is acoustic pressure, $v_n(r_P)$ is the normal velocity at the surface.

For ERP, the plane wave assumption is used. As the result,

$$Z = \frac{p}{v_n} = \rho c \quad (2)$$

where ρ is the density of the fluid (e.g. air), c is the sound speed in acoustic fluid. For air, $\rho = 1.21$ kg/m^3 and $c = 340$ m/s. Z is acoustic characteristic impedance.

With some manipulation of the equation (2), one can get

$$p(r_P) = \rho c v_n \quad (3)$$

The ERP absolute value can be computed as integral of acoustic intensity over the surface S:

$$W_{ERP} = \int_S I(r_S)dS = \rho c \int_S v_n(r_S)v_n^*(r_S)dS \quad (4)$$

As pointed in reference [1], corrected radiation efficiency for low frequencies is given as

$$\sigma = 1 - \frac{J_1(2kR)}{kR} \text{ I} \quad (5)$$

Where, $k = \omega/c$ is the wave number and R is the radius of a rigid circular piston. In equation (5), the Bessel Function J_1 is dependent on the Helmholtz number kR. With the introduction of the corrected radiation efficiency, the equation (4) can be rewritten as

$$W_{ERP\_c} = \left(1 - \frac{J_1(2kR)}{kR}\right)\rho c \int_S v_n(r_S)v_n^*(r_S)dS \quad (6)$$

For pressure given by Rayleigh Integral, it is given as

$$p(r_P) = \frac{i\omega\rho}{2\pi}\int_S v_n(r_P)\frac{e^{-ikR}}{R}dS \quad (7)$$

And the radiated power by Rayleigh Integral is given as below

$$W_{RI} = \int_S I(r_S)dS = \frac{\omega\rho}{4\pi}\int_{S'}\int_S v_n(r_S)\frac{\sin kR}{R}v_n^*(r_S)dSdS' \quad (8)$$

Keywords

A typical keyword for running ERP and acoustic radiated power by Rayleigh integral is given below. The option _ERP after *FREQUENCY_DOMAIN_SSD indicates that the calculation for ERP (Equivalent Radiated Power) is requested. With this option, cards 4, 5 for the keyword *FREQUENCY_DOMAIN_SSD are required [2]

```
*FREQUENCY_DOMAIN_SSD_ERP
$#    mdmin      mdmax      fnmin      fnmax     restmd     restdp
          1         20      0.000      0.000
$#    dampf      lcdam      lctyp     dmpmas     dmpstf
   0.010000          0          0      0.000      0.000
$#                                      nerp     strtyp       nout      notyp       nova
                                           1
$#       ro          c     erprlf     erpref     radeff
       1.21       340.         1.                     1
$#      pid       ptyp
          1          2
$#      nid       ntyp        dof        vad        lc1        lc2     lcflag        vid
$# horizontal base acceleration
                                  1          3        200

*DATABASE_FREQUENCY_BINARY_D3SSD
$#   binary
          1
$#     fmin       fmax      nfreq     fspace     lcfreq
        10.      1000.        100
```

To use the corrected radiation efficiency for low frequencies for ERP results, one can set "ERPREF" = -1.

Example: a simplified engine model

This example considers a simplified auto engine model. It has 16041 nodes and 13484 Hexahedron elements. Elastic material is used for this model. The engine model is constrained to a shaker table from the base (see Figure 2). The harmonic excitation is given in x-direction through the shaker table. The range of excitation frequency is 10-1000 Hz, with frequency step 10 Hz. The excitation is given in the form of constant acceleration amplitude 0.02 g, for the whole range of frequency.

Fig 1. FEM mesh of a simplified auto engine model **Fig 2. Constraints of the engine model**

The whole outer surface of the engine model is taken as the acoustic radiation surface. With ERP option and air density, sound speed in air, as well as the radiation panel defined in card 4 and 5, one can get the ERP results in the form of

1) Binary plot database D3ERP, which shows the ERP density on the surface, and
2) ERP_ABS and ERP_DB for the ERP absolute value, and dB values (if a reference ERP value is provided in the position of ERPREF in card 4).

Particularly, the ERP density fringe plot at frequency 100 Hz and 500 Hz are shown in Figures 3 and 4

Fig 3. ERP density at frequency 100 Hz   Fig 4. ERP density at frequency 500 Hz

The ERP absolute value for the whole range of frequency 10-1000 Hz can be found in Figure 5.

Fig 5. ERP absolute value (watt) vs. frequency

Since the "RADEFF" is set to be 1 in the input deck, LS-DYNA also runs radiated acoustic power calculation based on Rayleigh integral, and calculates the radiation efficiency, which is given as a ratio between the radiated acoustic power based on Rayleigh integral, and the acoustic power based on plane wave assumption (which is ERP absolute value computed before). By setting "ERPREF" = -1, one can also introduce the correction on the radiation efficiency for low frequencies for ERP, and get a "corrected" ERP absolute value. Figure 6 below shows the radiated acoustic power, given by the three methods: 1) classic ERP; 2) ERP with corrected radiation efficiency for lower frequencies; and 3) Rayleigh integral.

Fig 6. Radiated acoustic power (watt) by classic ERP, corrected ERP and Rayleigh integral

As can be seen in Figure 6, the radiated acoustic power by the classic ERP, the ERP with corrected radiation efficiency at low frequencies, and Rayleigh integral method have a good match at higher frequencies (e.g. frequency over 600 Hz). For the lower frequencies, the radiated acoustic power calculated by the Rayleigh Integral method is much lower than those given by ERP methods (classic one and the one with low frequency radiation efficiency correction). Besides, from Figure 6, one can see that the correction on the ERP absolute value by equation (6) has only influence on the results in low frequency range.

Fig 7. Radiation efficiency

Figure 7 shows radiation efficiency, which is given as a ratio between acoustic power by Rayleigh integral and ERP. One can see that the radiation efficiency is much higher and approaching to 1 for the higher frequency range.

Conclusion

This paper introduces three acoustic radiated power computation methods for vibrating structures, based on the keyword `*FREQUENCY_DOMAIN_SSD`. They are all much cheaper and faster than the standard finite element or boundary element acoustic methods. They help to characterize the structure borne noise quickly. They can be very useful in the early design phase of product development. The three methods are based on different theories and assumptions. It is important for user to understand the difference in the corresponding assumptions in order to use them appropriately.

References

[1] Münch, H. Equivalent Radiated Power - Sensibilisierung für Grenzen und Potenziale einer akustischen Berechnungsmethode, Master of Science Study Work, Friedrich-Alexander University, Erlangen, (2014).

[2] Livermore Software Technology Corporation, LS-DYNA® Keyword User's Manual, 2019.

BETA CAE Systems.   www.beta-cae.com

BETA CAE Systems - ANSA

BETA CAE Systems μETA

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

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

Solutions for:

Process Automation - Data Management – Meshing – Durability - Crash & Safety NVH - CFD - Thermal analysis - Optimization - Powertrain

 Products made of composite materials - Analysis Tools -

Maritime and Offshore Design - Aerospace engineering - Biomechanics

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

etainfo@eta.com

Inventium Suite™

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

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

PreSys

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

VPG

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

DYNAFORM

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

ESI Group   www.esi-group.com

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

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

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

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

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

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

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

JSOL Corporation

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.

ANSYS **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.

Engineering Solutions   *Material Science Corp.*

Material Sciences Corporation

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

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

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

failure modeling of composite structures currently available.

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

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

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

Oasys Ltd. LS-DYNA Environment

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

Oasys PRIMER

Key benefits:

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

www.oasys-software.com/dyna

- Contact penetration checking and fixing
- Connection feature for creation and management of connection entities.
- Support for Volume III keywords and large format/long labels
- Powerful scripting capabilities allowing the user to create custom features and processes

www.oasys-software.com/dyna

Oasys D3PLOT

Key benefits:

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

www.predictiveengineering.com

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

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

Our History

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

Shanghai Hengstar

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

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Rescale: Cloud Simulation Platform

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

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

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

Rescale has strategic/technology partnerships with infrastructure and software providers to offer the following:
· Largest global hardware footprint – GPUs, Xeon Phi, InfiniBand
· Customizable configurations to meet every simulation demand
· Worldwide resource access provides industry-leading tools to every team
· 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.

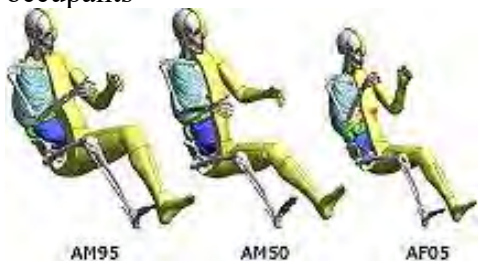**Key collaboration capabilities:**
- Data, workflow or project asynchronous collaboration
- Multi-user, browser based collaboration for CAD, geometry, mesh and results models
- Real-time design review with notes, annotations and images archiving and retrieval
- Email invite to non ESI Cloud users for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

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ESI Group

TWITTER

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ETA   CADFEM

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
LS-DYNA OnLine - (Al Tabiei)	https://www.youtube.com/user/LSDYNATV

GOOGLE+

BETA CAE Systems