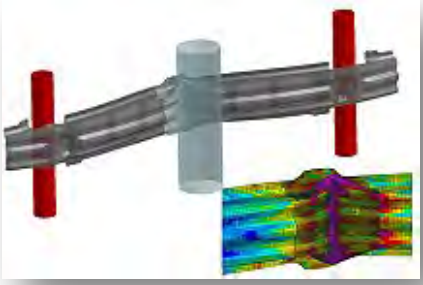
fea INFORMATION Engineering Solutions

Volume 5, Issue 11, November 2016

BETA CAE Systems
ANSA / Epilysis / µETA v17.0.2 suite.

Cray Launches Next-Generation Supercomputer



ESI Group Unleashes Virtual Performance Solution

Introduction to second order Lagrangian elements in LS-DYNA

Hailong Teng - LSTC

FEA Information Inc.

A publishing company founded April 2000 – published monthly since October 2000.

The publication's focus is engineering technical solutions/information.

FEA Information Inc. publishes:

FEA Information Engineering Solutions

FEA Information Engineering Journal

FEA Information China Engineering Solutions

Livermore Software Technology, Corp. (LSTC) Developer of LS-DYNA One Code Methodology.

LS-DYNA provides fully integrated, strongly coupled, solvers for extensive multiphysics capabilities. Integrated, at no additional cost. Optimized for shared and distributed memory for Unix, Linux, & Windows Based platforms.

DYNAmore GmbH – LSTC's Master Distributor in the EU

DYNAmore is dedicated to sales, support, training engineers with LS-DYNA to solve non-linear mechanical problems numerically. Employs 85 engineers in Europe. Co-develops the LSTC software and provide engineering services.

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FEA Information News Sections

Articles – Blogs – News

Automotive News - Editor - Dilip Bhalsod
Aerospace News - Editor - Marnie Azadian
Classes – Webinars - Social Media Editor - Aleta Hays
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Participant Solutions
Distribution/Consulting
Cloud/On Demand/ Subscription
Models - THUMS - ADT - Barrier

LS-DYNA Recent Developments, Features, Updates – Editor – Yanhua Zhao
Introduction to second order Lagrangian elements in LS-DYNA
Hailong Teng - LSTC

Announcements

Class Announcement Not To Miss
SPH Training Classes
www.lstc.com/training/chrono
Feb - 16-17 Thur-Fri CA SPH
Aug - 24-25 Thur-Fri CA SPH

Kaizenat - the LS-DYNA Users Conference
15th Dec 2016 at Bangalore and 16th Dec 2016 at Pune.
Scientist from LSTC will be conducting the sessions and also case studies from customers will be presented

TWITTER! LSTC/DYNAmore has just opened a twitter account. Tweets will be starting December so please sign up for when new versions are released , updated news on LSTC ATD and Barrier Models – Special classes coming up – and other technical information.

https://twitter.com/LSTCandDYNAmore

WEBINAR: LSTC/DYNAMORE are in the final stages of testing for US customers for the first **Information Webinar – New Features in LS-DYNA**. They look forward to posting a formal sign up in late December. If space is filled, an additional webinar will be scheduled for this topic.

Sincerely,
Marsha Victory Trent Eggleston
Marnie Azadian Suri Bala Dilip Bhalsod Yanhua Zhao Aleta Hays

Kaizenat is glad to announce the LS-DYNA Users Conference on 15th Dec 2016 at Bangalore and 16th Dec 2016 at Pune. Scientist from LSTC will be conducting the sessions and also case studies from customers will be presented.

Below is draft agenda

	BANGALORE	PUNE
09:30-10:00	Registration	
10:00 - 10:15	**Welcome Address**	
	Ramesh Venkatesan, CEO, Kaizenat Technologies Pvt Ltd	
10:15 - 11:15	**LS-DYNA Structural - New Developments**	
	Satish Pathy, Sr. Scientist, LSTC	
11:15 - 11:45	Tea Break	
11:45 - 12:15	**Co-simulation approach for real time evaluation of system and component level automotive seat belt components under a given crash pulse**	**Fluid Structural Interaction & optimization**
	Sagar Venkatesh /Naveen Chandra, Autoliv	Aneesh Nair & Roopesh Puthalath, Pricol Technologies Pvt. Ltd.
12:15 – 13:00	**Kaizen-Automation Tools**	
	Jithesh Erancheri, Country Head, Kaizenat Technologies Pvt Ltd	
13:00 - 14:00	**Lunch**	

14:00 - 14:30	**LS-PrePost - New Developments**	
	Satish Pathy, Sr. Scientist, LSTC	
14:30 - 15:00	**Impact study on Aircraft Engine components**	**Simulation of truck cabin behavior under the safety regulation ECE R 29-Test A and Test B using LS-Dyna.**
	Dr. Rajeev Jain, GTRE	Dhanavanti Mohite & Jitendra Pawa, TechMahindra
15:00 - 15:30	Tea Break	
15:30 - 16:00	**Electromagnetic pulse welding, forming, crimping, electro-hydoforming and compacting**	**Vehicle Accident Reconstruction & Occupant Injury Evaluation using LS DYNA**
	Bhavani Sankar Cherukuri, Magpulse Technologies Pvt. Ltd.	Saurabh R. Deshpande, ARAI
16:00 - 16:30	**Semi Piercing Process simulation using Element Free Galerkin Method in LS DYNA**	**Analysis of skid marks, shock lines and scouring in deep drawing using LS-DYNA**
	Prudhvi Raj.P, Tube Investments of India	Vijaya Bhaskar, Jyoti Technical Services Pvt. Ltd
16:30 - 17:00	**Vote of Thanks**	
	Nandakumar, Regional Manager, Kaizenat Technologies Pvt Ltd	Pankaj Kumar, Regional Manager, Kaizenat Technologies Pvt Ltd

Please contact support@kaizenat.com for complete agenda and registration.

Author: Nils Karajan nik@dynamore.de Conference Contact: conference@dynamore.de

Announcement & Call for Papers

11th European LS-DYNA® Conference

May 9 - 11 2017, Salzburg, Austria

Conference Website:
www.dynamore.de/conference2017

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

Venue: Salzburg Congress is located in the center of Salzburg. Salzburg can be reached easily via freeway, the high speed train ICE, and the international airports of Salzburg or Munich. www.salzburgcongress.at

Make sure that you will be part of the conference by submitting your abstract latest January 27, 2017!

Abstract submission: Please submit your abstract (maximum length 2,500 characters) by E-Mail to conference@dynamore.de or online at www.dynamore.de/conference2017.

Important dates

Abstract submission:	27 January 2017
Author notification:	27 February 2017
Final paper deadline:	27 March 2017

Participant fees

Industry speaker:	400 Euro
Academic speaker:	340 Euro
Industry:	590 Euro 1) / 640 Euro
Academic:	440 Euro 1) / 490 Euro

1) Registration before 1 April 2017. All plus VAT.

Exhibiting and sponsoring: Please request further information.

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E-Mail: conference@dynamore.de
www.dynamore.de/conference2017

Author: Alexander Gromer ag@dynamore.de

LS-DYNA Implicit: Workshop on the nonlinear solver

A. Gromer, T. Erhart (DYNAmore); T. Borrvall (DYNAmore Nordic)

Download workshop slides: www.dynamore.de/implicit_workshop_2017
Download input decks: www.dynaexamples.com/implicit

Motivation: Why implicit?

There are several scenarios where an implicit solution scheme will assist you in saving valuable computation time. Typically, these scenarios involve applications with gravity loading or other types of static pre-loading where dynamic effects are vanishing. Thus, instead of trying to calm down a fully dynamic simulation using dynamic relaxation or the application of a critical damping, one can directly compute the "steady-state solution" using the implicit nonlinear solver of LS-DYNA. Other scenarios include long duration analyses beyond five seconds of real time (i.e. dummy positioning) or local parts with much finer meshes that would lead to a very small explicit time step. Besides the dynamic explicit time stepping scheme, the one-code strategy of LS-DYNA also provides implicit time integration schemes which can be applied for static as well as dynamic problems. This enables the engineer to use one input deck for all time integration schemes and thus, guarantees greatest flexibility in choice and application of the "right" method.

The CCSA (former NCAC) Toyota Yaris model

The model provided by CCSA has a typical model setup suitable for crashworthiness analysis. The basic idea was to do as little modifications as necessary to make the model "implicit ready" but keeping the explicit model structure/philosophy. The detailed steps on how this was achieved can be read in the workshop slides. In total, the model consists of about 1.2 million nodes, ~ 1.2 million elements (mostly shells), 1 global contact between parts and 1 global tied contact to capture spotwelds.

Available Load Cases

- Dynamic Shock Absorber Loading
- Static Shock Absorber Loading
- Dynamic Roof Crush
- Static Door Sag

Author: Alexander Gromer ag@dynamore.de

These examples were presented within a workshop on the 14th German LS-DYNA Forum 2016 in Bamberg by Alexander Gromer of DYNAmore. Other recent examples of this section are published by Satish Pathy of LSTC. Download input decks:

www.dynaexamples.com/implicit

Features of LS-DYNA R9.0.1

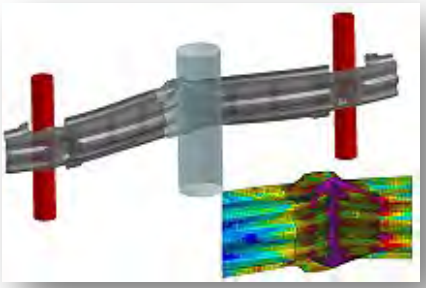
- Newmark methods with consistent mass matrix
- Newton, Quasi-Newton, arclength methods
- Direct and iterative linear solvers
- Automatic step size adjustment
- High scalability using MPP
- Switching between implicit and explicit
- Fringe plot of residual (out-of-balance) forces
- Mortar contact
- Highly for implicit analyses

Download workshop slides: www.dynamore.de/implicit_workshop_2017
Download input decks: www.dynaexamples.com/implicit

ESI Unleashes Virtual Performance Solution Version 2016

www.esi-group.com/company/press/news-releases/esi-unleashes-virtual-performance-solution-version-2016

New Enhancements to Answer Lightweighting and Environmental Challenges



New dynamic remeshing capabilities during a bumper impact in ESI Virtual Performance Solution 2016.

Paris, France – November 2, 2016 – ESI Group, leading innovator in Virtual Prototyping software and services for manufacturing industries, announces the latest release of Virtual Performance Solution (VPS). ESI's flagship software is a unique solution allowing manufacturers to face emerging design challenges — including those related to lightweight and green vehicles — while avoiding over-engineering. It enables design and simulation engineers to test rapidly their innovations on virtual prototypes, rather than real ones, and to evaluate the impact of real driving conditions. VPS also offers a distinctive approach, allowing the virtual testing of product performance across multiple domains, using a single core model. With this latest release of ESI Virtual Performance Solution, manufacturers can predict in a more efficient way the impact of use of composite and advanced lightweight materials on product performance, and simulate the vibration-

As automotive OEMs strive to develop lightweight vehicles, they continuously face challenges related to the introduction of new materials, new grades, and new processes. The selection of advanced lightweight materials, composite materials, ultra-high strength steels or aluminums can hardly be based on existing know-how. Rather, today's innovative multi-material strategies require a precise understanding, and an early prediction, of the as assembled behavior. Any level of uncertainty may lead to conservative decisions and costly over-engineering.

Virtual Performance Solution 2016 offers new functionalities to help OEMs tackle challenges related to the introduction of new materials, and thereby enables them to design the next generation of lightweight vehicles. First, thanks to new dynamic re-meshing capabilities, the accuracy of rupture propagation after an impact is now better captured; important as engineers investigate in detail what happens in the crash rupture area when using new materials and novel assembly methods.

Second, Virtual Performance Solution 2016 includes new advanced composite crash and strength models that enable prediction of the rupture behavior of composite parts and their capability to absorb energy during a crash. In this new version, the accuracy of composite structural performance prediction is importantly increased by taking into account manufacturing effects, such as fiber orientation, that are inherited from the composite forming process. (For more information on this topic please see our latest technical paper, presented at the 17th European Conference on Composite Materials (ECCM).)

Another important challenge for car makers is meeting the new environmental regulations aimed at reducing the level of noise generated by cars. The European Commission recently introduced stringent new noise limitations, which will become applicable in 2026. In the case of electric and hybrid vehicles, which are exceedingly quiet, legislators are considering adding noise so as to reduce the risk of collision with pedestrians.

To solve noise related problematics in an effective way, Virtual Performance Solution 2016 offers extended capabilities for Noise, Vibration & Harshness (NVH) and now enables the prediction of noise radiation, combining the Finite Element Method for the structure and the Boundary Element Method for the outside of the car. The same single-core model is used for the complete vehicle, which facilitates setting the correct pre-loading conditions; mandatory to high quality prediction of structural responses. To achieve greater accuracy, the single-core model also integrates frequency dependency and manufacturing history, even for very innovative and advanced materials and production processes. The use of this single-core model for all engineering teams delivers a drastic reduction of development cycles and costs.

With this single core model, engineers can not only perform regulatory crash and NVH tests, they can also run virtual tests to evaluate real driving conditions. Thanks to VPS's water flow module, they can detect potential leakages and assess how rain will affect driving visibility. Find out more about water management with VPS.

For more information about ESI Virtual Performance Solution, please visit www.esi-group.com/VPS Join ESI's customer portal myESI to get continuously updated product information, tips & tricks, view the online training schedule and access selected software downloads: https://myesi.esi-group.com

For more ESI news, visit: www.esi-group.com/press

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BETA CAE Systems announces the release of the v17.0.2 of its software suite

www.beta-cae.com/news/20161110_announcement_suite_v17.0.2.htm

About this release

BETA CAE Systems announces the release of the new ANSA / Epilysis / μETA v17.0.2 suite.

This maintenance release focuses on resolving identified issues with v17.0.2.

The most important enhancements and fixes implemented in v17.0.2 are listed below.

Enhancements and known issues resolved in ANSA

Enhancements in ANSA

- **Model Browser**: Replace: The incoming part is added to a chain of multiple instances, only if the outgoing part is already part of such a chain.
- **TOPO**: Mid Surface Check: The sensitivity of the algorithm has been improved.
- **Shell Mesh:** Elements Point Cloud: Significant performance improvement for cases with millions of Points.
- **DECKs**: Results Mapping: Sequence name, Layer name, and Layer group fields are now imported by the results mapper when laminate information is loaded from Simulayt .Layup files.
- **Abaqus**: Scripting: The SetEntityCardValues is now able to handle the ELSET/INTERACTION field. of the *CHANGE FRICTION keyword.
- **HEXA BLOCK:** Modification Offset: The option "Allow interior faces selection" is now available in the options list.

Known issues resolved in ANSA

- General: Scripting: The CreateShellsFromSolidFacets function now accepts only Solid elements as objects, instead of solid facets.
- Volume Mesh: Volumes: Not all erroneous entities would be detected and listed at the Volume Check List.
- Unstructured Mesh: During the creation of Unstructured Volume Mesh, some solid elements might be missing.
- CFD DECKSs: Deleting properties through the Property list, properties with FROZEN_DELETE were also deleted, when the option "Delete Included Entities" was activated.
- NASTRAN: Deck Info: Improved algorithm for the Mass calculation related to NSM.
- PERMAS: Input: MPCs with ids > 99999999, would not be read.

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

Known issues resolved in μETA

Supported interfaces:

- ANSYS total mechanical & thermal GCS strain results for shell elements would not be read.
- Unexpected termination might occur when reading Pam-Crash files with CDATA comments of 82 characters or more.
- LS-DYNA ECS solid element results were not supported.
- OpenFOAM displacement results would not be read correctly.
- Star-CCM+ VolumeFractionResults would not be read.
- General: Software blocking trying to create a stress linearization report.
- Unexpected termination with linear combination of Medina nodal stress results.
- Unexpected termination when trying to copy a curve to another plot window.
- Unexpected termination could occur when saving a curve in TABLED format with the option to generate A/LC points as ANSA comments.

NVH Calculators

- In the Modal Response tool if a response node was not present, modal energy plots appeared to lack phase.
- In the FRF Assembly tool, states created by the Animate button had no results in certain cases.

Identify

- Software blocking with the identify history command at certain cases.
- Identify history on complex results would not plot real part of curves.
- Node to plane distances were not identified correctly.

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

Compatibility and Supported Platforms

- ANSA files saved by all the first and second point releases of a major version are compatible to each other. New major versions can read files saved by previous ones but not vice versa.
- To read µETA Project files by versions earlier than v17.0.2, they have to be saved selecting the option "Version <17.0.2".
- Support for 32-bit platform has been discontinued for all operating systems.

Download

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

BETA CAE Systems announces the release of the v17.0.2 of its software suite

What to download:

- All files required for the installation of this version reside in the folder named "BETA_CAE_Systems_v17.0.2" and are dated as of November 10, 2016. These files should replace any pre-releases or other files downloaded prior to that date.
- The distribution of this version of our pre- and post-processing suite is packaged in one, single, unified installation file, that invokes the respective installer and guides the procedure for the installation of the required components.
- For the installation of the software on each platform type, the.sh installer file residing in the folder with respective platform name, for Linux and MacOS or the respective .msi installer file for Windows, 64bit, have to be downloaded.
- In addition to the above, optionally, the μETA Viewer is available to be downloaded for each supported platform.
- The tutorials and the example files reside in the folder named "TUTORIALS". This folder includes the complete package of the tutorials and example files, and a package with only the updated ones.
- The Abaqus libraries required for the post-processing of Abaqus .odb files are included in the installation package and can be optionally unpacked.
- Earlier software releases are also available in the sub-directory called "old" or in a folder named after the product and version number.

Cray Launches Next-Generation Supercomputer

http://investors.cray.com/phoenix.zhtml?c=98390&p=irol-newsArticle_print&ID=2221937

Cray® XC50™ System Delivers One Petaflop of Peak Performance in a Single Cabinet

SEATTLE and SALT LAKE CITY, Nov. 14, 2016 (GLOBE NEWSWIRE) -- At the 2016 Supercomputing Conference in Salt Lake City, Utah, global supercomputer leader Cray Inc. (Nasdaq:CRAY) today announced the launch of the Cray® XC50™ supercomputer – the company's fastest supercomputer ever with a peak performance of one petaflop in a single cabinet.

The Cray XC50 supercomputer is engineered to address the broad application performance challenges of today's most demanding high performance computing (HPC) users. Special features of the Cray XC50 supercomputer include:

- the industry-leading Aries network interconnect, which is designed specifically to meet the performance requirements seen in today's emerging class of data center GPU accelerated applications, where high node-to-node communication performance is critical;
- a Dragonfly network topology tightly integrated with Aries that reduces communication latency for scale-out applications that rely heavily on the Message Passing Interface;
- optional SSD-enabled DataWarp™ I/O accelerator technology, enabling software-defined provisioning of application data for improved performance;
- innovative cooling systems to lower customers' total cost of ownership;
- the next-generation of the high performance and tightly integrated Cray Linux Environment that supports a wide range of applications;
- image-based systems management for easy upgrades, less downtime, and field-tested large-scale system deployment;
- enhancements to Cray's HPC optimized programming environment for improved performance and programmability of GPU environments;
- support for the NVIDIA® Tesla® P100 GPU accelerator as well as support for next-generation Intel® Xeon® and Intel Xeon Phi™ processors.

"Supercomputing applications are evolving to include more deep learning algorithms, and with this evolution, the uses for GPUs in our systems are increasing, enabling our customers to use new analytics techniques to gain insight from increasingly large and complex data," said Ryan Waite, Cray's senior vice president of products. "The new Cray XC50 system represents a major advancement in our supercomputing capabilities. It provides the highest performance density of any Cray supercomputer, and gives customers the computational resources they need to take on larger, more complex workloads, as well as the next generation of scientific challenges."

Located in Lugano, Switzerland, CSCS is currently upgrading its Cray XC30™ supercomputer nick-named "Piz Daint" to a Cray XC50 system, and will combine it with the Centre's Cray XC40™ supercomputer nick-named "Piz Dora". Once completed, the combined system will adopt the Piz Daint name and will be one of the fastest supercomputers in the world.

"Our new Cray XC50 supercomputer will significantly accelerate our computational research capabilities allowing our users to perform more advanced, data-intensive simulations, visualizations and data analyses across a wide array of scientific studies," said Prof. Dr. Thomas C. Shulthess, director of the Swiss National Supercomputing Centre (CSCS). "Cray's next-generation supercomputer and its continued integration of GPU acceleration has created a powerful and efficient hybrid multi-core system for addressing our current and future HPC workloads."

For more information on the Cray XC50 supercomputer, please visit the Cray website at www.cray.com.

About Cray Inc.: Global supercomputing leader Cray Inc. (Nasdaq:CRAY) provides innovative systems and solutions enabling scientists and engineers in industry, academia and government to meet existing and future simulation and analytics challenges. Leveraging more than 40 years of experience in developing and servicing the world's most advanced supercomputers, Cray offers a comprehensive portfolio of supercomputers and big data storage and analytics solutions delivering unrivaled performance, efficiency and scalability. Cray's Adaptive Supercomputing vision is focused on delivering innovative next-generation products that integrate diverse processing technologies into a unified architecture, allowing customers to meet the market's continued demand for realized performance. Go to www.cray.com for more information.

Safe Harbor Statement: FOR COMPLETE STATMENET – Visit www.cray.com This press release contains forward-looking statements within the meaning of Section 21E of the Securities Exchange Act of 1934 and Section 27A of the Securities Act of 1933, including, but not limited to, statements related to the availability of future processors (including accelerators) for Cray XC50 systems, the system purchased by CSCS and Cray's ability to deliver a system that meets CSCS's requirements. These statements involve current expectations, forecasts of future events and other statements that are not historical facts. Inaccurate assumptions and known and unknown risks and uncertainties can affect the accuracy of forward-looking statements and cause actual results to differ materially from those anticipated by these forward-looking statements. Factors that could affect actual future events or results include, but are not limited to, the risk that Cray is not able to successfully complete its planned product development efforts in a timely fashion or at all, the risk that the processors (including accelerators) planned for Cray XC50 systems are not available with the performance expected or when expected or are not incorporated into Cray XC50 systems when expected or at all, the risk that that the system required by CSCS does not perform as expected….

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Primary Logo - Cray Inc

Dams and Water Conservation

Aleta Hays, ayh225@aol.com

Glen Canyon Dam – flood control, electrical generation

Six years of extreme California drought, with 2015 as the warmest year on record and quite possibly several more years of the same looming in the future, Californians have come to understand the importance of our dams and reservoirs. According to Wikipedia there are over 1,400 dams and over 1,300 reservoirs in California alone. These advanced engineering accomplishments are not only critical for our water storage, but they provide a host of other functions, including flood control, electrical generation and debris control. www.fema.gov/benefits-dams

November showcase:

1. YouTube Video by Edouard Yreux
2. Drought statistics powered by USGS
3. Role of dams powered by ICOLD
4. Benefits of dams powered by FEMA
5. Papers from the 11th International LS-DYNA® Users Conference 2010

YouTube Video by Edouard Yreux
Published August 11, 2016
www.youtube.com/watch?v=KkoaKgv2fhc&list=PLBcXmzqlnOg05RHAhbKH5cjw-R1djkBTs

Drought Statistics powered by USGS
This site provides drought facts and current status information
ca.water.usgs.gov/data/drought

Role of dams powered by ICOLD
This site provides both historical and current information on the importance of dams and reservoirs
hhtp://www.icold-cigb.net/GB/Dams/role_of_dams.asp

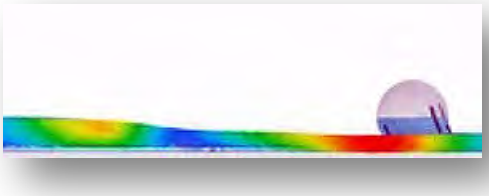
Benefits of dams powered by FEMA
This site provides information on the invaluable role dams play in human society
www.fema.gov/benefits-dams

11th Int'l LS-DYNA Users Conference 2010

Nonlinear Analysis of Copper Water Stop
Lou Pingyi, Cao Deqing - Beijing Engineering Software Technology Co. Ltd.

Analysis and Design of Large-Scale Civil Works Structures Using LS-DYNA
David DePolo, Eric Kennedy, Thomas Walker, Ryan Tom - US Army Corps of Engineers

Structure-Fluid Interaction Analysis of an Existing Water Tank
Mohammad Ghorbanie, Glen Norlander - AMEC Americas

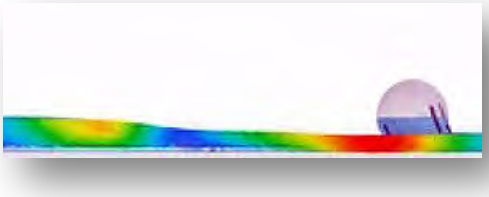


This simulation is done using LS-DYNA explicit solver, with SPH elements.
Simulation by BeenuZz

Smoothed-particle hydrodynamics (SPH) is a computational method used for simulating fluid flows.

- A mesh-free Lagrangian method (where the coordinates move with the fluid),
- A mesh free Lagrangian method where the resolution of the method can easily be adjusted with respect to variables such as the density.
- The smoothed-particle hydrodynamics (SPH) method works by dividing the fluid into a set of discrete elements, referred to as particles.
- These particles have a spatial distance (known as the "smoothing length",
- These particles are typically represented in equations by h {\displaystyle h} h), over which their properties are "smoothed" by a kernel function.
- (Courtesy Wikpedia)

www.youtube.com/watch?v=yO-Y-Vc9Bas&list=PLXFT4P5W0f3-r_Rb3b3RkSj9oCOHvmWJb&index=43
YOUTUBE - BeenuZz - Published on Oct 24, 2016



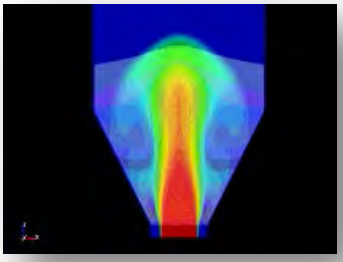
- This simulation is done using LS-DYNA explicit solver, with SPH elements.
- The model contains 80k elements, and takes about 30h to compute over
  9 seconds. (12 Xeon CPUs at 3.3Ghz)

LS-DYNA and LS-DYNA's, fully integrated, strongly coupled, solvers for extensive multiphysics capabilities. All LS-DYNA Solvers are strongly coupled and integrated, at no additional fees.

LSTC – DYNAmore SPH EXAMPLES -
www.dynaexamples.com/sph

SPH Training Classes
www.lstc.com/training/chrono
Feb - 16-17 Thur-Fri CA SPH
Aug - 24-25 Thur-Fri CA SPH

LANCEMORE Japan – Updated LS-DYNA Analysis Models



LS-DYNA Analysis Models

www.lancemore.jp/index_en.html

The sample models have been created and collected for the purposes of letting you know what LS-DYNA can do and demonstrating our knowledge and abilities to create models. We are hoping that our models come in useful for you. If you wish to create a particular model, please contact us. We will offer the best cost-effective solutions. Thank you for your interest in our models!

www.lancemore.jp/index_en.html
Updated on 11-11-2016

No.452

Analysis of powder blending inside fluid bed based on the coupling analysis method(Long Version)

NO. 452

Crash Simulation of the protection system which is constituted of high strength steel ring nets

No 451

Crash Simulation of the protection system which is constituted of ring nets and tecco nets

https://caeai.com/blog

Engineering Advantage Blog

Tap into the thinking of some of the world's leading simulation experts.

Our consulting engineers share helpful tips and insights into how they've solved significant engineering challenges.

Adventures in High Speed PCB Design - Part 3
Chris Mesibov, Senior Project Manager

A Top Ten List for Explicit Dynamics Analysis – Part 2
Steven Hale, M.S.M.E, Senior Engineering Manager

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AUTOMOTIVE NEWS & EVENTS

Dilip Bhalsod

The purpose of this section is to provide a place, for our automotive readers, to share news and events relative to their company and/or products.

The criteria for submitting information is as follows:

- It has to be public information
- Published on the Internet
- Be automotive informational, or human interest.
- We do not accept financial quarterly information

We would welcome the opportunity to share information about your company with our readership.

You may send Title to your information and the accompanying URL to aqiac99@aol.com - Subject Line please

use " Automotive News"

Submissions should be received by the 15th of each month, of the month you want your article placed

Submission publications is at the sole discretion of FEA Information Inc.

USA premiere for the fourth generation smart electric drive: Electrification of all smart models - EXCERPT

Electric energy consumption: 13.1 – 12.9 kWh/100 km; CO2 emissions, combined: 0 g/km

The new smart electric drive* makes opting into electric mobility more attractive than ever.

Stuttgart/Los Angeles. The new smart electric drive* makes opting into electric mobility more attractive than ever. This is because it combines the agility of the smart with local emission-free driving – the ideal combination for urban mobility. Fourth-generation electric driving pleasure can be experienced not only in the smart fortwo coupé and smart fortwo cabrio, but for the first time also in the four-seater smart forfour. In future smart will be the only car manufacturer worldwide to offer its model range with both combustion engines and pure battery-electric drive. The smart electric drive celebrated its world premiere at the Paris Motor Show (1 to 16 October 2016), while the market launch will start in early 2017. In Germany prices for the smart fortwo electric drive will start at €21,940 (recommended retail price including 19% VAT).

"The smart is the perfect city car, and with electric drive it becomes a little bit more perfect", says Annette Winkler, Head of smart. "This is why we will soon be offering our entire range – smart fortwo, smart cabrio and even our smart forfour – as all-electric versions. Together with lots of smart fans and enthusiastic drivers of the three predecessor generations, we are looking forward to the unique driving fun offered by the new smart electric drive. And at very attractive prices, especially in countries where there is a buyer's premium".

The most important information at a glance:

smart is the only car manufacturer worldwide to offer its model range with both combustion engines and pure battery-electric drive as the smart fortwo, smart fortwo cabrio and smart forfour are available as electric drive models.

The smart fortwo cabrio is the only electric cabriolet on the market.

USA premiere for the fourth generation smart electric drive: Electrification of all smart models - EXCERPT

With torque of 160 Newton metres the 60 kW electric car boasts exceedingly agile acceleration.

The fully charged battery has sufficient power to cover approximately 160 kilometres in accordance with the NEDC, making it ideal for urban use.

With the high-performance on-board charger the smart electric drive can be charged up to twice as fast as before (depending on the country version and the electricity supply network).

With the new fast charger (optional extra available from 2017) the vehicle can be fully charged in less than 45 minutes (depending on the country version and the electricity supply network).

In Germany prices for the smart fortwo electric drive will start at €21,940. When the environmental bonus is taken into account this means that it will cost less than €18,000.

smart electric drive: agile, quiet and local emission-free urban driving

The driving characteristics are as agile and lively as ever. The ultra-small turning circle also contributes to this, and at 6.95 metres for the two-seater it corresponds precisely to that of its sibling with conventional drive. And every wish will be catered for with regard to colours and optional equipment – electric driving at smart offers maximum scope for customisation.

The charging time is an important factor for electric vehicle customers and the new smart electric drive also boasts major improvements here. All models have a new, powerful on-board charger as a standard feature. In the USA and Great Britain the charging time is 2.5 hours – half as long as for the predecessor. With the "smart control" app the charging process can be conveniently monitored from afar and many more functions such as intelligent charging can be controlled.

From 2017 a particularly powerful 22 kW fast charger will be available as an option. This enables the smart electric drive to be charged much more quickly: in less than 45 minutes if local conditions allow three-phase charging.

The smart fortwo electric drive models are series produced at smart's Hambach plant. The smart forfour electric drive is produced at the Novo Mesto site (Slovenia). The smart is equipped with a battery from the Daimler subsidiary Deutsche ACCUMOTIVE. The company based in Kamenz, Saxony, has been building the electric heart of the smart electric drive since 2012.

A 60 kW (81 hp) electric motor works at the rear of the smart electric drive and transmits its power via a constant ratio to the wheels. Powerful torque of 160 Nm is immediately available from a standstill. The electric drive has a range of approximately 160 km – ideal for local emission-free mobility in urban areas. The maximum speed is electronically limited to 130 km/h to maximise the range.

---- End of Excerpt

AEROSPACE NEWS & EVENTS

Marnie Azadian

The purpose of this section is to provide a place, for our automotive readers, to share news and events relative to their company and/or products.

The criteria for submitting information is as follows:

- It has to be public information
- An internet URL
- Be technical, informational, or human interest.
- We do not accept financial quarterly information

We would welcome the opportunity to share information about your company with our readership.

You may send Title to your information and the accompanying URL to Marnie Azadian at agiac99@aol.com - Subject Line please use "Aerospace News"

Submissions should be received by the 15th of each month, of the month you want your article placed. For example: We would need the title of the news or event by December 15th, 2015 to be featured in the December 2015 FEA newsletter.

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NASA Successfully Launches NOAA Advanced Geostationary Weather

The GOES-R satellite will be NOAA's most sophisticated weather observation spacecraft and is expected to improve forecasts and tracking substantially.

Credits: NASA/Kim Shiflett

NASA successfully launched for the National Oceanic and Atmospheric Administration (NOAA) the first in a series of highly advanced geostationary weather satellites Saturday from Cape Canaveral Air Force Station in Florida.

NOAA's Geostationary Operational Environmental Satellite-R (GOES-R) lifted off at 6:42 p.m. EST on its way to boost the nation's weather observation capabilities, leading to more accurate and timely forecasts, watches and warnings.

"The launch of GOES-R represents a major step forward in terms of our ability to provide more timely and accurate information that is critical for life-saving weather forecasts and warnings," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate in Washington. "It also continues a decades-long partnership between NASA and NOAA to successfully build and launch geostationary environmental satellites."

After it reaches its final designated orbit in the next two weeks, GOES-R will be renamed GOES-16. The new satellite will become operational within a year, after undergoing a checkout and validation of its six new instruments, including the first operational lightning mapper in geostationary orbit.

"The next generation of weather satellites is finally here," said NOAA Administrator Kathryn Sullivan. "GOES-R will strengthen NOAA's ability to issue life-saving forecasts and warnings and make the United States an even stronger, more resilient weather-ready nation."

Forecasters will use the lightning mapper to hone in on storms that represent the greatest threats. The satellite's primary instrument, the Advanced Baseline Imager, will provide images of Earth's weather, oceans and environment with 16 different spectral bands, including two visible channels, four near-infrared channels, and 10 infrared channels.

Improved space weather sensors on GOES-R will monitor the sun and relay crucial information to forecasters so they can issue space weather alerts and warnings. In all, data from GOES-R will result in 34 new or improved meteorological, solar and space weather products.

NASA Successfully Launches NOAA Advanced Geostationary Weather

"NOAA and NASA have partnered for decades on successful environmental satellite missions," said Sandra Smalley, director of NASA's Joint Agency Satellite Division at the agency's Headquarters in Washington, which worked with NOAA to manage the development and launch of GOES-R. "Today's launch continues that partnership and provides the basis for future collaboration in developing advanced weather satellites."

Beyond weather forecasting, GOES-R also will be part of the Search and Rescue Satellite Aided Tracking (SARSAT) System, an international satellite-based search and rescue network operated by NOAA. The satellite is carrying a special transponder that can detect distress signals from emergency beacons.

There are four satellites in the GOES-R series: –R, –S, –T and –U, which will extend NOAA's geostationary coverage through 2036.

NOAA manages the GOES-R Series Program through an integrated NOAA-NASA office. NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, acquired and managed the United Launch Alliance Atlas V launch service and led the countdown. NASA's Goddard Space Flight Center in Greenbelt, Maryland, oversees the acquisition of the GOES-R series spacecraft and instruments.

For more information about GOES-R, visit:
https://www.nasa.gov/content/goes-r/index.html
and
http://www.goes-r.gov

-end-

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Last Updated: Nov. 20, 2016

Editor: Sarah Ramsey

Conference – Events – Users Meetings

Keep up to date on upcoming

Conferences

Meetings

Events

We will be adding to this section monthly – if you have a new event to be listed please send to agiac99@aol.com

January 26, 2017

14th Annual UK Oasys LS-DYNA Users' Meeting

Location: Ashorne Hill Conference Centre, Warwickshire, UK
www.oasys-software.com/dyna/en/events/users_jan-17/users_jan-17.shtml

We are delighted to announce that the fourteenth in a series of update meetings for UK Oasys LS-DYNA Users will take place on the 26th January 2017 at the Ashorne Hill conference centre in Warwickshire.

The day will bring together around 100 users of the Oasys and LS-DYNA software to provide information on upcoming features and to learn more about current and new applications, as well as other related software products.

The event is an ideal networking opportunity as well as a chance to gain insights, and speak with the Oasys software developers and support team. Attendees will enjoy talks from Dilip Bhalsod from LSTC, Tim Armitage from UK Autodrive, as well as the Oasys LS-DYNA team at Arup.

The event will be followed by a complimentary meal at Ashorne Hill dining.

The Oasys LS-DYNA Users meeting is kindly being sponsored by OCSL and cloud computing provider, Microsoft Azure.

Registration: Attendance is free of charge. To register for the event and the evening meal simply send us an email with your company/affiliation and contact details. Please also let us know if you have any particular dietary requirements when you register.
Conference 14th Annual UK Oasys LS-DYNA Users' Meeting Conference

7th BETA CAE International Conference
30 May - 1 June, 2017
Thessaloniki, Greece

SPONSORED EVENTS: BETA CAE Systems participation

Author: Nils Karajan nik@dynamore.de Conference Contact: conference@dynamore.de

May 9 - 11 2017

Announcement & Call for Papers

11th European LS-DYNA® Conference

May 9 - 11 2017, Salzburg, Austria

Conference Website:
www.dynamore.de/conference2017

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

Venue: Salzburg Congress is located in the center of Salzburg. Salzburg can be reached easily via freeway, the high speed train ICE, and the international airports of Salzburg or Munich. www.salzburgcongress.at

Make sure that you will be part of the conference by submitting your abstract latest January 27, 2017!

Abstract submission: Please submit your abstract (maximum length 2,500 characters) by E-Mail to conference@dynamore.de or online at www.dynamore.de/conference2017.

Important dates

Abstract submission:	27 January 2017
Author notification:	27 February 2017
Final paper deadline:	27 March 2017

Participant fees

Industry speaker:	400 Euro
Academic speaker:	340 Euro
Industry:	590 Euro 1) / 640 Euro
Academic:	440 Euro 1) / 490 Euro

1) Registration before 1 April 2017. All plus VAT.

Exhibiting and sponsoring: Please request further information.

Contact: DYNAmore GmbH
Industriestr. 2, D-70565 Stuttgart, Germany
Tel. +49 (0) 7 11 - 45 96 00 - 0
E-Mail: conference@dynamore.de
www.dynamore.de/conference2017

Training and Social Media Section

Aleta Hays

Training

Classes

Webinars

On Site – On Line

We will be adding to this section monthly – if you have a new event to be listed please send to Aleta ayh225@aol.com and cc Anthony agiac99@aol.com

Participant's Training Classes

Webinars

Info Days

Class Directory

Participant Class Directory

Arup **(corporate)**	www.oasys-software.com/dyna/en/training
BETA CAE Systems **(corporate)**	www.beta-cae.com/training.htm
DYNAmore **(corporate)**	www.dynamore.de/en/training/seminars
ESI-Group **(corporate)**	https://myesi.esi-group.com/trainings/schedules
ETA **(corporate)**	www.eta.com/support2/training-calendar
LSTC **(corporate)**	www.lstc.com/training
LS-DYNA OnLine **(Al Tabiei)**	www.LSDYNA-ONLINE.COM

ARUP Visit the website for complete listings/changes/locations

www.oasys-software.com/dyna/en/training

To enrol on any of these courses please email Dyna Support at dyna.support@arup.com.

Date	Training Class
Scheduled on request	Oasys PRIMER - An Introduction
Scheduled on request	Oasys PRIMER - Automatic Assembly of Multiple Crash Cases
Scheduled on request	Oasys PRIMER - Spotwelds and Connections
Scheduled on request	Oasys PRIMER - Seat and Dummy Positioning
Scheduled on request	Oasys PRIMER & D3PLOT - An Introduction to JavaScripting

BETA CAE SYSTEMS Visit the website for complete listings/changes/locations

www.beta-cae.com/training.htm

Basic and advanced training courses can be scheduled upon request. A variety of standard or tailored training schedules, per product or per discipline, are being offered to meet customers needs.

A number of recommended training courses offered are described below. The list is not exhaustive and more courses can be designed according to your needs.
Please, contact ansa@beta-cae.com for further details.

Recommended Training Courses (Complete information on website)

- SPDRM
- ANSA / μETA Basics
- ANSA / μETA for CFD
- ANSA / μETA for Crash & Safety simulation
- ANSA / μETA for Durability simulation
- ANSA / μETA for NVH analyses
- Multi-Body Dynamics
- Laminated Composites
- Morphing and Optimization
- Automation
- Additional special sessions

Author: Nils Karajan nik@dynamore.de

DYNAmore Visit the website for complete overview and registration

www.dynamore.de/seminars

Selection of trainings as well as free-of-charge information & support days in December 2016

Download full seminar brochure (pdf): www.dynamore.de/seminars-2016

Trainings

Introduction to Composite Modeling	1-2 Dec.
Introduction to Primer for LS-DYNA	5 Dec.
Crashworthiness Simulations	6-9 Dec.
Introduction to Nonlinear Implicit Analyses	16 Dec.

Information days (free of charge)

Biomechanics	5 Dec.

Support days (free of charge)

Occupant Safety	16 Dec.

If not otherwise stated, the event location is Stuttgart, Germany.
Other event locations are: G = Göteborg, Sweden; V = Versailles, France; T = Turin, Italy,

If the offered seminars do not fully suit your needs, we are pleased to meet your individual requirements by arranging tailored on-site training courses on your company premises.

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

https://myesi.esi-group.com/trainings/schedules

Please visit the website for complete information on all the classes and locations

GERMANY

Introduction to ProCAST
1 Dec 2016 to 4 Dec 2016

OpenFOAM Advanced Course
7 Dec 2016 to 8 Dec 2016

OpenFOAM Foundation Course
5 Dec 2016 to 6 Dec 2016

Basic OpenFOAM and Visual-CFD Training
9 Dec 2016

Farmington Hills, Detroit, MI

Introduction to ProCAST
1 Dec 2016 to 4 Dec 2016

Weld Quality and Residual Stress Engineering
7 Dec 2016 to 9 Dec 2016

OpenFOAM Foundation Course
5 Dec 2016 to 6 Dec 2016

Weld Quality and Residual Stress Engineering
7 Dec 2016 to 9 Dec 2016

Introduction to ProCAST
6 Dec 2016 to 8 Dec 2016

2016

Tabiei	Adv Impact	MI	Dec 8-9
Yan / Ho	Intro to LS-PrePost	MI	Dec 12
Tabiei	Intro to LS-DYNA	MI	Dec 13-16

2017

January	**23**	**Mon**	**MI**	**Intro to LS-PrePost 1 day** **P. Ho / Q. Yan**
	24-27	**Tue-Fri**	**MI**	**Intro to LS-DYNA 3.5 days** **A. Nair**
February	**13-15**	**Mon-Wed**	**CA**	**ALE 3 days** **M. Souli**
	16-17	**Thur-Fri**	**CA**	**SPH 2 days** **M. Souli**
	16-17	**Thur-Fri**	**ONLINE**	**Contact in LS-DYNA 2 days** **A. Tabiei**
	23-24	**Thur-Fri**	**ONLINE**	**Implicit LS-DYNA 2 days** **A. Tabiei**

LS-DYNA Visit the website for complete listings/changes/locations

On Line www.LSDYNA-ONLINE.COM

For Information contact: courses@lsdyna-online.com or 513-3319139

Composite Materials In LS-DYNA

This course will allow first time LS-DYNA users to use composite materials. The most important elements to start using all the composite material models in LS-DYNA will be presented in the 8 hours.

Foam & Viscoelastic Materials in LS-DYNA

Objective of the course: Learn about several foam material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures

Plasticity, Plastics, and Viscoplastics Materials in LS-DYNA

Objective of the course: Learn about several plasticity based material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures.

Rubber Materials in LS-DYNA

Objective of the course: Learn about several rubber material models in LS-DYNA to solve engineering problems. Detailed descriptions are given of the data required to use such material in analysis. Examples are used to illustrate the points made in the lectures.

 **FACEBOOK**

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ESI Group Lenovo

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ETA CADFEM Lenovo

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ESI Group

 **NEWS FEEDS** ETA:

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BETA CAE Systems	www.beta-cae.gr
CADFEM	www.cadfem.de
Cray Inc.	www.cray.com
ESI Group	www.esi-group.com
ETA	www.eta.com
Lancemore	www.lancemore.jp/index_en.html
Lenovo	

GOOGLE+

BETA CAE Systems	

LS-DYNA Resource Links

LS-DYNA Multiphysics YouTube Facundo Del Pin

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

FAQ LSTC Jim Day

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/tiki/tiki-index.php

BETA CAE Systems S.A. **www.beta-cae.gr**

BETA CAE Systems S.A.– ANSA

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

BETA CAE Systems S.A.– μETA

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

Solutions for:

Process Automation - Data Management – Meshing – Durability - Crash & Safety NVH - CFD - Thermal analysis - Optimization - Powertrain Products made of composite materials - Analysis Tools -

Maritime and Offshore Design - Aerospace engineering - Biomechanics

CRAY **www.cray.com**

THE CRAY® XC™ SERIES: ADAPTIVE SUPERCOMPUTING ARCHITECTURE

The Cray® XC™ series delivers on Cray's commitment to an adaptive supercomputing architecture that provides both extreme scalability and sustained performance. The flexibility of the Cray XC platform ensures that users can precisely configure the machines that will meet their specific requirements today, and remain confident they can upgrade and enhance their systems to address the demands of the future.

Cray® XC40™ and XC40-AC™ supercomputers are enabled by a robust Intel® Xeon® processor road map, Aries high performance interconnect and flexible Dragonfly network topology, providing low latency and scalable global bandwidth to satisfy the most challenging multi-petaflops applications.

While the extreme-scaling Cray XC40 supercomputer is a transverse air-flow liquid-cooled architecture, the Cray XC40-AC air-cooled model provides slightly smaller and less dense supercomputing cabinets with no requirement for liquid coolants or extra blower cabinets. A reduced network topology lowers costs, and the system is compatible with the compute technology, OS, ISV and software stack support of high-end XC40 systems.

MAXIMIZE PRODUCTIVITY WITH CRAY CS SERIES SUPERCOMPUTERS

Understanding the need for nimble, reliable and cost-effective high performance computing (HPC), we developed the Cray® CS™ cluster supercomputer series. These systems are industry-standards-based, highly customizable, and expressly designed to handle the broadest range of medium- to large-scale simulation and data analytics workloads.

All CS components have been carefully selected, optimized and integrated to create a powerful HPC environment. Flexible node configurations featuring the latest processor and interconnect technologies mean you can tailor a system to your specific need — from an all-purpose cluster to one suited for shared memory, large memory or accelerator-based tasks.

Innovations in packaging, power, cooling and density translate to superior energy efficiency and compelling price/performance. Expertly engineered system management software instantly boosts your productivity by simplifying system administration and maintenance.

Maximize your productivity with flexible, high-performing Cray CS series cluster supercomputers.

CRAY www.cray.com

CRAY® SONEXION® SCALE-OUT LUSTRE®STORAGE SYSTEM

Brought to you by Cray, the world's leading experts in parallel storage solutions for HPC and technical enterprise, the Cray® Sonexion® 2000 system provides a Lustre®-ready solution for popular x86 Linux® clusters and supercomputers through Cray Cluster Connect™. As a leader in open systems and parallel file systems, Cray builds on open source Lustre to unlock any industry-standard x86 Linux compute cluster using InfiniBand™ or 10/40 GbE utilizing proven Cray storage architectures.

The Cray Sonexion 2000 system provides 50 percent more performance and capacity than the Sonexion 1600 system in the same footprint.

Simplify

- Through its fully-integrated and pre-configured design, Cray Sonexion storage gets customers deployed faster and reduces the total number of components to manage.
- The Sonexion system's compact design reduces the total hardware footprint of petascale systems by 50 percent over component-based solutions.

Scale

- Performance scales from 7.5 GB/s to 1.7 TB/s in a single file system.
- Capacity scales in modular increments; the Sonexion 2000 system stores over two usable petabytes in a single rack. Fewer drives and components reduce capital costs as capacity grows.

Protect

- New software-based GridRAID offers higher levels of data protection and up to 3.5 times faster rebuild times than traditional RAID6 and MD-RAID storage.
- Cray ensures quality, reliability and stability at scale through exhaustive thermal and real-world stress testing, system hardening and availability, and tight hardware and software integration.

OPEN ARCHIVE AND TIERED STORAGE SYSTEM FOR BIG DATA AND SUPERCOMPUTING

Cray Tiered Adaptive Storage (TAS), powered by Versity, is designed to meet the expansive data preservation and access needs driven by big data, where data needs to migrate fluidly from high performance storage to deep tape archives, while always being accessible to users.

CRAY www.cray.com

With Cray TAS you can:

- Deploy tiered storage and archives faster
- Feel confident preserving and protecting data into the future, using Linux®
- Simplify managing data using familiar tools for years to come

CRAY® URIKA-XA™ EXTREME ANALYTICS PLATFORM

Pre-integrated, open platform for high performance analytics delivers valuable business insights now and into the future

The flexible, multi-use Cray® Urika-XA™ extreme analytics platform addresses perhaps the most critical obstacle in data analytics today — limitation. Analytics problems are getting more varied and complex but the available solution technologies have significant constraints. Traditional analytics appliances lock you into a single approach and building a custom solution in-house is so difficult and time consuming that the business value derived from analytics fails to materialize.

In contrast, the Urika-XA platform is open, high performing and cost effective, serving a wide range of analytics tools with varying computing demands in a single environment. Pre-integrated with the Apache Hadoop® and Apache Spark™ frameworks, the Urika-XA system combines the benefits of a turnkey analytics appliance with a flexible, open platform that you can modify for future analytics workloads. This single-platform consolidation of workloads reduces your analytics footprint and total cost of ownership.

Based on pioneering work combining high-performance analytics and supercomputing technologies, the Urika-XA platform features next-generation capabilities. Optimized for compute-heavy, memory-centric analytics, it incorporates innovative use of memory-storage hierarchies and fast interconnects, which translates to excellent performance at scale on current as well as emerging analytics applications.

Additionally, the enterprise-ready Urika-XA platform eases the system management burden with a single point of support, standards-based software stack and compliance with enterprise standards so you can focus on extracting valuable business insights, not on managing your environment.

CRAY **www.cray.com**

THE URIKA-GD™ GRAPH DISCOVERY APPLIANCE IS A PURPOSE-BUILT SOLUTION FOR BIG DATA RELATIONSHIP ANALYTICS.

The Urika-GD™ appliance enables enterprises to:

- Discover unknown and hidden relationships and patterns in big data
- Build a relationship warehouse, supporting inferencing/deduction, pattern-based queries and intuitive visualization
- Perform real-time analytics on the largest and most complex graph problems

The Urika-GD system is a high performance graph appliance with a large shared memory and massively multithreaded custom processor designed for graph processing and scalable I/O.

With its industry-standard, open-source software stack enabling reuse of existing skill sets and no lock in, the Urika-GD appliance is easy to adopt.

The Urika-GD appliance complements an existing data warehouse or Hadoop® cluster by offloading graph workloads and interoperating within the existing enterprise analytics workflow.

Realize rapid time to powerful new insights.

DatapointLabs **www.datapointlabs.com**

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

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

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

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

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

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

etainfo@eta.com

Inventium Suite™

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

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

PreSys

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

VPG

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

DYNAFORM

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

Latest Release is ESI Visual-Environment 12.0

ESI Group **www.esi-group.com**

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

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

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

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

Latest Release is ESI Visual-Environment 12.0

ESI Group **www.esi-group.com**

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

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

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

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

HYCRASH

Easy-to-use one step solver, for Stamping-Crash Coupled Analysis. HYCRASH only requires the panels' geometry to calculate manufacturing process effect, geometry of die are not necessary. Additionally, as this is target to usage of crash/strength analysis, even forming analysis data is not needed. If only crash/strength analysis data exists and panel ids is defined. HYCRASH extract panels to calculate it's strain, thickness, and map them to the original data.

JSTAMP/NV

As an integrated press forming simulation system for virtual tool shop the JSTAMP/NV meets the various industrial needs from the areas of automobile, electronics, iron and steel, etc. The JSTAMP/NV gives satisfaction to engineers, reliability to products, and robustness to tool shop via the advanced technology of the JSOL Corporation.

JMAG

JMAG uses the latest techniques to accurately model complex geometries, material properties, and thermal and structural phenomena associated with electromagnetic fields. With its excellent analysis capabilities, JMAG assists your manufacturing process

Livermore Software Technology Corp. **www.lstc.com**

LS-DYNA

A general-purpose finite element program capable of simulating complex real world problems. It is used by the automobile, aerospace, construction, military, manufacturing, and bioengineering industries. LS-DYNA is optimized for shared and distributed memory Unix, Linux, and Windows based, platforms, and it is fully QA'd by LSTC. The code's origins lie in highly nonlinear, transient dynamic finite element analysis using explicit time integration.

LS-PrePost: An advanced pre and post-processor that is delivered free with LS-DYNA. The user interface is designed to be both efficient and intuitive. LS-PrePost runs on Windows, Linux, and Macs utilizing OpenGL graphics to achieve fast rendering and XY plotting.

LS-OPT: LS-OPT is a standalone Design Optimization and Probabilistic Analysis package with an interface to LS-DYNA. The graphical preprocessor LS-OPTui facilitates definition of the design input and the creation of a command file while the postprocessor provides output such as approximation accuracy, optimization convergence, tradeoff curves, anthill plots and the relative importance of design variables.

LS-TaSC: A Topology and Shape Computation tool. Developed for engineering analysts who need to optimize structures, LS-TaSC works with both the implicit and explicit solvers of LS-DYNA. LS-TaSC handles topology optimization of large non-linear problems, involving dynamic loads and contact conditions.

LSTC Dummy Models:

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

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

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

Oasys T/HIS

Key benefits:

- Graphical post-processor created specifically for LS-DYNA®
- Automatically reads all LS-DYNA® results
- Wide range of functions and injury criteria
- Easy handling of data from multiple models
- Scripting capabilities for fast post-processing

Oasys REPORTER

Key benefits:

- Automatic report generation tool created specifically for LS-DYNA®
- Automatically post-process and summarize multiple analyses
- Built-in report templates for easy automatic post-processing of many standard impact tests

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 focus 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..

Lenovo www.lenovo.com

Lenovo is a USD39 billion personal and enterprise technology company, serving customers in more than 160 countries.

Dedicated to building exceptionally engineered PCs, mobile Internet devices and servers spanning entry through supercomputers, Lenovo has built its business on product innovation, a highly efficient global supply chain and strong strategic execution. The company develops, manufactures and markets reliable, high-quality, secure and easy-to-use technology products and services.

Lenovo acquired IBM's x86 server business in 2014. With this acquisition, Lenovo added award-winning System x enterprise server portfolio along with HPC and CAE expertise.

Canada	**Metal Forming Analysis Corp MFAC** galb@mfac.com www.mfac.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	
	eta/DYNAFORM	INVENTIUM/PreSys		
Mexico	**COMPLX** Armando Toledo **www.complx.com.mx /** armando.toledo@complx.com.mx			
	LS-DYNA LS-OPT		LS-PrePost LS-TAsc Barrier/Dummy Models	
United States	**CAE Associates Inc.** info@caeai.com www.caeai.com			
	ANSYS Products	CivilFem	Consulting ANSYS Consulting LS-DYNA	
United States	**DYNAMAX** sales@dynamax-inc.com www.dynamax-inc.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models		LSTC Barrier Models	

United States	**ESI Group N.A** **info@esi-group.com** www.esi-group.com			
	PAM-STAMP			
	QuikCAST	SYSWELD	PAM-COMPOSITES	CEM One
	VA One	CFD-ACE+	ProCAST	
		Weld Planner	Visual-Environment	IC.IDO
United States	**Engineering Technology Associates – ETA** etainfo@eta.com www.eta.com			
	INVENTIUM/PreSy	NISA	VPG	LS-DYNA
	LS-OPT	DYNAform		
United States	**Livermore Software Technology Corp** sales@lstc.com **LSTC** www.lstc.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	
United States	**Predictive Engineering** george.laird@predictiveengineering.com www.predictiveengineering.com			
	FEMAP	NX Nastran	LS-DYNA	LS-OPT
	LS-PrePost	LS-TaSC	LSTC Dummy Models	
			LSTC Barrier Models	

France	**DynaS+**		v.lapoujade@dynasplus.com	
	www.dynasplus.com		Oasys Suite	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	DYNAFORM	VPG	MEDINA	
	LSTC Dummy Models		LSTC Barrier Models	

France	**DYNAmore France SAS**		sales@dynamore.eu	
	www.dynamore.eu			
	LS-DYNA, LS-PrePost	LS-OPT	Primer	DYNAFORM
	DSDM Products		LSTC Dummy Models	FEMZIP
	LSTC Barrier Models		DIGIMAT	

Germany	**CADFEM GmbH**		lsdyna@cadfem.de	
	www.cadfem.de			
	ANSYS	LS-DYNA	optiSLang	
	ESAComp	AnyBody		
	ANSYS/LS-DYNA			

Germany	**DYNAmore GmbH**		uli.franz@dynamore.de	
	www.dynamore.de			
	PRIMER	LS-DYNA	FTSS	VisualDoc
	LS-OPT	LS-PrePost	LS-TaSC	DYNAFORM
	Primer	FEMZIP	GENESIS	Oasys Suite
	TOYOTA THUMS		LSTC Dummy & Barrier Models	

The Netherlands	**Infinite Simulation Systems B.V**		j.mathijssen@infinite.nl	
	www.infinite.nl			
	ANSYS Products	CivilFem	CFX	Fluent
	LS-DYNA	LS-PrePost	LS-OPT	LS-TaSC

Italy	**EnginSoft SpA**		info@enginsoft.it	
	www.enginsoft.it			
	ANSYS	MAGMA	Flowmaster	FORGE
	CADfix	LS-DYNA	Dynaform	Sculptor
	ESAComp	AnyBody	FTI Software	
	AdvantEdge	Straus7	LMS Virtual.Lab	ModeFRONTIER

Russia	**STRELA**		info@dynarussia.com	
	LS-DYNA	LS-TaSC	LS-OPT	LS-PrePost
	LSTC Dummy Models		LSTC Barrier Models	
Sweden	**DYNAmore Nordic**		marcus.redhe@dynamore.se	
	www.dynamore.se		Oasys Suite	
	ANSA	µETA	LS-DYNA	LS-OPT
	LS-PrePost	LS-TaSC	FastFORM	DYNAform
	FormingSuite		LSTC Dummy Models	
			LSTC Barrier Models	
Switzerland	**DYNAmoreSwiss GmbH**		info@dynamore.ch	
	www.dynamore.ch			
	LS-DYNA		LS-OPT	LS-PrePost
	LS-TaSC		LSTC Dummy Models	
			LSTC Barrier Models	
UK	**Ove Arup & Partners**		dyna.sales@arup.com	
	www.oasys-software.com/dyna		TOYOTA THUMS	
	LS-DYNA		LS-OPT	LS-PrePost
	LS-TaSC	PRIMER	D3PLOT	T/HIS
	REPORTER	SHELL	FEMZIP	HYCRASH
	DIGIMAT	Simpleware	LSTC Dummy Models	
			LSTC Barrier Models	

China	**ETA – China**		lma@eta.com.cn	
	www.eta.com/cn			
	Inventium	VPG	DYNAFORM	NISA
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
			LSTC Barrier Models	LS-TaSC
China	**Oasys Ltd. China**		Stephen.zhao@arup.com	
	www.oasys-software.com/dyna			
	PRIMER D3PLOT	HYCRASH	T/HIS REPORTER	SHELL
	LS-DYNA	LS-OPT	LSTC Dummy Models	LS-PrePost
	DIGIMAT	FEMZIP	LSTC Barrier Models	LS-TaSC
China	**Shanghai Hengstar Technology**		info@hengstar.com	
	www.hengstar.com			
	LS-DYNA	LS-TaSC	LSTC Barrier Models	D3VIEW
	LS-PrePOST	LS-OPT	LSTC Dummy Models	
	Genesis	VisualDoc		ELSDYNA
	Visual-Crahs DYNA	Visual-Proeces		DynaX & MadyX
	Enki Bonnet	Visual Environement		

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

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

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

Japan	**CTC**	LS-dyna@ctc-g.co.jp		
	www.engineering-eye.com			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CmWAVE	
Japan	**JSOL**			
	www.jsol.co.jp/english/cae		Oasys Suite	
	JSTAMP	HYCRASH	JMAG	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	TOYOTA THUMS	
Japan	**FUJITSU**			
	http://www.fujitsu.com/jp/solutions/business-technology/tc/sol/			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	CLOUD Services	
Japan	**LANCEMORE**	info@lancemore.jp		
	www.lancemore.jp/index_en.html			
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models		
Japan	**Terrabyte**	**English:**		
	www.terrabyte.co.jp	www.terrabyte.co.jp/english/index.htm		
	Consulting			
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	AnyBody	

Korea	**THEME**	wschung7@gmail.com		
	www.lsdyna.co.kr		Oasys Suite	
	LS-DYNA	LS-OPT	LS-PrePost	LS-TaSC
	LSTC Dummy Models	LSTC Barrier Models	eta/VPG	Planets
	eta/DYNAFORM	FormingSuite	Simblow	TrueGRID
	JSTAMP/NV	Scan IP	Scan FE	Scan CAD
	FEMZIP			

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

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

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 use of LS-DYNA more and more in recent years.

In calculations of optimization, robustness, statistical analysis, larger amount of LS-DYNA license in short term are required.

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 epensive 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

Rescale Cloud Simulation Platform

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.

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

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

ESI Cloud Based Virtual Engineering Solutions

www.esi-group.com/software-solutions/cloud-solutions/esi-cloud

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

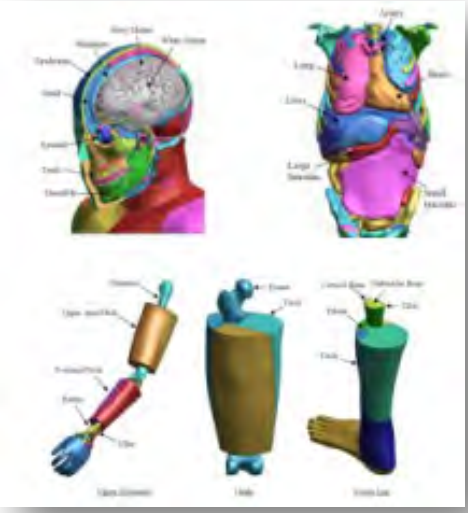
Collaboration

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

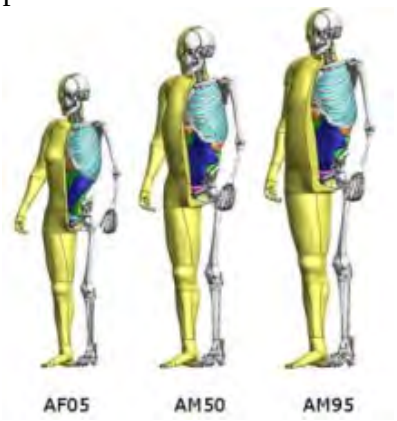
TOYOTA - Total Human Model for Safety – THUMS



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.

LSTC – Dummy Models

LSTC Crash Test Dummies (ATD)

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

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

e-mail to: atds@lstc.com

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

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

Models In Development

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

Planned Models

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

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Introduction to second order Lagrangian elements in LS-DYNA

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Abstract

This paper presents recent advances of second-order Lagrangian element developed for explicit/implicit analysis in LS-DYNA, i.e., 27-node hexahedral element, 21-node pentahedral element, and 15-node tetrahedral element. Several benchmark problems are studied to demonstrate the performance of the higher order element. The results obtained in modeling practical applications involving large deformations, nearly incompressible materials, severe distortions, bending, and contact-impact are also encouraging. Compared to standard linear element, the high order elements are computationally expensive, but they are found to be competitive with other element types due to its much higher accuracy and higher convergence rate. Furthermore, high order element naturally contains the linear strain field and is capable of modeling bending and curved shape accurately without using either hourglass control or introducing incompatible modes. From a user viewpoint, what is gained is versatility in modeling a wide variety of geometries including three-dimensional or plate/shell geometries, and simplicity since only displacement degrees of freedom are used.

Introduction

In many applications, one needs to analyze a body comprising of one or multiple shells connected to a solid body. As the shell elements cannot transfer rotational reaction forces to the solid elements, special techniques are required to match the rotational degrees of freedom of the shell elements with the translational degrees of freedom of the solid elements. Ideally, in such a case, it is convenient to model the entire structure using elements that involve only displacement degrees of freedom as in a standard displacement-based brick element. However, modeling shell parts with standard solid elements would require a huge number of elements (3~5 elements through thickness) to prevent locking and leads to prohibitive computational costs. Furthermore, modeling thin structures with standard solid elements often leads to elements with high aspect ratios, which degrades the accuracy of the solution.

Based on the above considerations, what one would like to have is an element which work well not only when used to model three-dimensional geometries, but also relatively immune from locking when used to model plate/shell geometries. This is the motivation for the development of the second order Lagrangian elements in this work. Second-order elements can naturally represent curved shapes and model bending accurately for thick to moderately thin plate/shells without using an artificial hourglass control or by adding any incompatible modes [4]. While performing well as flexural elements, they still maintain their versatility as solid elements. Compared to linear elements, second order element are expensive, buy they provide an important modeling alternative in LS-DYNA and they do have distinct advantages for certain applications.

Definition of second order Lagrangian element

The element formulations for second order Lagrangian element in LS-DYNA are Elform 24 (27-node hexahedral element), Elform 25 (21-node pentahedral element), and Elform 26(15-node tetrahedral element). Besides corner node and edge-center node, each element has face-center nodes and one body-center node. The node numbering are shown in Figure 1.

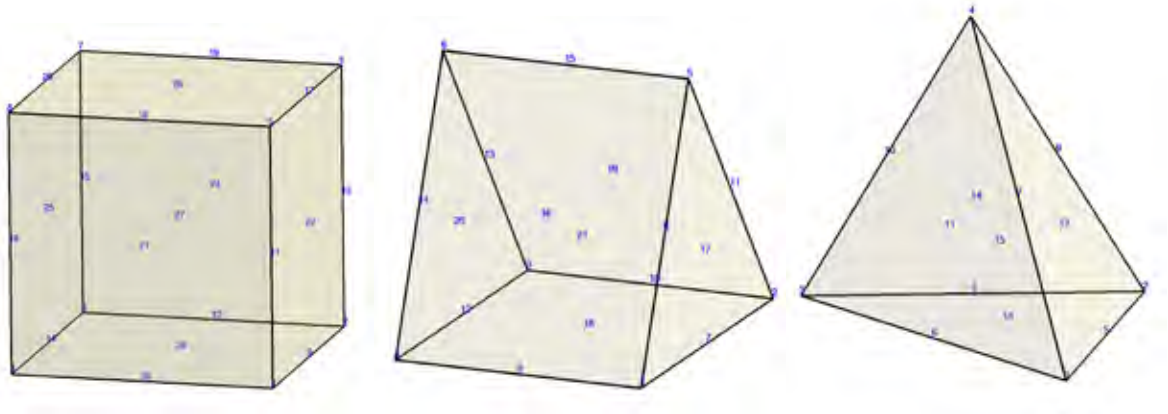


Figure 1 Node numbering

In LS-DYNA, there are two ways to define element connectivity. The first one is one directly define element connectivity by *ELEMENT_SOLID_H*, the nodal numbering follow the rule defined in Figure 1 as shown in the following example:

```
*ELEMENT_SOLID_H27
      1       1       0
      1       2       3       4       5       6       7       7       9      10
     11      12      13      14      15      16      17      18      19      20
     21      22      23      24      25      26      27
*ELEMENT_SOLID_H21
      1       1       0
      1       2       3       4       5       6       7       7       9      10
     11      12      13      14      15      16      17      18      19      20
     21
*ELEMENT_SOLID_H15
      1       1       0
      1       2       3       4       5       6       7       7       9      10
     11      12      13      14      15
```

LS-DYNA also provide another option *ELEMENT_SOLID_H8TOH27 to automatically transfer an existing linear model to second order element model. However, one need to be careful about the boundary conditions for the newly added nodes if automatically transfer option is utilized. If BC's of existing node are defined with *NODE, for example, as shown in the following:

```
*NODE
$#   nid               x               y               z      tc      rc
       2           3.000          -2.000    -1.0000000       7       3
```

Then appropriate boundary condition are applied to the newly added node based on the BC's of its neighbor node.

If BC's are defined to a node set, *BOUNDARY_PRESCRIBED_MOTION_ SET for example, and all the neighbor node of a newly added node belong to this node set, then the BC's are also applied to the newly added node.

If BC's are defined directly to existing node, *BOUNDARY_PRESCRIBED_MOTION_NODE, for example, then LS_DYNA does not know what kind of BC's should be applied to the newly added node, as such, free BC's are applied to the newly added node.

Numerical Tests

The first numerical example is 6 element straight cantilever beam. This test was first proposed in [1] and is useful to test the accuracy of the element formulation in bending dominant regime as well as for distorted element configuration.

The cantilever of length l = 6.00, height h = 0.20 and depth d = 0.10 is discretized with six elements. Three mesh types with regular, trapezoidal and parallelepiped shapes are used (see Figure 2). The cantilever has a tip unit load (0.25 for each tip node) and the numerical results for extension, in plane and out of plane shear loading at the tip are evaluated and normalized with the analytical values taken from the Bernoulli beam theory. An isotropic elastic material with Poisson's ratio ν=0.3 and Young's modulus E=1.0E+7 is used. Theoretical values for the deflection are u_{ext} = 3.0E-5 in extension, u_{ip} = 0.1081 for in plane shear load and u_{op} = 0.4321 for out of plane shear load. Results of 27-node hexahedral element are given in Table 1 and 15-node tetrahedral element results are list in Table 2. Both formulations give very good accuracy. Furthermore, it can be seen that second order formulation are not very sensitive to element distortion.

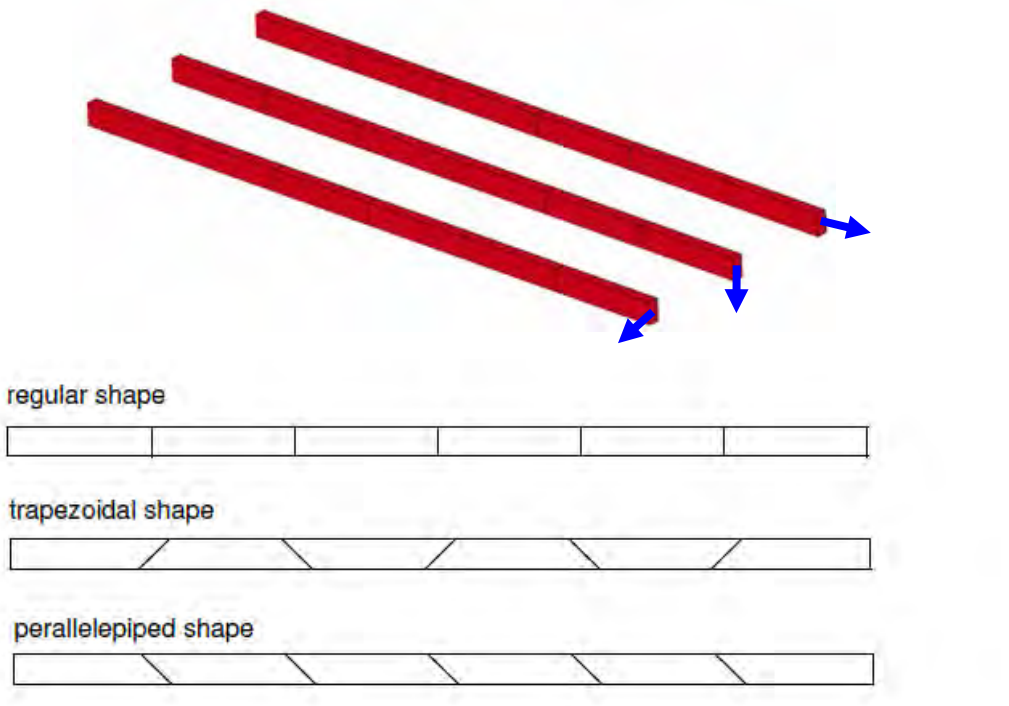


Figure 2 Straight cantilever beam test. Loading: unit forces at free end

Type	Ext	In-Plane	Out of Plane
Regular	1.0	0.9899	0.9766
Trapezoidal	1.0	0.9852	0.9674
parallelogram	1.0	0.9852	0.9674

Table 1 Straight cantilever beam test for hexahedral element, normalized displacement

Type	Ext	In-Plane	Out of Plane
Regular	0.9875	0.9771	0.9753
Trapezoidal	0.9875	0.9668	0.9618
parallelogram	0.9875	0.9656	0.9601

Table 2 Straight cantilever beam test for tetrahedral element, normalized displacement

The twisted beam tests proposed in [1] tests the effect of warp on plate elements. The tip loaded 90◦ twisted cantilever beam, shown in Figure 3, is a three-dimension bending example. The twist between the two faces of each element along the length is 7.5◦. A vertical unit tip load is applied instantaneously and held constant in magnitude and orientation. Twelve elements are used along the 12.0-in length, two elements spans the 1.1-in width and one element spans the 0.32-in thickness. An isotropic elastic material with Poisson's ratio ν=0.22 and Young's modulus E=2.9E+7 is used. One end is clamped, with unit forces at tip: in-plane shear, and out-of-plane shear loading. Theoretical values for the deflection are u_{ip} = 5.424E-3 for in plane shear load and u_{op} = 1.754E-3 for out of plane shear load. This problem is modeled with Belytshcko-Tsay 1-point shell formulation 2, fully integrated shell element16, 8-node quadratic quadrilateral shell 23, and 6-node quadratic triangular shell 24 as well as solid formulation 2, 24, 25, and 26. Results are given in Table 3.

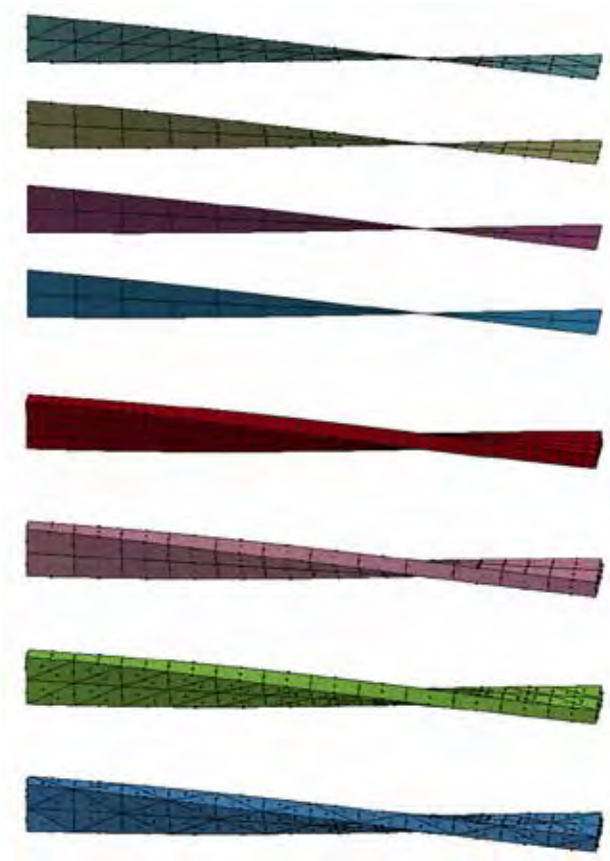


Figure 3 Twisted beam test

E-type	Description	In-plane	Out-of-plane
Shell Elform 2	Belytshcko-Tsay	5.80708E-3(7.06%)	1.81453E-3(3.45%)
Shell Elform 16	Fully integrated	5.74599E-3(5.94%)	1.85316E-3(5.65%)
Shell Elform 23	8-node quadratic	5.41806E-3(0.11%)	1.71941E-3(1.97%)
Shell Elform 24	6-node quadratic Triangle	6.43572E-3(18.65%)	2.09962E-3(19.71%)
Solid Elform 2	8-node B-bar hex	7.52991E-3(38.83%)	2.48888E-3(41.89%)
Solid Elform 24	27-node hexahedron	5.42513E-3(0.02%)	1.72386E-3(1.72%)
Solid Elform 25	21-node pentahedron	5.34353E-3(1.48%)	1.69729E-3(3.23%)
Solid Elform 26	14-node tetrahedron	5.39546E-3(0.53%)	1.71724E-3(2.10%)

Table 3 Twisted beam test, error in parenthesis

Taylor bar impact problem uses a quarter symmetric mesh of a cylindrical impact a rigid wall at 227m/s. The bar is 3.23E-2m long with a 3.2E-3m radius. The isotropic and kinematic hardening plasticity model use a modulus of elasticity of 1.17E11Pa, Poisson's ratio of 0.33, tangent plastic modulus of 1.0E8Pa, yield stress of 4.0E8 Pa and mass density of 8930kg/m^3.

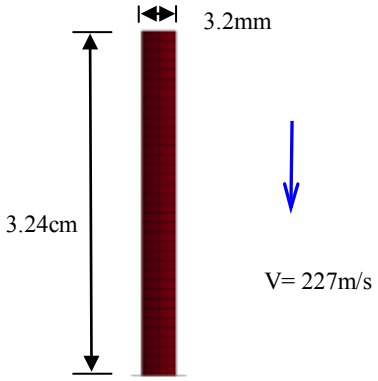


Figure 4 Taylor model description

The bar impact problem is modeled using 972 selective reduced 8-node element (Elform2), 972 27-node elements (Elform24), and 7776 selective reduced 8-node element (Elform2). Figure 5 compares the prediction of three simulations. The final predicted length of the bar for 27-node element agree with the selective reduced 8-node elements and compare reasonably with experimental predictions of Wilkins and Guinan [2].

Figure 5 Deformed model for bar impact problem using a) 972 Elform2 element b) 972 Elform24 Element c) 7776 Elform2 element

In term of CPU time, 27-node element is much more expensive than 8-node element. Generally speaking, the CPU time of 27-node element is about 30 times of selective reduced 8-node element with same number of elements. However, we believe that instead of comparing the computational cost for a given number of degrees of freedom, the comparison ought to be between computational costs incurred to achieve a given level of accuracy. From this viewpoint, since relatively far lesser number of 27-node elements are required, they might not be so bad in term of CPU time. For the bar impact problem, the 27-node elform 24 with 972 elements uses about 35% more CPU time than 8-node elform 2 with 7776 element.

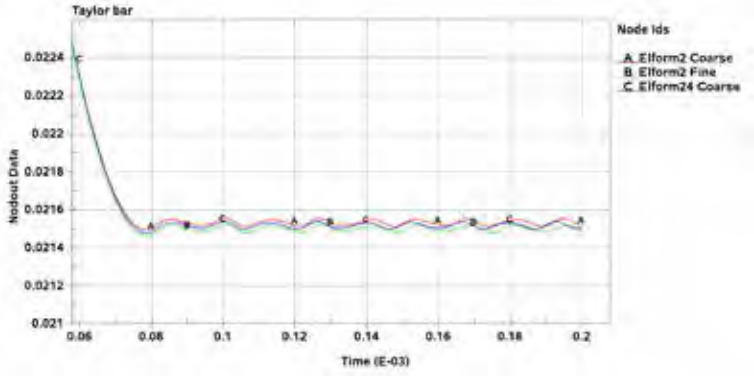


Figure 6 Displacement comparison between a) 972 Elform2 element b) 972 Elform24 Element c) 7776 Elform2 element

The following model is an implicit model and taken from [3], where a clamped plate of dimensions 10x5x1 mm is subjected to 1Nm torque at the free end. The Young's modulus is E=210 Gpa. Analytical solution for end tip deflection is 0.57143mm. The problem is modeled by 5 different discretization with fixed aspect ratio 5:1.

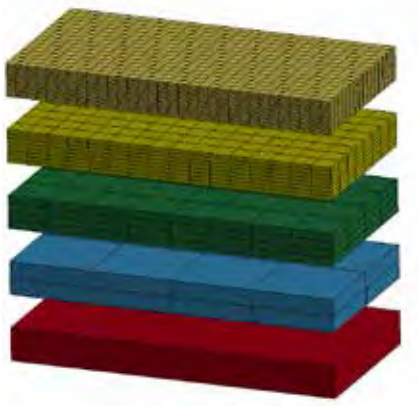


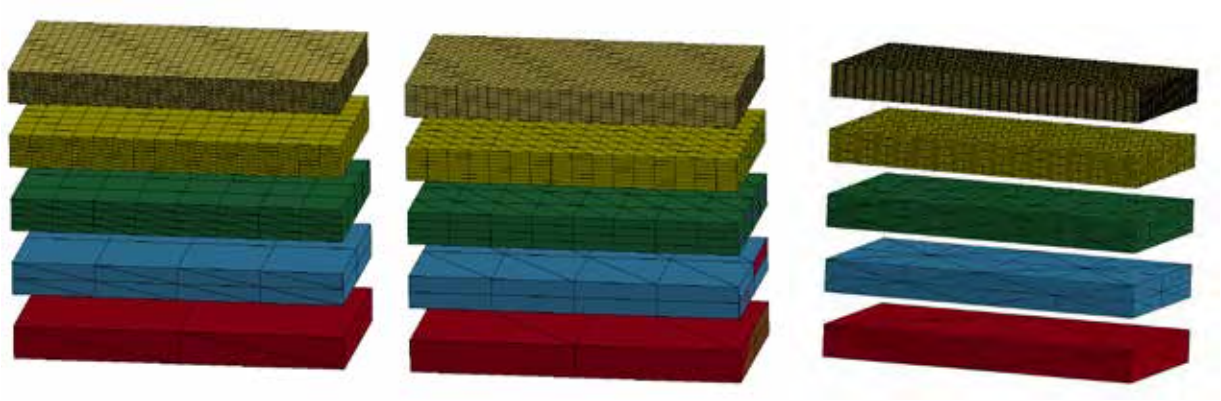
Figure 7 Clamped plate subjected torque

Results of 27-node hexahedral element are given in Table 4. Also compare the results using other element formulation from [3]. Elform2 shows strong locking and the error is still not acceptable even using 8 layers of mesh. The performance of Elform-1 and Elform-2 are much better, but still have large error with coarse mesh. While second order hexahedral element show good accuracy even with very coarse discretization.

Discretization	Elform2	Elform-2	Elform-1	Elform24
2x1x1	0.0564(90.1%)	0.6711(17.4%)	0.6751(18.1%)	0.5525(3.3%)
4x2x2	0.1699(70.3%)	0.5466(4.3%)	0.5522(3.4%)	0.5534((3.1%)
8x4x4	0.3469(39.3%)	0.5472(4.2%)	0.5500(3.8%)	0.5541(3.0%)
16x8x8	0.4820(15.7%)	0.5516(3.5%)	0.5527(3.3%)	0.5543(3.0%)
32x16x16	0.5340(6.6%)	0.5535(3.1%)	0.5540(3.1%)	0.5545(3.0%)

Table 4 End tip deflection for different mesh discretization and element types, error in parenthesis.

This problem is also modeled with 21-node pentahedral element15-node tetrahedral element, with pentahedral models have two different discretization. The results are compared to 27-node hexahedral element and list in Table 5.



a) Pentahedral model 1 b) Pentahedral model 2 a) tetrahedral model 1

Figure 8 Clamped plate subjected torque, pentahedral and tetrahedral model

Discretization	Elform25 model1	Elform25 model 2	Elform26	Elform24
2x1x1	0.5433(4.9%)	0.5454(4.5%)	0.5266(7.8%)	0.5525(3.3%)
4x2x2	0.5484(4.0%)	0.5499(3.8%)	0.5441(4.8%)	0.5534((3.1%)
8x4x4	0.5518(3.4%)	0.5528(3.3%)	0.5512(3.5%)	0.5541(3.0%)
16x8x8	0.5533(3.2%)	0.5539(3.1%)	0.5536(3.2%)	0.5543(3.0%)
32x16x16	0.5340(3.0%)	0.5542(3.0%)	0.5540(3.0%)	0.5545(3.0%)

Table 5 End tip deflection for different mesh discretization and element types, error in parenthesis.

Finally, the axial crushing and crashing of thin-walled high-strength steel tubes is performed using second order element. The Crush Box is a thin-walled structure attached between the vehicle bumper structure and the side rail. The need of the Crush box is quite most important for absorbing the energy of impact. This kind of problem is usually modelled with shell element. For this problem, we firstly do convergence study with 27-node hexahedral element. Only one layer of element is required over thickness (Figure 9). For convergence study, the model is discretized with 4mm, 2mm, and 1mm element (Figure 10). The piecewise linear isotropic plasticity model use a modulus of elasticity of 207Gpa, Poisson's ratio of 0.3, tangent modulus 2.0Gpa, yield stress of 200M Pa and mass density of 7830kg/m^3.

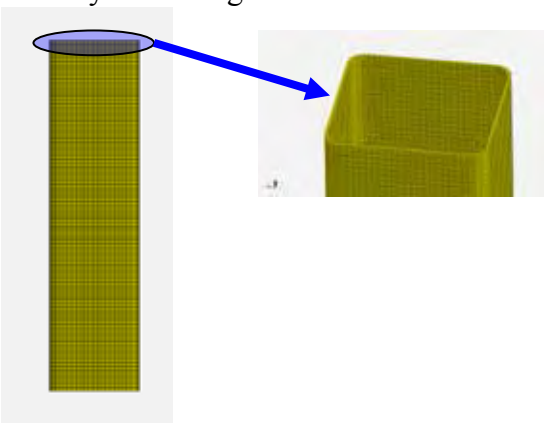


Figure 9 Model set up for crush box, one layer of mesh over thickness

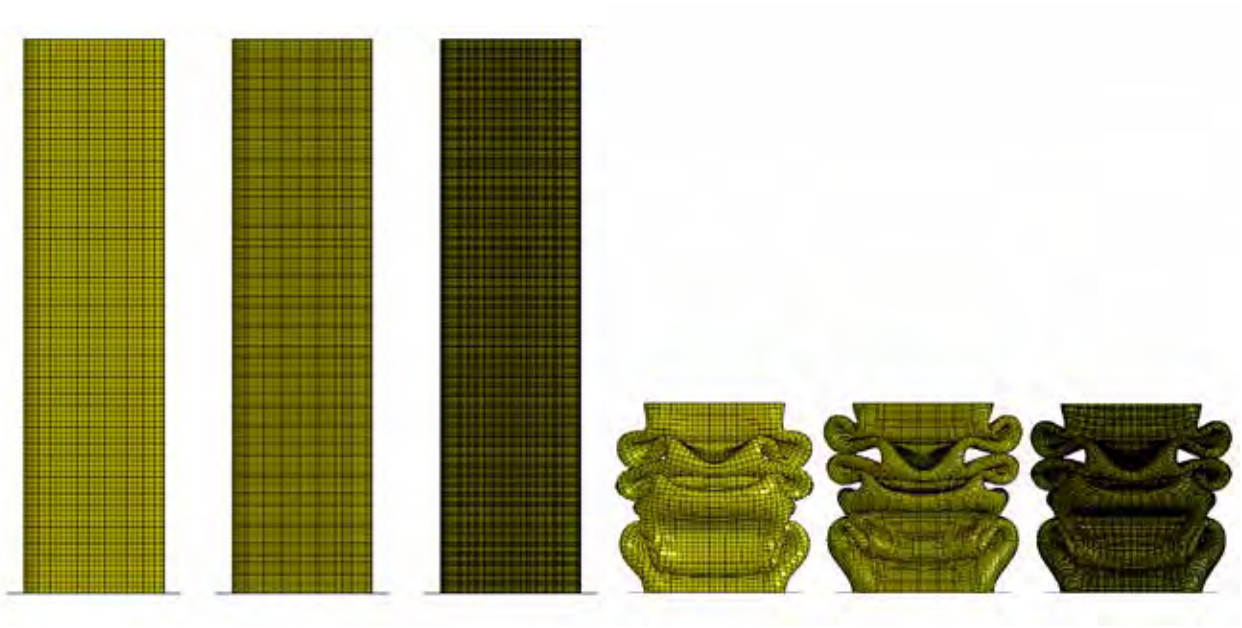


Figure 10 Initial and deformed model with 4mm, 2mm, and 1mm mesh

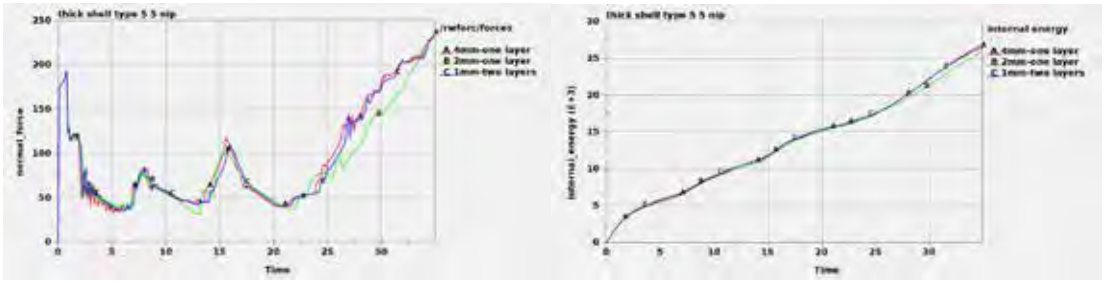


Figure 11 Contact force and internal energy curve

The predicted deformed geometries are quite similar for the three discretization. The contact force history and internal energy history curve are shown in Figure 11. It can be seen that, even with 4mm coarse mesh, the 27-node element already get converged results and agree with fine mesh very well.

Next, second order tetrahedral and pentahedral element are utilized to simulate the same problem. The initial model and deformed model are shown in Figure 12. Compared to second order 27-node element, the behavior of second order tetrahedral and pentahedral elements are slightly stiffer, which can also been observed from the contact force history and internal energy history curve in Figure 13.

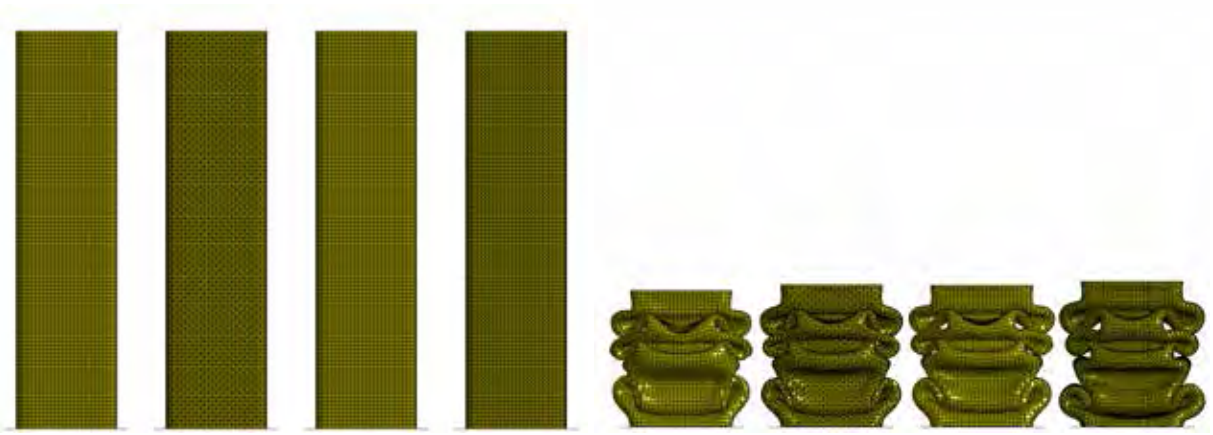


Figure 12 Initial and deformed model for hex, tet and penta element

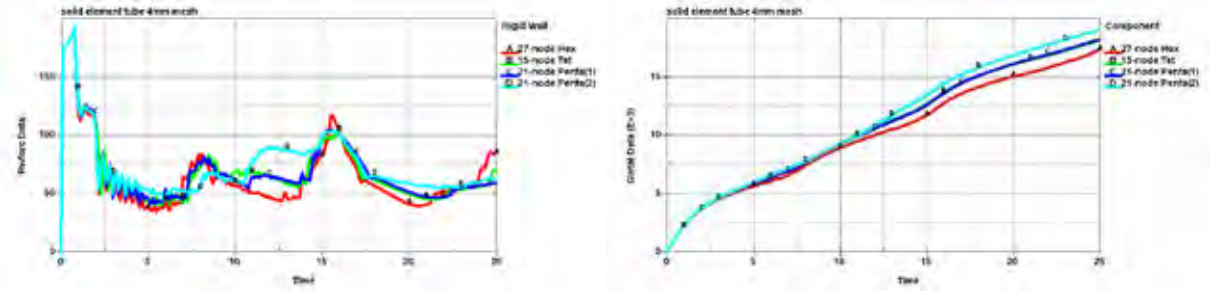


Figure 13 Contact force and internal energy curve

Summary

The paper present recently implemented second order element in LS-DYNA for both explicit and implicit analysis. Several numerical tests demonstrate that the proposed element work well for shell/plate as well as fully three-dimensional problems, for the material is compressible or nearly incompressible, for the mesh is regular or distorted. Even no special strategies have been used to eliminate shear locking, the proposed elements yield acceptably accurate results without the use of artificial hourglass control or incompatible modes, and the convergence with mesh refinement is very rapid. The computational cost as compared to stand 8-node elements is higher, but what is gained is versatility in modeling a wide variety of geometries including shell/plate and three-dimensional ones, and simplicity from a user viewpoint since only displacement degrees of freedom are used.

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