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ANSYS LSTC

Volume 8, Issue 12, December 2019

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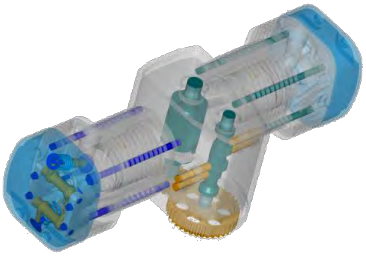
ANSYS

BETA CAE Systems



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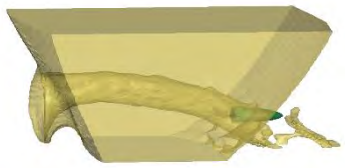

Livermore Software Technology, an ANSYS company

FEA Information Engineering Solutions

www.feapublications.com

The focus is engineering technical solutions/information.

FEA Information China Engineering Solutions

www.feainformation.com.cn

Simplified and Traditional Chinese

The focus is engineering technical solutions/information.

Livermore Software Technology, an ANSYS company

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

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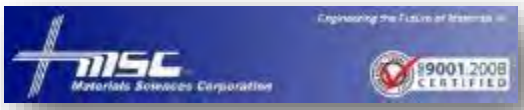
Platinum Particpants



Platinum Particpants

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About ANSYS, Inc.

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

Published on November 14, 2019 by Siddharth Shah, Marleigh Hallquist, Marisa Melchiorre
ANSYS LS-DYNA, ANSYS Mechanical, ANSYS Workbench, Automotive

Simulate Crashes and Other Nonlinear Dynamics With ANSYS

Engineers will experience a lot of benefits from the recent ANSYS acquisition of Livermore Software Technology Corporation (LSTC). These benefits will center around the integration of linear and nonlinear simulation technologies.

For instance, engineers can use ANSYS Mechanical to study linear deformations that happen over large time steps. LS-DYNA, on the other hand, can handle nonlinear deformations that happen in milliseconds. Combining these studies has various applications in the automotive, aerospace, manufacturing, electronics and defense industries.

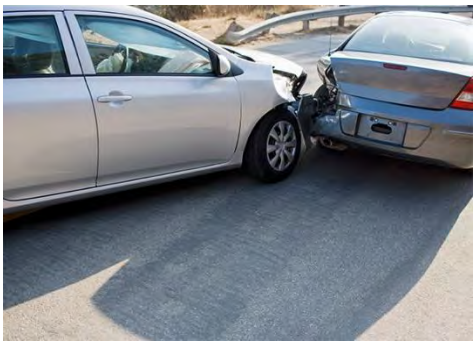
The demand to use both technologies in a complementary capacity led to a partnerships, lasting decades, that saw the incorporation of ANSYS LS-DYNA into the ANSYS Workbench platform. With the acquisition, simulation users should expect to see this integration expand.

For instance, LS-DYNA users will experience increased access to, and compatibility with, the ANSYS portfolio of pervasive engineering simulation technology. They will also have uninterrupted access to:

LS-OPT — for design optimization and probability analysis
LS-PrePost — for pre- and post-processing
LS-TaSC — for topology and shape optimization
LSTC Models – of crash test dummies, barriers and tires

ANSYS users, meanwhile, will benefit from new capabilities in nonlinear dynamics, explicit time integration and multiphysics. They will be able to study events in which objects experience high loads over short periods of time.

What is Nonlinear Dynamics?



This crash cannot be simulated using linear equations, because the deformations remain after the force has reduced to zero. Therefore, it is a nonlinear system.

When engineers study linear dynamics, mechanical forces are typically determined by how much an object has deformed. In this case, Hooke's law states that the force is equal to the deformation times a constant that is material dependent.

Hooke's law doesn't just model springs; it is the prototype for all linear mechanical simulation models.

However, an assumption in Hooke's law — that everything returns to its original shape — means that it is unable to model every structural situation. For instance, it cannot model plastic deformations — as anybody who has stretched a spring too far knows.

Nonlinear dynamics is the study of systems that operate in a manner that can't be simplified into a linear equation. Examples include rubber (which experiences nonlinear elasticity) and crash simulations (where damage remains after forces on the object are removed).

Nonlinear dynamics is calculated using explicit time steps. With explicit time, the forces are determined at each time step based on the previous state of the system. These forces are then used to determine the next iteration of the system.

How to Simulate Nonlinear Dynamics

LS-DYNA specializes in nonlinear dynamics like impact, metal stamping, jet-engine bird strike, earthquake, explosion and crash simulations. These kinds of simulations are employed in the design of cars, aircraft, spacecraft, manufacturing lines, electronics and defense equipment.

Using LS-DYNA, simulation engineers can assess various nonlinear dynamic problems like the landing of the Orion spacecraft.

LS-DYNA is also able to study multiphysics, multiscale, multistage simulations with wide scalability. This means that engineers can solve small problems (using a desktop's processors) or large complex problems (using thousands of processors on a cluster).
As for LS-DYNA's ability to model various physics, its capabilities include (but are not limited to):

- Computational fluid dynamics (CFD)
- Granular flow
- Electromagnetism
- Fluid-structure interactions
- Noise, vibration and harshness (NVH)
- Thermal transfer
- Crack formation and failure
- Composites

LS-DYNA has many features, so choosing the right parameters to set up a simulation can be complex. Workbench automates this process so users can benefit from the robust capabilities of LS-DYNA without having to worry about the details. This access enables engineers to become productive with nonlinear dynamic simulation with minimal training.

Crash Simulation Ubiquity Can Expand Other Modeling Technologies

Automotive engineers can use LS-Dyna to create crash simulations to reduce the number of physical tests that are needed to certify the car. Crash Simulation, nonlinear dynamicsAutomotive engineers can use LS-Dyna to create crash simulations to reduce the number of physical tests that are needed to certify the car.

LS-DYNA's ability to simulate car crashes can reduce the number of physical prototypes needed during development. As a result, most automotive organizations use these simulations to design and optimize automotive components and vehicles.

Automotive engineers can use LS-Dyna to create crash simulations to reduce the number of physical tests that are needed to certify the car.

Combining LS-DYNA with the ANSYS portfolio opens up new applications within the automotive industry.

For instance, ANSYS has shown great commitment to the automotive market with autonomous vehicle, electrification, aerodynamics, NVH, embedded software and other technologies.

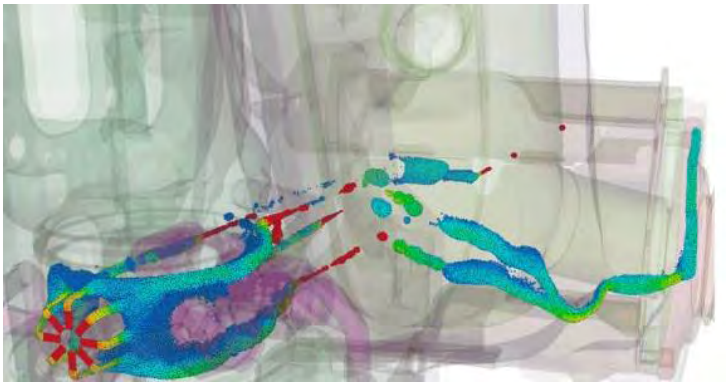
Adding automotive crash simulations to this lineup will entice users to gravitate to adjacent simulation technologies, so they can completely optimize their products within one software portfolio.

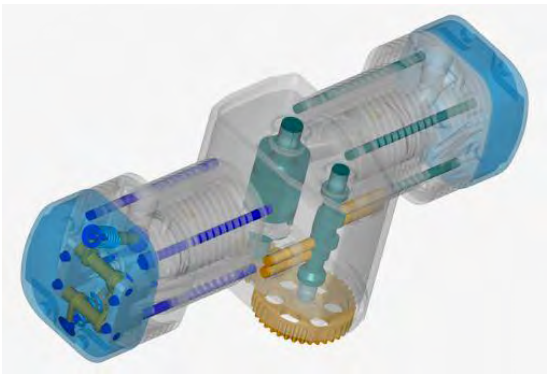
To learn more about ANSYS LS-DYNA, click here.

Developing CAE software systems for all simulation disciplines. Products: ANSA pre-processor/ EPILYSIS solver and META post-processor suite, and SPDRM, the simulation-process-data-and-resources manager, for a range of industries, incl. the automotive, railway vehicles, aerospace, motorsports, chemical processes engineering, energy, electronics…

BETA CAE Systems announces the release of versions 19.1.5 and 20.0.2 of the ANSA/EPILYSIS/META software suite

December 9, 2019





Version 19.1.5 is addressed to users who wish to continue using the v19.0.x series and not to migrate yet to v20.0.x. This version focuses on the correction of many issues of the earlier releases, while at the same time, it also incorporates selected enhancements.

Version 20.0.2 is the second evolution release of its series and apart from correcting identified issues, it brings new features and performance improvements. Among the numerous improvements, ANSA adds new python functions and builds further on its efficiency when using SDPRM as the data management backbone for your simulations. EPILYSIS adds new parameters for SOL103 while META introduces support for the LS-DYNA i10 format, and enhances its Math Operations and Data Management capabilities.

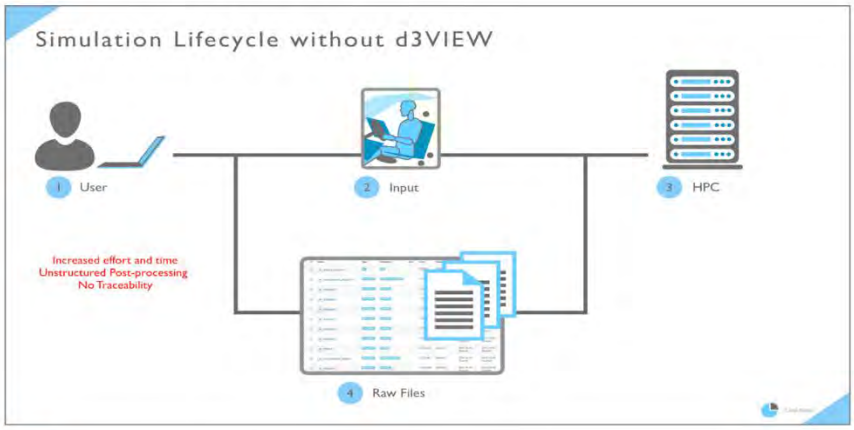
The most important enhancements and fixes implemented appear in the respective announcements for v19.1.5 and v20.0.2 on our web site.

Customers who are served directly by BETA CAE Systems, or its subsidiaries, may download the new software, examples and documentation from their account on our server. They can access their account through the "user login" link at our web site. Customers who are served by a local business agent should contact the local support channel for the software distribution details. All files required for the installation of this version reside in the folder named "BETA_CAE_Systems_v19.1.5" and "BETA_CAE_Systems_v20.0.2" are dated as of December 6 and December 9, 2019 respectively.

Website: DISCOVER v19.1.5 DISCOVER v20.0.2

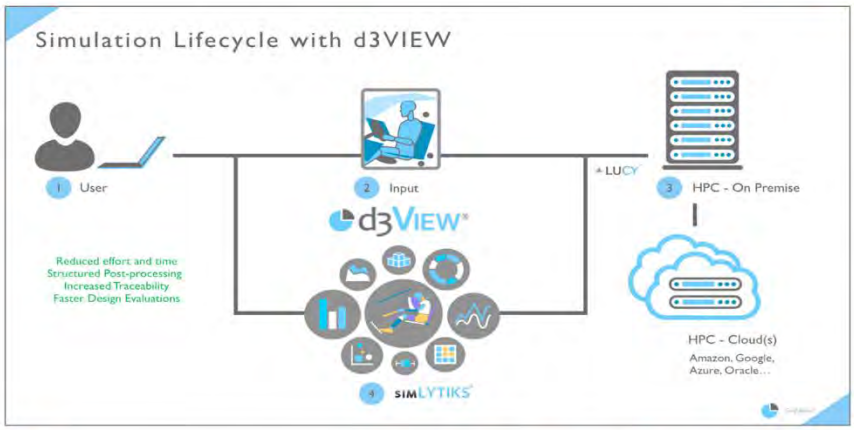
d3VIEW is a data to decision platform that provides out-of-the box data extraction, transformation and interactive visualizations. Using d3VIEW, you can visualize, mine and analyze the data quickly to enable faster and better decisions.

d3VIEW Updates



Without d3VIEW

In the traditional workflow, the user submits his simulations to a on-premise HPC which results raw data. This results in increased user effort and non-standard processing of result files.



With d3VIEW

As a data-to-decision platform, d3VIEW helps process results files and provides a comprehensive result analysis. We believe this helps in bringing standardization in results data processing. In addition, you can submit jobs to both on-premise and a host of cloud providers in one single platform

Visualization Library

d3VIEW is continuously adding more visualizers to help make decisions on a variety of data. Recently added visualizations include Ped-Pro, Curve Manager, Image Comparison, and Occupant Rating

www.d3view.com.
For more information email info@d3view.com

d3VIEW®

Author: Christian Frech christian.frech@dynamore.de

Material Competence Center moves into new premises

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

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

Areas of expertise

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

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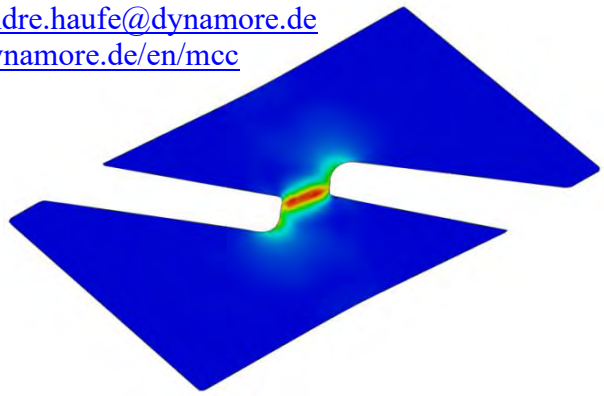


A leading innovator in Virtual Prototyping software and services. Specialist in material physics, ESI has developed a unique proficiency in helping industrial manufacturers replace physical prototypes by virtual prototypes, allowing them to virtually manufacture, assemble, test and pre-certify their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

ESI Group, Strategic Partner for French Start-Ups

15 Dec 2019 Location Paris, France

The French Start-Up Gazelle Tech Wins the Sustainable Innovation Prize Awarded by Climate Action During COP25, & Validates its Business Model Thanks to Virtual Prototyping

ESI Group, a world player in virtual prototyping software and services for industrials, and Gazelle Tech, a French start-up developing a sustainable vehicle concept, emphasized the strategic nature of their cooperation in light of the second fundraiser aiming to certify their ultra-lightweight vehicle concept, and the start-up's success as it was awarded the Sustainable Innovation prize of Climate Actions during COP25 conference in Madrid.

Rewarded by key leaders of sustainable mobility and innovation, Gazelle Tech finalized its second fundraising of M€ 1.1million with the support of Nouvelle-Aquitaine region and Bpifrance.

Gazelle Tech is developing a concept for sustainable mobility with their vehicle prototype, conceived thanks to ESI's Virtual Prototyping solutions. In less than three years, the start-up has created a vehicle concept that is disruptive in its:

lightweight composition – 1/2 of the typical weight, reducing energy consumption by 40%

manufacturing process – built-in portable micro-factories that can be shipped across the world, and specifically to developing nations

design – developed virtually, foregoing physical prototyping altogether, and bringing about considerable cost savings.

This collaboration between the two companies confirms the relevance of ESI to the start-up ecosystem, thanks to the efficiency of its solutions and the expertise of its teams, in developing and quickly certifying innovative concepts and business models while keeping costs minimal.

Founded in 2014 in Bordeaux, France, Gazelle Tech is the first manufacturer of micro-factories for car assembly. The use of composite materials, especially in the vehicle chassis, allows for a 40% decrease in vehicle consumption resulting from the significantly lighter weight, while preserving safety and comfort. The company was born from a desire to make mobility accessible in isolated and rural areas, specifically in emerging countries, by enabling vehicle production locally. The Gazelle Tech vehicle body is composed of ten parts that can be assembled in one hour, in dedicated container micro-factories that can be installed anywhere, no matter how far from an industrial area. The certification of this vehicle is now the startup's next step.

Founder Gaël Lavaud recalls how the first Gazelle prototype came to light in 2015, and how ESI's simulation software was instrumental in that process: "We were capable of developing this vehicle model and ensuring its performance, thanks to a virtual prototype on which we iterated as many times as necessary until design validation. Resorting to physical tests and prototypes would have slowed down our time to market, in addition to associated costs – too high for a start-up like ours." Lavaud continued: "Being capable of showing a functioning prototype of the vehicle to our investors proved decisive. We have, over time, established a true strategic partnership with ESI, founded on a solid relationship of mutual trust that goes far beyond customer-supplier ties.

"Cristel de Rouvray, Chief Executive Officer of ESI Group, commented: "Time is a valuable asset that start-ups don't have. They must establish themselves and develop quickly to survive and meet their growth objectives.

We are proud of the support we bring to this pioneering company as they pave the way to validating their business model, in record time, thanks to the elimination of physical tests and prototypes. This illustrates ESI's capacity to support innovation and empower promising start-ups to accelerate their development."

Meet Gaël Lavaud and Cristel de Rouvray at CES in January, where they'll be hosting a round table discussion. Contact us to sign up!

About ESI Group

ESI Group is a leading innovator in Virtual Prototyping software and services. Specialist in material physics, ESI has developed a unique proficiency in helping industrial manufacturers replace physical prototypes by virtual prototypes, allowing them to virtually manufacture, assemble, test and pre-certify their future products. Coupled with the latest technologies, Virtual Prototyping is now anchored in the wider concept of the Product Performance Lifecycle™, which addresses the operational performance of a product during its entire lifecycle, from launch to disposal. The creation of a Hybrid Twin™, leveraging simulation, physics and data analytics, enables manufacturers to deliver smarter and connected products, to predict product performance and to anticipate maintenance needs.

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

DYNAFORM

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

ACP OpDesign

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

VPG Suite

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

ETA

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

Season's Greetings from ETA

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

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

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

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

www.feantm.com

Monday 12/16/2019 And with this week's coffee I am grabbing my tool kit and giving a free wingnut with each to go cup! Why you ask? Because it is Cafe Wingnut simulation week!

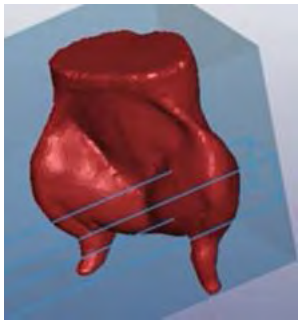
Wingnut simulation in LS-DYNA displaying the Dzhanibekov effect

The Dzhanibekov effect was tested with a simulation using LS-DYNA. Unsurprisingly, but still fascinating to watch, it does actually work.

Monday 12/09/2019 I am proud to let you know my To Go Cups didn't spill in the below video/simulation. NOW, off we go to watch the simulation by GDTech Belgium - LS-DYNA simulation compared to experiment

38T truck impacting a bridge barrier (containment level H4b) with a speed of 65 km/h at an angle of 20°.

Monday 12/02/2019 - Time to grab your coffee, sit back and watch a tutorial. LS-DYNA Structured ALE using LS-Prepost Solution Explorer: bullet penetration



A tutorial to setup LS-DYNA Structured ALE model using a newly developed Solution Explorer module. A bullet penetrating pig leg at a speed of 900m/s.

Wenhui YU, LS-DYNA, Dalian Office

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

Shanghai Hengstar & Enhu Technology

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

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

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

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

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

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

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

Shanghai Hengstar Technology Co., Ltd

hongsheng@hengstar.com

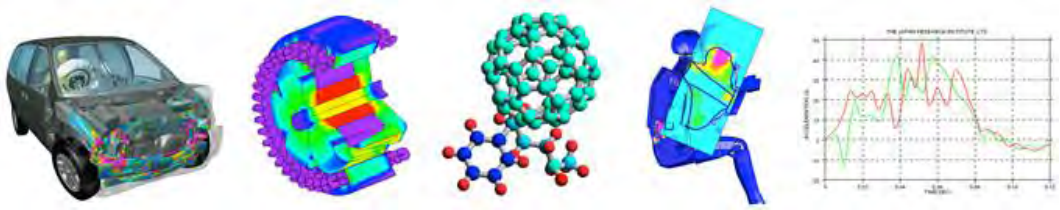
http://www.hengstar.com

Shanghai Enhu Technology Co., Ltd

http://www.enhu.com

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

JSOL



Support tool design and process design for forming

Integrated forming simulation system JSTAMP

Sheet metal forming Simulation

JSTAMP@

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

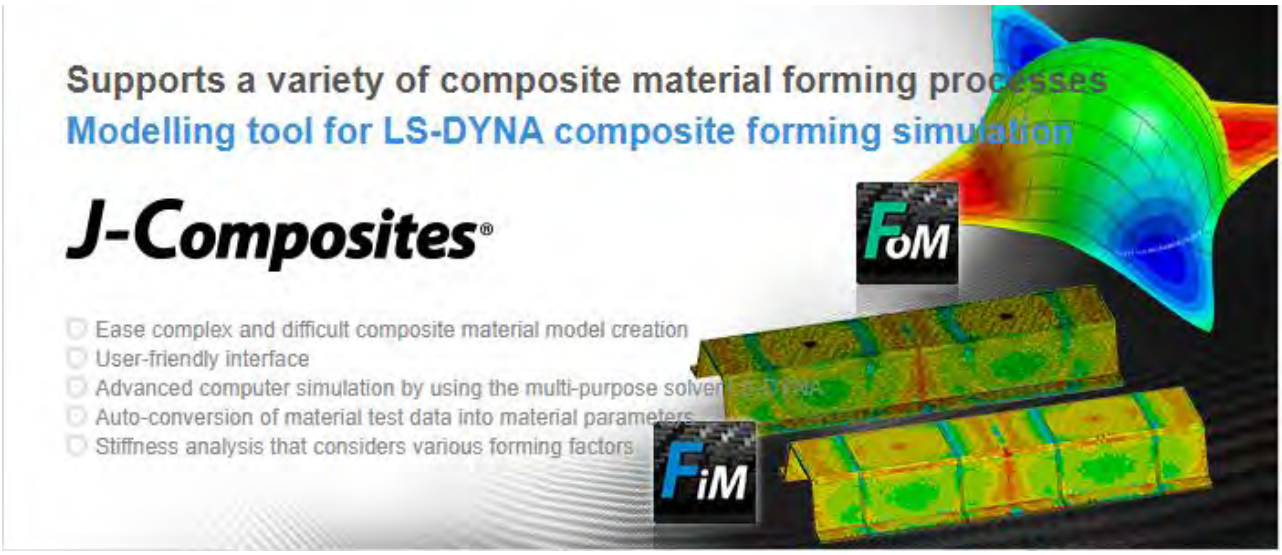
J-Composites partners - Dec 09, 2019 NEW

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

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

MITSUBISHI CHEMICAL

'TORAY'
Innovation by Chemistry

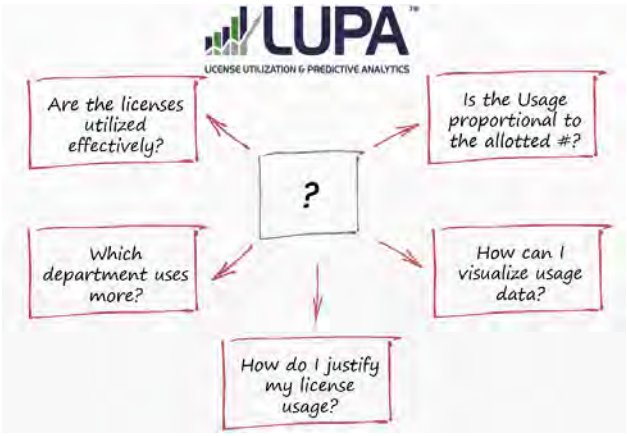


KAIZENAT Technologies Pvt Ltd is the leading solution provider for complex engineering applications and is founded on Feb 2012 by Dr. Ramesh Venkatesan, who carries 19 years of LS-DYNA expertise. KAIZENAT sells, supports, trains LS-DYNA customers in India. We currently have office in Bangalore, Chennai,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

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

Kaizenat's Offering:

Kaizenat's Tools around LS-DYNA:



Kaizen-DYNA is a mobile and web based to help LS-DYNA users across the world.
This powerful application helps LS-DYNA users across the world to stay connected and help each other by sharing their knowledge.
The key feature of this application is QUERY and RESPONSE.

LUPA is a License Utilization and Predictive Analytics platform that helps engineers, Managers & IT-Dept to visualize the usage analytics and take business decisions accordingly.
It's Predictive Analytics capability helps business leaders to forecast their license utilization for the coming years and plan for the investments accordingly.

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

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

LS-DYNA® Structured ALE & FSI

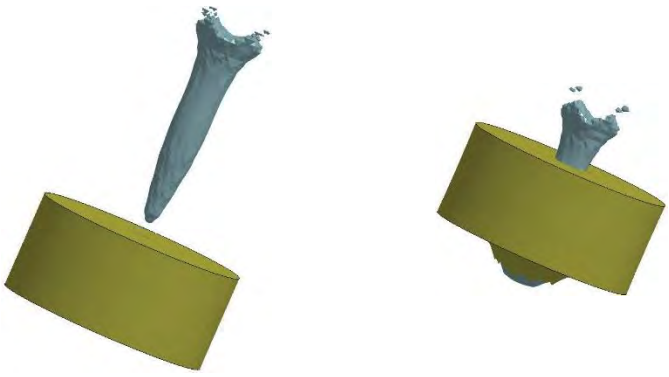
The Structured Arbitrary Lagrangian Eulerian (ALE) solver is to model multiple fluids flowing in one or more rectilinear meshes. It has a newly developed penalty based Fluid Structure Interaction (FSI) module which tightly couples fluids to the structure. The FSI module could effectively capture the momentum transfer and hence predict the structure response accurately. It contains a new leakage control algorithm which automatically detects and cures fluid leakage completedly.

Solver Features:

- Donor cell and Van Leer advection.
- Interface reconstruction to track fluid interface accurately.
- Automatically generated rectilinear ALE mesh.
- Enhanced MPP initialization to support large model up to 200 million
- Mesh trimming option to cut off elements far from domain of interest and mesh motion option to reduce the calculation domain
- New FSI module with automated leakage detection and cure. No more leakage.

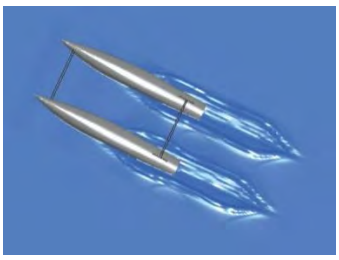
Applications Include:

- Shock loading from shaped charges perforating oil well casings.
- Design of blast resistant structures.
- Ship responses due to under water explosions.
- Hyper-velocity impact (e.g. a meteor striking a satellite).
- Bird strike.
- Fuel tank sloshing, forging, hydroplaning, and airbag deployment.
- Low velocity flows such as sailing boat wave and wind interactions, water landing.

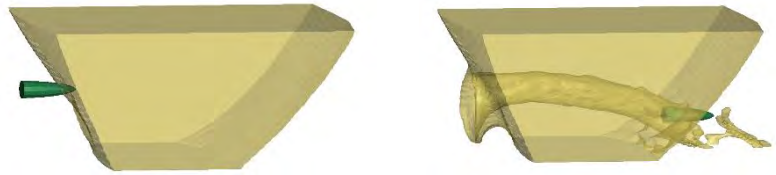


Shaped Charge Modeling

Bird Strike



Amphibious Plane Water Landing



Bullet penetrating tissue

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.

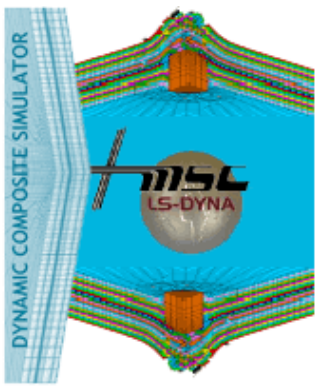
.

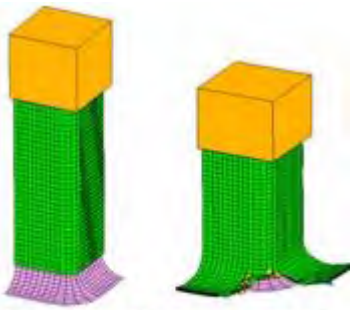
Bottom photos courtesy of TPI Composites, Inc. (left) and Seemann Composites, Inc. (right)

MSC/LS-DYNA Composite Software and Database

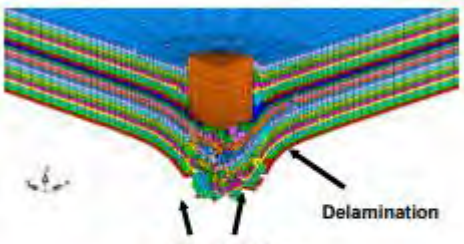
Materials Sciences Corporation (MSC) and Livermore Software Technology Corporation (LSTC, an ANSYS company) announce the Dynamic Composite Simulator module of LS-DYNA.

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





Simulation of Dynamic Crush of Square Composite Tube



Penetration involving perforation behavior in composite armor

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

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

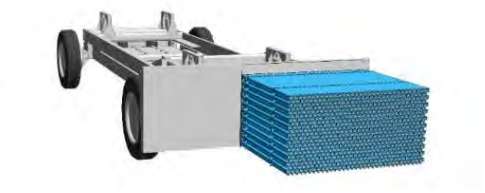
Monday, 30th March 2020

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

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

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

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



New version 1.2 MPDB - Shell Model

Mobile Offset Progressive Deformable Barrier for frontal impact

In collaboration with Cellbond, Arup has developed a range of LS-DYNA finite element models based on the aluminum honecomb barriers produced by Cellbond. Our new MPDB Shell Model has been developed to take advantage of the latest developments in the LS-DYNA code and is designed to provide robust and efficient analysis.

To obtain this barrier model or for more information about a trial license contact dyna.support@arup.com or visit Oasys LS-DYNA website here.

Webinars 2020

Oasys and LS-DYNA team offers several free webinars

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

Next upcoming webinars:

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

To view past and future webinars click here.

Season's Greetings

The Oasys LS-DYNA team would like to thank all of our partners, customers and friends for your continued support. We wish you and your families Happy Holidays and a prosperous New Year 2020.

FINITE ELEMENT ANALYSIS
Predictive Engineering

Who We Are

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

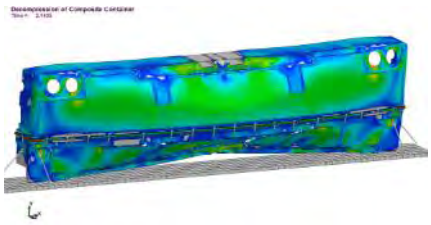
Our History

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

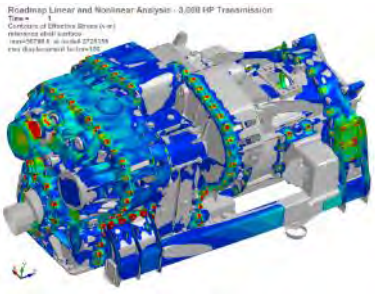
View our portfolio

FEA, CFD and LS-DYNA consulting projects

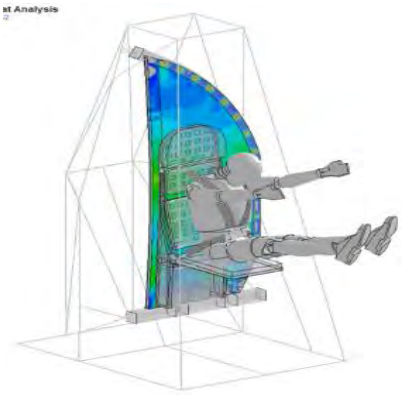
Composite Engineering



Nonlinear Dynamics



Aerospace



Offering industry-leading software platforms and hardware infrastructure for companies to perform scientific and engineering simulations. Providing simulation platforms that empower engineers, scientists, developers, and CIO and IT professionals to design innovative products, develop robust applications, and transform IT into unified, agile environments.

Rescale Unveils ScaleX Government, the First Federally Compliant HPC Cloud Service

December 4, 2019 | Robert Combier

SAN FRANCISCO–(BUSINESS WIRE)–Rescale, the leader in high performance computing (HPC) in the cloud, announced today that they are the first company to deliver a completely cloud-based HPC platform for the public sector. Rescale's latest offering, ScaleX Government, is the only fully managed HPC service that delivers the scalability of the cloud with FedRAMP Moderate (In-Process), ITAR compliance, or both.

"Our customers rely on us to consistently exceed industry and federal standards in order to protect their sensitive data and workloads. We are excited to be the first HPC platform solution to achieve this FedRAMP milestone."

Until now, HPC in the cloud has been inaccessible for all Federal Agencies and many research institutions because cloud products and services cannot be adopted without FedRAMP status. ScaleX Government delivers the first cloud HPC service that is compliant end-to-end across every constituent element, including compute, storage, application management, and orchestration stack.

With this announcement, Rescale can now be found in the official FedRAMP Marketplace. This enables federal engineers, scientists and researchers to shift outdated, fixed IT infrastructure to the latest in on-demand cloud architectures and meet their compliance requirements. The National Renewable Energy Lab (NREL), a division of the U.S. Department of Energy (DOE), co-sponsored the FedRAMP application with Rescale, to accelerate its energy efficiency and exploration research. HPC in the cloud makes it possible to instantly scale workloads up or down as needed, without requiring resource management that often results in long wait times. This ultimately leads to better research, faster results, and more efficient spending.

"Delivering a world-class innovation experience with strong security and compliance is a top priority at Rescale," said Shawn Hansen, COO of Rescale. "Our customers rely on us to consistently exceed industry and federal standards in order to protect their sensitive data and workloads. We are excited to be the first HPC platform solution to achieve this FedRAMP milestone."

For further information about HPC cloud security, visit https://www.rescale.com/security , or listen to the Big Compute podcast featuring NREL.

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

仿坤软件 LS-DYNA China

Seminar on Development and Technology of the LS-DYNA's Related Products 01/06/2020

With the rapid development of CAE technologies, LS-DYNA has been widely used and recognized as the most popular finite element software in the vehicle industry, die &tooling, aerospace and electronics industries, etc.

Beside LS-DYNA technology, many LSTC's partners have developed LS-DYNA's related products to help users in various industries to more conveniently and efficiently use LS-DYNA for product design and development. Especially in the automotive industry, many related products have been developed for LS-DYNA solver such as:

- Professional Pre & Post processors;
- Professional dummy models such as Hybrid III dummies，Q child dummies，Thor dummies, THUMS dummies, etc.;
- Professional barriers and pedestrian protection models such as AE-MDB，ODB，MPDB，Flexpli，aPLI, etc.;
- Professional metal forming;
- Professional optimization analysis;
- Professional automated process processing.

LS-DYNA has been integrated into ANSYS family recently. There is a strong request from many users to obtain the latest development information and technology of related products based on the LS-DYNA solver. To help users to systematically understand the related products of LS-DYNA, we will invite developers and users of the related products, and LS-DYNA developers to this meeting to share technology and application experience.

We wholeheartedly welcome any LS-DYNA users and the developers of the related products to attend this seminar.

City:	Shanghai
Date:	Jan. 6th, 2020
Participant Fee:	Free (not including hotel fee, transportation fee)
Tel.:	021-61261195
Email:	marketing@lsdyna-china.com

仿坤软件
LS-DYNA China

About Shanghai Fangkun Software Technology Ltd.

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

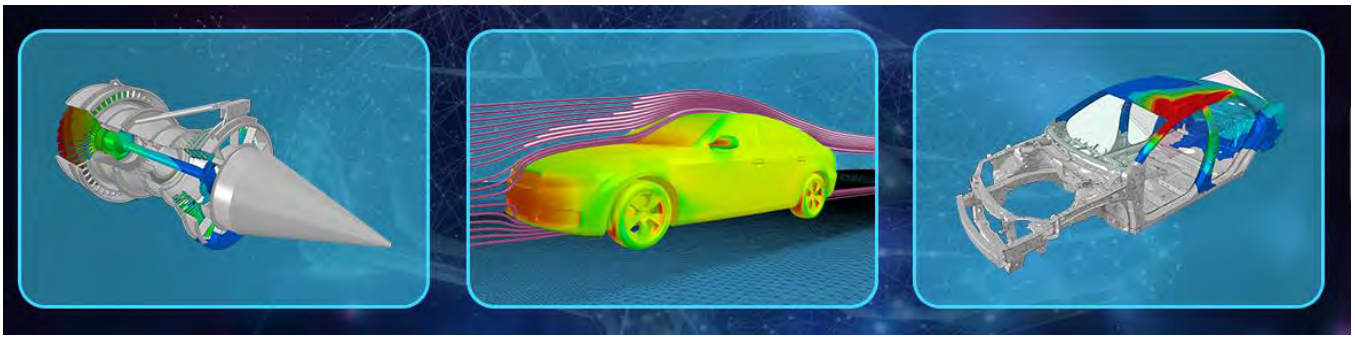
Contacts:

Address: Room 2219, Building No.1, Global Creative Center, Lane 166, Minhong Road, Minhang District, Shanghai, China 201102

Tel.: 021-61261195 4008533856

Email: sales@lsdyna-china.com

Website: www.lsdyna-china.com



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

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

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

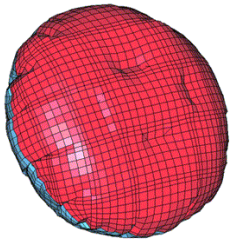
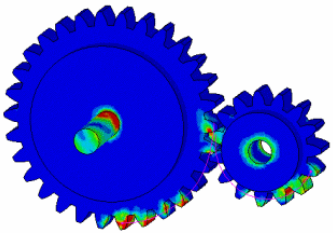
- JSTAMP is an integrated forming simulation system for virtual tool shop based on IT environment. JSTAMP is widely used in many companies, mainly automobile companies and suppliers, electronics, and steel/iron companies in Japan.

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.


An illustration of the OSIRIS-REx spacecraft, short for Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer. Credit: NASA

NASA spacecraft will visit **asteroid's north pole for** sample collection

BY CAT HOFACKER
DECEMBER 12, 2019
https://aerospaceamerica.aiaa.org/

Scientists adapt OSIRIS-REx to navigate the rocky asteroid

A 16-meter-wide sandy area in the north polar region of the near-Earth asteroid Bennu will be the site for NASA's first asteroid sample collection attempt, the agency announced Thursday.

Japan was first to return an asteroid sample, when in 2010 the Hayabusa probe delivered less than a gram of particles to Earth after crashing during one of the collection maneuvers five years earlier. The Hayabusa 2 probe is scheduled to return an asteroid sample next year.

The NASA site, nicknamed Nightingale, was chosen by scientists after a yearlong survey by the OSIRIS-REx spacecraft, which beamed home images of Bennu shortly after arriving in orbit around it in December 2018. NASA scientists pored over the images and chose the polar region and specifically Nightingale from 50 areas on what appears to be a carbon-rich surface.

"We made our final decision based on which site has the greatest amount of fine-grained material and how easily the spacecraft can access that material while keeping the spacecraft safe," said Dante Lauretta, OSIRIS-REx principal investigator at the University of Arizona in Tucson, during a livestream from the American Geophysical Union conference in California. When the probe first arrived at Bennu, scientists expressed surprise at the boulders in the images. They grew worried that OSIRIS-REx's sampling mechanism could be damaged when it attempts a series of "touch-and-go" maneuvers to lift dusty regolith off Bennu, or that those particles might prove to be too large to capture.

Plans call for OSIRIS-REx to descend toward the surface of Bennu in July and unfold TAGSAM, short for the Touch-and-Go Sample Acquisition Mechanism. Built by Lockheed Martin, TAGSAM consists of a circular sampler head attached to a robotic arm that raises and lowers the head from the spacecraft.

Once the head touches the surface of Bennu, a burst of nitrogen gas through its outer ring will stir up the regolith, sending the fine material swirling into TAGSAM. After five seconds, the spacecraft will raise itself back to orbit, and the arm will fold TAGSAM back up and place the head inside a capsule on the side of OSIRIS-REx.

NASA chose the Nightingale site from these four options. Credit: NASA

Out of all the areas surveyed for this sample collection, Nightingale "best ensures mission success," Lauretta said. Located in a 70-meter-wide crater in Bennu's north polar region, Nightingale had the "most scientific value" of all the sites OSIRIS-REx surveyed, Lauretta said. Along with the "relatively smooth" surface of the crater that will make landing the spacecraft easier, the colder temperatures will "better preserve" the regolith OSIRIS-REx will collect.

But the location is not without challenges. Lauretta described a "large wall of tall rock" on the eastern side of Nightengale's crater that "may tip over a little bit" if the OSIRIS-REx spacecraft touches it during its descent.

"We recognize this [site] does have some hazards around it," he said.

To help OSIRIS-REx whisk off samples safely, the team uploaded "hazard map" software to the spacecraft, said Mike Moreau, a flight dynamics system manager who works on OSIRIS-REx navigation. If the spacecraft detects that it's come too close to a boulder or cannot safely land to collect the sample, "it will back away and try the sample collection again." OSIRIS-REx has three tries to collect regolith, he said, and TAGSAM can hold up to 2 kilograms of samples, about the weight of a chihuahua.

Following sample collection, the spacecraft will orbit Bennu until March 2021, at which time it will head back to Earth. The sample should reach NASA scientists by 2023, a date that's eagerly awaited by Lori Glaze, director of planetary science at NASA Headquarters in Washington, D.C.

Scientists have been observing Bennu for 20 years with ground-based and space-based telescopes, but "there really is no substitute to being able to pick up some of that material from the surface and bring it back to Earth," Glaze said.

NASA and university scientists will analyze some of the regolith, but most of the samples will be preserved for "generations to come," she said, similar to the lunar samples from the Apollo moon landings that "we're still analyzing today 50 years later."

Read in website

ALL-NEW 2020 ESCAPE HYBRID TOPS SMALL SUV CLASS WITH EPA-ESTIMATED 44 MPG CITY, 41 MPG COMBINED FUEL ECONOMY RATINGS

December 10, 2019 | DEARBORN, MICH.

- 2020 Ford Escape Hybrid equipped with front-wheel drive beats out the segment with best-in-class EPA-estimated ratings of 44 mpg city and 41 mpg combined. EPA-estimated highway rating is 37 mpg; actual mileage will vary
- Front-wheel-drive Escape Hybrid has an EPA-estimated range of 582 miles per tank – more than enough for a one-way trip from Sacramento to San Diego
- New EV coach and eco mode features encourage more efficient driving to make the most out of the hybrid ownership experience
- Escape Hybrid has plenty of room for passengers and cargo by placing its liquid-cooled lithium-ion battery smartly below the second-row seats rather than occupying a significant portion of the cargo area

DEARBORN, Mich., Dec. 10, 2019 – Your drive over the river and through the woods to grandma's house this holiday season might cost you less if you're behind the wheel of the all-new 2020 Ford Escape Hybrid.

With a best-in-class combined EPA-estimated fuel economy rating of 41 mpg, the redesigned front-wheel drive small SUV also tops its class while driving around town, with an EPA-estimated 44 mpg city. The 2020 Escape Hybrid Titanium with front-wheel drive has an EPA-estimated rating of 37 mpg on the highway.

With the average American driving 29 miles a day, making that trip in the all-new Escape Hybrid Titanium means barely using a gallon of fuel per trip – and fewer gas station stops along the journey. This makes the all-new Ford Escape Hybrid both easier on the wallet while helping to conserve fuel.

"This all-new Escape Hybrid is our best one yet, as it answers the call from our customers who loved the original Escape Hybrid but want better fuel efficiency without compromising interior space," said Hau Thai-Tang, Ford chief product development and purchasing officer. "Plus, with driving range like no Escape before, we're giving our customers a vehicle truly capable of letting them focus on living their lives while worrying less about stopping for gas."

Each model in the all-new Escape lineup, whether hybrid-powered or equipped with EcoBoost® technology, has an EPA-estimated range of at least 400 miles per tank. Front-wheel-drive Escape Hybrid's outstanding fuel efficiency is bolstered by an EPA-estimated 582-mile driving range per tank – more than enough for a one-way trip from Sacramento to San Diego.

Outfitted with available all-wheel drive, Escape Hybrid has an EPA-estimated 43 mpg city and 40 mpg combined with an EPA-estimated 568 miles of range. Like the front-wheel-drive Escape, the all-wheel-drive model has an EPA-estimated 37 mpg on the highway.

2020 Ford Escape Hybrid customers can see their potential fuel savings come to life with a new EV coach feature included in the 12.3-inch digital instrument cluster, which is standard on SE Sport and Titanium trim levels. EV coach lets drivers know when they're using electric or hybrid power – allowing them to adjust their driving style to meet their power needs. In addition, eco mode, one of five standard selectable drive modes, helps conserve fuel when driving range is your priority.

There's also plenty of room of passengers and cargo. The all-new Escape Hybrid packages its liquid-cooled lithium-ion battery smartly below the second-row seats rather than occupying a significant portion of the cargo area. The briefcase-shaped battery in the standard hybrid measures approximately one-third the size of the battery in the first Escape Hybrid, which was the world's first-ever hybrid SUV when it debuted in 2004.

The all-new Ford Escape, built at Louisville Assembly Plant, is on sale now.

About Ford Motor Company

Ford Motor Company is a global company based in Dearborn, Michigan. The company designs, manufactures, markets and services a full line of Ford cars, trucks, SUVs, electrified vehicles and Lincoln luxury vehicles, provides financial services through Ford Motor Credit Company and is pursuing leadership positions in electrification, autonomous vehicles and mobility solutions. Ford employs approximately 191,000 people worldwide. For more information regarding Ford, its products and Ford Motor Credit Company, please visit corporate.ford.com.

SOURCE: Ford

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

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
LSTC	www.lstc.com/training
LS-DYNA OnLine - (Al Tabiei)	www.LSDYNA-ONLINE.COM
OASYS	www.oasys-software.com/training-courses
Predictive Engineering	www.predictiveengineering.com/support-and-training/ls-dyna-training

Author: Christian Frech christian.frech@dynamore.de

Seminars 2020

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

Selection of trainings for January/February

Introduction	
Introduction to LS-DYNA	27-29 January (V) 11-13 February
Introduction to LS-PrePost	10 February
Basics/Theory	
User Interfaces	3 February
Passive Safety	
Dummy/Pedestrian Impactor Modeling	4 February
Metal Forming	
Hot Forming with LS-DYNA	21-22 January
Applied Forming Simulation with eta/DYNAFORM	23-24 January
Pre- and Postprocessing	
ANSA/ METApost	6-7 February
Multiphysics	
ALE and FSI	17-18 February
Particle Methods	
Smoothed Particle Hydrodynamics	19-20 February
STAR-CCM+	
Basic Training STAR-CCM+	3-5 February

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

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

www.lstc.com

January 2020

Date		Location	Course Title	Instructor(s)
Jan 28	Jan 31	***MI***	Introduction to LS-DYNA®	H. Devaraj

February 2020

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

Adaptive Smoothed Particle Hydrodynamics and Higher Order Kernel function in Ls-Dyna

Jingxiao Xu, Wei Hu, Bo Ren, Youcai Wu, Xiaofei Pan, C. T. Wu

Livermore Software Technology, an ANSYS company

ABSTRACT

This paper presents the implementation of an adaptive smoothed particle hydrodynamics (ASPH) method for high strain Lagrangian hydrodynamics with material strength in LS-DYNA. In standard SPH, the smoothing length for each particle represents the spatial resolution scale in the vicinity of that particle and is typically allowed to vary in space and time so as to reflect the local value of the mean interparticle spacing. However, in the presence of strongly anisotropic volume changes which occur naturally in most of the applications the local mean interparticle spacing varies not only in time and space, but in direction as well. In ASPH, the isotropic kernel in the standard SPH is replaced with an anisotropic kernel whose axes evolve automatically to follow the mean particle spacing as it varies in time, space, and direction around each particle. By deforming and rotating these ellipsoidal kernels so as to follow the anisotropy of volume changes local to each particle, ASPH can capture dimension-dependent features such as anisotropic deformations with a more generalized elliptical or ellipsoidal influence domain. Some numerical examples are investigated using both SPH and ASPH, also higher order kernel function is studied for both SPH and ASPH formulation. The comparative studies show that ASPH has better accuracy than the standard SPH when being used for high strain hydrodynamic problems with inherent anisotropic deformations, also higher order kernel function has better accuracy than the standard cubic kernel function.

Introduction

SPH is a Lagrangian method for solving partial differential equations. Essentially, the domain is discretized by approximating it by a series of roughly equi-spaced particles. They move and change their properties (such as temperature) in accordance with a set of ordinary differential equations derived from the original governing PDEs. SPH was first applied by Lucy (1977) to astrophysical problems, and then was extended by Gingold (1982). Cloutman (1991) used SPH to model hypervelocity impacts. Libersky and Petschk have shown that SPH can be used to model materials with strength. In recent years it has been developed as a method for incompressible isothermal enclosed flows by Monaghan (1994).

The standard SPH method uses an isotropic smoothing kernel, which is characterized by a scalar smoothing length. One of the problems associated with the standard SPH is that the isotropic kernel of SPH can be seriously mismatched to the anisotropic volume changes that generally occur in many problems. To closely match the anisotropic volume changes, an anisotropic smoothing kernel that can be characterized by a matrix (2D) or a tensor (3D) smoothing length can be efficacious. This leads to the development of the

adaptive smoothed particle hydrodynamics in which the smoothing length can be adapted with the volume changes or other dimension-dependent features. The idea of using anisotropic kernel with SPH dates back to Bicknell and Gingold. Shapiro et al. first began investigating a generalized approach using an ellipsoidal kernel in SPH. Fulbright et al. also presented a three-dimensional SPH designed to model systems dominated by deformation along a preferential axis using spheroidal kernels. Later Shapiro et al. systematically introduced anisotropic kernels, tensor smoothing and shock tracking to SPH to create ASPH. Owen et al. presented an alternative formulation of the ASPH algorithm for evolving anisotropic smoothing kernels. Except for problems with anisotropic deformations, the concept of elliptical kernel has also been applied to channel flows with very large length width ratio for saving computational efforts. The numerical results presented in the references further demonstrated that ASPH has better performance than the standard SPH in terms of resolving ability for a wide range of problems.

The cubic spline function has been, so far, the most widely used smoothing function in the emerged SPH literatures since it resembles a Gaussian function while having a narrower compact support. However, the second derivative of the cubic spline is piecewise linear functions, and accordingly, the stability properties can be inferior to those of smoother kernels. In addition, the smoothing function is in pieces, which is slightly more difficulty to use compared to one piece smoothing functions. Morris introduced higher order (quartic and quantic) splines that are more closely approximating the Gaussian and more stable.

This paper presents the implementation of an adaptive smoothed particle hydrodynamics (ASPH) method for high strain Lagrangian hydrodynamics with material strength in LS-DYNA. Some numerical examples are investigated using both SPH and ASPH, also higher order kernel function is studied for both SPH and ASPH formulation. The comparative studies show that ASPH has better accuracy than the standard SPH when being used for high strain hydrodynamic problems with inherent anisotropic deformations, also higher order kernel function has better accuracy than the standard cubic kernel function.

Standard SPH formulation

Fundamentals of the SPH method.

Particles methods are based on quadrature formulas on moving particles $(x_i(t), w_i(t))i \in P$, P is the set of the particles. $x_i(t)$ is the location of particle i and $w_i(t)$ is the weighthe particle i. The quadrature formulation for a function can be written as:

$$\int_{\Omega} f(x)dx = \sum_{j \in P} w_j(t) f(x_j(t)) \tag{1}$$

The quadrature formulation (1) together with the definition of smoothing kernel leads to the definition of the particle approximation of a function. The interpolated value of a function: $u(X)$ at position X using the SPH method is:

$$\prod^h (u(x_i)) = \sum_{j \in \Omega} w_j(t) u(x_j) W(x_i - x_j, h) \tag{2}$$

Where the sum is over all particles inside Ω and within a radius $2h$, W is a spline based interpolation kernel of radius $2h$. It mimics the shape of a delta function but without the infinite tails. It is a C^2 function. The kernel function is defined as following:

$$W(x_i - x_j, h) = \frac{1}{h}\theta\left\{\frac{x_i - x_j}{h(x,y)}\right\} \tag{3}$$

$W(x_i - x_j, h) \to \delta$ when $h \to 0$, δ is Dirac function, h is a function of x_i and x_j and is the so-called smoothing length of the kernel.

Isotropic kernel function options.

The cubic B-spline function has been so far the most widely used smoothing function in the emerged SPH literatures since it resembles a Gaussian function while having a narrower compact support. The cubic B-spline function is defined:

$$\theta(d) = C \times \begin{cases} 1 - \frac{3}{2}d^2 + \frac{3}{4}d^3 & \text{when } 0 \le d \le 1 \\ \frac{1}{4}(2-d)^3 & \text{when } 1 \le d \le 2 \\ 0 & \text{elsewhere} \end{cases} \tag{4}$$

The second derivative of the cubic spline is piecewise linear functions, and accordingly, the stability properties can be inferior to those of smoother kernels. In addition, the smoothing function is in pieces, which is slightly more difficulty to use compared to one piece smoothing functions. Morris (1994) introduced higher order (quintic) splines that are more closely approximating the Gaussian and more stable and have bigger support size too. The quintic spline is:

$$\theta(d) = C \times \begin{cases} (3-d)^5 - 6(2-d)^5 + 15(1-d)^5 & when\ 0 \le d < 1 \\ (3-d)^5 - 6(2-d)^5 & when\ 1 \le d < 2 \\ (3-d)^5 & when\ 2 \le d \le 3 \\ 0 & d > 3 \end{cases} \tag{5}$$

Where C is $\frac{120}{h}, \frac{7}{478\pi h^2}$ *and* $\frac{3}{359\pi h^3}$ in one, two and three dimensional space, respectively. This kernel can help to reduce the tensile instability due to Eulerian kernel.

The gradient of the function $u(X)$ is given by applying the operator of derivation on the smoothing length:

$$\nabla \prod^h (u(x_i) = \sum_j w_j u(x_j) \nabla W(x_i - x_j, h) \tag{6}$$

Evaluating an interpolated product of two functions is given by the product of their interpolated values.

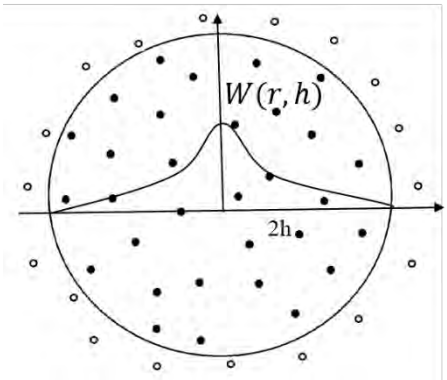


Fig 1. Two dimensional isotropic kernel function.

The ASPH with anisotropic kernel.

In general, the local mean interparticle spacing varies in time, space, as well as direction. The influence domain of the smoothing function should represent the variation of the interparticle spacing. The standard SPH method with a variable scalar smoothing length can only reflect the interparticle spacing variation in time and space but not the direction. It can lose neighbor information in some directions and is not suitable for simulating problems with anisotropic deformations.

The ASPH models use an anisotropic algorithm that employs an ellipsoidal smoothing function characterized by a different smoothing length along each axis of the ellipsoidal. The smoothing length long each axis is evolved so as to follow the variation of the local interparticle separation surrounding each particle. By deforming and rotating the ellipsoidal smoothing function so as to follow the anisotropic volume changes associated with each particle, ASPH adapts its spatial resolution scale in time, space, and direction. Hence, ASPH was shown to significantly improve the spatial resolving capability over that of the standard SPH method for the same number of particles used.

The main idea of the ASPH is that in three-dimensional space, the smoothing function is of ellipsoidal shape, which can be arbitrarily oriented. A smoothing tensor H can be used to characterize the influence domain of the smoothing function

$$H = \begin{pmatrix} h_{xx} & h_{yx} & h_{zx} \\ h_{xy} & h_{yy} & h_{zy} \\ h_{xz} & h_{yz} & h_{zz} \end{pmatrix} \tag{7}$$

H is a second order, real and symmetric tensor, $h_{yx} = h_{xy},\ h_{zx} = h_{xz},\ h_{yz} = h_{zy}$. The eigenvectors of H are the directions along the three axes of the ellipsoid and the corresponding eigenvalues are the dimensions of the ellipsoid along each axis. SPH can be regarded as a special case of ASPH, with each diagonal element of H equal to h while other elements equal to zero. Therefore, one has more freedom with ellipsoidal smoothing functions that one has with spherical smoothing functions.

The smoothing function in ASPH can be written as a function of the tensor smoothing length H and the normalized position vector:

$$\bar{\kappa} = \frac{1}{H} \cdot \bar{r} = G \cdot \bar{r}$$

The H tensor can be evolved both spatially and temporally, nine components of tensor define three vectors that adapt their special resolution scale in time, space and direction, the anisotropic volume changes represented by a smoothing ellipsoid can be transformed through a local, linear transformation of coordinates into those in which the underling anisotropic volume changes appear to be isotropic. This tensor for each particle is dynamically evolved by using the components of the deformation tensor $\partial v_i/\partial x_j$ to follow the local deformation and vorticity of the flow. All the SPH equations can now be rewritten in terms of the H tensors and these expressions for W and ∇W. Three principal axes based on the principal direction of the deformation tensor can be defined for an ellipse support domain, three principal vector values (h_x, h_y, h_z) are updated based on the principal values of deformation tensor.

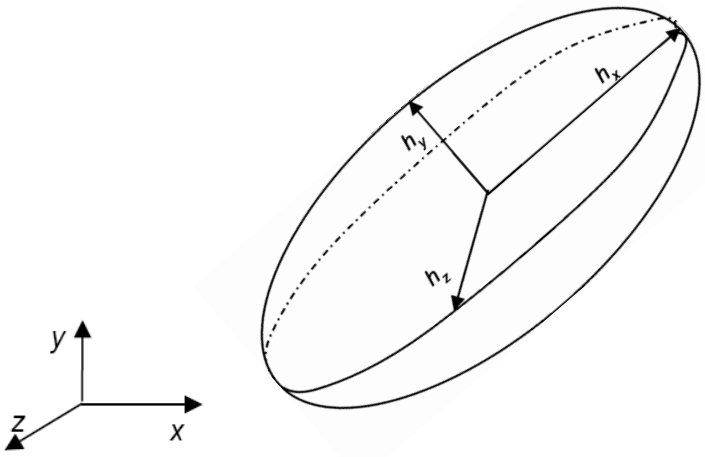


Figure 2. Three dimensional anisotropic kernel support function

Continuity equation and Momentum equation.

The particle approximation of continuity equation is defined as:

$$\frac{d\rho_i}{dt} = \rho_i \sum_j \frac{m_j}{\rho_j} \left(v^\beta{}_i - v^\beta{}_j \right) W_{ij'\beta} \tag{8}$$

It is Galilean invariant due to that the positions and velocities appear only as differences, and has good numerical conservation properties. $v^\beta{}_i$ is the velocity component at particle i.

The discretized form of the SPH momentum equation is developed as:

$$\frac{dv_i^\alpha}{dt} = -\sum_j \frac{m_j}{\rho_i \rho_j} (\sigma_i^{\alpha\beta} \pm \sigma_j^{\alpha\beta}) W_{ij,\beta} \tag{9}$$

The above formulation ensures that stress is automatically continuous across material interfaces. Different types of SPH momentum equations can be achieved through applying the identity equations into the normal SPH momentum equation. Symmetric formulation of SPH momentum equation can reduce the errors arising from particle inconsistency problem.

From equation (6), the following particle body forces were derived:

$$F_i^{pressure} = -\sum_j m_j \frac{p_i + p_j}{2\rho_j} \nabla W(r_{ij}, h)$$

$$F_i^{viscosity} = \mu \sum_j m_j \frac{v_i - v_j}{2\rho_j} \nabla^2 W(r_{ij}, h) \tag{10}$$

Where $r_{ij} = x_i - x_j$, μ is the viscosity coefficient of the fluid. The pressure p_i are computed via the constitutive equation:

$$p_i = k(\rho_i - \rho_0) \tag{11}$$

where k is the stiffness of the fluid and ρ_0 is its initial density.

Numerical Examples

ASPH option in the Ls-Dyna: FORM=9,10 for ASPH formulation and ASPH with renormalization formulation respectively in *CONTROL_SPH keyword. Those two formulations must be used with the *SECTION_SPH_ELLIPSE keyword for the ellipsoidal support of domain, HXCSLH, HYCSLH, HZCSLH have to be define to set the scale factor in each direction. The default smoothing kernel function is cubic B_spline kernel function with SPHKERN = 0 in *SECTION_SPH keyword. For higher order kernel function, set SPHKERN = 1 for quintic spline kernel function with a larger support size which is available for both SPH and ASPH formulation (recommend using with HMAX = 3.0 or larger in *SECTION_SPH keyword).

1. Three point bending test with SPH

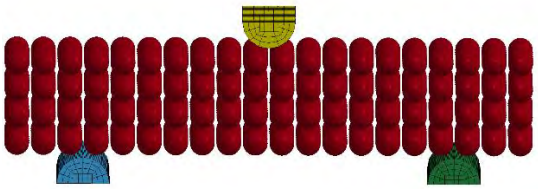


Figure 3. Three point bending test set up

A 3D isotropic plate was modeled by SPH particles under bending test. The plate has the dimension of 100x40x20, and is loaded as shown in figure 3 with two bottom rigid solid fixed in the space, top rigid solid moved with a prescribed motion along z direction. The plate was modeled with 640 SPH particles, and the deformation, stresses distribution are plotted and compared for SPH and ASPH method, higher order kernel was tested here and compared with standard cubic spline kernel function.

In the model, automatic_ node_ to surface contact was used for the interaction between SPH particles and rigid solid elements. *MAT_57 was used for SPH particles with density equal 1.7e-11, E=2.5. For ASPH formulation, *SECTION_SPH_ELLIPSE with hxcslh = hycslh = hzcslh = 1.2 was used.

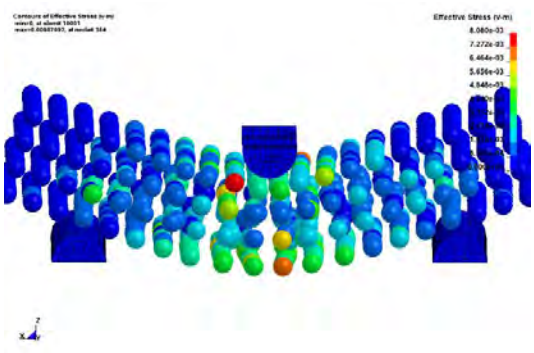


Figure 4. Particle distribution and stress contour for SPH with cubic spine kernel at t=1 form=1

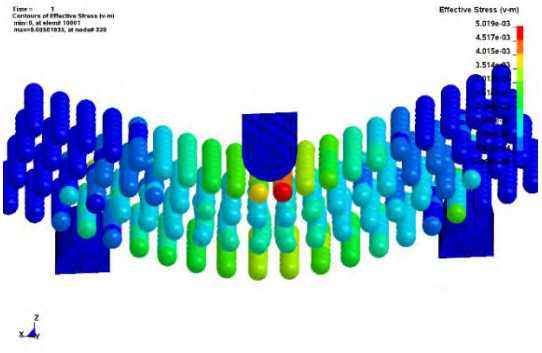


Figure 5. Particle distribution and stress contour for SPH with quintic spline kernel at t=1 Form=1

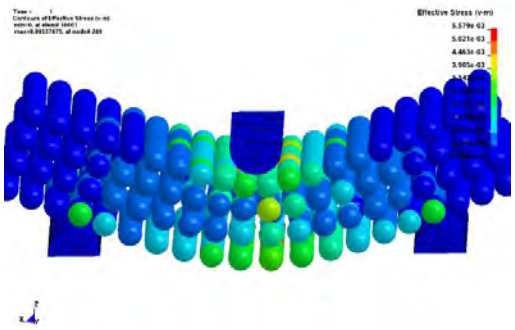


Figure 6. Particle distribution and stress contour for ASPH with cubic spine kernel at t=1 form=10

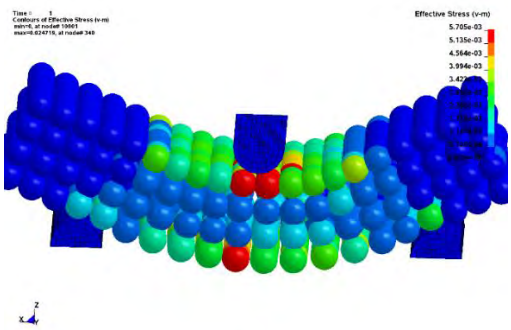


Figure 7. Particle distribution and stress contour for ASPH with quintic spline kernel at t=1 Form=10

As we can see that in fig 4, the standard SPH formulation have particle clustering and fracture problem around the center of the plate, the stresses distribution is non-smooth and irregular. The higher order kernel with standard SPH formulation help to reduce the particle clustering and fracture problem greatly, also have much smoother stresses distribution than normal cubic b-spline kernel function.

ASPH (form=10) formulation with standard cubic spline kernel function can capture dimension-dependent features such as anisotropic deformations with a more generalized elliptical or ellipsoidal influence domain. ASPH is shown here to significantly improve the spatial resolving capability over that of the standard SPH method for the same number of particles used, has much smoother particle distribution and stress contour results than the standard SPH method. Also ASPH with cubic b-spline kernel help to reduce the particle clustering and fracture problem greatly.

2. Swegle rubber ring impact with SPH

Two 3D isotropic rubber rings modeled with SPH particles impact into each other with initial speed V=50m/s. Each ring has outer radius R=40mm, inner radius r=30.5mm and thickness H = 10mm, density of rubber ring rho=3.0e-3, E=1401. The whole setup modeled with 43920 SPH particles and the deformation, stresses distribution are plotted and compared for SPH and ASPH method, higher order kernel was tested here and compared with standard cubic spline kernel function. The standard SPH integral method (Eulerian kernel) was used as interaction method between two rubber rings.

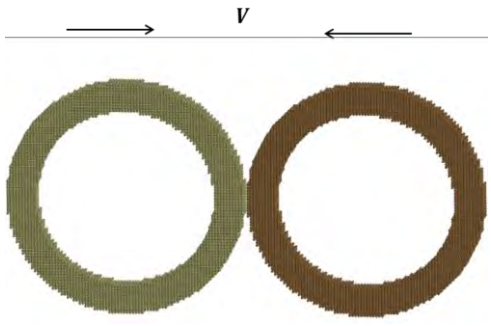


Figure 8. Swegle rubber ring impact problem setup

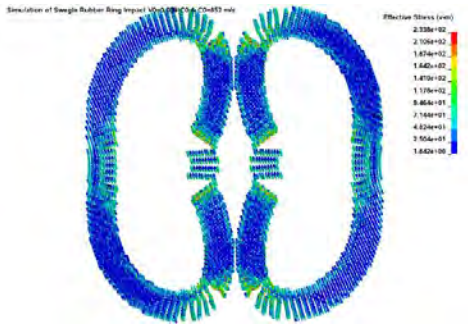


Figure 9. Particle distribution and stress contour for SPH with cubic spine kernel at t=0.54 form=1

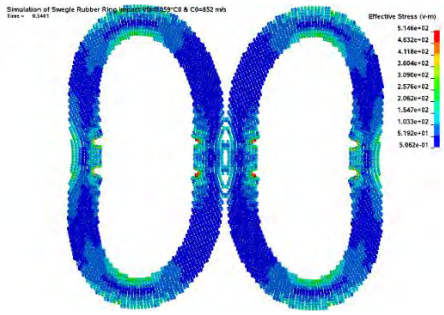


Figure 10. Particle distribution and stress contour for SPH with quintic spline kernel at t=0.54 Form=1

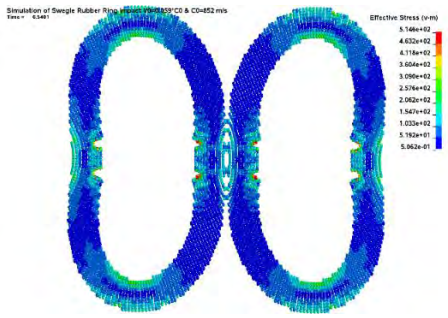


Figure 11. Particle distribution and stress contour for ASPH with cubic spine kernel at t=0.54 form=10

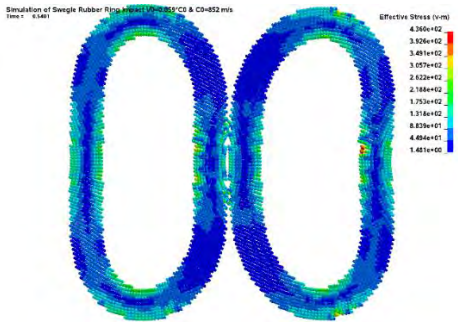


Figure 12. Particle distribution and stress contour for ASPH with quintic spline kernel at t=0.54 Form=10

As we can see that in fig 9, the standard SPH formulation have particle clustering and fracture problem around the corners that under tension pressure, the stresses distribution is non-smooth and irregular. Those phenomena are call the tensile instability since the fractures are not caused by the material failure but by the numerical errors. The higher order kernel with standard SPH formulation help to reduce the tensile instabilities around the corners greatly, also have much smoother stresses distribution than normal cubic b-spline kernel function.

ASPH (form=10) formulation with standard cubic spline kernel function can capture dimension-dependent features such as anisotropic deformations with a more generalized elliptical or ellipsoidal influence domain. ASPH is shown here to significantly improve the spatial resolving capability over that of the standard SPH method for the same number of particles used, has much smoother particle distribution and stress contour results than the standard SPH method (i.e. help to reduce the tensile instability around the corner too). ASPH formulation with quintic spline kernel help to reduce the tensile instabilities issue even more compared to the ASPH with cubic b-spline kernel option. The results are very close to the results with Lagrangian kernel option (form=8, which can totally avoid the tensile instability issue in this case).

CONCLUSION

This paper presents the implementation of an adaptive smoothed particle hydrodynamics (ASPH) method for high strain Lagrangian hydrodynamics with material strength in LS-DYNA. In ASPH, the isotropic kernel in the standard SPH is replaced with an anisotropic kernel whose axes evolve automatically to follow the mean particle spacing as it varies in time, space, and direction around each particle. By deforming and rotating these ellipsoidal kernels so as to follow the anisotropy of volume changes local to each particle, ASPH can capture dimension-dependent features such as anisotropic deformations with a more generalized elliptical or ellipsoidal influence domain. Some numerical examples are investigated using both SPH and ASPH, also higher order kernel function is studied for both SPH and ASPH formulation. The comparative studies show that ASPH has better accuracy than the standard SPH when being used for high strain hydrodynamic problems with inherent anisotropic deformations, also higher order kernel function has better accuracy than the standard cubic kernel function.

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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.

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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.

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

LSTC Barrier Models

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

Material Sciences Corporation www.materials-sciences.com

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

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

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

MSC/LS-DYNA Composite Software and Database -

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

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

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

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

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

Oasys PRIMER

Key benefits:

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

www.oasys-software.com/dyna

Oasys D3PLOT

Key benefits:

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

www.predictiveengineering.com

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

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

Our History

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

恒士达科技
Hengstar Tech.

Shanghai Hengstar www.hengstar.com

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

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

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

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

Consulting

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

Cloud - HPC Services - Subscription JSOL

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

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

JSOL Corporation is cooperating with chosen cloud computing services

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

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

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

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

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

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

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

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

Platform Computation Cloud - CreDist.Inc.

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

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

Cloud - HPC Services - Subscription RESCALE

www.rescale.com

Rescale: Cloud Simulation Platform

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

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

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

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

ScaleX Enterprise: Transform IT, Empower Engineers, Unleash Innovation
The ScaleX Enterprise simulation platform provides scalability and flexibility to companies while offering enterprise IT and management teams the opportunity to expand and empower their organizations.

Rescale Cloud Simulation Platform www.rescale.com

ScaleX Enterprise allows enterprise companies to stay at the leading edge of computing technology while maximizing product design and accelerating the time to market by providing:

- Collaboration tools
- Administrative control
- API/Scheduler integration
- On-premise HPC integration

Industry-Leading Security

Rescale has built proprietary, industry-leading security solutions into the platform, meeting the needs of customers in the most demanding and competitive industries and markets.

- Manage engineering teams with user authentication and administrative controls
- Data is secure every step of the way with end-to-end data encryption
- Jobs run on isolated, kernel-encrypted, private clusters
- Data centers include biometric entry authentication
- Platforms routinely submit to independent external security audits

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

LSTC - DYNAmore GmbH JSOL Corporation

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

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

ESI Cloud Based Virtual Engineering Solutions

www.esi-group.com

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

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

With ESI Cloud users can choose from two basic usage models:

- An end-to-end SaaS model: Where modeling, multi-physics solving, results visualization and collaboration are conducted in the cloud through a web browser.
- A Hybrid model: Where modeling is done on desktop with solve, visualization and collaboration done in the cloud through a web browser.

Virtual Performance Solution:

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

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

The benefits of VPS hybrid on ESI Cloud include:

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

VPS On Demand

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

Key solution capabilities:

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

Result visualization

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

Key result visualization capabilities:

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

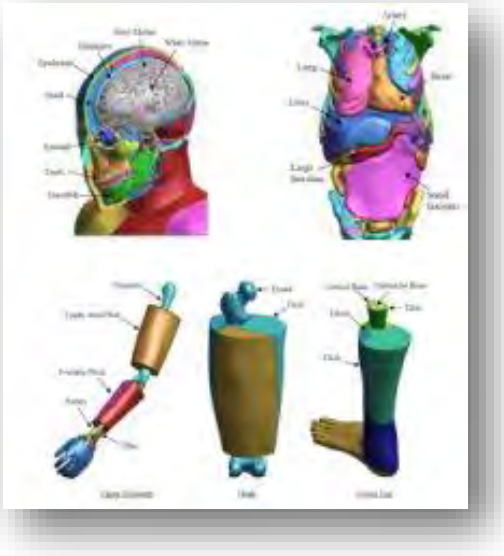
Collaboration

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

Key collaboration capabilities:

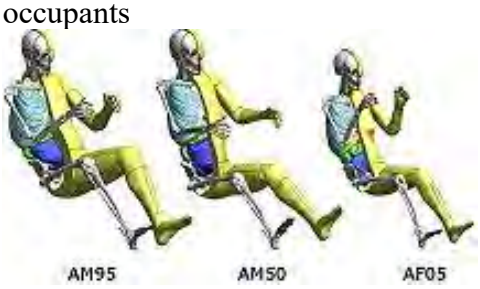
- Data, workflow or project asynchronous collaboration
- Multi-user, browser based collaboration for CAD, geometry, mesh and results models
- Real-time design review with notes, annotations and images archiving and retrieval
- Email invite to non ESI Cloud users for real time collaboration

TOYOTA - Total Human Model for Safety – THUMS

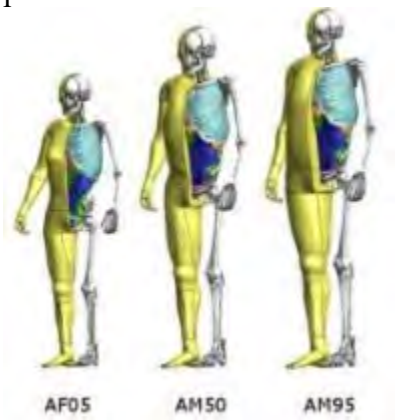


The Total Human Model for Safety, or THUMS®, is a joint development of Toyota Motor Corporation and Toyota Central R&D Labs. Unlike dummy models, which are simplified representation of humans, THUMS represents actual humans in detail, including the outer shape, but also bones, muscles, ligaments, tendons,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

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



and as standing model to represent pedestrians.



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

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

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

For information please contact: THUMS@lstc.com

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

LST, An ANSYS Company – Dummy Models

LSTC Crash Test Dummies (ATD)

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

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

e-mail to: atds@lstc.com

Models completed and available (in at least an alpha version)

- Hybrid III Rigid-FE Adults
- Hybrid III 50th percentile FAST
- Hybrid III 5th percentile detailed
- Hybrid III 50th percentile detailed
- Hybrid III 50th percentile standing
- EuroSID 2
- EuroSID 2re
- SID-IIs Revision D
- USSID
- Free Motion Headform
- Pedestrian Legform Impactors

Models In Development

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

Planned Models

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

LST, An ANSYS Company – Barrier Models

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

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

- ODB modeled with shell elements
- ODB modeled with solid elements
- ODB modeled with a combination of shell and solid elements
- MDB according to FMVSS 214 modeled with shell elements
- MDB according to FMVSS 214 modeled with solid elements
- MDB according to ECE R-95 modeled with shell elements
- AE-MDB modeled with shell elements
- IIHS MDB modeled with shell elements
- IIHS MDB modeled with solid elements
- RCAR bumper barrier
- RMDB modeled with shell and solid elements

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

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

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

Social Media

FACEBOOK

BETA CAE Systems
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ESI Group
ETA
CADFEM
Lenovo

LINKEDIN

BETA CAE Systems
CADFEM
DYNAmore Nordic
ETA
ESI Group

YOUTUBE

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

GOOGLE+

BETA CAE Systems