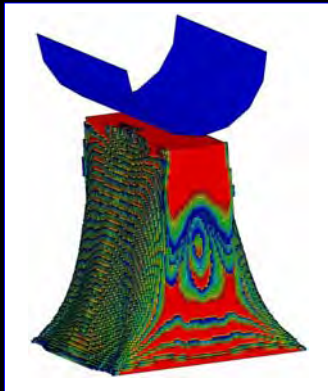


# *FEA* Information [www.feainformation.com](http://www.feainformation.com)

Engineering Journal and Website Resource

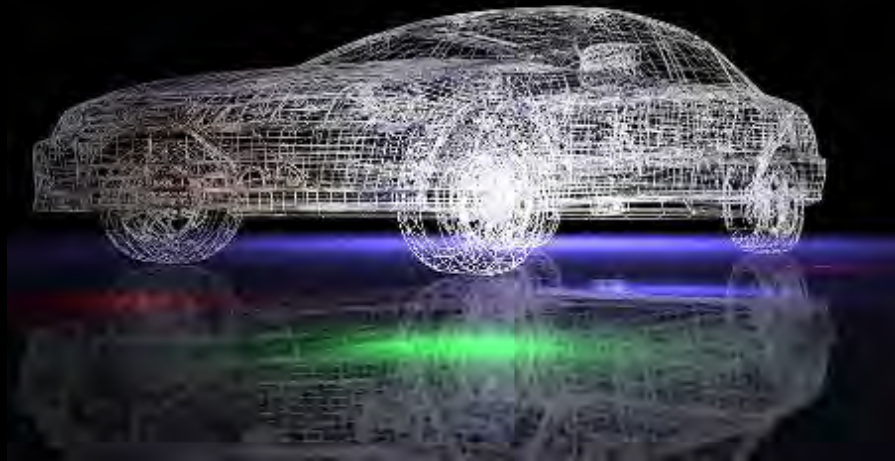
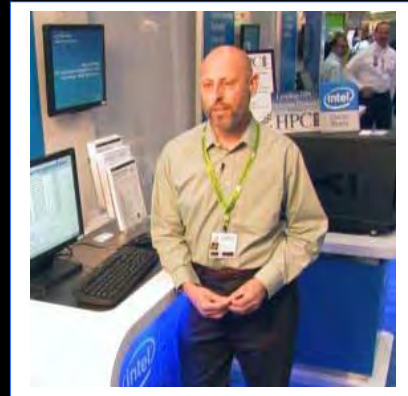
Revised Edition due to formatting errors

CRAY CX1



Topology Optimization

Dr. Wayne Mindle, LSTC -  
LS-DYNA and The Intel  
Cluster Ready Program





## FEA Information Announcements

Hi everyone – after numerous notifications and requests for a revised edition I am sending the FEA news again. What transpired was typing in an older version of a program and creating a pdf, which looked fine. For the final version I used an updated version of the software wherein older edits were not recognized by the newer version - the pdf was created with errors. Marsha Victory

### LS-DYNA Conferences

#### 7<sup>th</sup> EUROPEAN LS-DYNA CONFERENCE 2009

May 14<sup>th</sup> & 15<sup>th</sup> 2009, Salzburg, Austria

#### 11<sup>th</sup> International LS-DYNA User's Conference 2010 corrected dates are:

June 6<sup>th</sup> -8<sup>th</sup> - Hosted by Livermore Software Technology Corp

The Hyatt Regency, Dearborn

**New area/contributor – India News/Ramesh Venkatesan:** Ramesh will be bringing technology news, events, and announcements specifically relating to India. Additionally, Ramesh is with EASi, one of the LS-DYNA distributors in India.

### LS-DYNA Articles:

1. On Topology – Tushar Goel
2. On keyword \*Perturbation – Willem Roux
3. On LS-DYNA's Sheet Metal Stamping One-Step – Xhinai Zhu

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# 7<sup>th</sup> EUROPEAN LS-DYNA CONFERENCE

14<sup>th</sup> - 15<sup>th</sup> May 2009, Salzburg, Austria

## Invitation

We cordially invite you to the 7th European LS-DYNA Users Conference, to be held May 14<sup>th</sup> - 15<sup>th</sup>, 2009, in Salzburg (Austria). The conference is an ideal forum for LS-DYNA and LS-OPT users to present, share and discuss experiences, to obtain information on upcoming features, and to learn more about new application areas.

## Highlights:

- More than 140 papers from users and developers worldwide
- Papers from both, academic and industrial parties
- Numerous LS-DYNA related topics are covered.
- Contributions about crash applications, metal forming processes, occupant and pedestrian safety, material modeling for metals, plastics, foams, and composites.
- Within five sessions aspects of optimization and stochastic analysis will be discussed.
- Several sessions dealing with new developments regarding element technology, implicit capabilities, SPH, ALE, and EFG.
- Numerous papers about CAE software that support the daily work with LS-DYNA and about new developments in IT used in connection with LS-DYNA.
- Exhibition featuring the latest software and hardware

developments related to LS-DYNA and LS-OPT

- Pre and post conference seminars - held in English language and will take place in Salzburg

## Keynote presentations:

- J. Hallquist (LSTC),
- Prof. J. Eberhardsteiner (University Vienna),
- J. Kohler (Daimler),
- W. Volk (BMW),
- M. Seitzberger (Siemens),
- T. Zeguer (Jaguar Cars),
- F. Sautter (Dr.-Ing. h.c. F. Porsche),
- M. Nucci (Snecma),
- Prof. M. Langseth (NTNU).

## Agenda including abstracts available at

<http://www.dynamore.de/conferences/eu7/agenda>

## More Information and Registration

<http://www.dynamore.de/conference>

The Conference is organized by DYNAMore with assistance from

- Alyotech,
- Arup,
- ERAB,
- LSTC.

Contact:

E-Mail: [cf09@dynamore.de](mailto:cf09@dynamore.de)

# Topology Optimization using LS-OPT®/Topology

Author: Tushar Goel - LSTC, Livermore CA

Topology optimization is a first-principle based optimization method to develop new concepts in engineering problems. Most previous studies in topology optimization have focused on designing linear structures with static loading conditions but there is relatively little work on handling non-linear problems involving dynamic loads, like those observed in crashworthiness optimization. The topology optimization in the context of impact analysis is a very complex problem due to non-linear interactions among material non-linearities, geometry, and the transient nature of the boundary conditions. Conventional methods are not practical for solving these non-linear topology optimization problems due to the high computational cost and the lack of sensitivity information.

A heuristic topology optimization method developed at the University of Notre Dame, known as hybrid cellular automata, has shown the most potential in handling topology optimization problems for

crashworthiness problems. This method updates the design variable of an elements based on the objectives and constraint function information from its neighbors. No gradient information is required. The simplicity and effectiveness of this method for both two- and three-dimensional problems has made it a suitable choice for implementation in LS-OPT® for topology optimization. This method has been applied to a host of linear and non-linear examples.

The first application example is a statically loaded structure with linear behavior. While the bottom section is fixed, a uniformly distributed load is applied to the top. The geometry is meshed using 125k elements (1mm element size). Each linear-static analysis using the LS-DYNA implicit solver takes approximately 75s on a 2.66GHz Intel Xeon CPU with 4GB memory.

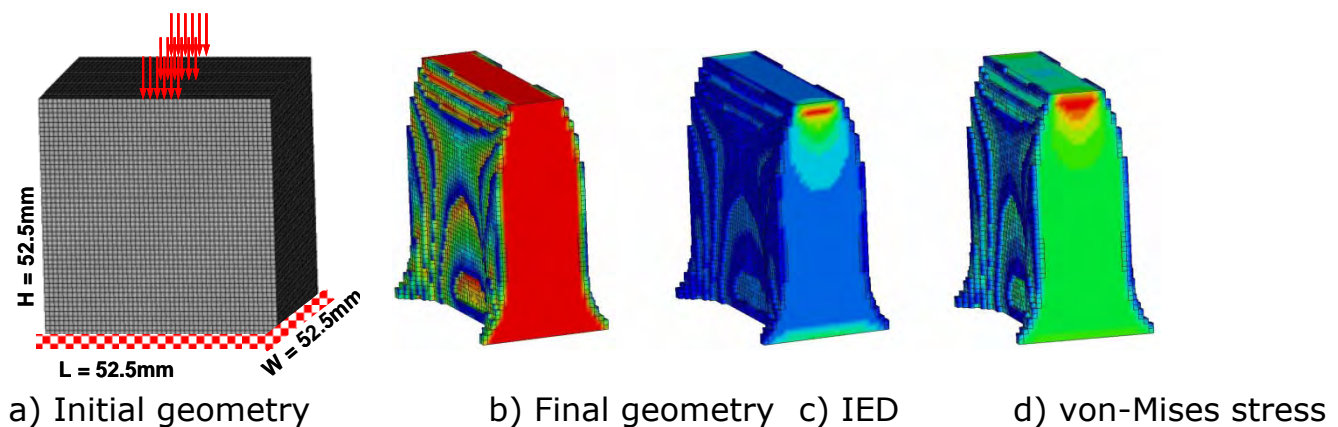


Figure 1: Topology optimization of a statically loaded structure (125k elements).

The initial and final geometry obtained using the HCA method along with the resulting internal energy density (IED) and von-Mises stress contours are shown in Figure 1. The



structure evolves to one with a homogenous material distribution and a reasonably uniform distribution of loads as depicted by the internal energy density and stress contours.

The initial geometry shown in Figure 1 is also analyzed by considering a dynamic load case when a pole hits the block with an initial velocity of 8.9m/s. The simulation is analyzed for 3ms. For this example, a refined mesh of one million elements (0.5mm element size) was used. The LS-DYNA® MPP explicit solver takes

approximately 90 min on 32 processors of an SGI cluster to solve this problem. The final result, shown in Figure 2, clearly indicates the double-arch structure of the optimized shape and a relatively homogenous distribution of the internal energy density

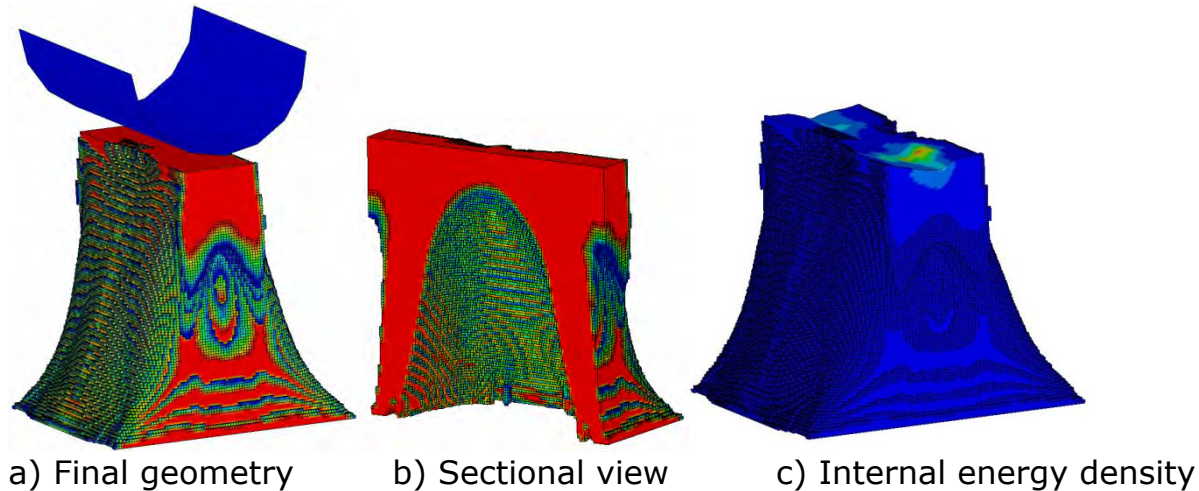


Figure 2: Final geometry and internal energy density obtained using the HCA based topology optimization method for dynamically loaded structures (1 million elements).

While the results shown here provide a glimpse of the applicability of the topology optimization method available in LS-OPT/Topology, the capabilities of the tool also extend to handling

- non-box shaped domains,
- extruded design domains, and
- multiple loading conditions.

This topology optimization method is capable of handling large models

incorporating both linear and non-linear structural analysis as applied to the industrial applications. The beta version of the LS-OPT®/Topology tool (without the graphical user interface) would be released by the end of April 2009. The first production version of the LS-OPT®/Topology tool including the graphical user interface should be available by the end of December 2009.

## Event & Technology India News - Ramesh Venkaten

FEA Information News would like to welcome and introduce Ramesh. He will be concentrating on bringing LSTC's LS-DYNA, LS-OPT, LS-PrePost's latest technology to the engineering community in India. With a Master of Engineering Degree and over ten years experience with LS-DYNA and other software, Ramesh has already been supporting India & Thailand's commercial industry and educational institutions.

Among his projects have been analysis in: head impact, side impact, drop test, hemming analysis of a wash basin, forming analysis optimization, meshing, and sheet metal forming using LS-DYNA, LS-OPT, LS-PrePost.

Additionally he has expertise in ANSA, and other software programs.

Please look for his informational articles in our FEA Information News editions.

To reach Ramesh: [rvenkate@easi.com](mailto:rvenkate@easi.com)

### **Ramesh:**

Through the end of April I'm at LSTC headquarters, Livermore, CA, working with the technical support staff, attending the ALE Advanced Applications Course, discussing the latest developments with the LS-DYNA, LS-OPT, LS-PrePost developers and working with sales & marketing. Meeting Dr. John O. Hallquist has been one thing I've always wanted to accomplish. Now, personally speaking and discussing LSTC's software with Dr. Hallquist I know that I'm bringing back to the engineering community the latest technical information and new features available.

In discussions with Dr. Xinhai Zhu, I've learned about LS-DYNA's one-step solution in metal forming, referenced in Dr. Zhu's article in this month's FEA news.



Morten Jenson, Ramesh Venkatesan,  
Wayne Mindle

Sincerely,

Ramesh Venkaten  
[rvenkate@easi.com](mailto:rvenkate@easi.com)

## A Brief Introduction to One-Step Solution – Dr. Xhinai Zhu

In sheet metal stamping solution, one-step solution has been extensively used for different purpose. Some people use this approach to obtain initial blank size, while the others use it to have rough approximation of formability.

Recently, this capability has been added to LSDYNA®. The sequence of performing one step solution is that: first, the 3-D part is project to flat plane; second, the

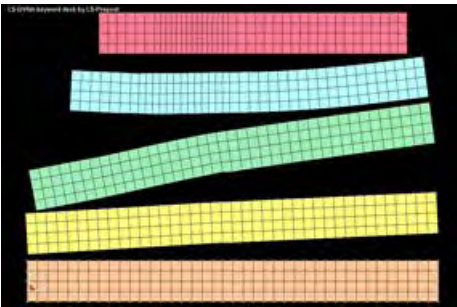
final flat geometry is obtained by using force balance.

The keyword to activate this feature is: \*CONTROL\_IMPLICIT\_ONESTEP. It supports both quad and triangle elements.

Many benchmarks have been conducted to validate this new feature. In the following, two examples will be shown: one is flattening of U-Channel, and the other is a hood-inner.

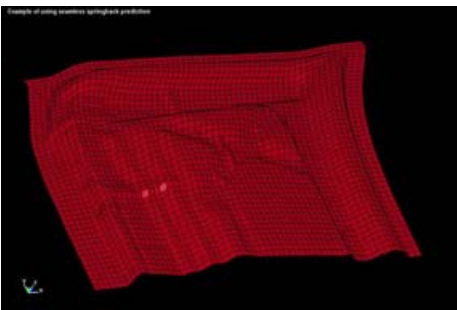


Figure 1. Deformed U-Channel (only half is shown due to symmetric condition)



1. Red - Initial guess
2. Blue - Step 2
3. Green - Step 3
4. Yellow - Step 4
5. Beige – Final Step

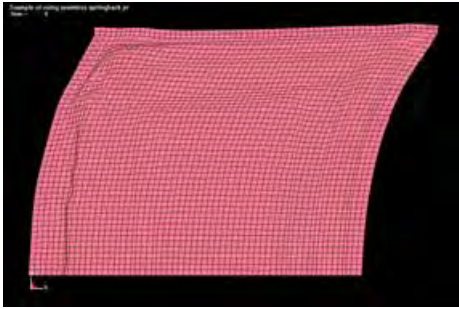
Figure 2. The flattening process of this U-Channel.



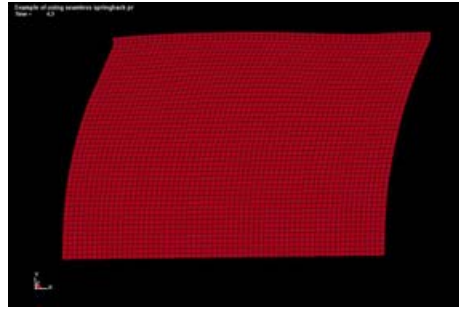
Purpose: Evaluate code developments  
production applications

Figure 3. Deformed hood-inner





Initial Guess



Final mesh

Figure 4. Flattening of hood-inner

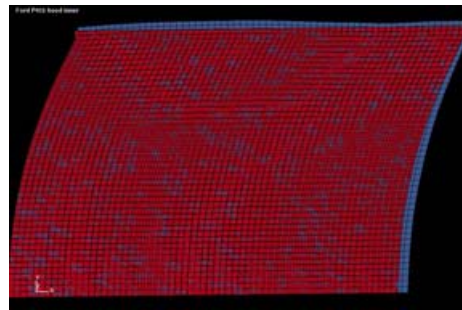


Figure 5. Comparison of the predicted blank size (the red one) and the real blank size (the blue one)

From the benchmark tests, it is found that the one-step approach implemented is now working.

## China LS-DYNA News – ETA China

Grace Su – msu@eta.com.cn

The 4th Auto Safety Seminar & Airbag Training held on April 18-21, 2009 at Yi Duo Hotel, Shanghai, China was organized by the Mechanical Industry Automation Institute of Chinese Mechanical Engineering Society, and ETA-China.

Attending as the keynotes speakers for the training were:

Dr. James Cheng, Safety Manager of Ford gave a detailed presentation on analysis about the evolution of global OEM manufactures' - their needs & challenges, as well as on advanced automotive safety technology.

Dr. Isheng Yeh, China Technical Training/Support Manager of LSTC gave an exciting presentation to introduce the latest features and development trend of LS-DYNA, including the solver overview and update, LS-DYNA models for safety application, FHM and barrier, safety analysis, LS-OPT and LS-Pre/Post.

Livermore Software Technology, US - LS-DYNA, LS-PrePost, LS-OPT Authorized Distributors in China: ETA, CHINA – ARUP - NEC

More than 50 engineers participated in this seminar; they are from Foton, FAW, Great Wall Motor and major auto parts suppliers. Many other industries were represented by attendees.

There was an active discussion between the experts and participators, this training not only promotes the development of auto safety technology, but also provides a chance for all participators to make technical exchange.



## Intel® Microarchitecture - Code-named Nehalem for LS-DYNA

Timothy C Prince, PhD ME, Intel Developer Relations

Anthony Hu, Intel Taiwan

April 4, 2009 - Power Point Presentation

### AGENDA

- Intel® microarchitecture code-named Nehalem
  - Intel® Xeon® Processor 5500 series dual quad
  - Intel® Core™ i7 processor single quad core CPU
- Special features
- RAM speed vs slots in use
- Affinity Settings
- CPU/RAM speed performance range
- OS support
- Summary

### Intel® micro-architecture code-named Nehalem: memory config

- 8 cores total: Intel® Xeon® 5500 series (2 CPU)
  - Primary HPC marketing emphasis
  - 3 channels, 18 RAM slots total (see later slide)
  - Also, a half width board for clusters:
    - 3 channels 6 slots or 2 channels 8 slots total
- Intel® Core™ i7 processor, 1 CPU, 4 cores total:
  - 3 channels in models recommended for LS-DYNA
  - 4 RAM slots: 3 channels 3 slots or 2 channels 4 slots
  - 6 RAM slots: 2 slots/channel

### Special Features

- Intel® Turbo Boost Technology
  - Extra CPU speedup when within power/temp limits
  - Intel® Xeon® processor 5500:
    - +7% performance/+15% increased power
    - (topcrunch.org benchmarks, 2.93Ghz base)
- Hyper-Threading "HT" Technology
  - Hardware supports 2nd thread per core
  - Recommend disable in BIOS for LS-DYNA

### Intel® micro-architecture code-named Nehalem: RAM speed support

- 3 slots maximum per channel per package/socket
  - 2GB (or greater) sticks recommended
  - 3rd slot typically left empty (unless needed for LS-DYNA implicit)
- 1 slot/channel: DDR3-1333 (higher models only)
  - 1 CPU Intel® Core™ i7 typical 6GB
- 2 slots/channel: DDR3-1066
  - Xeon® 5500 18 or 24GB, using 2GB DDR3
- 3 slots/channel: DDR3-800
  - Xeon® 5500 (for LS-DYNA implicit) supports 36GB of 2GB sticks
- Validated memory testing:
  - [www.intel.com/technology/memory/ddr/valid/ddr3\\_UDIMM\\_RDIMM\\_results.htm](http://www.intel.com/technology/memory/ddr/valid/ddr3_UDIMM_RDIMM_results.htm)

### Affinity Settings

- 1 CPU Intel® Core™ i7: no affinity option needed
  - All 4 cores equal, not paired as in Core™ 2 Quad
- 2 CPU Intel® Xeon® 5500 processor series
  - SMP, all cores used, HT disabled
    - Set KMP\_AFFINITY=compact
  - Intel MPI: defaults OK
  - Intel MPI/hybrid, HT disabled
    - export I\_MPI\_PIN\_DOMAIN=omp
    - export OMP\_NUM\_THREADS=8
  - HP-MPI, all cores used, HT disabled
  - cpu\_bind default OK
- HT enabled (not effective use of LSTC license)
  - Set explicit table to use 1 thread per core

### Intel® Xeon® processor 5500 series performance range

mpp971sR321 linux

Neon	8p	16p	
NHM2.80Ghz/1066		838s	454s
NHM2.93Ghz/1333		795s	439s
Ratio	1.05	1.03	

3car	8p	16p	
NHM2.80Ghz/1066		11596	6001
NHM2.93Ghz/1333		10823	5601
Ratio	1.07	1.07	

2.8Ghz: Nick Meng, Intel Mich; 2.93: Horikoshi, Intel Japan

### **Primary recommended OS**

- Red Hat or CentOS
  - 5.2 minimum for Intel® Core™ i7 processor
  - 5.3 for Intel® Xeon® processor 5500 series
- SLES
  - 10.2 x86\_64 recommended
  - SLES11 for future
  - OpenSuSE OK, but not fully validated by Intel
- Windows
  - X64 (all versions) recommended
  - Intel tests primarily Server 2008
  - 32-bit well tested also
  - Windows 7 good for HyperThread or dual quad CPU

### **Summary**

- Intel® micro-architecture code-named Nehalem doubles Intel® Core™ 2 Quad core performance
- Intel® Xeon® 5500 series for large SMP/MPP jobs
- Current LS-DYNA releases for Xeon® supported

## CRAY CX1™ supercomputer - HPC performance to everyone

A compact, desktside system that plugs into a standard wall outlet.

Right size performance, functionality, cost and support packages.



**Take the HPC cluster out of the data center and place it next to your desk:**

- Desktside or Rack-Mount Form Factor
- Standard office power
- Active noise reduction
- Up to Eight Blades per Chassis  
Mix-and-match Compute, Graphic, Storage and GPGPU blades.

Designed for individuals and departmental workgroups to harness HPC without the complexity of traditional clusters.

Delivering the power of a high performance cluster with the ease-of-use and seamless integration of a workstation the CRAY CX1 supercomputer is equipped with powerful Intel® Xeon® processors and integrated with Windows® HPC Server® 2008 or Linux-based Rocks+, the Cray CX1 delivers the power of a high performance cluster.

The CRAY CX1 offers a complete set of support choices that are designed to meet your individual needs. You select the offering that is right for you and your product:

### **Standard CX1 Hardware Service**

- Three years parts and labor
- Seven days per week, 24 hours per day  
(call center or email support)
- Next business day onsite response time

### **OS Software Service Options Available for Linux and Microsoft**

- One or three year options
- Seven days per week, 24 hours per day  
(call center or email support)
- Two business day response time

**For information e-mail:**

[cx1info@cray.com](mailto:cx1info@cray.com)



## Specifications

### Chassis Enclosure

Form Factor: 7U modular enclosure (rackmount and/or pedestal)

Dimensions: W 12.22" (31.04cm) x H 17.5" (44.45cm) x D 35.5" (90.42cm)

Weight:

- Chassis with all I/O modules (Gigabit and InfiniBand) and power supplies - 62.2lbs (28.3kg)
- Chassis fully loaded with blades and I/O modules - 136.6lbs (62kg)

### Power Supplies

1600 watt hot-plug power supplies

- Based on high efficiency and "power factor correction"

1600W @ 120V = 13.33A (92% efficiency: 14.40A)

1600W @ 220V = 6.66A (92% efficiency: 7.19A)

- Redundant power supplies support 2+2 (fully populated, full redundancy) or 1+1 (half populated, full redundancy) or 1 or 2 + 0 (non-redundant) modes

- Power supplies require 110 or 200+ volt AC input

Dimensions: W 4.274" (108.56 mm) x H 1.543" (39.19 mm) x D 21.52" (546.61 mm)

Weight: 5.9 lbs (2.68 kg)

### Cooling Fans

Chassis comes standard with hot pluggable, redundant fan modules based on Smart Energy Technologies

### Input Device

Front control panel with touch screen graphical LCD

- Supports initial configuration wizard
- Local server nodes, enclosure, and module information

Two USB "pass-throughs" in front and back

### Enclosure I/O Modules

Up to two fabrics, featuring Ethernet switches providing uplink scalability and high speed InfiniBand modular switches (8 ports SDR, 12 or 24 ports DDR)

#### **Ethernet Switch**

16 RJ-45 auto-sensing 10/100/1000 Mbps UTP ports

- Bandwidth: 32 Gbps (non-blocking)
- Forwarding Mode: Store-and-forward
- Forward rate: 10 Mbps port = 14,800 packets/sec; 100 Mbps port = 148,000 packets/sec; 1000 Mbps port = 1,488,000 packets/sec
- Latency: 100 to 100 Mbps = 40  $\mu$  (max); 1000 to 1000 Mbps = 10  $\mu$  (max)

- Queue buffer memory: 512 Kbytes per port

- Status LED: Power, activity and link indicators for each port, link and speed indicators built into each RJ-45 port

#### **IBS12DDR/IBS24DDR 12 or 24 Ports InfiniBand Switch**

IBS12DDR - Twelve -4X 10/20Gbps (SDR/DDR) CX4 ports with support for optical adapters and cables

- Subnet management software
- Embedded management with Linux OS with Ethernet and secure

shell access

- Ultra-low latency < 180ns
- InfiniBand v1.2 compliant
- Dual redundant auto-sensing
- Status LED: Power, activity and link indicators for each port, link and speed indicators built into each CX4 port
- IBS24DDR - Optional 12-4X 10/20Gbps CX4 Ports daughter card (for a total of 24 ports)
- 480Gb/s (SDR) or 960Gb/s (DDR)

**Management** ***Web-based Remote System Management***

Graphical Mode Console Redirection

Performance monitoring

System Management: Local System Management Application, Windows Management Instrumentation (WMI)

Reports: System Information, Health Log, Administration, Application for local management

Pager Alert and E-mail Alerts

SNMP support

Health monitoring: CPU and system temperatures, system voltages, CPU and chassis fans, power failure

## Creating imperfections in LS-DYNA® using the \*PERTURBATION keyword

Willem Roux, Livermore Software Technology Corporation, [willem@lstc.com](mailto:willem@lstc.com)

Imperfections for buckling and other instability problems can be created in LS-DYNA® using the \*PERTURBATION keyword. These imperfections and perturbations are also known as stochastic fields. Modeling these imperfections is crucial for instability problems such as buckling analysis.

The intended class of problems is those problems whose results depend on getting the imperfections or initial conditions correct. Modeling the observed imperfections and stochastic fields correctly is an important step in getting the mechanics correct, which in turn will allow analysts to validate more results in the realm of unstable and stochastic behavior.

The latest LS-DYNA release (R4) includes a general ability to create stochastic fields from correlation functions. This makes LS-DYNA® the only commercial product with a general ability to create random fields having the correlation properties as measured in practice.

Two types of imperfections are currently implemented:

- *Geometric imperfections.* Buckling analysis is done using geometric imperfections.
- *Variation of a shell thickness.* This is currently mostly used for robustness analysis of metal forming problems where the change

in thickness is due to the rolling process.

The stochastic variation of material properties is also currently being developed. This should be available for MAT\_PIECEWISE\_LINEAR\_PLASTICITY in LS-DYNA® version 980.

There are three methods of creating a stochastic field:

- Specifying a correlation function via parameters.
- Specify it as a sum of sine waves (a Fourier expansion).
- Specify it directly for every element or node.

Additionally, these perturbations can be created in coordinate systems and scaled.

### Using correlation functions to create a random field

This is a generic method of creating stochastic fields is available in the R4 version of LS-DYNA® 971. This is a very general method and can create quite a variety of random fields.

This methodology requires that a correlation function be specified as shown in Figure 1 and Figure 2. The figures also show how different stochastic fields are created for the different types of stochastic fields and different values of the parameters.

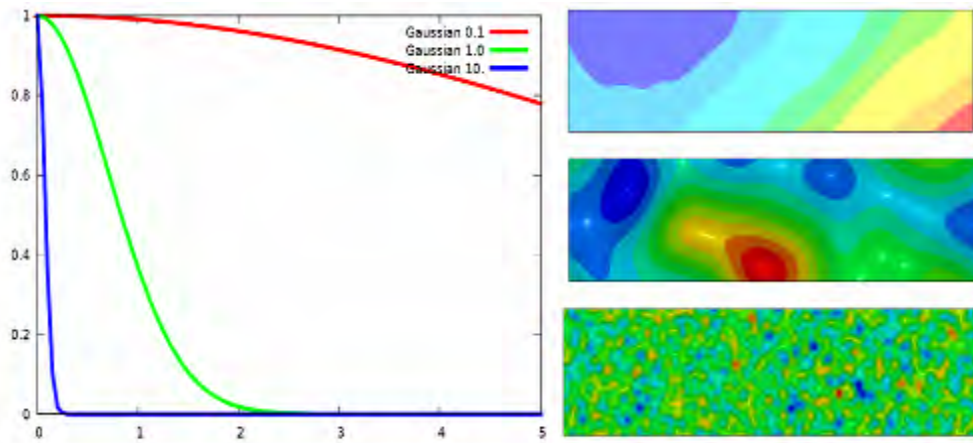


Figure 1 This figure shows how the correlation distance affects the different stochastic fields that can be obtained. Decreases in the width of the Gaussian correlation functions results in more fine-grained stochastic fields.

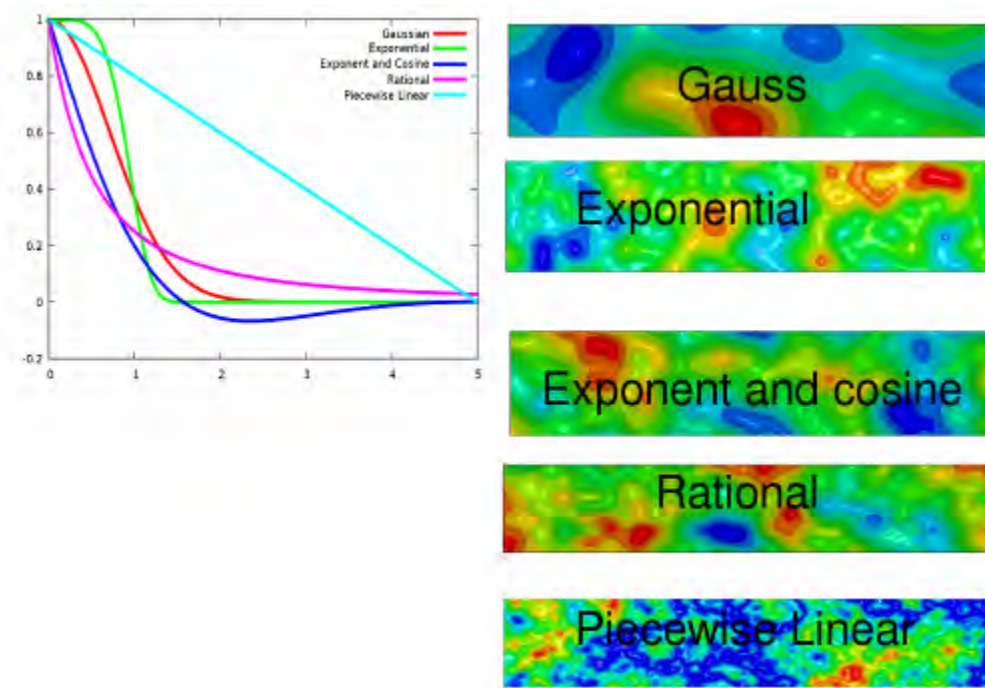
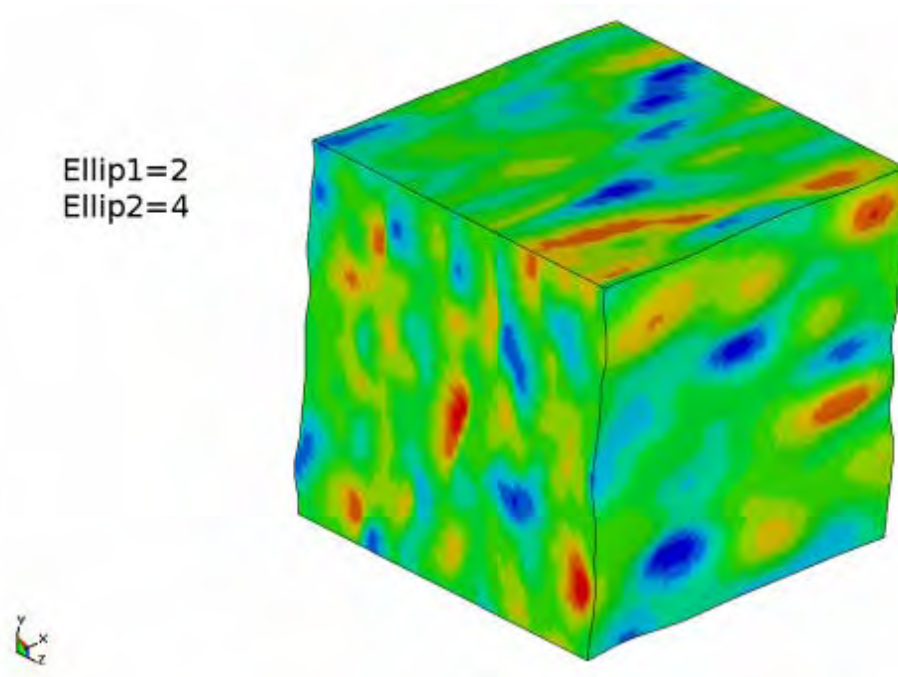


Figure 2 This figure shows how the different perturbations that can be obtained from different types of correlation functions.

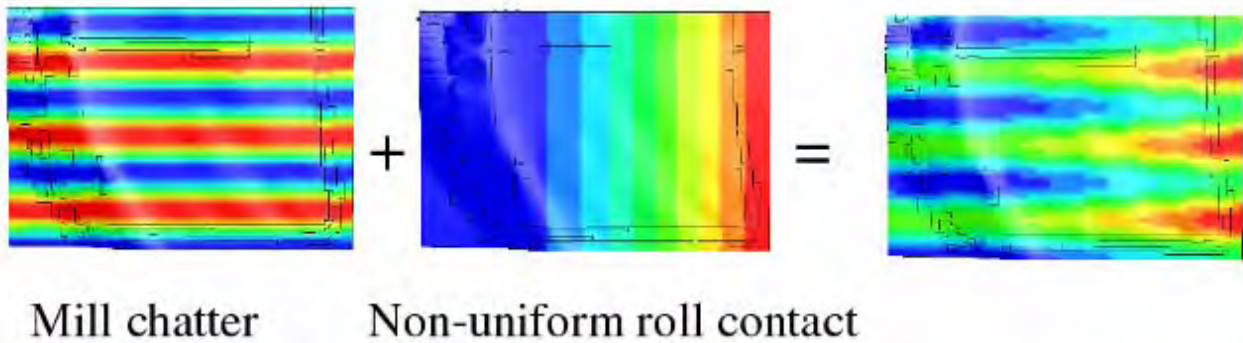
Additionally, Figure 3 shows how the properties of the stochastic field can differ in different directions.



*Figure 3 The stochastic properties does not have to be the same in all directions. This figure shows a stochastic field with properties that are different in the x, y, and z directions. This is controlled using parameters.*

### **Specification using sine waves**

Sinusoidal imperfections can be add together to specify the final imperfection. In Figure 4 we show how this was done for to simulate a metal forming blank. See also Reliability Based Design Optimization with LS-OPT® for a Metal Forming Application by Müllerschön, Lorenz & Roll, Frankenthal, 2007 for more information regarding the stochastic simulation of metal forming problems.



*Figure 4 This example shows how two sinusoidal imperfections were added to simulate the variation in a metal forming blank due to the rolling of the steel.*

### Direct specification of a random field

The values of the stochastic field can be specified directly. For element thicknesses this is done using the existing `*ELEMENT_SHELL_THICKNESS` card; for nodal locations the stochastic field can be read in directly.

Two interesting cases can be distinguished:

- The values can be LS-DYNA® results exported using LS-PREPOST® – this allows the use, for example, of a summation of the eigen modes to be used as a perturbation.
- Alternatively, one can use this capability to make the shape changes for shape optimization.

### Summary

Stochastic fields are provided in LS-DYNA® for problems whose behavior depends on these imperfections or initial conditions. This should allow the further validation of results in the realm of unstable and stochastic behavior. Modeling the observed imperfections and stochastic fields is required to get the mechanics correct in these cases.



## TOPCRUNCH.org Benchmarks –

Vendor/Submitter Org. INTEL/SSG/ASE

Submission Date 03/31/2009 – 04/01/2009

Processor - Intel® Xeon® Quad Core X5560

Computer/Interconnect	#Nodes x #Processors per Node x #Cores Per Processor = Total #CPU	Time (Sec)	Benchmark Problem
Supermicro Board X8DTN qual/IB	16 x 2 x 4 = <b>128</b>	113	<a href="#">neon refined revised</a>
Supermicro Board X8DTN qual/IB	8 x 2 x 4 = <b>64</b>	168	<a href="#">neon refined revised</a>
Supermicro Board X8DTN qual/IB	4 x 2 x 4 = <b>32</b>	257	<a href="#">neon refined revised</a>
Supermicro Board X8DTN qual/IB	2 x 2 x 4 = <b>16</b>	455	<a href="#">neon refined revised</a>
Supermicro Nehalem Server/QPI	1 x 2 x 4 = <b>8</b>	760	<a href="#">neon refined revised</a>
Supermicro Board X8DTN qual/QPI	1 x 2 x 4 = <b>8</b>	838	<a href="#">neon refined revised</a>
Supermicro Board X8DTN qual/IB	16 x 2 x 4 = <b>128</b>	1163	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/IB	8 x 2 x 4 = <b>64</b>	1839	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/IB	4 x 2 x 4 = <b>32</b>	3154	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/IB	64 x 2 x 4 = <b>512</b>	4346	<a href="#">car2car</a>
Supermicro Board X8DTN qual/IB	2 x 2 x 4 = <b>16</b>	6001	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/IB	32 x 2 x 4 = <b>256</b>	6105	<a href="#">car2car</a>
Supermicro Board X8DTN qual/IB	16 x 2 x 4 = <b>128</b>	10503	<a href="#">car2car</a>
Supermicro Nehalem Server/QPI	1 x 2 x 4 = <b>8</b>	10761	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/QPI	1 x 2 x 4 = <b>8</b>	11596	<a href="#">3 Vehicle Collision</a>
Supermicro Board X8DTN qual/IB	8 x 2 x 4 = <b>64</b>	19252	<a href="#">car2car</a>
Supermicro Board X8DTN qual/IB	4 x 2 x 4 = <b>32</b>	31762	<a href="#">car2car</a>
Supermicro Board X8DTN qual/IB	2 x 2 x 4 = <b>16</b>	59685	<a href="#">car2car</a>
Supermicro Nehalem Server/QPI	1 x 2 x 4 = <b>8</b>	104789	<a href="#">car2car</a>
Supermicro Board X8DTN qual/QPI	1 x 2 x 4 = <b>8</b>	111730	<a href="#">car2car</a>

## TOPCRUNCH (continued)

Vendor/Submitter Org. SGI/Applications Engineering  
 Submission Date 03/29/2009 – 04/01/2009

Computer/Interconnect	Processor	#Nodes x #Processors per Node x #Cores Per Processor = Total #CPU	Time (Sec)	Benchmark Problem
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	64 x 2 x 4 = <b>512</b>	65	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	32 x 2 x 4 = <b>256</b>	69	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	16 x 2 x 4 = <b>128</b>	98	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	8 x 2 x 4 = <b>64</b>	157	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	4 x 2 x 4 = <b>32</b>	229	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	2 x 2 x 4 = <b>16</b>	411	<a href="#">neon refined re vised</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	128 x 2 x 4 = <b>1024</b>	441	<a href="#">3 Vehicle Collision</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	64 x 2 x 4 = <b>512</b>	514	<a href="#">3 Vehicle Collision</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	32 x 2 x 4 = <b>256</b>	653	<a href="#">3 Vehicle Collision</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	16 x 2 x 4 = <b>128</b>	989	<a href="#">3 Vehicle Collision</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	8 x 2 x 4 = <b>64</b>	1640	<a href="#">3 Vehicle Collision</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	128 x 2 x 4 = <b>1024</b>	2316	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo Boost E	4 x 2 x 4 = <b>32</b>	2762	<a href="#">3 Vehicle Collision</a>

## TOPCRUNCH (continued)

Vendor/Submitter Org. SGI/Applications Engineering  
 Submission Date 03/29/2009 - 04/01/2009

<u>Computer/Interconnect</u>	<u>Processor</u>	<u>#Nodes x #Processors per Node x #Cores Per Processor = Total #CPU</u>	<u>Time (Sec)</u>	<u>Benchmark Problem</u>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	64 x 2 x 4 = <b>512</b>	3130	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	32 x 2 x 4 = <b>256</b>	4852	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	16 x 2 x 4 = <b>128</b>	8418	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	8 x 2 x 4 = <b>64</b>	15720	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	4 x 2 x 4 = <b>32</b>	27231	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	2 x 2 x 4 = <b>16</b>	51899	<a href="#">car2car</a>
Altix ICE8200EX/IP95 Blades with Mellanox ConnectX IB HCA DDR Fabric OFED v1.4	Intel® Xeon® Quad Core X5570 2.93GHz Turbo ON	2 x 2 x 4 = <b>16</b>	5081	<a href="#">3 Vehicle Collision</a>

## LSTC Intel Cluster Ready Interview



LSTC's LS-DYNA, one solver that includes all capabilities – structural civil engineering, thermal analysis, occupant safety, blast loading, one step solver for metal forming, explicit, implicit, dummies & barriers...

Hear Wayne Mindle, Senior Engineer, Technical Sales & Marketing at Livermore Software Technology Corp. (LSTC), as he explains the capabilities of LS-DYNA, a solver that's all in one package, to simulate complex real world problems. Simulating a model before you build the design helps to optimize the structure. What's best to run the software on? The Intel Cluster Ready program makes it easier for end users to find systems and OEMs to recommend hardware that work well together with the Intel Cluster Ready registered LS-DYNA applications.

Watch the video

<http://software.intel.com/en-us/videos/lstc-intel-cluster-ready-simulation-software-and-hpc-clusters-made-easy/>

For more information on LS-DYNA go to [www.lstc.com/lsdyna.htm](http://www.lstc.com/lsdyna.htm)

For more information on Intel Cluster Ready go to [www.intel.com/go/cluster](http://www.intel.com/go/cluster), **First Intel® Cluster Ready Certified Xeon® Clusters (excerpt):** ...Our first benchmarks with the 'real world' applications ANSYS and LS-DYNA show impressive performance numbers for our new Relion servers that are based on Intel Nehalem CPUs. To make it as easy as possible for our HPC customers to take advantage of these performance gains we will also be offering Intel Cluster Ready (ICR) certified Nehalem clusters that will be running Penguin Computing's cluster management solution Scyld ClusterWare...  
Read the Complete Article at:

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

FEA Information Participants Supporting The Cluster Connection

ANSYS – CRAY – LSTC – NEC – PANSAS – VOLTAIRE

## Voltaire Scale-out Fabrics and Intel® Cluster Ready

Excerpt from the full article at:

[www.voltaire.com/Solutions/intel\\_cluster\\_ready\\_certified\\_solutions](http://www.voltaire.com/Solutions/intel_cluster_ready_certified_solutions)

As a member of the Intel® Cluster Ready program, Voltaire is making it easier to experience the power of high-performance computing (HPC) by helping to simplify the purchasing, deployment, and management of Intel® processor-based clusters.

Voltaire Scale-out Fabric products are Intel Cluster Ready Certified Components that allow customers to maximize the utilization of their Intel-based systems.

Follow our blog on Intel Cluster Ready solutions on the Cluster Connection site!  
Protect your Intel Nehalem Investment with Voltaire QDR Switches

Voltaire's InfiniBand QDR Switches, which offer speeds up to 40Gb/s per port and the industry's lowest latency at 100ns, are the best way to gain maximal scalability when building an Intel Nehalem-based cluster.

### **Maximize Availability and Interoperability of Clusters**

David Bryan, President of Silicon Mechanics, a Voltaire reseller, talks about the latest generation quad-core Intel Xeon® processor 5500 series (Nehalem), and how the combination of Voltaire's InfiniBand QDR Switches, Unified Fabric

Manager™ Software, and Intel Cluster Ready certification allows end users to maximize availability and operability.

### **Video Interview with David Bryan:**

[www.voltaire.com/Solutions/intel\\_cluster\\_ready\\_certified\\_solutions](http://www.voltaire.com/Solutions/intel_cluster_ready_certified_solutions)

### **Visit Voltaire at Several Upcoming Industry Events**

Voltaire will be participating in the following industry events. Please stop by and say hello!

#### **HP Technology Forum & Expo**

June 15 - 18, 2009 - Las Vegas, NV  
Voltaire is exhibiting in Booth #613 at the HP Technology Forum & Expo.

#### **International Supercomputing Conference (ISC)**

June 23 - 26, 2009 - Hamburg, Germany  
Voltaire is a Bronze Sponsor and exhibiting in Booth #540 at ISC'09.

#### **SIFMA's 29th Annual Technology Management Conference & Exhibit**

June 23 - 25, 2009 - Hilton New York

Visit Voltaire in Booth #1432 at SIFMA.

**LS-DYNA® and Related Courses LSTC & Worldwide 2009**  
**Information on LSTC classes contact [jane@lstc.com](mailto:jane@lstc.com)**

<u>Advanced - Impact Analysis</u>	\$950	MI June 23-26
<u>Advanced Options</u>	\$750	MI June 11-12, CA Sept 07-08, MI Dec 10-11,
<u>ALE/Eulerian &amp; Fluid/Structure Interaction</u>	\$750	CA July 15-17,
<u>ALE Advanced Applications</u>	\$400	CA April 22-24
<u>Blast &amp; Penetration</u>	\$1,250 minimum 15 students	MI Oct. 22-23
<u>Composite Materials</u>	\$750	CA June 23-24
<u>Concrete and Geomaterial Modeling</u> (min 3 students)	\$1,000	CA Sept. 24-25
<u>Contact</u>	\$750	CA June 25-26 MI Sept 10-11,
<u>Element-free Galerkin</u>	\$400	MI July 21-22
<u>Heat Transfer &amp; Thermal-Stress Problems</u>	\$500	To be announced contact Art Shapiro for information <a href="mailto:shapiro@lstc.com">shapiro@lstc.com</a>
<u>Implicit</u>	\$750	CA June 29-30 MI Sept 21-22
<u>Introduction to LS-DYNA</u> LS-PrePost is no fee and held the day prior to dates shown	\$750	CA May 05-08 CA Aug 04-07 CA Nov 10-13 MI June 16-19 MI Sept 15-18 MI Dec 15-18
<u>Introduction to LS-OPT</u>	\$750	CA Nov 3-6
<u>Material Modeling Using User Defined Options</u>	\$750	CA July 01-02
<u>MESH Free Methods (SPH and EFG)</u>	\$750	CA Dec 08-11

Please check with the listed Company for accuracy of dates/courses.



## LS-DYNA Courses Worldwide Listing

If you have any courses, that you want listed in the FEA News please send:

Course Name - Country you are holding it in - Date of course to [agiac99@aol.com](mailto:agiac99@aol.com)

<b>Courses are in Alpha Order</b>	<b>Country</b>	<b>Company</b>	<b>Date</b>
Contact Simulation	India	CADFEM India <a href="http://www.cadfem.in">www.cadfem.in</a>	25 May
Implicit Training	France	ALYOTECH <a href="http://www.alyotech.fr">www.alyotech.fr</a>	24-June
Introduction to LS-DYNA	India	CADFEM India <a href="http://www.cadfem.in">www.cadfem.in</a>	28-April
Material Modeling	India	CADFEM India <a href="http://www.cadfem.in">www.cadfem.in</a>	26-May

### Courses by Paul Du Bois

Blast & Penetration	France	ALYOTECH <a href="http://www.alyotech.fr">www.alyotech.fr</a>	8-Oct
Crash Analysis	Germany	DYNAmore <a href="http://www.dynamore.de">www.dynamore.de</a>	11-May
Crash Analysis	Germany	DYNAmore <a href="http://www.dynamore.de">www.dynamore.de</a>	1-Dec
Crash Analysis	Germany	CADFEM <a href="http://www.cadfem.de">www.cadfem.de</a>	5-May
Crash Analysis	Germany	CADFEM <a href="http://www.dynamore.de">www.dynamore.de</a>	24-Nov
Crash Analysis	SWEDEN	ERAB <a href="http://www.erab.se">www.erab.se</a>	26-May

## August 17-August 21, 2009 Austin TX

A short course taught by: Thomas J. R. Hughes and Ted Belytschko

Learn the methods and the basics of nonlinear finite elements from two international experts in the field and get up to date on the latest research in finite elements. Some of the topics are:

Nonlinear constitutive equations  
Element Technology  
Isogeometric methods  
XFEM and level sets  
Plates and shells

Time integration  
Multiscale analysis  
Finite elements in fluids  
Meshfree methods  
Fluid-structure interaction

A limited number of graduate student registrations at reduced tuitions are available.

The course starts with a review of the basics of nonlinear finite element analysis, constitutive equations, element design and selection, and solvers. It then progresses to state-of-the-art methods, including current topics such as the extended finite element method, isogeometric methods, multiscale methods and mesh free methods. Important concepts are clearly explained so that students can obtain a thorough grounding in and overview of nonlinear finite element analysis.

This Short Course is intended for engineers and scientists who are interested in obtaining an understanding of nonlinear finite element analysis, both as users of software and developers of software. A background in engineering or applied sciences and some previous exposure to the finite element method are necessary for understanding the material covered in this short course. The course has been attended by engineers and scientists from corporations, such as Dassault, Boeing, General Motors, Ford,

Daimler Benz, BMW, Fiat, PSA, Renault, Philips, Fujitsu, IBM, EDF, Siemens; software companies; government laboratories, such as Livermore, Argonne, Sandia; government offices, such as NSF and the Defense Nuclear Agency; U.S. Navy, NASA, ESA, Air Force Laboratories, and universities. Many attendees have been graduate students, post-doctoral students and young faculty.

### Course Objectives

The purpose of this short course is to provide engineers, scientists and researchers with an understanding of the fundamentals and a critical survey of the state-of-art of nonlinear finite element methods in solids, structures, and fluids. The theoretical background needed for an understanding and use of nonlinear software, the computer implementation of various techniques, and modeling strategies will be treated. Advantages and shortcomings of alternative methods and the practical implications of recent research developments will be stresses. Mathematical and algorithmic developments will be explained in terms comprehensible to engineers.

**August 17-August 21, 2009 Austin TX**  
(continued from previous page)

A short course taught by: Thomas J. R. Hughes and Ted Belytschko

Registrants will receive three books as part of their registration fee:

T Belytschko, WK Liu and B Moran:

Nonlinear Finite Elements for Continua and Structures

**Available for Purchase From Amazon.com**

**TJR Hughes**

J Simo and TJR Hughes:

Computational Inelasticity

**[The Finite Element Method](#)**

TJR Hughes:

The Finite Element Method

**T. Belytschko, WK Liu, B Moran**

**[Nonlinear Finite Elements for Continua and Structures](#)**

Contact Information:

If you have any questions regarding this course, please send us an e-mail at [info@feshortcourse.com](mailto:info@feshortcourse.com)

**J Simo and TJR Hughes:**

**[Computational Inelasticity](#)**

If you have any questions regarding registration for this course, please send us an e-mail at : [registration@feshortcourse.com](mailto:registration@feshortcourse.com)

For more details see **[FE Short Course](#)**

## Pre Post Processing Software

### Livermore Software Technology Corporation

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

### Engineering Technology Associates, Inc.

FEMB Engineering Technology Associates' Finite Element Model Builder (FEMB) is a finite element pre- and post-processor for use with all major analysis codes and CAD Software.

### JSOL Corporation

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

### Oasys, Ltd

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.

### BETA CAE Systems S.A.

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, a thriving innovative software with special features for the high performance and effortless 3D & 2D post-processing of LS-DYNA results.

### Simpleware

Provides software solutions for robust, fast, and easy conversion of 3D images into high quality meshes which can be used for FEA, CFD, CAD, RP.

## Participant LS-DYNA® Resource Page (alpha order)

Fully QA'd by Livermore Software Technology Corporation

### SMP and MPP Hardware and OS

#### FUJITSU

FUJITSU Prime Power	SUN OS 5.8
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#### HP

HP PA-8X00	HP-UX 11.11. and above
HP IA-64	HP-UX 11.22 and above
HP Opteron	Linux
HP Alpha	True 64

#### INTEL

INTEL IA32	Linux, Windows
INTEL IA64	Linux
INTEL Xeon EMT64	Linux, Windows 64

#### NEC

NEX SX6	Super-UX
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#### SGI

SGI Mips	IRIX 6.5X
SGI IA64	SuSE 10 w/Propack 4 Red Hat 3 or 4 w/ Propak 3

## Participant LS-DYNA® Resource Page (alpha order)

Fully QA'd by Livermore Software Technology Corporation

### MPP and Interconnect MPI

#### CRAY

	O/S	HPC Interconnect	MPI Software
CX1	Windows HPC Server 2008, Linux	InfiniB	MS MPI, HP MPI, Intel MPI
XT5	Linux	SeaStar2	Cary MPI
XT5M	Linux	SeaStar1	Cray MPI

#### FUJITSU

	O/S	HPC Interconnect	MPI Software
FUJITSU Prime Power	SUN OS 5.8		

#### HP

	O/S	HPC Interconnect	MPI Software
HP PA8000	HPUX		
HPIA64	HPUX		

#### INTEL

	O/S	HPC Interconnect	MPI Software
INTEL IA32	Linux, Windows	InfiniBand (Voltaire), MyriCom	MPICH, HP MPI, OpenMPI
INTEL IA64	Linux		MPICH, HP MPI, OpenMPI
INTEL Xeon EMT 64	Linux	InfiniBand(Topspin, Voltaire), MyriCom, PathScale InfiniPath	MPICH, HP MPI, INTEL MPI, OpenMPI

#### NEC

	O/S	HPC Interconnect	MPI Software
NEX SX6	Super-UX		

#### SGI

	O/S	HPC Interconnect	MPI Software
SGI Mips	IRIX 6.5 X	NUMALink	MPT
SGI IA 64	Propack 3, 4 & 5	Numalink, InfiniBand(Voltaire)	MPT, Intel MPI, MPICH
SGI/Xeon64	Propack 3		MPT

## LS-DYNA® Resource Page - Participant Software

The following list are software programs interfacing to, or have the LS-DYNA solver embedded within their product. For complete information on the software products visit the corporate website.

### ANSYS/LS-DYNA

Built upon the successful ANSYS interface, ANSYS/LS-DYNA is an integrated pre and postprocessor for the worlds most respected explicit dynamics solver, LS-DYNA. The combination makes it possible to solve combined explicit/implicit simulations in a very efficient manner, as well as perform extensive coupled simulations in Robust Design by using mature structural, thermal, electromagnetic and CFD technologies.

### AI\*Environment:

A high end pre and post processor for LS-DYNA, AI\*Environment is a powerful tool for advanced modeling of complex structures found in automotive, aerospace, electronic and medical fields. Solid, Shell, Beam, Fluid and Electromagnetic meshing and mesh editing tools are included under a single interface, making AI\*Environment highly capable, yet easy to use for advanced modeling needs.

### ETA – DYNAFORM

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.

### ETA – VPG

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.

### MSC.Software - MSC.Dytran LS-DYNA

Tightly-integrated solution that combines MSC.Dytran's advanced fluid-structure interaction capabilities with LS-DYNA's high-performance structural DMP within a common simulation environment. Innovative explicit nonlinear technology enables extreme, short-duration dynamic events to be simulated for a variety of industrial and commercial applications on UNIX, Linux, and Windows platforms.

### MSC.Software - MSC.Nastran/SOL 700

The MSC.Nastran™ Explicit Nonlinear product module (SOL 700) provides MSC.Nastran users the ability access the explicit nonlinear structural simulation capabilities of the MSC.Dytran LS-DYNA solver using the MSC.Nastran Bulk Data input format.

### MSC.Nastran

Explicit Nonlinear will allow users to work within one common modeling environment using the same Bulk Data interface. NVH, linear, and nonlinear models can be used for explicit applications such as crash, crush, and drop test simulations. This reduces the time required to build additional models for another analysis programs, lowers risk due to information transfer or translation issues, and eliminates the need for additional software training.

### MSC.Software – Gateway for LS-DYNA

Gateway for LS-DYNA provides you with the ability to access basic LS-DYNA simulation capabilities in a fully integrated and generative way. Accessed via a



specific Crash workbench on the GPS workspace, the application enhances CATIA V5 to allow finite element analysis models to be output to LS-DYNA and then results to be displayed back in CATIA.

### **Oasys software for LS-DYNA**

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

### **ESI Group**

#### **Visual-CRASH For DYNA**

Visual-Crash for 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.

### **APTEK**

The MMCD is a graphics-based and menu-driven program that interfaces with the LS-DYNA library of material models and the LS-OPT optimization code. The core of the MMCD is the driver, which calculates

the stress-strain behavior of material models driven by combinations of strain increments and stress boundary conditions, i.e. pure shear stress, and combinations of uniaxial, biaxial, and triaxial compression and tension. MMCD input and output is accessed via pre- and post-processors; graphical user interfaces (GUIs) for easily selecting the material model parameters and load histories, and for plotting the output in both two (stress-strain curves) and three (yield surfaces) dimensions. The pre-processor, driver, and post-processor are combined into a web downloadable software package that operates seamlessly as a single code.

### **BETA CAE Systems - ANSA**

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 - μETA**

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

## FEA Information Participants –

Company name takes you directly to Website

**OASYS Ltd:** Markets engineering software products. Consulting engineers, planners and project managers working in all areas of the built environment.

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**JSOL Corporation:** Specializing in Research & Consulting; System Consulting, Frontier Business, System Integration and Science Consulting.

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**HP:** Leading provider of high performance computing solutions for CAE, including workstations, servers, blades and storage..

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**ANSYS Inc.:** Develops, markets, supports and delivers collaborative analysis optimization software tools.

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**SGI:** Silicon Graphics, Inc., is a leader in high-performance computing, visualization, and storage.

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**MSC.Software:** Information technology software and services provider.. Products & services used to enhance & automate the product design/manufacturing process.

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**NEC:** A history of more than 100 years of leadership/innovation in the core high-technology sectors of communications, computers/electronic components

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**INTEL:** For more than three decades, Intel Corporation has developed technology enabling the computer and Internet revolution that has changed the world.

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**Engineering Technology Associates, Inc.:** Provides engineering & IT services & has created the streamlined simulation software packages DYNAFORM and VPG

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**ESI Group:** A software editor for the numerical simulation of prototype and manufacturing process engineering in applied mechanics.

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**BETA CAE Systems S.A.:** Specialized in the development of state of the art CAE pre- and post-processing software systems.

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Participant page is continued on next page

## FEA Information Participants –

Company name takes you directly to Website

**APTEK**: Among the software developed APTEK develops and licenses an interactive program for driving LS-DYNA material models - the Mixed Mode Constitutive Driver (MMCD).

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**PANASAS**: High performing Parallel Storage for scalable Linux clusters. Delivering exceptional scaling in capacity and performance for High Performance Computing (HPC) organizations.

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**Voltaire**: Voltaire is a leading provider of scale-out computing fabrics for data centers, high performance computing and cloud environments. Voltaire's InfiniBand-based solutions help software applications run simulations and product-design analysis faster.

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**CRAY**: A global leader in supercomputing, Cray provides innovative systems that enable scientists and engineers in government, industry and academia to meet both existing and future computational challenges. Building on expertise in designing, developing, marketing and servicing the world's most advanced supercomputers, Cray offers a comprehensive portfolio of high performance computing (HPC) systems that deliver unrivaled sustained performance on a wide range of challenging applications.

## LS-DYNA® Software Distributors

Alphabetical order by Country

Australia	<a href="#">Leading Engineering Analysis Providers</a>
Canada	<a href="#">Metal Forming Analysis Corporation</a>
China	<a href="#">Arup</a>
China	<a href="#">ETA China</a>
France	<a href="#">Alyotech</a>
France	<a href="#">AS+</a>
Germany	<a href="#">CAD-FEM</a>
Germany	<a href="#">DYNAmore</a>
India	<a href="#">Oasys, Ltd.</a>
India	<a href="#">Cranes Softwaree Ltd.</a>
India	<a href="#">EASi Engineering</a>
India	<a href="#">CADFEM Engineering Services India</a>
Italy	<a href="#">DYNAmore</a>
Italy	<a href="#">ENGINSOFT</a>
Japan	<a href="#">JSOL Corporation</a>
Japan	<a href="#">ITOCHU Techno-Solutions Corporation</a>
Japan	<a href="#">Fujitsu</a>
Korea	<a href="#">Theme Engineering</a>
Korea	<a href="#">Kostech</a>
Netherlands	<a href="#">Infinite Simulation Systems BV</a>
Russia	<a href="#">State Unitary Enterprise - STRELA</a>
Sweden	<a href="#">Engineering Research AB</a>
Taiwan	<a href="#">Flotrend Corporation</a>
USA	<a href="#">Engineering Technology Associates, Inc.</a>
USA	<a href="#">Dynamax</a>
USA	<a href="#">Livermore Software Technology Corp.</a>
UK	<a href="#">ARUP</a>

## Consulting and Engineering Services

Australia	<u>Leading Engineering Analysis Providers (LEAP)</u> Greg Horner info@leapaust.com.au 02 8966 7888
Canada	<u>Metal Forming Analysis Corp. - (613) 547-5395</u> Chris Galbraith galb@mfac.com
Canada	<u>ROI Engineering Inc.</u> (416)249-1471
France	<u>Alyotech</u> 33 (0) 1 55 59 59 30 Nima Edjtemai nima.edjtemai@alyotech.fr
France	<u>AS+</u> 33 (0)5 61 44 54 98 Vincent Lapoujade v.lapoujade@asplus.fr
Netherlands	<u>Infinite Simulation Systems BV</u> Jurgen Mathijssen j.mathijssen@infinite.nl
UK	<u>ARUP - 44 (0) 121 213 3317</u> Brian Walker brian.walker@arup.com
UK	<u>GRM +44 (0) 1926 889300</u> info@grm-consulting.co.uk
UK	<u>Dutton Simulation</u> +44 (0)1926 732147 enquiries@duttonsimulation.com
USA	KBEC L.C - (512) 363-2739 Khanh Bui kdbui@sbcglobal.net
USA	<u>SE&amp;CS - (707) 837-0559</u> Len Schwer len@schwer.net
USA	<u>Engineering Technology Associates, Inc:</u> (248) 729-3010
USA	<u>Predictive Engineering - (1-800) 345-4671</u> George Laird george.laird@predictiveengineering.com
USA	<u>Friedman Research Corporation</u> (805) 683-1300
USA	<u>Structure Technology</u> (920).722.7060
USA	<u>CAE Associates, Inc</u> (203) 758-2914

## Educational & Contributing Participants

### Alphabetical Order By Country

China	Dr. Qing Zhou	Tsinghua University
India	Dr. Anindya Deb	Indian Institute of Science
Italy	Professor Gennaro Monacelli	Prode – Elasis & Univ. of Napoli, Federico II
Russia	Dr. Alexey I. Borovkov	St. Petersburg State Tech. University
USA	Dr. Ted Belytschko	Northwestern University
USA	Dr. David Benson	University of California – San Diego
USA	Dr. Bhavin V. Mehta	Ohio University
USA	Dr. Taylan Altan	The Ohio State U – ERC/NSM
USA	Dr. Ala Tabiei	University of Cincinnati
USA	Prof. John D. Reid	University of Nebraska
USA	Professor Thomas Vasko	Connecticut State University

## Informational Websites

The LSTC LS-DYNA Support site: [www.dynasupport.com](http://www.dynasupport.com)

<a href="#">LS-DYNA Support Site</a>	<a href="#">FEA Informationwebsites</a>
<a href="#">LS-DYNA Examples</a> (more than 100 Examples)	<a href="#">LS-DYNA Conference Site</a>
<a href="#">TopCrunch</a> – Benchmarks	<a href="#">LS-DYNA Publications</a> to Download On Line
<a href="#">LS-DYNA Publications</a>	<a href="#">LSTC LS-PrePost Tutorials</a>
<a href="#">CADFEM GmbH Portal</a>	<a href="#">LS-OPT Support Site</a>
<a href="#">LS-DYNA Distributors</a>	<a href="#">LS-DYNA Consulting</a>
<a href="#">D3 VIEW - Tracking Developments in LS-DYNA®</a>	



# ANSYS Conference & 27th CADFEM Users Meeting

November 18 - 20, 2009

Leipzig, Germany

Register now and receive the early-birds discount!

Whether you apply as a lecturer or participant – your early registration by June 30th, 2009 will help us plan the event – and we consider this worthy of a 10 % early-birds discount.

You are not risking anything as you can cancel, free-of-charge, until October 30,

2009 and replacement participants can be appointed at any time.

For Complete Details Visit

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

## "3rd ANSA & μETA International Conference"

**This is an excerpt: For full conference information visit:**

[http://www.beta-cae.gr/3rd\\_conference\\_announcement.htm](http://www.beta-cae.gr/3rd_conference_announcement.htm)

Being consistent to our biannual appointment and celebrating the 10 years since the establishment of **BETA CAE Systems S.A.**, it is our pleasure to invite you to participate in the "**3rd ANSA & μETA International Conference**" to be held on September 9-11, 2009, in Porto Carras Grand Resort Hotel, Halkidiki, 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 & μETA**. Technical papers will be presented outlining the latest advances in CAE strategy, methodology, techniques and applications related to our products.

Participants will have the chance to be informed about the latest software trends, demonstrate their concepts and achievements and present new development requirements.

....

...The conference will be of interest to decision makers, strategy & methodology planners, simulation experts, applications users and

researchers at the forefront of the CAE simulation for various disciplines, coming from OEMs and suppliers from a wide spectrum of industrial sectors, specially from, but not limited to, the:

- automotive,
- motorsports,
- railway,
- aerospace,
- shipbuilding/offshore,
- electronics,
- energy,
- heavy machinery,
- medical/biomechanics,
- chemical processes and
- academic
- power tools,

A wide range of topics on various simulation application fields and disciplines will be covered, including:

- CAE strategy & process planning,
- Process automation,
- Product & Simulation Data Management (PDM / SDM),
- Durability,
- Crash & Rollover,
- Occupant & Pedestrian Safety,
- Dynamics,
- Noise, Vibration & Harshness,
- Computational Fluid Dynamics (CFD),

- Optimization,
- Composite materials modeling,
- Climate control,
- Engine technology,
- Heat transfer,
- Simulation results assessment, etc

Papers are invited on the outlined topics and others falling within the scope of the event.

**UPDATE** Speakers will receive free accommodation for the duration of the event, courtesy of BETA CAE Systems S.A. Further information and instructions will be provided to those who respond to this call.

In order to keep a low overall budget for the participants, there is no participation fee.

Nevertheless, your registration is essential for the organization of the event.

Registration includes coffee breaks, dinner on September 8th, and meals on September 9th, 10th and 11th, 2009.

Return the registration form by fax or email no later than June 30, 2009, to:

**BETA CAE Systems S.A.**

fax: +30-2392-021828

email: [congress@beta-cae.gr](mailto:congress@beta-cae.gr)

Mrs. Photini Paraskevopoulou

**BETA CAE Systems S.A.**

tel: +30-2392-021914

fax: +30-2392-021828

email: [congress@beta-cae.gr](mailto:congress@beta-cae.gr)

Abstracts submission:

Final manuscripts submission:

**June 20, 2009**

Registration until: **June 30, 2009**

Event: **September 9 - 11, 2009**

## 2<sup>nd</sup> International Conference on Hot Sheet Metal Forming Of High-Performance Steel -

June 15-17, Luleå, Sweden

The 2<sup>nd</sup> International Conference on Hot Sheet Metal Forming of High-Performance Steel will be held in Luleå, Sweden, from June 15 to 17, 2009. It is organised by the Swedish-German Centre of Excellence for Hot Sheet Metal Forming of High-Performance Steel, CHS<sup>2</sup>. For further information: [www.chs2.eu](http://www.chs2.eu). See also [www.ltu.se/tfm/chs2](http://www.ltu.se/tfm/chs2) and [www.metform.de](http://www.metform.de). Any questions can be addressed to Lena Olsson, [lena.m.olsson@ltu.se](mailto:lena.m.olsson@ltu.se).

The purpose of the conference is to bring technical and scientific experts from different countries together, in order to encourage the exchange of knowledge and to establish a forum for discussion of the state-of-the-art and new research results in the field of hot sheet metal forming of high-performance steel. The conference will cover the topics *Material, Process Design, Modelling & Simulation* and *Products*.

The second international conference on the topic of hot sheet metal forming of high performance steel will be held in Luleå, Sweden, where the technology of press hardening was invented and industrialized. The demand for hot sheet metal forming technology has steadily

increased and, pulled by strong international driving forces such as environment and safety, we are now experiencing and unprecedented growth in automotive applications. The research concerning hot forming processes, microstructure evolution, deformation, failure, thermal properties and issues such as coatings, heat transfer, high temperature tribology, is intense and a strong research community is under development. This second international conference takes off from where the first in Kassel, Germany (2008) was closed. The scientific and industrial community will be further strengthened and new results and developments from the growing international research programs will be displayed. As the second in a series of international conferences, in the future to be held alternatively every second year in Kassel and Luleå, CHS<sup>2</sup> 2009 will highlight multiple aspects from a scientific as well as an industrial viewpoint.

We are looking forward to welcoming you as an author or as a conference participant.

## American Society For Engineering Education

Invitation by Scott Williamson [s.williamson@asee.org](mailto:s.williamson@asee.org)

But act fast! 82% of the exhibit hall floor has been sold. If you're interested in participating, I strongly encourage you to confirm your space ASAP!

Why exhibit at ASEE2009? Location. Location. Location. The ASEE annual conference and exposition provides you with an outstanding opportunity to display your products and services to the largest gathering of engineering educators in the country. ASEE member faculty, department heads and deans are procurement and curriculum decision makers and represent over 40 engineering disciplines. ASEE has reserved more than 19,000 square feet of exhibit space in Austin, a highly visible platform to communicate your brand value proposition to over 3,600 engineering educators and administrators.

Founded in 1893, the American Society for Engineering Education (ASEE) has, for over a century, provided cutting edge leadership and innovative programs and services as the largest and most prestigious membership society for the U.S. engineering education community. Over 90% of all U.S. engineering colleges are ASEE members. The ASEE Annual Conference & Exposition provides a three day forum for over 3,500 leaders in the field, including professors, deans, instructors, and students, to present their research, exchange ideas, and interact with their colleagues and industry counterparts. Join companies like Autodesk, DuPont, National Instruments, MathWorks and Lockheed

Exhibiting at the ASEE annual conference provides you with cost-effective, value-added opportunities to:

- **PROMOTE YOUR BRAND – Create brand awareness and build brand loyalty among a**

targeted audience of engineering educators and administrators, including over 200 Deans.

- **DRIVE SALES REVENUE –** Gather new leads, build relationships with prospects and cultivate current customers at the largest multi-disciplinary gathering of engineering educators in the U.S.
- **AUGMENT YOUR RECRUITING EFFORTS –** Cultivating relationships with ASEE member deans and faculty is a great way to build a competitive advantage when you're recruiting their best and brightest students.
- **DISPLAY CORPORATE LEADERSHIP –** Highlight your commitment to promoting innovation and excellence in engineering and technology,

Please visit

<http://www.asee.org/conferences/annual/2009/Exposition.cfm>

Any questions, please let me know. I look forward to hearing with you!

Scott Williamson - Sales & Mkg Mgr.

[s.williamson@asee.org](mailto:s.williamson@asee.org)

American Society for Engineering Education

1818 N St. NW, Suite 600, Washington, DC 20036

ph: 202-331-3549

# ICCT09 1<sup>st</sup> International Conference on Concrete

## Tabriz, IRAN

The 1<sup>st</sup> International conference on concrete technologies serve the interchange of knowledge and experience in the field of concrete technologies among different research groups connected with this material and coming from all over the world.

The conference is organized by The Iranian National Retrofitting Center, Tabriz, Iran and will be organized in close contact with the Chair of Structural Design at Dresden University of Technology.

Sponsorship for the conference is Peshahvar Technical University Pakistan.

The conference venue is the Petroshimi Cultural Complex, located in Tabriz, Iran.

### Among the many conference topics are:

- High Performance Concrete
- Concrete in Fire
- Sustainability and Durability
- Concrete Construction in Architecture
- Analytical Models and Computer Simulation
- Ductile Fibre Reinforced Cementitious Composites
- Rehabilitation and Retrofitting of Concrete Structures
- Assessment, Monitoring and Environmental Aspect
- Concrete Materials and Chemical Admixtures
- Standard And Specifications

### Excerpt from Conference Format...

- The official language of the conference is English and all papers must be submitted in English. However, the presentations are possible to be in the Persian language.
- The special topics will be grouped in parallel sessions to attract specialists and interested persons in neighboring fields.
- There will be invited and welcome papers from all countries. The conference also will attract local attendees to participate and present papers and give an insight into the current level of the concrete in Iran.

### Call for Papers:

February 01, 2009

Abstract Submission Deadline:

May 15, 2009

First Announcement for Abstracts:

May 20, 2009

Full paper Submission Deadline:

Aug. 15, 2009

Final Announcement for full

papers: Sept. 20, 2009

Registration deadline:

Sept 20, 2009

Office Contact Locations:

Asia: Tabriz Iran

[asia@icct.ir](mailto:asia@icct.ir)

Europe: Dresden, Germany

[Europe@icct.ir](mailto:Europe@icct.ir)

## Conferences & Events

05/12-13 Germany	<a href="#"><u>MSC.Software 2009 Virtual Product Development Conference</u></a>
05/14-15 Austria	<a href="#"><u>7th European LS-DYNA Conference</u></a>
05/24-27 Korea	<a href="#"><u>Computational Tech. - research of Concrete/Reinforced Structures</u></a>
05/25-27 Greece	<a href="#"><u>5th Int'l Conference on Fluid Structure Interaction</u></a>
06/8-10 Portugal	<a href="#"><u>11<sup>th</sup> Int'l Conf.- Optimum Design of Structures and Materials Engineering</u></a>
06/15-17 Sweden	<a href="#"><u>2nd Int'l Conf. - Hot Sheet Metal Forming Of High-Performance Steel</u></a>
06/16-19 Greece	<a href="#"><u>NAFEMS World Congress</u></a>
06/23-24 USA	<a href="#"><u>PLM Summit North America 2008</u></a>
07/16-19 USA	<a href="#"><u>10<sup>th</sup> US National Congress on Computational Mechanics</u></a>
09/09-11 Greece	<a href="#"><u>3rd ANSA &amp; <math>\mu</math>ETA Int'l Conf</u></a>
10/01-02 Italy	<a href="#"><u>Enginsoft International Conference 2009</u></a>
11/14/-20 USA	<a href="#"><u>SC2009</u></a>

**2010 USA: June 6th-8th - Hosted by Livermore Software Technology Corp.  
The 11<sup>th</sup> International LS-DYNA<sup>®</sup> Users Conference  
The Hyatt Regency, Dearborn**



## **7<sup>th</sup> EUROPEAN LS-DYNA CONFERENCE**

### **Pre- and Post-Conference Seminars**

14<sup>th</sup> - 15<sup>th</sup> May 2009, Salzburg, Austria

#### **Crashworthiness Simulation using LS-DYNA**

This is an advanced course and applies to engineers which have experience in application of explicit programs or which bring along experience from the field of dynamic and nonlinear calculation with implicit programs. The aim of the course is to show how to perform a crashworthiness simulation in the automobile industry using LS-DYNA.

11<sup>th</sup> - 13<sup>th</sup> May 2009, 1.450.- Euro

Lecturer: P. Du Bois (Consultant)

#### **Implicit Analyses using LS-DYNA**

The seminar is designed for engineers intending to use LS-DYNA to carry out implicit analysis. Also, experienced 'explicit' users have the opportunity to learn more about the key issues to bear in mind when converting an explicit to an implicit input file.

12<sup>th</sup> - 13<sup>th</sup> May 2009, 980.- Euro  
Lecturer: Prof. Dr. M. Pitzer (University of Applied Sciences Gießen-Friedberg)

#### **Optimization with LS-OPT**

The seminar gives an introduction to the optimization program LS-OPT and shows its possibilities and limits. LS-OPT is a powerful optimization software particularly suitable for highly nonlinear problems. LS-OPT is

primarily intended to be used for general design optimization, shape optimization, parameter identification, DOE-studies and robustness or reliability analysis.  
11<sup>th</sup> - 13<sup>th</sup> May 2009, 1.450.- Euro

Lecturer: Dr. N. Stander (LSTC)

#### **Meshless Methods in LS-DYNA**

This seminar will introduce attendees to the application of the meshless "Element-Free Galerkin" (EFG) and "Smooth Particle Hydrodynamics" (SPH) methods in LS-DYNA. The seminar will outline the theoretical bases and thoroughly refers to the settings required in the LS-DYNA input deck in order to carry out an EFG/SPH simulation.

12<sup>th</sup> - 13<sup>th</sup> May 2009, 980.- Euro (490,- Euro per day, can be booked separately)

Lecturer: Dr. C.-T. Wu - EFG, Dr. J. L. Lacomme - SPH (LSTC)

#### **User Interfaces in LS-DYNA**

This seminar is designed for users in both industrial and academic research who intend to integrate their own routines in LS-DYNA. All available user interfaces will be presented, whereas the main focus will be on user materials, user elements and user friction.

11<sup>th</sup> May 2009, 490.- Euro

Lecturer: Dr. T. Erhart (DYNAmore)

#### **Modeling of Geomaterials with LS-DYNA**

The course starts from the common ground of introductory metal plasticity modeling and successively builds on this base adding the constitutive modeling

features necessary to model geomaterials.

12<sup>th</sup> - 13<sup>th</sup> May 2009, 980.- Euro  
Lecturer: Dr. L. Schwer (Schwer Engineering & Consulting Services)

### **PRIMER as a Preprocessor for LS-DYNA**

In this seminar the practical use of PRIMER is arranged for the participant. All important functions are described and demonstrated in the context of a Workshop. On the basis of many training examples the participant learns the safe operation for different areas of application.

12th - 13th May 2009, 980.- Euro

Lecturer: R. Sturt (Arup)

### **Enhanced Possibilities and Special Settings for Metal forming Simulation in LS-DYNA**

This seminar conveys the basics of the simulation of metal forming processes with LS-DYNA and provides information and hints for the application. Thereby it is particularly focused on the specific settings and features for the forming processes in LS-DYNA.

11<sup>th</sup> - 12<sup>th</sup> May 2009, 980.- Euro  
Lecturer: Dr. A. Haufe (DYNAmore)

### **LS-DYNA Modeling of Blast & Penetration**

This training class is intended for the LS-DYNA analysts possessing a comfortable command of the LS-DYNA keywords and options associated with typical Lagrangian analyses. This training class will attempt to

provide the analyst with the additional tools and knowledge required to model the class of high energy events.

18<sup>th</sup> - 19<sup>th</sup> May 2009, 980.- Euro  
Lecturer: Dr. L. Schwer (Schwer Engineering & Consulting Services)

### **Seminar Information**

Venue: Salzburg, Austria;

Language: English

Reduced conference fees for seminar attendees:

Per pre-/post-conference seminar day a discount of 50.- Euro on the registration fee for the European LS-DYNA conference in Salzburg is granted.

### **Contact**

DYNAmore GmbH

Industriestr. 2

D-70565 Stuttgart, Germany

Tel. +49 (0) 7 11 - 45 96 00 - 0

Fax +49 (0) 7 11 - 45 96 00 - 29

E-mail: cf09@dynamore.de

### **More Information and Registration**

<http://www.dynamore.de/conf-seminars>

## Available Newsletters Magazines Tutorials

If you would like a listing, or removal please e-mail [Anthony](mailto:Anthony)

Direct Link to the information sign up page.

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Newsletter](#)

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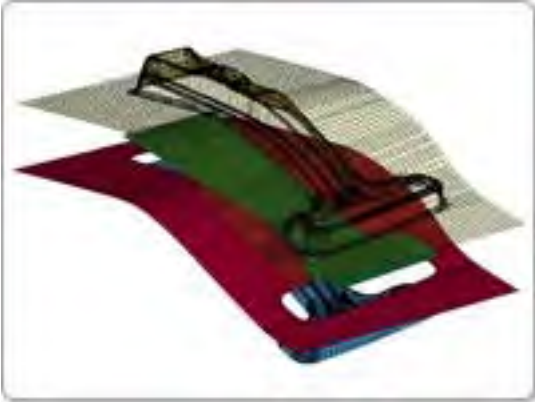
### Tutorials and Workshops

[Tutorials and Workshop Page](#) Oasys LS-DYNA Environment

## LS-PrePost Update -April

For downloading and files you will need to visit <http://www.lstc.com/lsp>

### Tutorial 17: Introduction to MetalForming Interface.



**Interface Used: Applications > MetalForming**

Files Required:

- LS-PrePost 2.3 MetalForming Tutorial (pdf)
- LS-PrePost 2.3 MetalForming Files (zip)
- LS-PrePost 2.4 MetalForming Tutorial (pdf)
- LS-PrePost 2.4 MetalForming Files (zip)