

**Employment Opportunity**



**Pratt & Whitney**



**Dassault Rafale**

**Showcase**



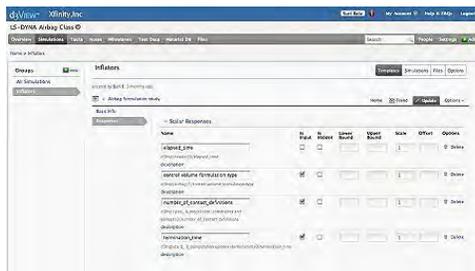
**ETA**

**LS-OPT®**

Job ID	View	Job	Progress	Case
43	PID 4143	Normal Termination	Run 1: Case PHS, Run 1	
44	PID 4152	Normal Termination	Run 1: Case PHS, Run 2	
45	PID 4160	Normal Termination	Run 1: Case PHS, Run 3	
46	PID 4168	Normal Termination	Run 1: Case PHS, Run 4	
47	PID 4185	Normal Termination	Run 1: Case PHS, Run 5	
48	PID 4196	Normal Termination	Run 1: Case PHS, Run 6	
49	PID 4205	Normal Termination	Run 1: Case PHS, Run 7	

**Release Version 4.2**

**d3VIEW**



**Template Capability**

**Yanhua Zhao**



**Business Manager  
LSTC Products - China**

**Making A Difference**



**Varmint AI**

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# Announcements

**LSTC –Yanhua Zhao**, has been appointed Manager, of LSTC’s China Business Unit.

**BETA CAE Systems SA - June 1-3 2011 -**  
4th ANSA & µETA Int’l Conference - Makedonia Palace

**8<sup>th</sup> European LS-DYNA® Users Conference Exhibitors: Please visit our FEA Information Inc. participants**

<b>Alyotech</b>	<b>ARUP</b>	<b>AS+ Booth #7</b>	<b>BETA CAE Systems SA</b>
<b>CRAY</b>	<b>ETA</b>	<b>FUJITSU</b>	<b>JSOL</b>
<b>MICROSOFT</b>	<b>PANASAS Inc.</b>	<b>SGI</b>	

**AS+ Invitation to visit their booth #7:**  
"Join our AS+ team to exchange information on your favorite software. Additionally, share our vision for LS-DYNA distribution in France and related consulting activities. We are looking forward to seeing you during the conference." *Your AS+ LS-DYNA team*

**Marsha Victory** - I will be attending the 2011 European Conference on May 23<sup>rd</sup> and would be interested in your personal opinions on Cloud Computing Services – and, of course, how to improve the FEA Information Engineering Journal.

**Sincerely, Marsha J. Victory,** President, FEA Information Inc

**From engineering to horses - <http://www.livermorehorses.com>**



Sabyl riding her horse Minow. Minow stays at our ranch.  
Minow is blind - Sabyl has taught Minow to trust leg and rein instruction.



## FEA Information

### Platinum Participants

<b>OASYS Ltd:</b> <a href="http://www.oasys-software.com/dyna/en/">http://www.oasys-software.com/dyna/en/</a>	<b>JSOL Corporation:</b> <a href="http://www.jsol.co.jp/english/cae">http://www.jsol.co.jp/english/cae</a>	<b>SGI :</b> <a href="http://www.sgi.com">http://www.sgi.com</a>
<b>ETA:</b> <a href="http://www.eta.com">http://www.eta.com</a>	<b>DYNAMore GmbH</b> <a href="http://www.dynamore.de">http://www.dynamore.de</a>	<b>ESI Group:</b> <a href="http://www.esi-group.com">http://www.esi-group.com</a>
<b>BETA CAE Systems S.A.:</b> <a href="http://www.beta-cae.gr">http://www.beta-cae.gr</a>	<b>LSTC:</b> <a href="http://www.lstc.com">http://www.lstc.com</a>	<b>Dalian Fukun Technology Co. Ltd.:</b>
<b>MICROSOFT</b> <a href="http://www.microsoft.com">http://www.microsoft.com</a>	<b>Panasas, Inc.</b> <a href="http://www.panasas.com">http://www.panasas.com</a>	<b>Shanghai Hengstar Technology Co. Ltd</b> <a href="http://www.hengstar.com/">http://www.hengstar.com/</a>



Conference Paper Showcase  
Paper available for download at:  
**DYNALOOK**  
<http://www.dynalook.com/>

## FE Modeling of Innovative Helmet Liners

<http://www.dynalook.com/international-conf-2010/Simulation-3-1.pdf>

D. Hailoua Blanco, A. Cernicchi - Dainese S.p.a  
via dell'Artigianato 35, Molvena, Italy

U. Galvanetto - University of Padua  
Department of Structural and Transportation Engineering  
via Marzolo 9. Padua, Italy

### Abstract

A key component of a safety helmet is the energy absorbing liner, which absorbs the greatest portion of impact energy during an accident. The aim of the present work was to study innovative structures for energy absorption that minimize the likelihood of head injuries for standard impact cases.

The innovative helmet liner consists of an ABS plastic lamina with deformable cones on it. Energy is absorbed via a combination of folding and collapsing of the cones. The main advantage that such liner may introduce over common EPS pads is that it allows a better optimization of energy absorption for different impact sites and configurations.

Numerical crash simulations of the novel liner employed in a ski helmet were carried out with LS-DYNA®. The model reproduced the testing conditions defined

by the standards EN1077. Experimental and numerical results were compared and possible causes of discrepancies were discussed. The finite element model so validated paves the way for a future numerical parametric optimization of the novel structure.



Ski helmet prototype on the head form

Keywords: Helmet, Crashworthiness, Energy Absorbing Structures, Drop testing



Conference Paper Showcase  
Paper available for download at:  
**DYNALOOK**  
<http://www.dynalook.com/>

## Simulation of Granular Ceramic Armor Under Impact from Bullets

<http://www.dynalook.com/international-conf-2010/BlastImpact-1-5.pdf>

James G. McLean,  
Seth Frutiger,  
Robert Dabek,  
Jeremy Reeves  
State University of New York at Geneseo,  
Department of Physics and Astronomy,  
Geneseo, NY 14454

### Abstract

Ballistic impact is studied for a novel form of armor, granular ceramic armor. Ceramic granules, in the millimeter size range, are closely packed and bonded together using a relatively soft polymer. This composite layer rests on a rigid backing. In field tests such panels have already shown the capability to stop armor piercing rifle rounds. The goal of the study is to determine the detailed mechanisms of energy and momentum dissipation. Because of the granular structure, the armor performance depends on the exact impact position. We are particularly interested in determining the weakest points for further design improvements. Mapping of exit velocities indicates that some of the stronger and weaker points are at surprising impact positions due to grain tumbling.

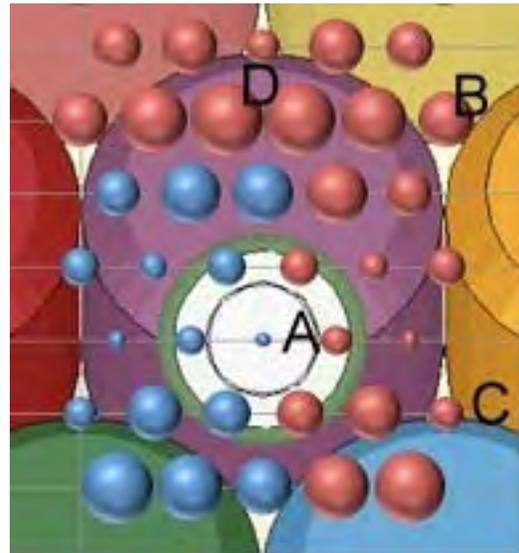


Fig. 1 Exit kinetic energies for non-eroded parts of the bullet obtained from simulations for various exit parameters. The green circle in the center is the bullet. Blue bubbles show direct simulation results; red bubbles are duplicates of those results based on the symmetry of the armor panel.



## Release of LS-OPT® Version 4.2

Nielen Stander  
Senior Scientist, LSTC

Livermore Software Technology Corporation is pleased to announce the release of LS-OPT® Version 4.2.

A major focus of the V4.2 development has been to refine and enhance the LS-DYNA® job distribution features for running LS-OPT on a PC or Linux machine controlling and monitoring LS-DYNA jobs distributed on a Linux cluster.

In a further major development, the material parameter identification feature in LS-OPT has been enhanced using a new Curve Mapping feature to enable complex curve matching typically used for the calibration of highly nonlinear hysteretic models.

Several other important features are summarized in the following overview.

### Curve Mapping for Parameter Identification

System parameter identification is a prominent feature of LS-OPT®, typically used for the purpose of calibrating material models. The procedure consists of minimizing the mismatch between two curves, of which one represents an experimental result. In addition to the optimization algorithm, a curve matching metric, which quantifies the mismatch, is a critical part of the methodology.

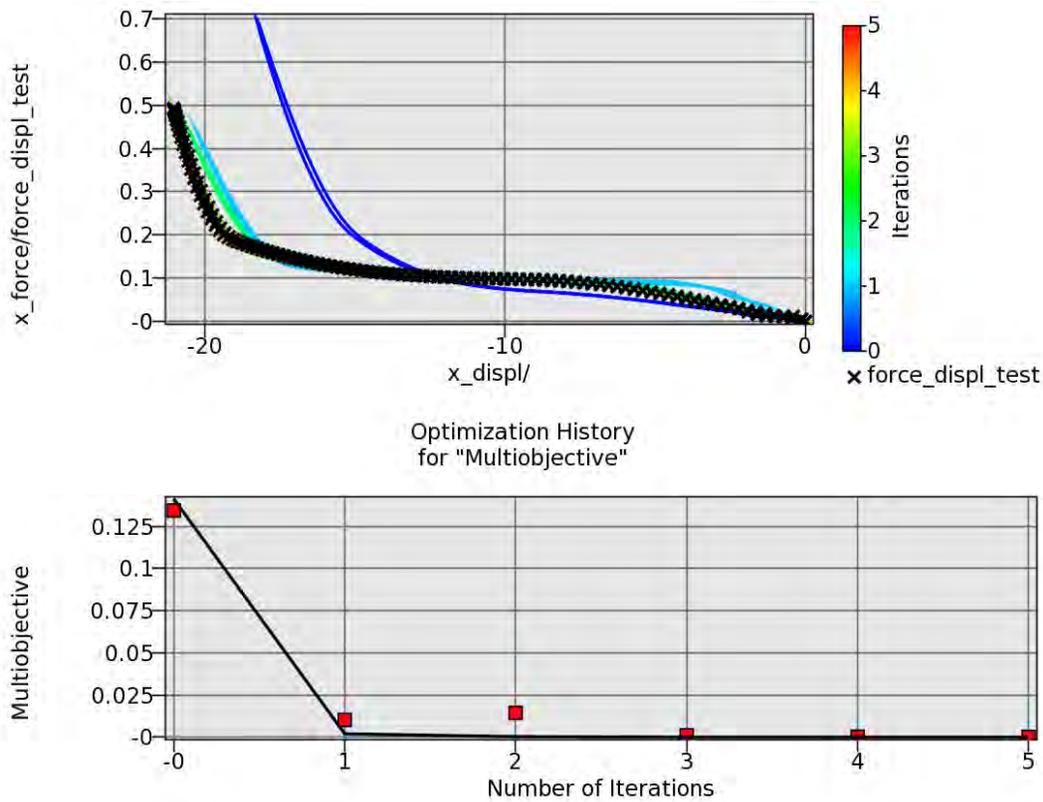
In Version 4.2, a new and simple curve matching approach has been introduced. The purpose of the approach has been to address the following problems typically associated with curve matching:

- The output is represented by a hysteretic curve which may have multiple ordinate values (e.g. force) for a particular abscissa (e.g. deformation). Hysteretic curves are common in materials testing.
- Less severe than the above, but still potentially problematic, is the possibility of encountering non-hysteretic curves but with very steep sections such as typically occur in damage models.
- Comparative curves are typically of different lengths precluding the use of full curve lengths for the mapping.

To address material or system calibration problems in general, a *Partial Curve Mapping* method has been introduced in LS-OPT. The feature involves the ability to continuously map one curve to another without having to be concerned about the relative curve

lengths or shapes. The LS-OPT GUI simply requires the names of the experimental and test curves without any additional attributes. An example result is shown in Figure 1.

**Figure 1:** An example of the calibration of a material model with hysteretic behavior using Partial Curve Mapping. Curves at several iterations are shown in the upper plot. The black crosses represent the experimental target curve. The optimization history of the curve match discrepancy appears below.



## LS-DYNA job distribution and the LSTCVM Secure Proxy Server for clusters

A popular execution mode for optimization is to run LS-OPT on Windows while launching, controlling and monitoring LS-DYNA on a Linux cluster. For this purpose, LSTCVM was created as a secure proxy server to allow on-line job monitoring in a secure network-based computing environment. LSTCVM allows the administrator to set up restrictions regarding allowable commands, run locations, users and interactivity. No login is required and hence no passwords are transmitted. LSTCVM interfaces with all the queuing systems currently available in LS-OPT.

To address the problem of individual straggling solver jobs, i.e. jobs of which the run times become unexpectedly long or jobs lost in the queuing system (this happens occasionally!), a job cancelling feature has been added for individual jobs. This feature allows the

user to cancel a particular simulation to avoid holding up the entire optimization run. Normal and accelerated cancellation features are available. The ability to cancel individual jobs is in addition to the existing feature for stopping the entire optimization job. The loss of a few individual jobs is usually not critical for the overall optimization result since LS-OPT provides some redundancy in this respect.

Along with these specific features, the job distribution facility has been significantly refined and tested in industrial environments involving very large clusters. As in the past, job progress can be fully monitored and the viewing of any solver job log requires a single mouse click.

LS-OPT and LS-TaSC™ utilize the same job distribution system.

**Figure 2** LS-OPT job progress display showing list of running jobs including a single cancelled job. A specific job running on a cluster can be viewed or cancelled by selecting the desired job button under the View Log.



## Progress visualization and stopping criteria for Direct Multi-Objective Optimization

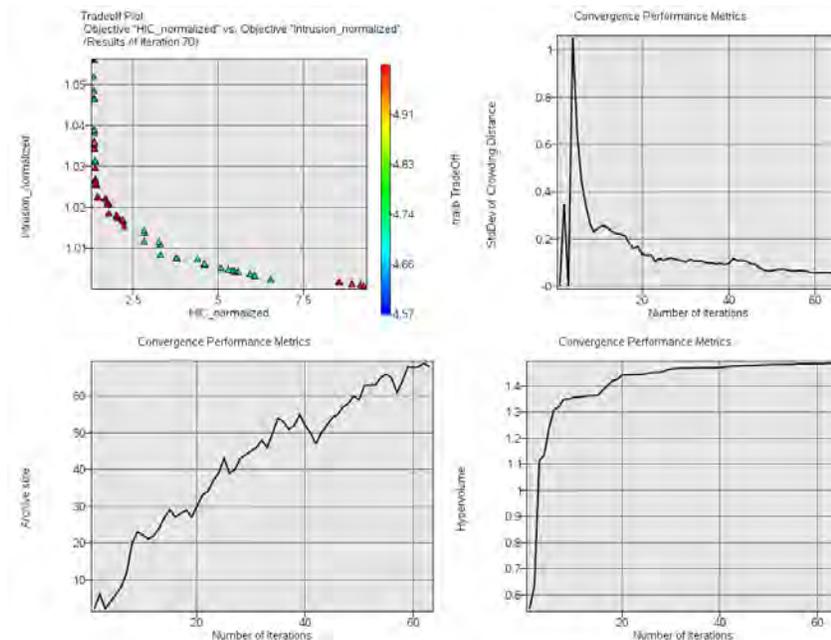
After Multi-Objective Optimization was introduced in LS-OPT in Version 3, it became apparent that unless an accuracy-based termination criterion was provided, this type of analysis could potentially be unnecessarily expensive. Direct Global Optimization algorithms typically require a large number of simulations to obtain accurate results and should therefore only be run to a specified level of accuracy.

Version 4.2 provides a number of stopping criteria of which the Crowding Distance (representing optimal design

point density) and the Dominated Hypervolume are the most intuitive to use. The Dominated Hypervolume is defined as the volume between the optimal solutions and a reference point in the objective space, so in 2D is simply the surface area above the front (see Figure 1, top left).

For deeper insight into the optimization process, the histories of various attributes of the POF can be plotted. These attributes include: Archive size, design points removed or added or carried over, hypervolume (and its change), crowding distance, spread and minimum and maximum objective values. Some of these are shown in Figure 1.

**Figure 1:** Result of a Multi-Objective Direct Optimization problem showing the convergence history of the crowding distance (standard deviation) (top right) , archive size (bottom left) and dominated hypervolume (bottom right) of the Pareto Optimal Front displayed at the top, left. Various criteria, including the hypervolume change can be used to terminate the optimization at a prescribed level of accuracy.



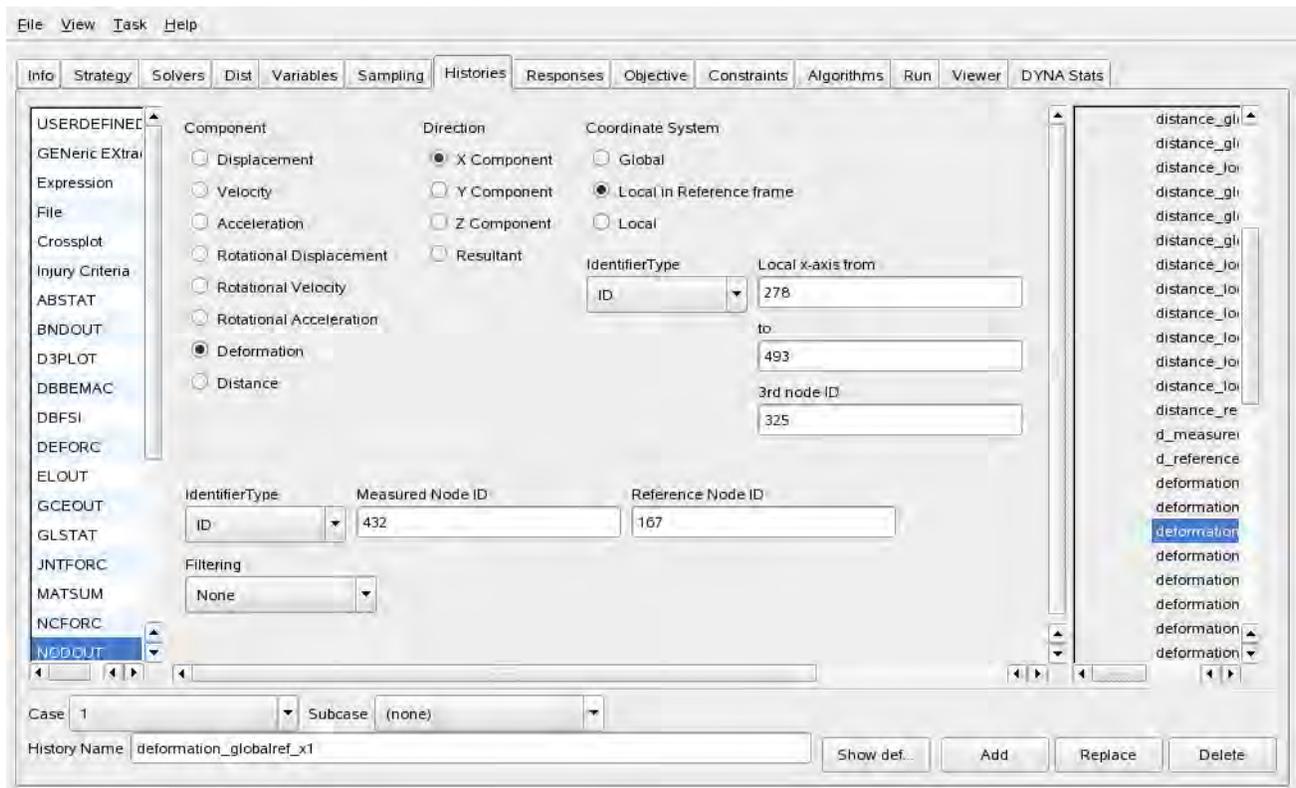
## Kinematics for crashworthiness

Safety requirements related to crashworthiness design often require the computation of distances between nodes or relative displacements (i.e. deformations) of a crashed structure. For this purpose deformation and distance have been added as output quantities that can be extracted from the LS-DYNA nodout database.

The feature makes it much easier to compute quantities in global or local coordinates and now makes it possible in the reference coordinates of a predefined moving rigid body.

Both histories and responses can be extracted.

**Figure 2:** LS-OPT Interface for nodout quantities showing dialogs for specifying local deformation relative to a rigid body fixed to the structure. The rigid body definition requires the specification of three nodes on the finite element model.



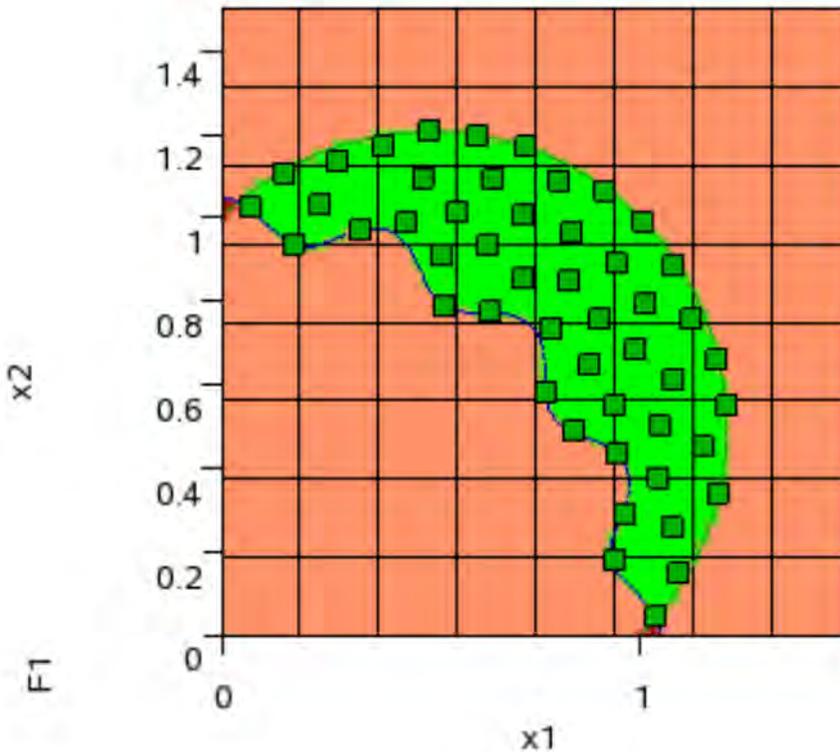
### Design sampling using Constrained Space Filling

In many design problems constraints exist on the relationships between design parameters, so that arbitrary parameter combinations do not necessarily represent analyzable designs. Such examples are typically shape design problems in which there is an interdependency between the parameters. The design space representing only the possible designs is often referred to as a reasonable design space. As a simple example, two

adjacent radii of an opening are dependent on one another so that their combined radii cannot exceed the size of the hole. This type of limitation results in an irregular shape of the design space which complicates the sampling method employed to build metamodels of the design.

In Version 4.2, Constrained Space Filling has been introduced as an improved method for providing sampling points within the reasonable design space. A 2-dimensional example is shown in the Figure below.

**Figure 3:** LS-OPT display of an example with points sampled in a 2D irregular design space. The method used is a Constrained Space Filling approach.



## **Selected other new features**

### **Injury Criteria for crash design.**

A comprehensive set of injury criteria for crash analysis is now available, the total list being HIC, NNIC, NIC, Nkm, LNLI, Chest Compression, Viscous Criterion, TTI, Chest Severity Index, Tibia Index, a3ms (3ms acceleration threshold) and Clip3m. A 3-node version of the injury criterion Clip3m has been added. Some criteria are available as histories.

### **Stopping criteria for sequential metamodel-based optimization.**

Metamodel prediction accuracy based on the PRESS error has been added as a stopping criterion for the classical Sequential Response Surface Method (SRSM). This feature can also be used as a stopping criterion for Multi-Objective Optimization problems based on sequential metamodel updating. The PRESS error defines the prediction accuracy of the metamodel, so allows the optimization to stop when the accuracy no further improves. Viewer refinements. The display of LS-DYNA histories and crossplots was improved by allowing the selection of multiple histories. This makes it easier to display multiple history vs. test comparisons in multi-case problems. The 2D Metamodel Interpolator display now also includes simulation points. In

general, homogeneity amongst the different types of displays has been improved and all metamodel-based displays have been significantly accelerated.

### **Generic Extraction from text files**

Histories have been added to the GenEx (generic extraction) result extraction feature. GenEx allows the extraction of quantities from text output files by locating user-defined markers at desired locations in the files. The feature allows LS-OPT to interface to non-LS-DYNA solvers. In earlier versions, GenEx could only be used to extract responses.

### **LS-OPT database**

Archiving has been expanded to optionally include extra files such as solver input files.

### ***Download and support:***

Downloads of V4.2 of LS-OPT are available for Linux and Microsoft Windows operating systems at <http://ftp.lstc.com/user/ls-opt/4.2> .

Interested users are invited to join the LS-OPT User Group at [http://groups.google.com/group/lsopt\\_user\\_group](http://groups.google.com/group/lsopt_user_group) .

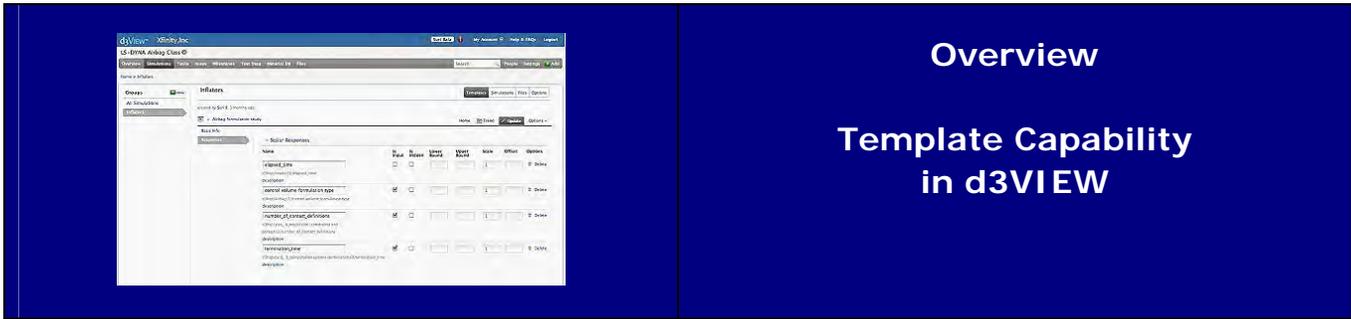
Nielen Stander  
[nielen@lstc.com](mailto:nielen@lstc.com)

## Summary:

1. Improved GUI gives better look and feel.
2. Up-to-dated LS-DYNA keyword data support allows handling of the latest keyword data
3. Improved geometry data cleaning and repair capability allows user to generate better mesh without fixing the finite element mesh
4. Semiautomatic solid element meshing by using cut and sweep scheme to generate hexahedron elements.
5. Batch mode processing with pictures or AVI movie output but without graphics windows

## Current and Future developments:

- Improve automatic surface meshing
- Fast graphics rendering for very large model with many thousands of parts and many states
- Model compare for post-processing data
- Programming language within command file for data manipulation
- Parallel processing – file IO,
- Very large model handling, shell normal computation, solid element internal faces eliminations, free edge computation, etc.
- Support Apple Mac OS
- Other new Applications:
  - LS-DYNA Airbag folding simulation setup
  - Die face engineering setup for metal forming
  - Drop test analysis setup
  - Provide API for other FEA code to create d3plot data file for post-processing



# Overview

## Template Capability in d3VIEW

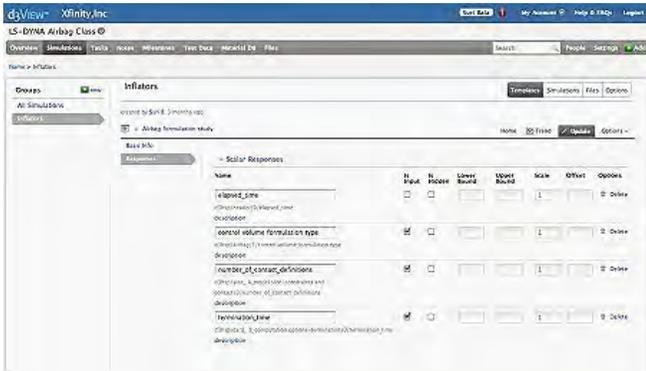
Author and Developer of d3VIEW – Suri Bala  
<http://www.d3view.com> - New way to view and explore LS-DYNA results  
<http://blog.d3view.com> - My LS-DYNA weblog  
<http://www.linkedin.com/in/suribala> - Linked In – Suri Bala

Post-simulation tasks performed by a typical Analyst are broadly classified as “Post-Processing” which includes evaluation of simulation quality, product performance, comparative analysis with previous designs and finally ending with collaboration with key stake holders. d3VIEW has functionalities to help in all of these areas with virtually no user input. It first extracts several thousands of responses that in some instances exceed well over a half a million responses that include both INPUT (mass, thickness, element formulation, etc) and OUTPUT (acceleration, pressure, etc). For any given set of simulations, d3VIEW can track changes within these large set of responses to present inputs/outputs that are different when compared with a baseline simulation.

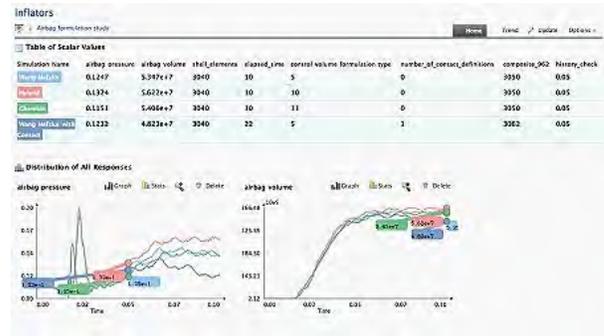
Typically between two simulations, there could be millions of variables that could potentially change. However, in a well-controlled design space and expected output, the number of input and outputs could be a substantially small subset of potential changes. d3VIEW’s template functionalities provide users with a powerful set of features to track a small set of responses from its collected set of

thousands of responses. d3VIEW also provides a powerful interface to view extended analytics of these data to allow in-depth insight over thousands of simulations. Since d3VIEW understands the responses to be input and output, it presents TRENDS of the output responses against the input responses.

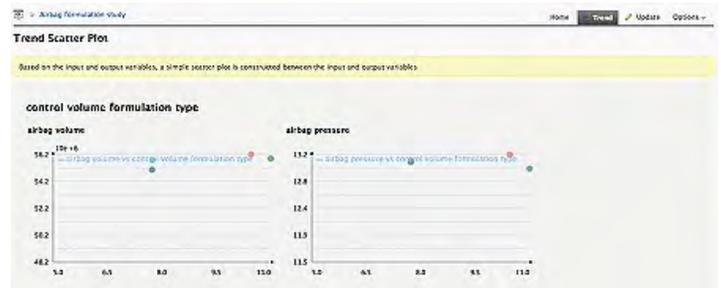
As an example, the screenshots, on the following page, show the template features using a airbag deployment simulation in which the input variable is the inflator model (Wang-nefske, Hybrid, etc) and the outputs are bag peak bag pressure, final volume, time-histories of pressure, and volume. All the screenshots were prepared by d3view with no user-input. All the simulations were run as we normally do, the input and output were extracted by d3view, and the responses subset were defined within d3VIEW to track the desired input and output.



This picture shows the creation of response templates from a large set of responses collected automatically by d3VIEW. d3VIEW allows thresholds to track simulations with are only within or outside of these threshold



This pictures shows the presentation of the small subset of data in the form of a DOE matrix or as a table and also as charts for time-histories



This picture shows the cross-plot of output-response against the input variable (TREND plot)



## LSTC Developers Presenting Papers At The 8<sup>th</sup> European LS-DYNA Users Conference

### **Nielen Stander - LS-OPT**

Session 4:  
Optimization for Crash Analysis  
"New curve matching methods  
for for parameter identification"

### **Willem Roux - LS-TaSC**

Session 4:  
Optimization for Crash Analysis  
"Topology design using  
LS-TaSC Version 2 and LS-DYNA"

### **Arthur Shapiro – Heat Transfer, Thermal Analysis**

Session 4:  
Optimization for Crash Analysis  
"How to us LS-OPT for parameter  
estimation hot stamping and  
quenching applications"

### **Roger Grimes - Solver Technology**

Session 6:  
High Performance Computation  
"Progress on GPU implementation for  
LS-DYNA implicit"  
"MPP execution of implicit mechanics  
with 10M or more elements"

### **William Feng - Constitutive Modeling**

Session 16:  
Polymer and rubber modeling  
"A constitutive equation for the  
aging of elastomer and application  
to dummy impact programs"

### **Yun Huang - Acoustics**

Session 23:  
New CFD and Acoustics Methods  
"Development of frequency domain  
dynamic and acoustic capabilities  
in LS-DYNA"

### **Brian Wainscott - MPP**

Session 24:  
High Performance Computation  
"Efficient Processing of Multiple  
Contacts in MPP-DYNA"

### **John O. Hallquist - LS-DYNA**

Plenary Session  
LS-DYNA Recent and Future  
Developments



## The Gavel

### Personal View Point Of Papers Not To Miss

**Personal View Point – Does NOT reflect opinions, of any participants, authors, companies, FEA Information personnel.**

Among the many papers I will be attending at the 8<sup>th</sup> European LS-DYNA® Users Conference I wanted to make sure you knew of the following that I find interesting and will be attending – all comments should be addressed to [mv@feainformation.com](mailto:mv@feainformation.com)

#### **A pregnant woman model to study injury mechanisms in frontal car crashes**

Session 7

Biomechanics and Safety

Mr. Peres  
(IFFSTAR)

#### **Transient response of stay cables during explosive loading of a large span stay cable bridge**

Session 15

Blast Simulation

Mr. Bojanowsk  
(Argonne National Lab)

#### **Applications of LS-DYNA to design airfreight containers for fissile materials**

Session 18

Nuclear and Industrial Applications

Mrs. O. Voykina  
(LLC Strela)

LSTC's direct distributor in Russia

#### **Numerical simulation of consequence of passenger aircraft tyre damage**

Session 21

CFD and FSI Applications

Mr. Romanov  
(Sarov Engineerin Center)

#### **Development of detailed FE model of hybrid III crabs test dummy by reverse engineering**

Session 19

Dummy Modeling

Mr. Onishi  
(Toyota)



**Yanhua Zhao**

**Business Manager  
LSTC's Products - China**

The continued rapid growth of LS-DYNA within the auto companies, universities and other industries, within China, has been recognized by LSTC, with new changes. In order to accommodate this growth LSTC instituted changes to their China Business Unit, and renewed commitment to bring the full LSTC Suite of software to the LS-DYNA users in China.

**Yanhua Zhao**, has been appointed Manager of LSTC's China Business Unit. As the Business Manager of China, and AP business that includes China, Yanhua works very closely with the Office Manager of the Dalian office, Ms. Shujuan Zhang.

LSTC announced the Dalian Fukun Technology Development Corp. as their "Master" distributor in China, interacting with the LS-DYNA suite of software product Distributors (Arup, ETA China & NEC) and Dalian's LS-DYNA resellers, to manage the sales, marketing and distribution of LSTC's products in China. It is expected that this transition will be finalized during Q3-2011.

The purchase of LS-DYNA software includes, at no additional fees the

software listed below, and includes MPP, Explicit, Implicit, at no additional fees.

- \* LS-DYNA®
- \* LS-OPT®
- \* LS-PrePost®
- \* LS-TaSC™
- \* LSTC Barrier Models
- \* LSTC ATD Models

**Marsha Victory** will continue as Global Business Administrator, inclusive of the Middle East and Asia Pacific.

**Philip Ho** will continue to be responsible for Business Development in China, inclusive of countries in AP that interact with China. Additionally, Philip will continue as well as lead developer of LS-PrePost, portions of which are being developed at the Dalian Fukun offices.

Dalian Fukun Technology Co., LTD is located at Kailun Business Building B#1308, Wu CaiTown A District, Development Zone, Dalian 116600 China. Dalian Fukun is a Platinum Participant of FEA Information Inc.

For demo's and pricing in China contact [yanhua@lstc.com](mailto:yanhua@lstc.com)



## FEA Participant Showcase

ETA

### Engineering Technology Associates

1133 E. Maple Rd, Ste #200 - Troy, MI 48083

[etainfo@eta.com](mailto:etainfo@eta.com)    <http://www.eta.com>

For over 25 years, ETA has been providing engineering solutions for a wide variety of clients. The organization credits this consulting experience for the knowledge which led to the development of its advanced CAE software tools. Naturally, ETA has seen tremendous evolution in the field over these years.

ETA first developed DYNAFORM, a die analysis tool, which has evolved into a complete die system solution. Now, beyond formability simulations and die face engineering, DYNAFORM allows the engineer to analyze scrap shedding/removal, die structural integrity and sheet metal transferring/handling.

Originally created to model a simple mechanism, ETA's team eventually developed VPG (Virtual Proving Ground), an analysis tool to simulate system-level interactions. VPG now features tailored, job-specific modules which create immensely insightful crash, structural analysis, drop test and fluid-structure interaction simulations.

ETA's software development team has needed to be one step ahead of its users'

technical demands over the years. Constant development has allowed DYNAFORM and VPG to continue to meet or exceed these expectations, adding more and more functionality with each release. When users requested an even more user-friendly and configurable environment, ETA's response was to develop and release a new unified and streamlined architecture, called the Inventium Suite™.

By design, Inventium products offer a high performance modeling and post-processing system, while providing a robust path for the integration of new tools and third party applications. The Inventium Suite's first tool, released in 2010, is PreSys™. ETA's 4th generation Pre/Post Processor, PreSys™ delivers industry-leading capabilities for finite element modeling and analysis. PreSys offers a scripting interface to automate processes and interact with 3rd party solutions, as well as a model explorer feature to provide in-depth data navigation. PreSys is offered in a user-friendly environment, with customizable menus and toolbars. Results are shown in realistic graphic illustrations which allow expert insight into designs.

ETA's engineering consulting team has also seen its share of progress. In recent years, ETA's team has completely revolutionized the way it performs its product development tasks. With the emergence of several key enablers which include model parameterization tools, multi-disciplinary optimization tools, analysis tools and high performance computing, the team was able to create a new award-winning methodology. Dubbed the Accelerated Concept to Product (ACP) Process, the method is a performance-driven, holistic product

design development method based on design optimization. This process enables the complete synchronization of design, optimization and analysis to ultimately find the optimal design concept. This technology has been used in the optimized design of several new vehicles as well as several closure systems. This approach has resulted in significant mass and cost reductions, while maintaining or improving functional performance targets. The final step will be a seamlessly integrated, easy to use software product within Inventium.



**Dr. Ron Knott's  
web pages on Mathematics:**

## **Egyptian Fractions**

"reprinted with permission of Dr. Ron Knott From his Website

Ph.D, M.Sc, B.Sc (Pure Maths), C.Math, FIMA, C.Eng, MBCS, CITP

<http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/contactron.html>

(c) Dr. Ron Knott, all rights reserved

Excerpt:

<http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fractions/egyptian.html>

Egyptian Fractions explains how the Egyptians and Babylonians of 3000 BC represented fractions and how they used them. In some ways, their method is better than the decimal system! There are now some online calculators on this page to take some of the work out of generating these fractions.

One of the papyrus scrolls, discovered in a tomb in Thebes, was bought by a 25 year old Scotsman, Henry Rhind at a market in Luxor, Egypt, in 1858. After his death at the age of 30, the scroll found its way to the British Museum in London in 1864 and remained there ever since, being referred to as the Rhind Mathematical Papyrus (or RMP for short).

So what did it say?

The hieroglyphs (picture-writing) on the papyrus were only deciphered in 1842 (and the Babylonian clay-tablet cuneiform writing was deciphered later that century).

It starts off by saying that the scribe "Ahmes" is writing it about 1600 BC but that he had copied it from "ancient writings" so it probably goes back to at least 2000BC and probably further. The picture is also a link so click on it to go to the St Andrews MacTutor biography of Ahmes.

Since early civilisations would need to predict the start of spring accurately in order to sow seeds, then a large part of such mathematical writing has applications in astronomy. Also, calculations were needed for surveying (geometry) and for building and for accounting. However, quite a lot of the problems in the RMP are arithmetic puzzles - problems posed just for the fun of solving them!

On this page we will look at how the Egyptians of 4000 years ago worked with fractions.

<http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fractions/egyptian.html>



## Making A Difference

State of stress in the Bat Machine Co. Inc. 8.5" action for the .408 CheyTac Cartridge with a 0.630"

To keep our magazine size to a minimum we have only published an excerpt.

<http://www.varmintal.com/abat85.htm> For The Complete Information

I have calculated the state of stress in the Bat Machine Co. Inc. 8.5" action for the .408 CheyTac Cartridge with a 0.630" case head diameter. The calculation was done with the LS-DYNA FEA code. Two conditions were calculated. The Nominal condition is for a 60,000 psi pressure (hot load) and an intact cartridge case with an internal diameter of 0.540". The second calculation assumes the worst case of a ruptured cartridge case head (but still

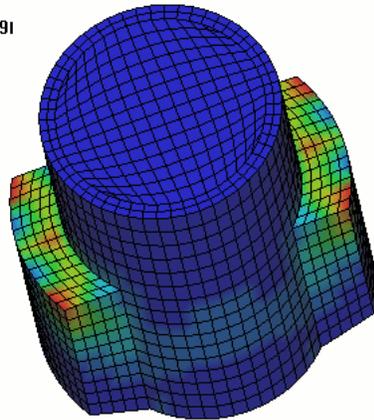
contained within the chamber) with 60,000 psi pressure over the full diameter of the 0.630" case head. The high strain rate that occurs when a cartridge is fired was not considered. Typically, steels have up to 10% higher yield strengths at higher strain rates and that extra strength was not included in these calculations since the high strain rate properties of these steels was not known.

**Summary Table**

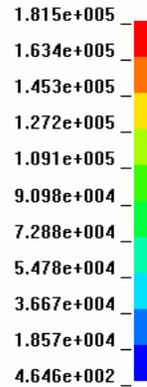
	Maximum Effective Stress at the bolt lugs (psi)	Maximum Effective Plastic Strain at the bolt lugs (in/in)	Maximum Effective Stress on the action (psi)	Bolt Face Axial Deflection (in)	Action Axial Deflection (in)
<b>Nominal Condition Intact Cartridge</b>	181,500	0.0020	119,900	0.0070	0.0020
<b>Ruptured Case Head</b>	185,400	0.0046	163,300	0.0095	0.0028

## Nominal Condition 60,000 psi with intact cartridge.

BAT 8.5" ACTION & BOLT 60 KSI CHAMBER P  
Time = 1  
Contours of Effective Stress (v-m)  
min=464.554, at elem# 695  
max=181504, at elem# 1169I

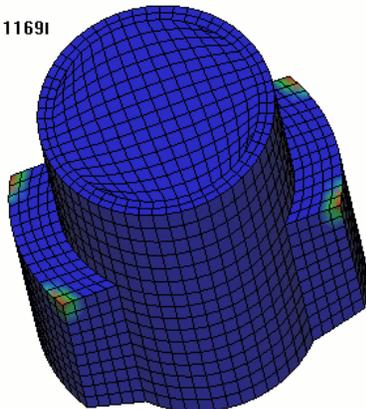


Fringe Levels



The yield stress is slightly exceeded at the very corners of the bolt lugs. This very small amount of yielding at the corners of the bolt lugs is not a serious problem and will not change the bolt's position for subsequent firings at or below the same pressure.

BAT 8.5" ACTION & BOLT 60 KSI CHAMBER P  
Time = 1  
Contours of Effective Plastic Strain  
min=0, at elem# 1  
max=0.00204787, at elem# 1169I



Fringe Levels



The plastic strain is slightly above the 0.2% yield offset and only at the corners of the bolt lugs.

<http://www.varmintal.com/abat85.htm> For The Complete Information

**New addition to the site:** Added Piecewise Linear Plasticity With Failure the LS-DYNA ([MAT\\_024](#)) . 5/6/11



**Rafale**

## Aerospace Information

<http://www.aerospaceinformation.com>

The picture of the month does not depict use of any software. It is chosen, based on the FEA Inc Team's interest in aerospace dynamics, aviation history, or interest. If you wish to have us show a plane, from any country, feel free to send your suggestion to [mv@feainformation.com](mailto:mv@feainformation.com)

[http://en.wikipedia.org/wiki/Dassault\\_Rafale](http://en.wikipedia.org/wiki/Dassault_Rafale)

The Dassault Rafale is a French twin-engine delta-wing multi-role jet fighter aircraft designed and built by Dassault Aviation. Introduced in 2000, the Rafale is being produced both for land-based use with the French Air Force and for carrier-based operations with the French Navy.

To satisfy stringent criteria formulated by the Ministry of Defense, Dassault built a technology demonstrator to prove the viability of its new product. Further development led to the current Rafale variants, which embody innovative

avionics and aerodynamics, optimised for air supremacy operations.

Built as an air supremacy fighter, the Rafale features an advanced avionics suite designed to provide its pilots with excellent situational awareness. It sports an integrated electronic survival system named "SPECTRA", which embodies a software-based virtual stealth technology. The SPECTRA electronic warfare system, jointly developed by Thales and EADS France, provides the aircraft with the highest survivability assets against airborne and ground threats.

### **Among the aerospace publications presented at the LS-DYNA Conferences:**

- Investigation of \*MAT\_58 for Modeling Braided Composites
- <http://www.dynalook.com/international-conf-2010/Aerospace-1-1.pdf>
- Development of Hail Material Model for High Speed Impacts on Aircraft Engine
- <http://www.dynalook.com/international-conf-2010/Aerospace-1-2.pdf>
- Engine Impeller Sub-Fragmentation Simulation Using EFG Method
- <http://www.dynalook.com/international-conf-2010/Aerospace-1-3.pdf>
- Modeling Bird Impact on a Rotating Fan: The Influence of Bird Parameters
- <http://www.dynalook.com/international-conf-2010/Aerospace-1-4.pdf>
- LS-DYNA Implemented Multi-Layer Fabric Material Model Development for Engine Fragment Mitigation
- <http://www.dynalook.com/international-conf-2010/Aerospace-1-5.pdf>
- Predicting the Dynamic Crushing Response of a Composite Honeycomb Energy Absorber Using Solid-Element-Based Models in LS-DYNA
- <http://www.dynalook.com/international-conf-2010/Aerospace-2-5.pdf>



## Employment Opportunity

### Pratt & Whitney

#### **Structures Engineer, Impact Dynamics**

**Job Code:** 92024-02

**Location:** Middletown, CT

Pratt & Whitney, a recognized leading producer of the world's most powerful jet engines, is looking for dedicated individuals to support our organization. If you would like to work in a dynamic environment and possess the motivation to incorporate new ideas into practice, this may be the opportunity you've been waiting for.

Pratt & Whitney's Compression Systems Module Center (CSMC) is currently seeking experienced, dedicated engineers with creativity, drive, and a desire to see their ideas become a reality. The individuals will be part of a growing team responsible for the development of fan and compressor hardware to meet the increasing performance demands of military and commercial aircraft jet engines. Senior level positions are available in Structural Analysis and Impact Dynamics.

The individuals will work as part of an Integrated Product Team to create and implement designs that meet engine-specific requirements. Specific tasks may include:

- Develop and apply state-of-the-art finite element based methods to the design of jet engine components and assemblies for composite and metallic rotating and stationary structures.
- Perform nonlinear, explicit dynamics analyses to accurately simulate bird strike, blade-off, and containment events, and develop improved methods for performing these analyses. Correlate results against rotating rig and full engine tests. Support FAA certification.
- Validate methods against sub scale and full-scale static, dynamic and impact tests.
- Develop computer and simulation-based methods and processes that support engineering productivity and throughput.
- Provide technical oversight and guidance to less experienced engineers within the group.

BS degree in Engineering is required. (Mechanical Engineering, Engineering Mechanics, or Aerospace Engineering preferred).



## Employment Opportunity

### Pratt & Whitney

Relevant structural analysis and impact dynamics experience in the aerospace, gas turbine, or automotive industries, with a demonstrated track record of success is required. The minimum number of years of experience required is as follows:

PhD: 5 years

MS: 10 years

BS: 15 years

A combination of skills and experience in the following areas is expected:

LS-DYNA, DYTRAN, Abaqus.

Hypermesh, PATRAN, ProStar.

Large-scale, non-linear, explicit finite element modeling and analysis.

The positions are located in Middletown, CT.

Occasional travel is required (approximately 10%).

[www.gearedturbofanengine.com](http://www.gearedturbofanengine.com)

[www.f135engine.com](http://www.f135engine.com)

United Technologies Corporation is An Equal Opportunity/Affirmative Action Employer.

Please refer to [www.PrattCareers.com](http://www.PrattCareers.com), keyword search: Impact Dynamics, to apply.



## Employment Opportunity

ARUP

Oasys LS-DYNA Environment

For Information Contact : [Carol.Lloyd@arup.com](mailto:Carol.Lloyd@arup.com)

<b>Job Description</b>	
<b>Group</b>	Technology Group
<b>Job title</b>	Software Developer
<b>Job grade</b>	<b>EDT 3/4</b>
<b>Job brief/ purpose</b>	<p>The main part of the job is writing software for the “Oasys LS-DYNA Environment”, e.g. Primer. This software is sold commercially; the income from sales funds a continuous program of improvements and new releases. The software is an expert, niche product; it is the team’s deep understanding of the needs of customers that gives the software its commercial edge. The post-holder will be expected to develop such understanding over time.</p> <p>The software development team sits within Advanced Technology &amp; Research, performing a wide range of consultancy work based largely on numerical simulation.</p>
<b>Relationships</b>	The post holder will liaise continuously with other members of the software development team who are working on the same products. The team is led by an Associate Director and a Director, with whom the post holder will be in daily contact.
<b>Responsibilities</b>	<p>The post holder will take responsibility for particular functions within the software, including some new functions that the post-holder will develop, as well as contributing to the general development effort (e.g. debugging, testing, and contributing to the design of new features).</p> <p>The role also includes some customer support of the products with which the post holder is familiar.</p>



## Employment Opportunity

ARUP

Oasys LS-DYNA Environment

<p><b>Scope</b></p>	<p>This post is newly created in response to growing sales and demand.</p> <p>Support will be given to achieve chartered status with an appropriate Institution.</p> <p>The post offers scope in the short term for increasing levels of responsibility within the software team. For example, responsibility for software releases, and for particular software products. There will also be opportunities to supervise junior staff, for example during testing, and there is the possibility of involvement in managing developers overseas. In the longer term, the specialist nature of the work does not constitute a barrier to promotion within Arup.</p>
<p><b>Contacts</b></p>	<p>The post-holder will have regular contact with other members of the AT&amp;R Group within Campus, Japan, India and the USA and external clients who are users of the software. The post-holder will also have frequent contact with customers, for example answering support questions, and at meetings to understand customer needs.</p>
<p><b>Environment</b></p>	<p>The post is within the Advanced Technology &amp; Research Group at the Arup Campus, a purpose-built office accommodation on the outskirts of Solihull, in the West Midlands, near junction 4 of the M42 and Widney Manor Station. The Campus is a non-smoking environment.</p>

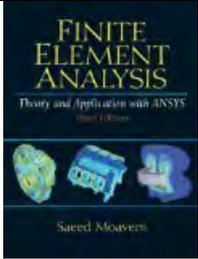
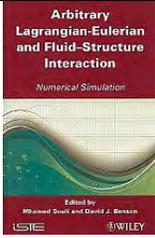
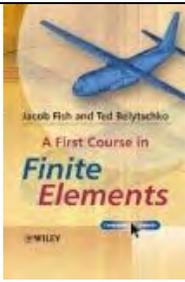
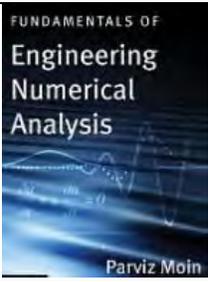
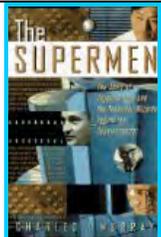
For Information Contact: : [Carol.Lloyd@arup.com](mailto:Carol.Lloyd@arup.com)



## Solutions

Available Books

Available From  
Amazon

	<p><a href="#">Finite Element Analysis Theory and Application with ANSYS (3rd Edition)</a></p>		<p><a href="#">Arbitrary Lagrangian-Eulerian and Fluid Structure Interaction.</a></p>
	<p><a href="#">Isogeometric Analysis: Toward Integration of CAD and FEA</a></p>		<p><a href="#">NURBS for Curve &amp; Surface Design: From Projective Geometry to Practical Use</a></p>
	<p><a href="#">A First Course in Finite Elements</a></p>		<p><a href="#">Engineering Numerical Analysis</a></p>
	<p><a href="#">Go To Book at Amazon</a></p>		



## Solutions

Available Books

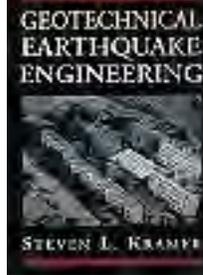
Available From  
Amazon

Meshless  
Methods in  
Solid  
Mechanics

[Meshless Methods in Solid Mechanics](#)



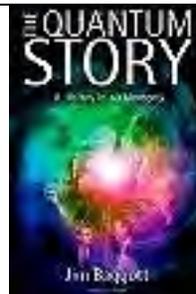
[Principles of Geotechnical Engineering](#)



[Geotechnical Earthquake Engineering](#)

Microflows and  
Nanoflows  
Fundamentals and Simulation  
George Karniadakis  
Ali Beskok  
Narayan Anand

[Microflows and Nanoflows](#)



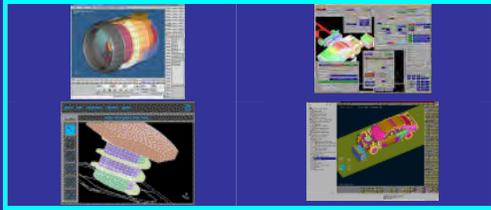
[The Quantum Story: A History in 40 Moments](#)



[The Quantum World: Quantum Physics for Everyone](#)

INTRODUCTION TO  
QUANTUM  
MECHANICS  
SIXTH EDITION  
DAVID J. GRIFFITHS

[Introduction to Quantum Mechanics \(2nd Edition\)](#)



## Solutions

Pre-Processing  
Post Processing  
Model Editing

A preprocessor is a program that processes its input data to produce output. This data is then used as input to another program.

### **BETA CAE Systems S.A.**

<http://www.beta-cae.gr/>

Provides complete CAE pre- and post-processing solutions. ANSA, the world wide standard pre-processor and full product modeler for LS-DYNA, with integrated Data Management and Task Automation.  $\mu$ ETA, with special features for the high performance an effortless 3D & 2D post-processing of LS-DYNA results.

### **Engineering Technology Associates, Inc.**

<http://www.inventiumsuite.com>

PreSys is an advanced Pre/Post Processor. PreSys is a full-featured, core solution that can be used on its own or with a variety of available add-on applications. The system offers advanced automeshing tools to provide the highest quality mesh with little CAD data preparation. It also features a scripting interface and model explorer feature for in-depth data navigation.

### **Oasys, Ltd**

<http://www.oasys-software.com/dyna/en/>

Oasys Primer is a model editor for preparation of LS-DYNA input decks. - Oasys D3Plot is a 3D visualization package for post-processing LS-DYNA analyses using OpenGL® (SGI) graphics.

### **JSOL Corporation**

<http://www.jsol.co.jp/english/cae/>

JVISION is a general purpose pre-post processor for FEM software. Designed to prepare data for, as well as support, various types of analyses, and to facilitate the display of the subsequent results.

### **Livermore Software Technology Corporation**

<http://www.lstc.com>

LS-PrePost is an advanced interactive program for preparing input data for LS-DYNA and processing the results from LS-DYNA analyses.



## Solutions Software

### ETA – DYNAFORM & VPG

<http://www.eta.com>

Includes a complete CAD interface capable of importing, modeling and analyzing, any die design. Available for PC, LINUX and UNIX, DYNAFORM couples affordable software with today's high-end, low-cost hardware for a complete and affordable metal forming solution.

### OASYS software for LS-DYNA

<http://www.oasys-software.com/dyna/en/>

Oasys software is custom-written for 100% compatibility with LS-DYNA. Oasys PRIMER offers model creation, editing and error removal, together with many

### ETA – VPG

<http://www.eta.com>

Streamlined CAE software package provides an event-based simulation solution of nonlinear, dynamic problems. eta/VPG's single software package overcomes the limitations of existing CAE analysis methods. It is designed to analyze the behavior of mechanical and structural systems as simple as linkages, and as complex as full vehicles.

specialist functions for rapid generation of error-free models. Oasys also offers post-processing software for in-depth analysis of results and automatic report generation.



## Solutions Software

### ESI Group Visual-CRASH For DYNA

<http://www.esi-group.com>

Visual-Crash for LS-DYNA helps engineers perform crash and safety simulations in the smoothest and fastest possible way by offering an intuitive windows-based graphical interface with customizable toolbars and complete session support. Being integrated in ESI

Group's Open VTOS, an open collaborative multi-disciplinary engineering framework, Visual-Crash for DYNA allows users to focus and rely on high quality digital models from start to finish. Leveraging this state of the art environment, Visual Viewer, visualization and plotting solution, helps analyze LS-DYNA results within a single user interface.

### BETA CAE Systems S.A.– ANSA

<http://www.beta-cae.gr>

Is 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

<http://www.beta-cae.gr>

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  
Cloud Service  
SGI  
HPC Cloud Cyclone™

**Complete Information can be found on the SGI Website including:**

- Cyclone™ and LS-DYNA® Success Story
- IDC White Paper - Cyclone Supported Applications
- Cyclone Usage Diagram

[http://www.sgi.com/products/hpc\\_cloud/cyclone/index.html](http://www.sgi.com/products/hpc_cloud/cyclone/index.html)

Cyclone™ is the world's first large scale on-demand cloud computing service specifically dedicated to technical applications. Cyclone capitalizes on over twenty years of SGI HPC expertise to address the growing science and engineering technical markets that rely on extremely high-end computational hardware, software and networking equipment to achieve rapid results. Cyclone supports a number of leading applications partners and five technical domains, including computational fluid dynamics, finite element analysis,

computational chemistry and materials, computational biology and ontologies.

Two Service Models: Cyclone is available in two service models: Software as a Service (SaaS) and Infrastructure as a Service (IaaS). With SaaS, Cyclone customers can significantly reduce time to results by accessing leading-edge open source applications and best-of-breed commercial software platforms from top Independent Software Vendors (ISVs). The IaaS model enables customers to install and run their own applications.

**LS-DYNA® Implicit Hybrid Technology on Advanced SGI® Architectures\***

White Paper pdf format is at URL: <http://www.sgi.com/pdfs/4231.pdf>

Olivier Schreiber, Scott Shaw, Brian Thatch - SGI Application Engineering  
Bill Tang, - SGI System Engineering



## Information Solutions Site Directory

LS-DYNA Application/Capability	<a href="http://www.ls-dyna.com/">http://www.ls-dyna.com/</a>
LS-DYNA LS-DYNA Benchmarks	<a href="http://www.topcrunch.org/">http://www.topcrunch.org/</a>
LS-DYNA Publications	<a href="http://www.dynalook.com/">http://www.dynalook.com/</a>
LS-DYNA Consulting Companies	<a href="http://www.ls-dynaconsulting.com/">http://www.ls-dynaconsulting.com/</a>
LS-DYNA Examples	<a href="http://www.dynaexamples.com/">http://www.dynaexamples.com/</a>
LS-OPT Support	<a href="http://www.lsoptsupport.com">http://www.lsoptsupport.com</a>
LS-OPT User Group	<a href="http://groups.google.com/group/lsopt_user_group">http://groups.google.com/group/lsopt_user_group</a>
LS-PrePost Support	<a href="http://www.lstc.com/lsp">www.lstc.com/lsp</a>
LS-DYNA Support	<a href="http://www.dynasupport.com/">http://www.dynasupport.com/</a>

### **ATD – Pedestrian – Barrier Models**

ATD LSTC Models:	<a href="http://www.lstc.com/models">http://www.lstc.com/models</a>
ATD LSTC Mailing List	<a href="mailto:atds@lstc.com">atds@lstc.com</a>
ATD Models - DYNAmore	<a href="http://dummymodels.com">http://dummymodels.com</a>
Pedestrian Impact Model - ARUP	<a href="http://oasys-software.com/en/fe-models/pedestrian.shtml">http://oasys-software.com/en/fe-models/pedestrian.shtml</a>
Cellbond Barrier Models - ARUP	<a href="http://oasys-software.com/en/fe-models/barrier.shtml">http://oasys-software.com/en/fe-models/barrier.shtml</a>
RCAR Barrier Model - ARUP	<a href="http://oasys-software.com/en/fe-models/rcar.shtml">http://oasys-software.com/en/fe-models/rcar.shtml</a>

### **Other**

High Strain Rate Testing of Advanced High Strength Steels	<a href="http://thyme.ornl.gov/ASP_Main/crashtests/crashtests_main.cgi">http://thyme.ornl.gov/ASP_Main/crashtests/crashtests_main.cgi</a>
High Strain Rate Characterization of Mg Alloys	<a href="http://thyme.ornl.gov/Mg_new">http://thyme.ornl.gov/Mg_new</a>
(FEM) models of semitrailer trucks for simulation of crash events	<a href="http://thyme.ornl.gov/FHWA/TractorTrailer">http://thyme.ornl.gov/FHWA/TractorTrailer</a>
Single Unit Truck crash model documentation	<a href="http://thyme.ornl.gov/FHWA/F800WebPage">http://thyme.ornl.gov/FHWA/F800WebPage</a>



June 1-3 2011  
BETA CAE Systems SA  
4th ANSA &  $\mu$ ETA Int'l Conference  
Makedonia Palace  
Thessaloniki, Greece

**For Complete Information and full conference announcement:**

[http://www.beta-cae.gr/conference04\\_announcement.htm](http://www.beta-cae.gr/conference04_announcement.htm)

Being consistent to our biannual appointment, it is our pleasure to invite you to attend the 4th ANSA &  $\mu$ ETA International Conference that will be held from June 1st to June 3rd 2011, in Classical Makedonia Palace Hotel, Thessaloniki, Greece.

The principal aims of this event are to bring the CAE Community together with BETA CAE Systems S.A. and to promote an international exchange of the latest concepts, knowledge and development requirements on our flagship software products, ANSA &  $\mu$ ETA. Technical papers will be presented outlining the latest advances in CAE strategy, methodology, techniques and applications related to our products. Participants will have the opportunity to be informed about the latest software trends, demonstrate their concepts and achievements and present new development requirements.

Following the success of our previous events and after the request of the majority of the participants, the duration of our 4th conference will be of three days. The closer technical communication with the software developers' team of our products, within

the framework of a technical forum, features this three-day conference.

Further discussions, sessions, meetings and events will allow the interaction between participants and organizers. Senior executives of our company, the engineers from the development and services teams and our business agents from around the world will be glad to meet with customers and users, to discuss the applications, the existing functionality, latest enhancements and future development plans of our software products. We expect that this will be a unique opportunity for you to share your success and for us to share our vision.

The attire of the event is business casual. The language of the event is English.

#### **Important Dates:**

##### **Abstracts: February 25th 2011**

Acceptance: March 11th 2011

Registration: April 15th 2011

Final manuscripts: April 29th 2011

Presentations files: April 29th 2011

Event: June 1st to June 3rd 2011



## Success Review

### 4th Series Oasys LS-DYNA Indian Update Meetings 2011 Pune and Bangalore

The fourth series update meetings for Oasys and LS-DYNA software were held at the Ista Hotel, Pune on 3rd May 2011 and at the Taj Vivanta Hotel, Bangalore on 5th May 2011. Both events attracted wide interest from the user community with over ninety five users registering in Pune and over one hundred and sixty in Bangalore.

Users at both events were updated on new features in release 5.1.1 of LS-DYNA 971 and version 10 of the Oasys Suite. They were also introduced to some forthcoming features in LS-DYNA 980 and in the Oasys suite. Mr. Suri Bala, Livermore Software Technology Corporation introduced a set of new and upcoming features of LS-DYNA. Mr. Bala also demonstrated D3View which can help manage large sets of simulation data and in gaining insight from past simulations.

Both events witnessed enthusiastic participation from the user community, with the Pune including three user presentations, and the Bangalore four. The Pune event included presentations by Mr. Aditya Malladi from Tata Motors, Mr. Kaviraj Shinde from Infotech Enterprises, and Mr. Srikanth Kethu from Mercedes-Benz R&D Pvt India Ltd. The Bangalore event included presentations by Mr. Ashok Kumar from Infotech Enterprises, Mr. P Chandra Mouli from Mahindra & Mahindra Ltd, Mr. Amit Gupta from Mercedes-Benz R&D Pvt India Ltd, and Mr. Vijay Kumar Iyer, GM Technical Center Pvt Ltd.

Please contact [india.support@arup.com](mailto:india.support@arup.com) for information, training and support of Oasys and LS-DYNA software.

Presentations can be downloaded from the events page at: <http://www.oasys-software.com/dyna/en/> .



Top left – Mr. Suri Bala presenting at Pune event; Right – delegates at Bangalore event; Bottom Left – Oasys & nance team



## Seminar on Crashworthiness

### Success

A three-day seminar on Crashworthiness with LS-DYNA (by Dr. Reika Akita, from CTC, Japan), Federal Motor Vehicle Safety Standards and its Trend, and Restraint System Development (by Dr. Hui Zhao, from Chongqing Changan Auto), and EFG method in LS-DYNA and its application (by Dr. Hongsheng Lu, from Shanghai Hengstar Technology) has been successfully held at Shanghai, by Shanghai Hengstar Technology ([www.hengstar.com](http://www.hengstar.com)) on 21 April to 23 April 2011.

We appreciated LSTC and FEA information Inc. for their kind support and assistance in arranging this course.

LSTC [www.lstc.com](http://www.lstc.com)  
FEA Information [www.feainformation.com](http://www.feainformation.com)

More than 30 attendees from OEM, suppliers, researcher institute, and university took part in the seminar. They are fully satisfied with the result of this seminar, and all the participants

appreciated the chance to have a face-to-face discussion with senior experts from automobile industry, and LS-DYNA community. More courses on using LS-DYNA, taught by high level experts from LSTC, OEMs, other consulting companies, will be available in the near future.

We look forward to providing additional seminars to the CAE engineering community and LS-DYNA users in China.

#### **21-23 July, "Crashworthiness Theory and Technology"**

by Dr. Shengrong Wu, Chief Engineer at Automobile Engineering Research Institute, Chery Automobile Co., Ltd.

#### **27-28 August, "LS-DYNA MPP"**

Airbag Simulation with LS-DYNA", by Dr. Jason Wang, senior scientist, from LSTC

#### **14-17 November, "Crashworthiness Simulation with LS-DYNA",**

by Paul A. Du Bois, a famous expert on LS-DYNA applications



May 23rd & 24th, 2011  
The 8th European  
LS-DYNA Users Conference  
hosted by ALYOTECH  
Strasbourg (France)

## 8th European LS-DYNA® Users Conference Strasbourg – France

The 8th European LS-DYNA Users Conference hosted by ALYOTECH with the support of ARUP, DYNAMORE, ERAB and LSTC. The conference will be an excellent occasion to meet LS-DYNA® users from all over the world and to share LS-DYNA® applications in different areas.

Presentations will cover various LS-DYNA® related topics, new developments and new applications from academic and industrial engineers. An exhibition area will allow to obtain information about the latest software and hardware developments related to LS-DYNA®.

Several training classes will be held immediately before or after the Conference:

- Crash & Impact Modeling
- FSI & ALE in LS-DYNA
- Material Modeling and User-Defined Materials in LS-DYNA

- Modeling & Simulation with LS-DYNA
- SPH & EFG Methods in LS-DYNA
- Optimization with LS-OPT
- Sheet Metal Forming with LS-DYNA & DYNAFORM
- LS-PrePost
- Using LS-DYNA for Heat Transfer with Hot Stamping Applications
- LS-DYNA Applications to Protective structures, blasts, vehicle mines, ...

Known as the European Capital, Strasbourg is home to the Council of Europe, the Human Rights Building and the European Parliament. It is a major hub, making for an easy access to the European LS-DYNA® meeting!

We hope to count you among our participants very soon!

Additional information/ registration:

[www.lsdynauc.alyotech.fr](http://www.lsdynauc.alyotech.fr)



## Korean LS-DYNA Conference KOSTECH

June 23, 2011

### **2011 Korean LS-DYNA Conference**

Kostech invites you to the 2011 Korean LS-DYNA Users Conference, which will take place in Korea (Seoul) on 23 June 2011.

The conference will offer an excellent occasion to meet LS-DYNA users in Korea and to share LS-DYNA applications in different areas.

#### **Presentations:**

Presentations will cover various LS-DYNA related topics, new developments and new applications from academic and industrial engineers.

#### **LS-DYNA professional Seminars:**

KOSTECH will offer LS-DYNA Professional Seminars on 21st, 22nd June, before the conference. (in Kostech training center)

Register to 2011 Korea LS-DYNA users conference and other information can be found at:

[http://kostech.co.kr/skin17/sub\\_page.php?page\\_idx=149](http://kostech.co.kr/skin17/sub_page.php?page_idx=149)



The 12<sup>th</sup> International  
 LS-DYNA® Users Conference.  
 June 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> 2012

**FIRST CALL FOR PAPERS**

**Hosted by Livermore Software Technology Corporation (LSTC)**

**To be held at The Hyatt Regency Dearborn, MI**

<b>Abstract Deadline:</b> November 11, 2011	<b>email</b> your abstract to: <a href="mailto:papers@lstc.com">papers@lstc.com</a>	<b>Notification:</b> Upon review, or no later than Dec 15, 2011
<b>Paper Deadline:</b> March 05, 2012	The presenter of each accepted paper will receive free admission to the conference, provided that the presenter registers for a room at the Hyatt Regency Dearborn under LSTC Conference registration.	

**Application Areas Being Accepted for Paper Submission:**

Aerospace	Heat Transfer	Seismic Engineering
Automotive Crashworthiness	Impact & Drop Testing	Ship Building
Ballistic & Penetration	Manufacturing Processes	Transportation
Biomechanics	Metal Forming	Virtual Proving Ground
Civil Engineering	Modeling Techniques	Nuclear Applications
Electro Magnetics	Occupant Safety	

Abstract Length: Approximately 300 words, please include figures, if possible  
 Paper Length: Maximum of 3000 words, single-spaced, on 8-1/2" x 11" paper  
 Format: A MS Word template will be provided  
 Contact: [papers@lstc.com](mailto:papers@lstc.com)

Livermore Software Technology Corporation  
 (925) 449-2500  
[www.lstc.com](http://www.lstc.com)  
[www.ls-dynaconferences.com](http://www.ls-dynaconferences.com)



**EnginSoft INTERNATIONAL  
CONFERENCE 2011  
CAE Technologies for Industry**

**EnginSoft INTERNATIONAL CONFERENCE 2011  
CAE Technologies for Industry**  
and ANSYS Italian Conference  
**Fiera Verona – Verona, Italy**  
**20–21 October 2011**

**Call for Papers:**

Mark your diary for one of the most important events in the global CAE Calendar ! The 2 parallel Conferences present a wide range of Virtual Prototyping applications, with a large presence of both technical experts and business decision makers.

The event organizers welcome contributions which describe applications of CAE Technologies in: mechanics, computational fluid dynamics, electromagnetism, acoustics, structural engineering, optimization, manufacturing process simulation, durability, fatigue, crashworthiness, CAD/CAE integration...

and for any industrial sector: from automotive to electronics, from aerospace/defense to the food and beverage industry...

A unique occasion to promote your work!

Papers can be submitted on-line.

**Deadline for abstract** submission: 30th June 2011

**Deadline for final paper** submission: 30th September 2011.

Visit [www.caeconference.com](http://www.caeconference.com) to plan your attendance, presentation and for more information about the exhibition



## Training Courses

CADFEM GmbH

The Complete Training Courses Offered Can Be Found At: <http://www.cadfem.de>

Please check the site for accuracy and changes.

Among the many course offering are the following:

### **Explicit structural mechanics with ANSYS Workbench and LS-DYNA**

Beside the trainings on all aspects of short time dynamics we offer also various seminars on new methods available in LS-DYNA.

- Seminar: Introduction to explicit structural mechanics with ANSYS LS-DYNA and LSTC LS-DYNA
- Seminar: Material modeling with LS-DYNA
- Seminar: Simulation of composites with ANSYS Composites PrepPost and LS-DYNA
- Online-Seminar: Contact modeling with LS-DYNA
- Online-Seminar: Modeling joints with LS-DYNA
- Seminar: Crash simulation with LS-DYNA

### **optiSLang**

Parametric simulation and optimization with optiSLang  
optiSLang is one of the most popular solver for optimization and robust design analyses

Online-Seminar: Advanced parametric simulation with ANSYS Workbench and optiSLang

### **AnyBody**

With AnyBody it is possible to simulate the kinematics of a human body like computing muscle forces for example.

- Seminar: Introduction to simulation of joint- and muscle- forces with AnyBody
- Seminar: Efficient coupling of AnyBody with ANSYS Workbench



## Training Courses

### Livermore Software Technology Corporation

LS-PrePost  
(no charge with Intro to LS-DYNA)  
CA 5/2/2011  
5/2/2011 Mon

Intro to LS-DYNA  
(3-1/2 days; half day on Friday)  
CA 5/3/2011 5/6/2011  
Tue-Fri

LS-PrePost  
(no charge with Intro to LS-DYNA)  
MI  
6/13/2011 6/13/2011 Mon

Intro to LS-DYNA  
(3-1/2 days; half day on Friday)  
MI  
6/14/2011 6/17/2011 Tue-Fri

Composite Materials  
CA  
6/21/2011 6/22/2011  
Tue-Wed

Material Modeling Using User-Defined  
Options  
CA  
6/23/2011 6/24/2011  
Thurs-Fri

Contact in LS-DYNA  
MI  
6/27/2011 6/28/2011  
Mon-Tue

LS OPT (Introduction;  
3 1/2 days half day on Friday)  
CA  
6/28/2011 7/1/2011  
Tue Fri

Classes Offered by Paul Du Bois and Len  
Schwer:

Concrete & Geomaterials  
10/4/2011 10/5/2011 Tue-Wed

Modeling & Simulation  
10/6/2011 10/7/2011 Thurs-Fri

Blast Modeling  
10/11/2011 10/12/2011 Tue-Wed

Penetration Modeling  
10/13/2011 10/14/2011 Thurs-Fri



## Training Courses

### Engineering Research AB ERAB

The Complete Training Courses Offered Can Be Found At <http://www.erab.se/courses/>  
Please check the site for accuracy and changes.

Webex seminar: New features in LS-DYNA R5.1.1  
New features in LS-DYNA, LS-PrePost and LS-OPT.

April 19 and May 4. Note, maximum 25 attendees can participate to each seminar.  
April 19, time 10.00 (Stockholm)  
May 4, time 10.00 (Stockholm)

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LS-PrePost 3, introduction  
September 12, 2011

LS-DYNA, implicit analysis  
October 11, 2011

LS-DYNA, introductory  
September 13, 2011

ANSA & Metapost, Introductory  
October 25, 2011

LS-DYNA, Adv. training in impact  
analysis  
September 20, 2011

LS-OPT, Optimization and robust design  
November 14, 2011



## Training Courses

### Alliance Services Plus (AS+)

The complete Training Courses offered can be found at  
<http://www.asplus.fr/ls-dyna>

Please check the site for accuracy and changes.

Among the many course offerings are the following:

#### **Other regular courses (in Paris) ...**

LS-DYNA Unified Introduction Implicit &  
Explicit Solver

June 20-23

November 21-24

LS-OPT & LS-TaSC Introduction  
October 19-20

Switch to LS-DYNA  
October 5-6

Switch from LS-PrePost 2.X to 3.X  
September 28  
December 14

LS-DYNA Advanced Implicit Solver  
September 27

LS-DYNA ALE / FSI  
October 17-18

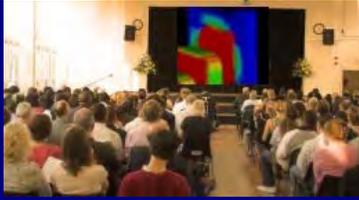
LS-DYNA SPH  
June 6-7  
November 8-9

LS-PrePost 3.0 – Advanced meshing  
capabilities  
September 29  
December 15

LS-DYNA User Options  
June 8-9

LS-DYNA – Plasticity, Damage & Failure  
– By Paul DU BOIS  
October 3-4

LS-DYNA – Polymeric materials – By Paul  
DU BOIS  
December 12-13



## Training Courses

Shanghai Hengstar  
Technology Co. Ltd.

Email: [info@hengstar.com](mailto:info@hengstar.com)

Phone: +86-021-61630122

2011	5	6	7	8	9	10	11	12
An Introduction to LS-DYNA(High Level)								
Crashworthiness Simulation with LS-DYNA								
Passive Safety and Restraint Systems Design								
LS-Prepost, LS-DYNA MPP, Airbag Simulation with LS-DYNA								
Pedestrian Safety and Passive Safety Simulation with LS-DYNA								
Crashworthiness Theory and Technology, Introduction of LS-OPT which is based on LS-DYNA								
Concrete & Geomaterial Modeling, Blast Modeling with LS-DYNA								
Frontal Restraint Systems according to FMVSS 208 and Euro NCAP								
Crashworthy Car Body disinterested, Simulation, Optimization								
Hot stamping with LS-DYNA								



## Training Courses

**KOSTECH**  
**June 21 to June 22, 2011**

### LS-DYNA professional Seminar in Korea

We are offering professional LS-DYNA seminar on June 21 to June 22, 2011 in Kostech. This seminar is focused on Foams, Elastomers, Thermoplastics simulation for 2 days. Foams and Elastomers are well settled in simulation but Thermoplastics simulation is still on the challenge research stage. Seminar attendees will get more information from the lecture and from questioning and answering.

### Material laws for polymers in LS-DYNA - June 21, 2011 – June 22, 2011

Lecturer: Paul.Dubois (LSTC)

Location: KOSTECH training center

**Registration due date: April 29, 2011**

Day	Time	Contents
<b>1</b>	09:00-10:30	Overview of foam materials
	11:00-12:30	Review of the German FAT research project How accurate can foam simulation get ?
	13:30-15:00	Data preparation for elastic foams (MAT_083)
	15:30-17:00	Unloading models and Simulation of airflow in porous foams
<b>2</b>	09:00-10:30	Overview of polymeric materials
	11:00-12:30	Thermoplastics : visco-elastic simulation (MAT_076)
	13:30-15:00	Thermoplastics : visco-plastic simulation MAT_024 and MAT_187
	15:30-17:00	Elastomers : simulation of rubbers (MAT_181)

Korea Simulation Technology Co.,Ltd.

Rm.804 Nam-Jung City Plaza 1th, 760 Janghang-dong,  
 Ilsandong-gu, Goyang-si, Gyeonggi-do, Korea

[www.kostech.co.kr](http://www.kostech.co.kr)

For further information please call us at +82 (0)31-903-2069







## Question 2

### LS-DYNA Users

### Challenge Your Knowledge

**Tobias Graf - DYNAmore GmbH**

Carrying out a FE simulation using an explicit time integration method, one of the main issues for stability is the upper limit of the time step, the so-called critical time step. This critical time step depends on a characteristic length of the elements and the wave speed, which is determined by the density and the stiffness of the material. The limitation of the time step is also known as the Courant-Friedrichs-Lewy (CFL) condition.

It is a necessary condition to make useful simulations. You may check detail in literature or at:

<http://www.dynasupport.com/tutorial/ls-dyna-users-guide/time-integration>.

By default, the appropriate time step is determined by LS-DYNA automatically. In addition, LS-DYNA allows the user to modify the time step size with several parameters.

- A. Please download the LS-DYNA input file beam.k  
(<http://www.dynasupport.com/links/fea-information-examples/beam.k>)
- B. Answer the following questions.

**The exercise intends to explain the CFL condition and its application in LS-DYNA.**

- 1.) Compute the critical time step of the beam and compare your result with the "smallest timestep" in LS-DYNA. Why is there a difference?
- 2.) How can you prompt LS-DYNA to output the analytical solution?
- 3.) Carry out a simulation, where  $DT2MS=-1.0E-3$ . Why is this time step not considered?
- 4.) How can you define a maximum time step size?
- 5.) What happens, if you carry out a simulation without mass scaling and  $TSSFAC=1.1$ ?



## Answer to Question #2

### LS-DYNA Users

### Challenge Your Knowledge

Solutions:

1a.) analytical:

$$dt = l \cdot \sqrt{\text{density} / \text{youngs\_modulus}} = 10.0 \cdot \sqrt{0.785E-5 / 210.0} = 0.19334E-02$$

LS-DYNA:  $dt = 0.17372E-02$

1b.) Scale factor for computed time step is by default TSSFAC=0.9

2.) Include \*CONTROL\_TIMESTEP keyword and define TSSFAC=1.0

3.) LS-DYNA chose the greatest possible time step and the computed critical time step is greater than the one defined via DT2MS.

4.) Define a load curve that limits the maximum time step size  
(\*CONTROL\_TIMESTEP, LCTM)

5.) Error termination due to "out-of-range (rotational) velocities" --> simulation gets unstable



## Students

### Formula One

If your University is working on a Formula One please consider listing it here. Send the information to [mv@feainformation.com](mailto:mv@feainformation.com)

#### **Brigham Young University:**



PACE Formula One Race Car Project begins a new year. The prior year was a success of many collaborative efforts. C. Greg Jensen, Professor, Mechanical Engineering, Brigham Young University and his students studied crash analysis and built a model. Among the collaboration Suri Bala led the LS-DYNA effort with his software, D3VIEW, an online collaboration tool for LS-DYNA projects

Last Year's Article [http://www.lstc.com/pdf/a\\_pace\\_car.pdf](http://www.lstc.com/pdf/a_pace_car.pdf)

#### **Slovak University of Technology**

Stuba GreenTeam is a racing team representing Slovak University of Technology in Bratislava. Our goal is to develop, design and manufacture a racing, participate on Formula Student electric and take the challenge to compete other racing teams from all over the world. [www.sgteam.eu](http://www.sgteam.eu) -



## North America

### Finite Element Analysis Consulting - Consultants

LS-DYNA Consulting    FEA Consultants

- Canada**                    Metal Forming Analysis Corporation - MFAC -  
                                  Contact: galb@mfac.com
- USA**                         Engineering Technology Associates, Inc  
                                  Contact: sales@eta.com
- USA**                         SE&CS  
                                  Contact: len@schwer.net
- USA**                         Predictive Engineering  
                                  Contact: george.laird@predictiveengineering.com
- USA**                         CAE Associates  
                                  Contact: info@caeai.com
- USA**                         AEG Product Engineering Services  
                                  Contact: support@engineering-group.com
- USA**                         APACS Services Inc.  
                                  Contact: apacs@comcast.net



## EUROPE

### Finite Element Analysis Consulting - Consultants

LS-DYNA Consulting    FEA Consultants

**DENMARK**            FaurConAps  
Contact: [faurholdt@faurcon.com](mailto:faurholdt@faurcon.com)

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**FRANCE**            ALYOTECH TECHNOLOGIES  
Contact: [nima.edjtemai@alyotech.fr](mailto:nima.edjtemai@alyotech.fr)

---

**FRANCE**            ALLIANCE SERVICES PLUS  
Contact: [v.lapoujade@asplus.fr](mailto:v.lapoujade@asplus.fr)

---

**Germany**            CADFEM GmbH  
Contact: [ls-dyna@cadfem.de](mailto:ls-dyna@cadfem.de)

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**Germany**            DYNAMore  
Contact: [uli.franz@dynamore.de](mailto:uli.franz@dynamore.de)

---

**ITALY**                EnginSoft SpA  
Contact: [info@enginsoft.it](mailto:info@enginsoft.it)

---

**Netherlands**        Infinite Simulation Systems, B.V  
Contact: [j.mathijssen@infinite.nl](mailto:j.mathijssen@infinite.nl)

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**Sweden**             Engineering Research AB  
Contact: [sales@erab.com](mailto:sales@erab.com)

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**UK**                    OVE ARUP & PARTNERS  
Contact: [brian.walker@arup.com](mailto:brian.walker@arup.com)

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## Asia Pacific

### Finite Element Analysis Consulting - Consultants

LS-DYNA Consulting    FEA Consultants

**AUSTRALIA**            Leading Engineering Analysis Providers, LEAP  
Contact: info@leapaust.com

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**China**                Ove Arup & Partners  
Contact:

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**China**                ETA China  
Contact:

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**INDIA**                nHance Engineering Solutions Pvt Ltd  
Contact: lavendra.singh@arup.com

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**INDIA**                EASi Engineering  
Contact: rvenkate@easi.com

---

**JAPAN**                JSOL Corporation  
Contact: cae-info@sci.jsol.co.jp

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**JAPAN**                Itochu Techo-Solutions Corp.  
Contact: ls-dyna@ctc-g.co.jp

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**KOREA**                THEME Engineering  
Contact: wschung@kornet.net

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**KOREA**                KOREAN SIMULATION TECHNOLOGIES  
Contact: young@kostech.co.kr

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## LS-DYNA Distributors

LS-DYNA is delivered with  
LS-OPT - LS-PrePost  
LSTC Dummy & Barrier Models

### Alpha Order by Country

<b>Australia</b>	Leading Eng. Analysis Providers - LEAP <a href="http://www.leapaust.com.au/">http://www.leapaust.com.au/</a> <a href="mailto:info@leapaust.com.au">info@leapaust.com.au</a>
<b>Canada</b>	Metal Forming Analysis Corp - MFAC <a href="http://www.mfac.com/">http://www.mfac.com/</a> <a href="mailto:galb@mfac.com">galb@mfac.com</a>
<b>China</b>	ETA China <a href="http://www.eta.com.cn/">http://www.eta.com.cn/</a> <a href="mailto:lma@eta.com.cn">lma@eta.com.cn</a>
<b>China</b>	OASYS Ltd. (software house of Arup) <a href="http://www.oasys-software.com/dyna/en">http://www.oasys-software.com/dyna/en</a> <a href="mailto:stephen.zhao@arup.com">stephen.zhao@arup.com</a>
<b>France</b>	ALYOTECH TECH. <a href="http://www.alyotech.fr">http://www.alyotech.fr</a> <a href="mailto:nima.edjtemai@alyotech.fr">nima.edjtemai@alyotech.fr</a>
<b>France</b>	ALLIANCE SVCE. PLUS - AS+ <a href="http://www.asplus.fr/ls-dyna">http://www.asplus.fr/ls-dyna</a> <a href="mailto:v.lapoujade@asplus.fr">v.lapoujade@asplus.fr</a>
<b>Germany</b>	CADFEM <a href="http://www.cadfem.de/en">http://www.cadfem.de/en</a> <a href="mailto:lsdyna@cadfem.de">lsdyna@cadfem.de</a>
<b>Germany</b>	DYNAmore <a href="http://www.dynamore.de/">http://www.dynamore.de/</a> <a href="mailto:uli.franz@dynamore.de">uli.franz@dynamore.de</a>
<b>Greece</b>	PhilonNet Engineering Solutions <a href="http://www.philonnet.gr">http://www.philonnet.gr</a> <a href="mailto:stavroula.stefanatou@philonnet.gr">stavroula.stefanatou@philonnet.gr</a>



## LS-DYNA Distributors

LS-DYNA is delivered with  
 LS-OPT - LS-PrePost  
 LSTC Dummy & Barrier Models

<b>India</b>	OASYS Ltd. (software house of Arup) <a href="http://www.oasys-software.com/dyna/en">http://www.oasys-software.com/dyna/en</a> <a href="mailto:lavendra.singh@arup.com">lavendra.singh@arup.com</a>
<b>India</b>	EASi Engineering <a href="http://www.easi.com/">http://www.easi.com/</a> <a href="mailto:rvenkate@easi.com">rvenkate@easi.com</a>
<b>India</b>	CADFEM Eng. Svce India <a href="http://www.cadfem.in/">http://www.cadfem.in/</a> <a href="mailto:info@cadfem.in">info@cadfem.in</a>
<b>Italy</b>	EnginSoft SpA <a href="http://www.enginsoft.it/">http://www.enginsoft.it/</a> <a href="mailto:info@enginsoft.it">info@enginsoft.it</a>
<b>Japan</b>	JSOL Corporation <a href="http://www.jsol.co.jp/english/cae">http://www.jsol.co.jp/english/cae</a> <a href="mailto:cae-info@sci.jsol.co.jp">cae-info@sci.jsol.co.jp</a>
<b>Japan</b>	ITOCHU Techno-Solutions Corp. <a href="http://www.engineering-eye.com/">http://www.engineering-eye.com/</a> <a href="mailto:ls-dyna@ctc-g.co.jp">ls-dyna@ctc-g.co.jp</a>
<b>Japan</b>	FUJITSU <a href="http://jp.fujitsu.com/solutions/hpc/app/lsdyna/">http://jp.fujitsu.com/solutions/hpc/app/lsdyna/</a>



## LS-DYNA Distributors

LS-DYNA is delivered with  
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LSTC Dummy & Barrier Models

<b>Korea</b>	Theme Engineering <a href="http://www.lsdyna.co.kr/">http://www.lsdyna.co.kr/</a> <a href="mailto:wschung@kornet.net">wschung@kornet.net</a>
<b>Korea</b>	Korea Simulation Technologies <a href="http://www.kostech.co.kr">http://www.kostech.co.kr</a> <a href="mailto:young@kostech.co.kr">young@kostech.co.kr</a>
<b>Netherlands</b>	Infinite Simulation Systems, BV <a href="http://www.infinite.nl/">http://www.infinite.nl/</a> <a href="mailto:j.mathijssen@infinite.nl">j.mathijssen@infinite.nl</a>
<b>Sweden</b>	Engineering Research AB <a href="http://www.erab.se/">http://www.erab.se/</a> <a href="mailto:sales@erab.se">sales@erab.se</a>
<b>Taiwan</b>	Flotrend Corporation <a href="http://www.flotrend.com.tw/">http://www.flotrend.com.tw/</a> <a href="mailto:gary@flotrend.tw">gary@flotrend.tw</a>
<b>Russia</b>	State Unitary Enterprise –STRELA <a href="mailto:info@ls-dynarussia.com">info@ls-dynarussia.com</a>

## LS-DYNA Distributors



LS-DYNA is delivered with  
LS-OPT - LS-PrePost  
LSTC Dummy & Barrier Models

<b>United Kingdom</b>	OVE ARUP & PARTNERS <a href="http://www.oasys-software.com/dyna/en/">http://www.oasys-software.com/dyna/en/</a> <a href="mailto:dyna.sales@arup.com">dyna.sales@arup.com</a>
<b>USA</b>	Livermore Software Tech. Corp. - LSTC <a href="http://www.lstc.com/">http://www.lstc.com/</a> <a href="mailto:sales@lstc.com">sales@lstc.com</a>
<b>USA</b>	Engineering Tech. Assc. Inc. – ETA <a href="http://www.eta.com/">http://www.eta.com/</a> <a href="mailto:sales@eta.com">sales@eta.com</a>
<b>USA</b>	DYNAMAX <a href="http://www.dynamax-inc.com/">http://www.dynamax-inc.com/</a> <a href="mailto:sales@dynamax-inc.com">sales@dynamax-inc.com</a>



## LSTC Mailing List For Models News



The LSTC Models Development Team has decided to formalize the procedure of distributing news about LSTC's models in order to handle the increased number of recipients.

Previously, you have received news about LSTC's models, via direct e-mails from Sarba Guha. The previous mailing list was retired, as of the first invitation to the new mailing list.

If you are interested in receiving the LSTC Models News:

1. **Subscribe** to this new mailing list at the following website:

[http://listserv.lstc.com/mailman/listinfo/lstc\\_models\\_news](http://listserv.lstc.com/mailman/listinfo/lstc_models_news)

2. **Receive:** You will receive an e-mail from the mail program with the following sender address:  
[lstc\_models\_news-request@listserve.lstc.com]  
with the subject line  
"confirm" and an alpha-numerical code.

3. **Confirm:** Per the instructions in that e-mail, please confirm your e-mail address

4. **Address Book:** To ensure receipt of emails from LSTC Models News, add  
[lstc\_models\_news@listserv.lstc.com]  
to your address book or safe list

5. **Confidentiality:** Your e-mail address will not be distributed outside of LSTC and only used for the LSTC Models News.

Thank you for your interest in our products!

**Best regards, LSTC Models Development Team**



## News Release

**CRAY**

### Cray and Sandia Establish a Supercomputing Institute for Learning and Knowledge Systems

SEATTLE, WA and ALBUQUERQUE, NM, May 12, 2011 -- Global supercomputer leader Cray Inc. (NASDAQ: CRAY) and Sandia National Laboratories today announced the formation of the Supercomputing Institute for Learning and Knowledge Systems (SILKS) -- a Cooperative Research and Development Agreement (CRADA) focused on knowledge discovery, data management and informatics computing.

Located at Sandia National Laboratories in Albuquerque, SILKS will leverage the strengths of both organizations by bringing together hardware resources, software assets and researchers that are proficient in knowledge discovery, data management and informatics computing at large scale.

Sandia and Cray are collaborating on the CRADA and establishing SILKS with three primary technical objectives:

- 1) Accelerate the development and application of high performance computing (HPC) technologies focused on solving knowledge discovery, data management and informatics problems at scale;
- 2) Collaborate to overcome the implementation barriers to a wider adoption of data-driven HPC computing technologies in knowledge discovery, data management and informatics;
- 3)

Apply the use of these technologies to enable discovery and innovation in science, engineering and for homeland security.

The main technical categories include software, hardware, services, outreach, and education and training.

"Sandia is a leading national lab with strong expertise in area of the data analysis," said Shoaib Mufti, director of knowledge management in Cray's Custom Engineering group. "Working together on SILKS will allow us to leverage Sandia's research and expertise in the area of large scale data analysis to build leading edge solutions for knowledge management. The concept of big data in the HPC environment is an important area of focus for Cray, and we are excited about the prospect of new solutions that may result from this collaborative effort with Sandia."

"This statement of intent for Sandia to collaboratively develop programs with Cray will leverage our respective strengths to originate new technologies for efficiently analyzing large data sets," said Bruce Hendrickson, Sandia manager of computational sciences and math. "These capabilities will be applicable to Sandia's fundamental science and mission work."

Cray and Sandia National Laboratories are each dedicated to enabling university faculty and students, as well as

government and industry scientists and engineers, to exploit the use of HPC for scientific discovery, knowledge discovery, United States competitiveness and national security. These joint interests and expertise make both organizations integral parts of this cooperative research effort.

A Cooperative Research and Development Agreement (CRADA) is a written agreement between a private company and a government agency to work together on a project. Created as a result of the Stevenson-Wydler Technology Innovation Act of 1980, as amended by the Federal Technology Transfer Act of 1986, a CRADA allows the Federal government and non-Federal partners to optimize their resources, share technical expertise in a protected environment, share intellectual property emerging from the effort, and speed the commercialization of federally developed technology.

### **About Cray Inc.:**

As a global leader in supercomputing, Cray provides highly advanced supercomputers and world-class services and support to government, industry and academia. Cray technology is designed to enable scientists and engineers to achieve remarkable breakthroughs by accelerating performance, improving efficiency and extending the capabilities of their most demanding applications. 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 surpass today's limitations and meeting the market's continued demand

for realized performance. Go to [www.cray.com](http://www.cray.com) for more information .

### **About Sandia National Laboratories**

Sandia National Laboratories is a multiprogram laboratory operated and managed by Sandia Corporation, a wholly-owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration. With main facilities in Albuquerque, N.M., and Livermore, Calif., Sandia has major R&D responsibilities in national security, energy and environmental technologies, and economic competitiveness.

### **Safe Harbor Statement:**

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 Cray's ability to leverage the SILKS collaborative effort to build leading edge solutions for knowledge management. 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 the collaboration under SILKS does not result in commercially viable or successful products for the Company when expected or at all, the risk that Cray is not able to expand and penetrate

its addressable market and such other risks as identified in the Company's quarterly report on Form 10-Q for the quarter ended March 31, 2011, and from time to time in other reports filed by Cray with the U.S. Securities and Exchange Commission. You should not rely unduly on these forward-looking statements, which apply only as of the date of this release. Cray undertakes no duty to publicly announce or report revisions to these statements as new information becomes available that may change the Company's expectations.

Cray is a registered trademark of Cray Inc. in the United States and other countries. Other product and service names mentioned herein are the trademarks of their respective owners.

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Sandia Media:



## News Release

### PANASAS

Panasas Chosen for US Department of Defense High Performance Computing Initiative  
Panasas® ActiveStor™ Storage and PanFS™ Parallel File System Deployed in Multiple DoD Locations as part of Modernization Program

SUNNYVALE, Calif., May 3, 2011 – Panasas®, Inc., the leader in high performance parallel storage for business-critical applications, today announced that it has been awarded a subcontract by Lockheed Martin to supply department-wide storage and parallel file system infrastructure as part of the Department of Defense's (DoD) High Performance Computing Modernization Program (HPCMP). The HPCMP supports DoD scientists and engineers by providing exceptional HPC systems, large-scale data storage and complementary technologies. With Panasas ActiveStor storage and the PanFS parallel file system, DoD research scientists and engineers will benefit from faster data access, more scalable storage, integrated data protection, and greatly simplified data manageability as they work to solve complex national defense challenges.

"We are pleased to be working with Lockheed Martin in order to provide premier parallel storage systems to the Department of Defense for its HPC Modernization Program," said Barbara Murphy, chief marketing officer of Panasas. "Panasas sets the standard for high performance parallel storage, and we are confident that ActiveStor and PanFS will deliver the desired results for the DoD."

Prior to its storage enhancement program, user archival and retrieval demands were pushing the performance limits of the DoD tape archival system. By deploying Panasas parallel storage, each site provides additional near-HPC storage to reduce data access times. By providing users additional time to analyze their computational data before having to archive it, the DoD HPCMP hopes to dramatically reduce the cost associated with storing unnecessary data. Because Panasas provides RAID data protection as an integral part of its parallel file system, the DoD HPCMP does not need additional third-party RAID controllers, thus reducing cost and complexity while eliminating performance bottlenecks and single points of failure.

Panasas storage is deployed at the following DoD HPC centers:

- Army Research Laboratory DSRC at Aberdeen Proving Ground, MD
  - U.S. Air Force Research Laboratory DSRC at Wright Patterson AFB, OH
  - U.S. Army Engineer Research and Development Center DSRC in Vicksburg, MS
  - Navy DoD Supercomputing Resource Center at Stennis Space Center, MS
- About Panasas

Panasas, Inc., the leader in high-performance parallel storage for business-critical applications, enables customers to rapidly solve complex computing problems, speed innovation and accelerate new product introduction. All Panasas storage products leverage the patented PanFS™ storage operating system to deliver

superior performance, data protection, scalability and manageability. Panasas systems are optimized for demanding storage environments in the energy, government, finance, manufacturing, bioscience and higher education industries. For more information, visit [www.panasas.com](http://www.panasas.com).

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## News Release SGI

### **SGI Expands Support for Lustre File System**

#### **Leveraging Years of Storage Expertise, SGI Now Offers Full End-to-End Lustre Coverage**

FREMONT, Calif. — May 9, 2011 — SGI (NASDAQ: SGI), a trusted leader in technical computing, today announced that it is expanding its support of the Lustre® file system to include Level 3 support, and now provides complete end-to-end coverage for its customers. Lustre is a massively parallel file system, capable of supporting compute clusters of thousands of nodes and many petabytes of storage. The addition of Level 3 support brings the SGI® Lustre® solution for scale-out computing environments to a support level equivalent to CXFSTM, SGI's own high-performance scale-up clustered file system.

As part of its continued investment in Lustre, SGI also recently joined OpenSFS, a non-profit mutual benefit organization dedicated to high-end open source file systems. OpenSFS will initially focus on the Lustre file system with goals to increase collaboration, communicate requirements to Lustre developers, and support a release of Lustre fashioned to the group's needs.

"OpenSFS was designed to create a community around open-source scalable file systems, focusing on further stabilizing Lustre and extending it to

serve the needs of next generation exascale machines," said Norman Morse, OpenSFS president and CEO. "SGI's investment in Lustre and participation in this organization is a valuable contribution to that effort."

The increase in SGI technical support for Lustre also includes the recent introduction of Data Migration Facility (DMF) Direct Archive, which extends the power of DMF storage tier virtualization directly to Lustre and other POSIX® file systems. By opening the tiered archive environment to Lustre, DMF can be used as an archive environment for high-speed Lustre file systems. This leverages the significant cost benefits of tiered storage achievable with DMF while easing the management requirements associated with traditional archive and backup.

"Lustre is the clear choice of many of our customers who are deploying scale-out solutions built around SGI® Altix® ICE 8400 and SGI® Rackable™ servers," said Jose Reinoso, vice president of storage engineering at SGI. "By investing resources in expanding our support model similar to what we do for scale-up environments with CXFS, SGI now provides complete end-to-end coverage for Lustre clients, enhancing

our offering and providing deeper solution support."

SGI has offered Level 1 and Level 2 support for several years. The addition of full Level 3 support now facilitates more rapid problem solving and development for SGI customers. With its powerful scale-out capabilities, Lustre is the file system used in 15 of the top 30 supercomputers in the world. NASA Ames and many other large SGI customers in government, oil and gas, and research depend on Lustre for their scale-out needs.

#### About SGI

SGI, a trusted leader in technical computing, is focused on helping customers solve their most demanding business and technology challenges. Visit [www.sgi.com](http://www.sgi.com) for more information.

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## News Release

ESI

### **ESI Group acquires Comet Technology Corporation's IP including "COMET Acoustics" software for low frequency noise and vibration modeling**

Strengthening of ESI Group's Vibro-Acoustics software - Substantial benefits to ESI and Comet Technology Corporation's combined customer base.

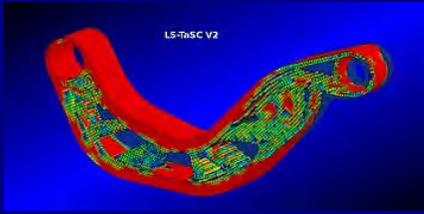
The IP of Comet Technology is the result of over 20 years of continual research and development. The Comet solver originated in the advanced consulting group of Automated Analysis Corporation. Under the technical leadership of industry veteran Dr. Ravi Raveendra, Comet established a global user base that includes many of the world's top companies, universities and research institutes. The low frequency Boundary Element solvers developed by Comet Technology (CTC) contain many unique features resulting from contract research programs with NASA, other US government agencies, and the automotive industry. These solvers are a central part of the acquisition and complement the existing solvers in ESI Group's vibro-acoustics software VA One and multi-domain virtual testing software Virtual Performance Solution.

"We are pleased to announce our collaboration with ESI Group on the integration of Comet Technology IP and vibro-acoustic modeling technologies," said Dr. Ravi Raveendra, President, Comet Technology Corporation. "The acquisition will enable us to work together on the development of the next generation of vibro-acoustic solvers."

With over 25 years of experience in the development of Boundary Element Methods (BEM), Dr. Raveendra further strengthens ESI's global vibro-acoustic research and development team.

"We are looking forward to working closely with Ravi and Comet Technology's R&D team" said Dr. Phil Shorter, Director of Vibro-Acoustic Product Operations at ESI Group. "The integration of Comet further strengthens our Vibro-Acoustics solutions and will benefit our combined customer base".

For more information on ESI's vibro-acoustics solutions, visit: [www.esi-group.com/VAOne](http://www.esi-group.com/VAOne); for Virtual Performance Solution, visit: [www.esi-group.com/virtual-performance-solution](http://www.esi-group.com/virtual-performance-solution). **About ESI:** ESI is a pioneer and world-leading provider in virtual prototyping that take into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 800 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit [www.esi-group.com](http://www.esi-group.com) /.



ARCHIVE NEWS Article

## LS-TaSC™ Version 2

### Topology Design

using LS-DYNA®

**Author & Developer Willem Roux, PhD, [willem@lstc.com](mailto:willem@lstc.com)**

**LS-Dyna - Topology And Shape Computation - LS-TaSC**

The second version of LS-TaSC has been released by Livermore Software Technology Corporation.

LS-TaSC is a tool for the topology optimization of non-linear problems involving dynamic loads and contact conditions. It can be used to find a concept design for most structures analyzed using LS-DYNA.

For more information, contact [sales@lstc.com](mailto:sales@lstc.com)

#### General capabilities

- Solid design using first-order hexahedrons and tetrahedral elements
- Shell design using first-order quadrilateral and triangular elements
- Global constraints
- Multiple load cases
- Tight integration with LS-DYNA
- Large models with millions of elements

#### Geometry definitions

- Multiple parts
- Extrusions
- Casting, one sided
- Casting, two sided
- Symmetry

#### Postprocessing

- Design histories
- LS-PREPOST plots of the geometry evolution and the final design

#### Casting Example

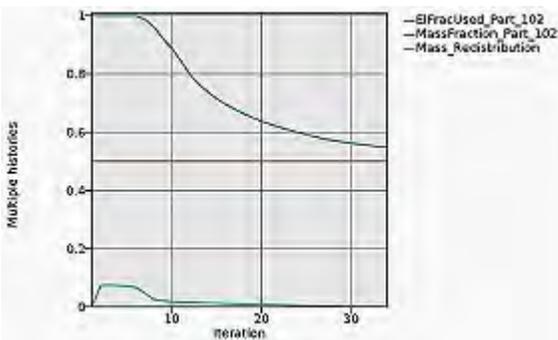
This example is a solid part to be manufactured as a casting, which was accordingly imposed as a casting geometry definition. Weight (material) was to be removed from the structure to obtain the best use of the material. The procedure accordingly computed an optimal design by strengthening stressed regions of the structure and removing redundant material. Alternative, this design procedure can also be viewed as computing a structure with the best load path for the given structural use.

The geometry and loading conditions for this component are shown in Figure 1. The FE model has about 60 000 elements and a single linear implicit load case as shown was considered.

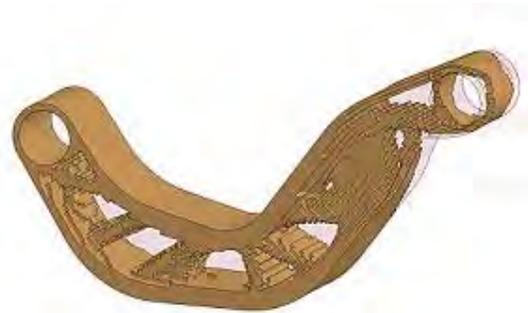


**Figure 1: The initial geometry and loading conditions.**

The convergence history is shown in Figure 2, while final design is shown in Figure 3. The mass fraction specified in the history is the amount of material that the user specified should be kept – in this case half (a mass fraction of 0.5) of the structure was scheduled to be retained. The element fraction used is the fraction of the original number of elements in the part used at any point in the design cycle – this value will therefore converge to close to the requested mass fraction. The mass redistribution is the fraction of the overall mass moved around in the design cycle – a small number indicates convergence of the procedure.



**Figure 2: Convergence history**

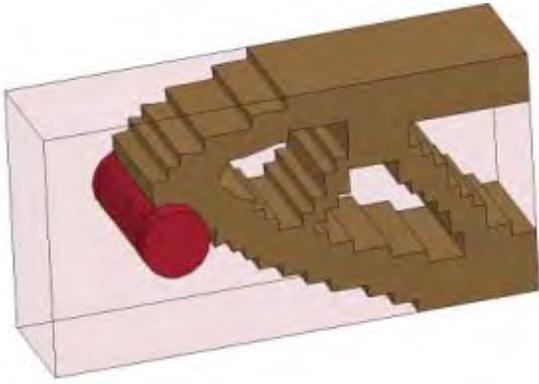


**Figure 3: Final design with casting geometry definition.**

### Nonlinear Mechanics Example

It is important to model the nonlinear effects correctly, because the optimal material layout may depend on them. Fortunately, nonlinear phenomena, such as contact definitions, do not require special consideration in LS-TaSC. Competing algorithms based on design sensitivity derivations requires you to create a linear, implicit problem which may not reflect the correct load path.

In Figure 4 a design with a contact definition is shown. No special inputs to LS-TaSC or changes to the LS-DYNA input file were required to perform the design optimization – you merely have to identify the design part in the LS-TaSC user interface.



**Figure 4 Problem with contact definition. No special treatment is required for nonlinearities such as contact.**

### **Summary**

Version 2 of LS-TaSC is a major step forward for the topology optimization of large models involving dynamic loads and contact conditions.