

*FEA* Information <http://www.feainformation.com>

## Engineering Journal and Website Resource

**GridCore AB**



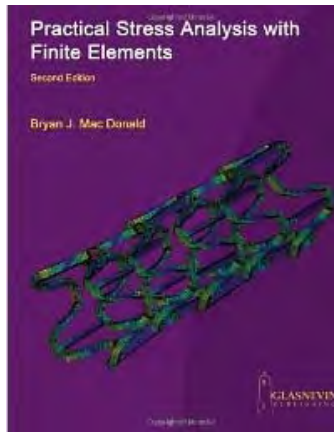
Compute on demand

**Automotive Showcase**



Mercedes-Benz C 63 AMG Coupé

**Book of the Month**



**Practical Stress Analysis With Finite Elements**

**Making A Difference**

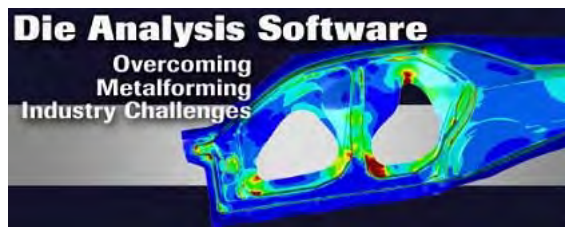


Dr. Bryan Mac Donald

**DYNAmore GmbH acquires Engineering Research AB**



**Free Webinar**



July 28th

**The Aeritalia F-104S Starfighter**



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# TABLE OF CONTENTS

## Articles

04	Announcements
05	FEA Platinum & Bronze Participants
06	DYNAmore acquires Engineering Research Nordic AB
08	High Fidelity In-Bore Pressure Modeling
09	An Assessment of the New LS-DYNA® Multi-Layered Solid Element: Basics, Patch Simulation and its Potential for Thick Composite Structural Analysis
11	Dr. Bryan Mac Donald
13	Gridcore AB
14	A free webinar sponsored by ETA
15	The Aeritalia F-104S Starfighter
16	Practical Stress Analysis With Finite Elements
17	Mercedes-Benz C 63 AMG Coupé
19	ARUP – Employment Opportunity

## Solutions

21	Reading Reference Library
23	Pre-Processing - Post Processing – Model Editing -
24	Software
26	Cloud Service
26	Site Directory – Resources

## EVENTS

29	12th International LS-DYNA Users Conference Announcement – Call For Papers
30	EnginSoft – International Conference

## Training Courses

31	CADFEM
32	LSTC
33	ERAB
34	AS+
35	Shanghai Hengstar
35	ETA

## LS-DYNA Users Challenge Your Knowledge

37	Challenge #1 Question & Answer
39	Challenge #2 Question & Answer
41	Challenge #3 Question & Answer

## Formula One Student Information

43	Formula One – Universities – Projects – Teams
----	---

## Directory Listings

44	FEA Consultants - Engineering Services - North America
45	FEA Consultants - Engineering Services - Europe
46	FEA Consultants - Engineering Services - Asia Pacific
47	LS-DYNA Distributors
51	LSTC Model Development Team

## News Release

52	SGI - Fifth-Generation Altix ICE HP Compute Solution
----	--

## Previous Article Not To Miss

April Issue: LSTC – Release of LS-OPT® Version 4.2
May Issue: LS-TaSC Version 2
June Issue: Lancemore Corp. AVI Rubber Powered Airplane

## Announcements

ETA will be holding a Free Webinar – July 28<sup>th</sup>

### Dr. Bryan Mac Donald

We are pleased to bring you Dr. Bryan Mac Donald in our section Making A Difference and an introduction to his book Practical Stress Analysis with Finite Elements

### New Participant:

#**GRIDCORE**

Gridcore AB in Sweden. Founded in 2002, Gridcore is active in three areas: Systems Integration, Research & Development and HPC as a service.

Offering Compute On Demand in Sweden and Germany. to LS-DYNA customers through DYNAmore Germany and DYNAmore Nordic.



Germany and the new company: DYNAmore NORDIC

Sincerely, **Marsha J. Victory**, President, FEA Information Inc  
[mv@feainformation.com](mailto:mv@feainformation.com)

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



**The Ranch Goss Hawk, Skylar.** Skylar is one of four Goss Hawks that live on the ranch



## FEA Information

### Participants

#### Platinum

<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>
<b>GridCore AB</b> <a href="http://gridcore.se">http://gridcore.se</a>		

#### Bronze Participants

<a href="#">Data Point Labs</a>	<a href="#">APACS</a>	<a href="#">Lancemore Corporation</a>
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DYNAmore Nordic AB

DYNAmore Germany AB

## **DYNAmore acquires Engineering Research Nordic AB**

Stuttgart and Linköping, July, 1st 2011 –

DYNAmore announces the acquisition of all assets of Engineering Research Nordic AB, the LS-DYNA distributor for the Nordic countries and the Baltic States. On July 1st, DYNAmore Nordic AB, a wholly owned subsidiary of DYNAmore GmbH, took over all the business of Engineering Research, including all software sales and support for LSTC, Beta CAE systems, ETA Engineering, ARUP, FTI, and Humanetics. Also all engineering and CAE services will be continued by DYNAmore Nordic AB. The Engineering Research staff continues to work for DYNAmore Nordic AB. The newly assigned executive directors, Dr. Daniel Hilding and Dr. Marcus Redhe, who were in leading positions with Engineering Research AB for many years, are extremely excited to be working with DYNAmore and bringing together top CAE experts from both companies:

“We are looking forward to join forces, with such an excellent company as DYNAmore. They have a very solid and extremely competent background in nonlinear mechanical simulation tasks. In a number of joint projects in the past, we have discovered that a potential merger between the companies has a huge potential as the expertise of the two companies is really complimentary. We are sure that our customers in the

Nordic countries and Baltic states will benefit in several ways: Support services can be handled more efficiently, training courses can be offered for new application areas, and software licensing can be handled in a global manner. In all aspects DYNAmore was the by far preferred partner for the next steps regarding our business in the Nordic countries.”

### **Uli Franz, Managing Director of DYNAmore GmbH:**

“The Engineering Research Nordic AB acquisition is one step in our strategy to offer our expertise in countries outside Germany as well. We will continue to work as LS-DYNA distributor for all german-speaking countries and selected countries in Europe providing top-level support, development, and consulting services. For such services the access to excellent staff members is crucial. Through the acquisition of Engineering Research Nordic AB our LS-DYNA code development group increased to a total of 10 people working in different areas of LS-DYNA, LS-OPT, and LS-PrePost functionalities. This also gives us the opportunity to unify and optimize our software development process in order to increase the output and value both for

our customers and our software partner LSTC, the owner of the LS-DYNA code.”

**John Hallquist, owner of LSTC adds:**

“We are pleased by the news that our leading European Distributor, DYNAmore, has acquired all assets of ERAB and will now be the representative of LS-DYNA in the Nordic countries. Additionally, DYNAmore is gaining new responsibilities in the areas of corporate licensing and reseller contracts throughout Europe. LSTC believes that the software development groups funded by LSTC, based in Linköping and Stuttgart, will play an increasingly important role in LS-DYNA, LS-OPT, and LS-PrePost developments. Many new features have been implemented by the European developers, and under the new structure

the two development groups will merge under a single management to decrease the turnaround time for new developments.”

**More Information:**

**DYNAmore GmbH**

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**DYNAmore Nordic AB**

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Internet: [www.dynamore.se](http://www.dynamore.se)



Conference Paper Showcase  
Paper available for download at:  
**DYNALOOK**

### High Fidelity In-Bore Pressure Modeling

<http://www.dynalook.com/international-conf-2010/BlastImpact-2-1.pdf>

Michael M. Chen  
U.S. Army Research Laboratory  
RDRL-WML-G  
Aberdeen Proving Ground, MD 21005

#### Abstract

Significant research efforts have been conducted to gain an in-depth understanding of projectile-weapon interactions at the U.S. Army Research Laboratory. The objective of this paper is to increase the fidelity of in-bore modeling and simulations that will facilitate the development of component and system models for U.S. Army weapon systems. Specifically, the in-bore pressure as a projectile travels through a gun tube, which has been known to be spatially and temporally varying distribution, will be programmatically taken into account in

finite element analysis of launch dynamics.

A computer program that embeds IBHVG2 Interior Ballistics code was implemented to automate the process. This tool can apply a substantial number of pressure curves to the corresponding barrel locations and generate LS-DYNA® compatible keyword files for analysis. The approach yields better accuracy and eliminates tedious manual efforts. In short, the development greatly streamlines the modeling efforts and significantly increases the fidelity of in-bore pressure modeling.







Conference Paper Showcase  
Paper available for download at:  
**DYNALOOK**

## **An Assessment of the New LS-DYNA® Multi-Layered Solid Element: Basics, Patch Simulation and its Potential for Thick Composite Structural Analysis**

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

Madhukar Chatiri<sup>1</sup>, Thorsten Schütz<sup>2</sup>, Anton Matzenmiller<sup>3</sup>

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### Abstract:

Limitation of fossil fuels and global warming favor the introduction of new powertrain concepts for road vehicles with highest efficiency and low greenhouse gas emissions. Fuel cell vehicles offer the highest potential for sustainable mobility in the future. One major component of fuel cell vehicles is the hydrogen storage system. A promising and currently the most-used approach is to store hydrogen in wet-wound carbon fiber reinforced plastic (CFRP) vessels manufactured by a filament winding process with an operating pressure of up to 70 MPa (hereafter referred as H<sub>2</sub> vessel). Due to the

inherent complexity and the 3-dimensional nature, accurate behavior of such thick composite structures in impact simulations needs an adequate representation of the composite plies.

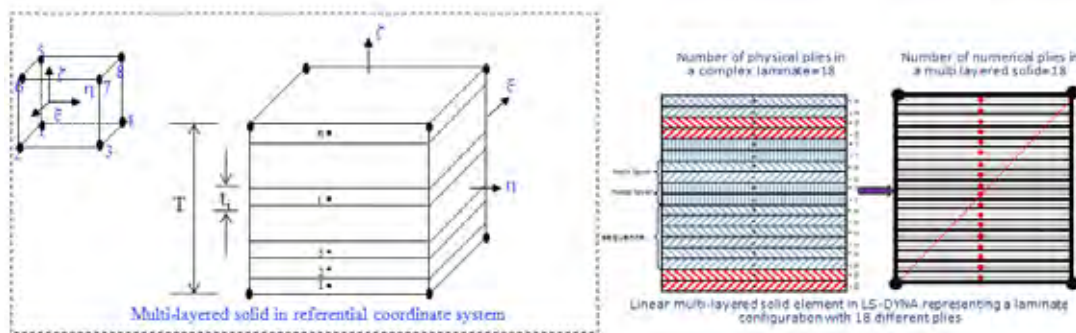
Modeling thick composite structures with two-dimensional elements will produce inaccurate results in transverse normal direction. Therefore, 3D modeling should be used but the idealization of each ply with one solid element leads to undesirably large models and is impractical for large structures. Hence, representation of several plies in one solid element and more such elements across the thickness is

aspired. An improved multi-layered solid element showing excellent efficiency of CPU time is implemented in the code of LS-DYNA® Version 971 R4. Like any brick element, it resolves the 3D stress state necessary for impact directions normal to the outer vessel surface. The element allows the definition of multiple integration points through the thickness in order to account for stacks of plies with arbitrary fiber orientation. By defining several layers with different material properties and ply orientations inside one multi-layered solid, the number of elements through the thickness is remarkably reduced and still, the result is close to the one obtained from the detailed

finite element model of one brick element per layer. As depicted in Fig.1.2, a complex laminate configuration consisting of 18 different plies with varied fiber angles is represented by one multi-layered solid element with 18 integration points through the thickness.

The above new element formulation is presented in this paper describing simulation results for both, different patches and for thick composite structures such as for hydrogen storage H2 vessels.

**Keywords:** Multi-layered solid, filament winding, thick composites, H2 pressure vessel analysis



**Fig. 1.2: Eight-node multi-layered solid element**



## Making A Difference

Dr. Bryan Mac Donald

Dublin City University

**Dr. Bryan Mac Donald** - Senior Lecturer in Computer Aided Design  
Medical Engineering Research Centre, School of Mechanical Engineering  
Dublin City University - Dublin 9 - Ireland

<http://www.medeng.dcu.ie/>

[http://www.dcu.ie/info/staff\\_member.php?id\\_no=1127](http://www.dcu.ie/info/staff_member.php?id_no=1127)

### Areas of Interest:

Computational modeling of the in-service behavior of orthopedic and vascular medical devices, design of innovative medical devices, optimization of complex engineering products/process using non-linear FEA

### Overview

Dr. Mac Donald is a senior lecturer in computer aided design at Dublin City University, Ireland, where he teaches on undergraduate and postgraduate programs in mechanical and biomedical engineering. He has been teaching FEA to trainee engineers for over 15 years. His experience of teaching introductory FEA to young engineers and seeing them struggle with the more advanced concepts led him to write the book "Practical Stress Analysis with Finite Elements" in 2007. Due to significant demand and impressive sales a second edition of this book was published in 2011. The objective of this book is to provide a gentle introduction to the field for students or practicing engineers/analysts who are encountering FEA for the first time. Although the book contains the requisite underlying theory of the FEM it is not the main focus of the book, rather the emphasis is on getting

the reader to the point where they can carry out their first independent analysis in a competent and professional manner. The book is written in a generic way so that it can be used in tandem with any available FE software and uses practical and "real world" examples to demonstrate key concepts and methodologies. Feedback from users of the book has been very positive and the book has been adopted as a key text for university courses in the USA, Europe and Asia.

### Research

Dr. Mac Donald's research has in the past focused on using non-linear FEA and optimization techniques to optimize a number of complex metal forming processes including hydro-forming and forming of magnesium alloys. Recent work has been more focused on medical devices and applying the skills learnt from previous work to this field. His current work falls into two major themes:

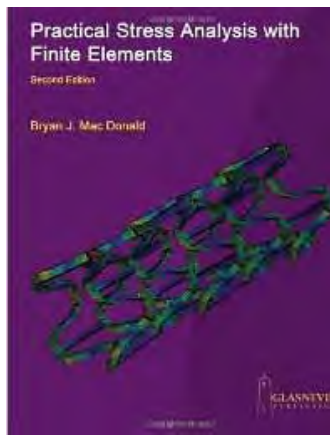
- Computational modeling of bio-absorbable vascular implants
- Computational modeling of the in-service behavior of orthopedic implants

Work with industrial partners on absorbable magnesium alloy devices has resulted in a number of absorbable magnesium implants which are the final stages of development. FE simulation of the deployment and subsequent degradation of these implants in-vivo played a key role in optimizing the final design of these implants.

Recent work in the orthopedic field has concentrated on understanding the process of bone healing via callus formation by using FEA to predict soft tissue and callus formation post fracture. This work was carried out in collaboration with clinicians from the Royal College of Surgeons in Ireland (RCSI).



(a) Antero-posterior view of radiographic image of fractured tibia with callus formation 3 months post-op and (b) Predicted callus formation in FE model of same tibial fracture. Note, element edge lines are not shown.



[Practical Stress Analysis With Finite Elements](#)



**Gridcore AB**  
**Sweden.**

## **Compute on demand®**

### **A Cloud HPC service oriented to Technical and Scientific users.**

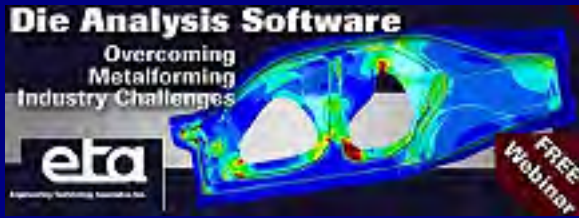
Compute is owned, developed and operated by Gridcore AB in Sweden. Founded in 2002, Gridcore is active in three areas: Systems Integration, Research & Development and HPC as a service.

Gridcore has wide experience of different industries and applications, developed a stable product portfolio to simplify an engineer/scientist's use of computers, and has established a large network of partners and collaborations, where we together solve the most demanding computing tasks for our customers. Gridcore has offices in Gothenburg (Sweden), Stuttgart (Germany), Durham NC (USA) and sales operations in The Netherlands and Norway.

The Gridcore developed E-Compute software for internal HPC resources gives end users (the engineers) a easy to use and complete environment when using HPC resources in their daily work, and enables collaboration, advanced application integrations, remote pre/post, accounting/billing of multiple teams, license tracking, and more, accelerating our customers usage of virtual prototyping.

Website: [www.gompute.com](http://www.gompute.com)

Website: [www.gridcore.se](http://www.gridcore.se)



A free webinar  
sponsored by ETA,  
hosted by MetalForming magazine

Thursday, July 28, 2011 • 2:00-3:00 PM  
EST

Learn how metalforming companies apply DYNAFORM, Engineering Technology Associates' die-analysis software, to meet design challenges head-on.

Attendees of this free 1-hr. webinar will enjoy demonstrations addressing key industry challenges using functions within specific DYNAFORM modules.

The specific challenges that will be addressed using three distinct software modules:

- Quickly Determining Part/Project Feasibility
- Providing Preliminary Validation of the Design Concept

- Identifying Potential Part Issues, During the Tooling Design Stage

Also, a metalforming case study will describe successful springback-compensation analysis at Woodbine Tool and Die, for stamping a fuel filler door.

To learn more and register to attend.

<http://www.eta.com/index.php/dynaformwebinar>



**Aerospace**

**Information**

## **The Aeritalia F-104S Starfighter**

The following does not represent any software. It is solely based on our Staff's choice of a Jet Fighter deserving a showcase.

The Aeritalia F-104S Starfighter was a licensed production Italian version of the Lockheed F-104 Starfighter which served in the Italian Air Force (AMI, Aeronautica Militare Italiana), and was the AMI's mainstay from the late 1960s until the beginning of the 21st Century. The F-104S also served in the Turkish Air Force until the mid-1990s. The F-104S was the final development of the Starfighter line.

Derived from Lockheed's design studies on a "Super Starfighter", the F-104S was one of the most capable of the F-104 series, and destined to be the last in service worldwide. The F-104S (upgraded to ASA/M standard) was retired from service in October 2004.

The F-104 series had entered a second development phase with the F-104G. While the USAF had no more interest in the F-104, Lockheed proposed the Model CL-901 featuring the new J79-GE-19 engine and the Sparrow III missiles; "G" denoted "Germany," the lead country for

this version, while "S" indicated the improved "Sparrow" version.[1] Further proposed developments included the CL-958 with larger wings, the CL-981 with retractable canard wings behind the cockpit, and the CL-984 optimised for low-level strike missions. An RF-104G was modified and flew in December 1966 as the prototype CL-901 "Super Starfighter." Externally, the new type had slightly larger air intakes and steel inlet guide vanes that allowed an increase in operating temperature from 121°C to 175°C, enabling a maximum speed of Mach 2.2.

During the first five years in Italian service, 23 F-104G aircraft were lost; and as only 80 to 90 F-104s (of 149 acquired) were operational at best, it was decided to purchase a new interceptor and fighter-bomber to reinforce the first line units.



## Book of the Month

### Practical Stress Analysis With Finite Elements

#### **Preface Excerpt:**

“....The intended audience is anyone who needs to learn how to use FEA and how to avoid making the common mistakes that newcomers to the method generally make. The text is written in a manner such that it is not specific to any particular FEA software package. Examples are shown using several different commonly available packages and the description of the analysis in each case is kept generic. Whilst the original goal of this text is to aid the undergraduate or postgraduate student who is taking a first course in FEA, it is my earnest hope that it may also be valuable to researchers and practicing engineers who are new to FEA and/or require guidance in its application....”

#### **Among the Chapters you will find:**

- Chapter 2: Fundamentals of Stress Analysis
- Chapter 3: Finite Element Procedures
- Chapter 4: Elements
- Chapter 5: Material Modeling
- Chapter 6: Modelling and Meshing
- Chapter 7: Boundary Conditions and Loading
- Chapter 8: Solution
- Chapter 9: Post Processing
- Chapter 10: Case Studies

[Practical Stress Analysis With Finite Elements](#)





## Moving Ahead Automotive Showcase

### Mercedes-Benz C 63 AMG Coupé

**Reprinted with Permission – All Copyright to Mercedes**

Affalterbach – Spectacular design, technology transfer from the world of motorsport and driving dynamics at the highest level; the new Mercedes-Benz C 63 AMG Coupé Black Series embodies the new AMG brand claim, Driving Performance, like no other AMG model. The new high-performance vehicle is the most powerful C-Class of all time, boasting a maximum output of 380 kW (517 hp) and a maximum torque of 620 newton metres. The AMG 6.3-litre V8 engine impresses with its hefty torque, tremendous pulling power and responsiveness, and ensures high-calibre performance: the C 63 AMG Coupé Black Series accelerates from zero to 100 km/h in 4.2 seconds (all data provisional). Exclusive fun at the wheel comes courtesy of the adjustable AMG coil-over sports suspension, the AMG high-performance compound braking system and the functional standard equipment. The AMG Track Package is available as an option to enhance driving dynamics even further. It boasts sports tyres and active rear-axle transmission cooling, plus the AMG Aerodynamics package including flics, a functionally tuned front splitter and an adjustable carbon-fibre rear aerofoil.

Broad, low, brawny and ready to pounce from a standstill – the C 63 AMG Coupé Black Series makes a mighty impression. It's clear right from the first time you set eyes on it that the C 63 AMG Coupé

Black Series is made for ambitious laps on a closed-off race track. In visual terms the new high-performance vehicle is reminiscent of the SLS AMG GT3 customer sports car and symbolises the transfer of technology from the sphere of motorsport, which has been part of the corporate philosophy of Mercedes-AMG GmbH for 44 years now.

With its new C 63 AMG Coupé Black Series, AMG is presenting an exciting sports car for enthusiasts who are passionate about sports cars which are big on horsepower, and this marks the impressive continuation of the Black Series strategy, which began back in 2006. AMG, the performance brand of Mercedes-Benz Cars, is once again demonstrating its expertise when it comes to designing and developing emotionally appealing high-performance cars.

“AMG has its roots in international motorsport. The new C 63 AMG Coupé Black Series is the best proof there is for the permanent transfer of technology from the race track to the road. The numerous successes in the DTM, the customer sports range featuring the SLS AMG GT3 and our commitment to Formula 1, where we have been providing the Official F1 Ô Safety Car and the Official F1 Ô Medical Car for the past 15 years, continuously spur on our engineers and technicians. The C 63 AMG

Coupé Black Series embodies the new AMG brand claim, Driving Performance, like no other AMG model", comments Ola Källenius, the CEO of Mercedes-AMG GmbH.

### **Key data at a glance:**

C 63 AMG Coupé Black Series

Displacement 6208 cc

Bore x stroke 102.2 x 94.6 mm

Compression ratio 11.3 : 1

Output 380 kW (517 hp) at 6800 rpm at 6800/min

Max. torque 620 Nm at 500 rpm

Engine weight (dry) 196 kg

Fuel consumption, NEDC combined 12.2 l/100 km\*

CO2 emissions 286 g/km\*

Acceleration 0-100 km/h 4.2 s\*

### **\* Preliminary data**

Arrow-shaped front section with large cooling air openings

It doesn't matter from which angle you're looking at it: the new C 63 AMG Coupé Black Series displays its ties with motorsport from every perspective. The arrow-shaped front section with the central Mercedes star in the radiator

grille is the visual synonym for its unfettered forwards thrust. The air intakes in the striking front apron ensure reliable air flow through the large cooling modules. Two openings in the aluminium bonnet support the expelling of engine heat, whilst the struts positioned at an angle in the front apron emphasise the vehicle's width. The black front splitter located at the lower end helps to balance the vehicle aerodynamically.

The expressive design continues in the side view: the newly developed front axle with a greater track width calls for new wings, which have been widened by 28 millimetres on each side. "6.3" logos give a nod to the sheer power of the large-displacement eight-cylinder high-speed naturally aspirated engine beneath the bonnet. Air outlets intimated behind the wheel cut-outs call to mind powerful racing cars. The onlooker discovers a black strip on the restyled AMG side skirts – a look which continues the idea of the front splitter. On each side the rear wings have also been widened by 42 millimetres, due to the greater track width of the rear axle. Air openings are hinted at in front of the rear wheels, forming a fitting conclusion....



## Employment Opportunity

ARUP

Oasys LS-DYNA Environment

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

Job Description	
<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

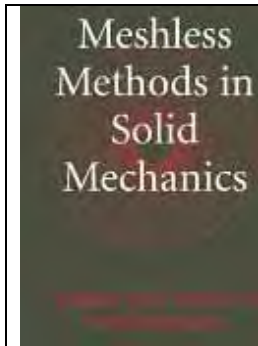
	<p><a href="#">Finite Element Analysis Theory and Application with ANSYS (3rd Edition)</a></p>		<p><a href="#">Arbitrary Lagrangian-Eulerian and Fluid Structure Interaction.</a></p>
	<p><a href="#">Isogeometric Analysis: Toward Integration of CAD and FEA</a></p>		<p><a href="#">NURBS for Curve &amp; 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

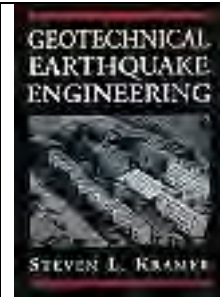
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Amazon



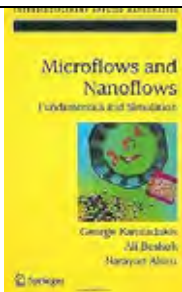
[Meshless Methods in Solid Mechanics](#)



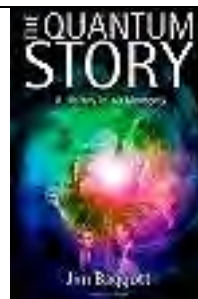
[Principles of Geotechnical Engineering](#)



[Geotechnical Earthquake Engineering](#)



[Microflows and Nanoflows](#)



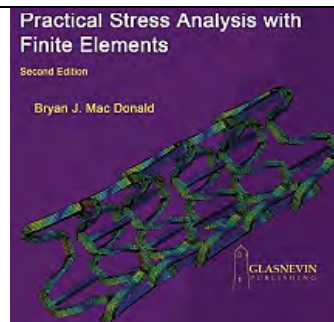
[The Quantum Story: A History in 40 Moments](#)



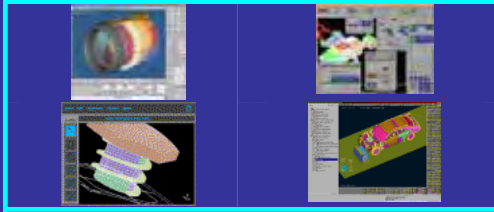
[The Quantum World: Quantum Physics for Everyone](#)



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



[Practical Stress Analysis With Finite Elements](#)



## 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 or 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  
FEA Participants  
Site Directory

**LS-DYNA On Demand Additional Core (cloud) Services**

US	<a href="http://www.sgi.com/products/hpc_cloud/cyclone/index.html">http://www.sgi.com/products/hpc_cloud/cyclone/index.html</a>
Sweden Germany	<a href="http://www.gompute.com">http://www.gompute.com</a>

**LS-DYNA Information Sites**

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/lsppl">www.lstc.com/lsppl</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>



## Information Solutions Site Directory

### Additional LS-DYNA Information Sites

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

**Call for Papers/Announcement  
June 3-5, 2012  
Dearborn, Michigan, USA**



**12th International LS-DYNA®  
Users Conference**

Livermore Software  
Technology Corp.

<http://www.ls-dynaconferences.com>

The 12<sup>th</sup> International LS-DYNA® Users conference will be held in Dearborn, Michigan, USA, June 3-5, 2012.

The conference will provide an ideal forum for LS-DYNA worldwide users to share technology. Providing a venue to learn new features, and applications of LS-DYNA, LS-OPT, LS-PrePost, LS-TaSC, LSTC Dummy and Barrier Models, as well as the many software and hardware alliances of LSTC's products.

All of our users from industry, research and academia are invited to present a paper.

The exhibition area hosts the latest software and hardware developments providing you the opportunity to speak directly with the company about their products.

**Call For Papers**

Application areas being accepted for submission:

- Aerospace
- Automotive Crashworthiness
- Ballistic/Penetraion
- Bimechanics
- Civil Engineering
- Compressible Fluid Dynamics
- Electro Magnetics
- Heat Transfer
- Impact/Drop Testing
- Manufacturing Processes
- Metal Forming
- Modeling Techniques
- Nuclear Applications
- Occupant Safety
- Seismic Engineering
- Ship Building
- Transportation
- Virtual Proving Ground

**Paper Submission\***

For submission details contact [papers@lstc.com](mailto:papers@lstc.com)

**Sponsorship**

For sponsor and/or Exhibit booth information contact [conference@lstc.com](mailto:conference@lstc.com)

**Registration Fees\***

Conference Only \$450  
Training Only \$450  
Conference/Training \$900

**Hotel Accomodations**

Conference attendees will be able to reserve a discounted room rate. Contact: [conference@lstc.com](mailto:conference@lstc.com)

\*The presenter of each accepted paper will receive free admission to the conference, provided that the presenter register for a room, at the Hyatt Regency, Dearborn under LSTC Conference registration

**Suggested Post-Conferences Courses:** Impact/Dummies & Barriers - Heat Transfer & hot stamping – ALE – EFG – SPH - Polymeric Material with LS-DYNA – Ballistics/Penetration – contact [conference@lstc.com](mailto:conference@lstc.com) with questions/course requests.

**Contact:** [conference@lstc.com](mailto:conference@lstc.com)

**e-mail:** [papers@lstc.com](mailto:papers@lstc.com) **tel:** 925-449-2500 **Fax:** 925-961-0806

Livermore Software Technology Corp., 7374, Las Positas Rd, Livermore, CA 94551 USA

**Conference Venue**

Hyatt Regency Dearborn  
600 Town Center Drive  
Dearborn, MI  
48126-2793, USA  
[www.dearborn.hyatt.com](http://www.dearborn.hyatt.com)

**IMPORTANT DATES**

**Abstract Deadline**

Nov. 11, 2011

**Acceptance Notification**

January 5, 2012

**Final Paper Deadline**

March 1, 2012

**AGENDA**

**Sunday, June 3**

Registration  
Pre-Conference Seminars  
Reception/Entertainment

**Monday, June 4**

Registration  
Plenary Presentations  
Keynote Presentations  
Technical Sessions  
Exhibit Area  
Banquet/Entertainment

**Tuesday, June 5**

Registration  
Exhibition Area  
Presentations:

- John O. Hallquist
- Sponsors

**POST CONFERENCES COURSES**

Wed/Thurs June 6-7



## 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 the 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

The Complete Training Courses Offered Can Be Found At <http://www.lstc.com>  
 Training Coordinator: Cathie Walton [Cathie@lstc.com](mailto:Cathie@lstc.com)

Start Date	Location	Course
08/01/11	CA	LS-PrePost (no charge with Intro to LS-DYNA)
08/02/11	CA	Intro to LS-DYNA
08/23/11	MI	Advanced ALE Applications
09/06/11	CA	Implicit
09/08/11	CA	Advanced Options in LS-DYNA
09/12/11	MI	LS-PrePost (no charge with Intro to LS-DYNA)
09/13/11	MI	Intro to LS-DYNA
09/19/11	CA	Contact in LS-DYNA
09/20/11	MI	LS-OPT

Courtesy Posting of 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

### DYNAmore Nordic AB

LS-PrePost 3, introduction  
September 12, 2011

LS-DYNA, introductory  
September 13, 2011

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

LS-OPT, Optimization and  
robust design  
October 4, 2011

LS-DYNA, implicit analysis  
October 11, 2011

ANSA & Metapost, Introductory  
October 25, 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  
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  
November 8-9

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

LS-DYNA User Options  
to be announced

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

ETA

<http://www.eta.com> for training dates and additional information

### **Introduction to DYNAFORM**

Introduction to DYNAFORM for sheetmetal forming applications. Includes Die Face Engineering and Blank Size Estimation tutorials.

Duration: 2 day course

### **Using PreSys with NISA**

An introduction to PreSys for finite element modeling and the NISA finite element solver. This course will teach the student how to use PreSys to create their finite element model, set up a NISA simulation and review the results of the simulation. Workshop problems will be used to demonstrate of the principles discussed in the course material.

Duration: 1 day course

### **Introduction to PreSys**

An introduction to the PreSys software for finite element modeling and results visualization. This course provides the basics for creating finite element model from CAD data, property definition and analysis preparation and

visualization of simulation results. Workshop problems will be used to demonstrate all of the principles discussed in the course material.

Duration: 1 day course

### **Introduction to LS-DYNA**

This course is intended for the new user, or those who might like a refresher on the basics of creating, running, debugging and analyzing an LS-DYNA model. The course will be in a lecture/workshop format, with the user running example models and post-processing the results.

Duration: 2 day course

Please contact [support@eta.com](mailto:support@eta.com) This e-mail address is being protected from spambots. You need JavaScript enabled to view it , call (248) 729-3010, or register online to reserve a seat at the desired training session. Space is limited, so please reserve a seat as early as possible.



## LS-DYNA Users

### Challenge Your Knowledge

#### Question 1

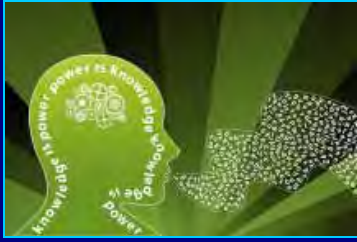
The following question was sent by Uli Franz of DYNAmore – DYNAmore is headquartered in Germany. <http://www.dynamore.de>

You may answer the questions and write the answers in the boxes below. The LS-DYNA Keyword User's Manual will help you to succeed.

C	O	N	T	R	O	L	_																				
C	O	N	T	R	O	L	_																				
M	A	T	_																								
M	A	T	_																								
C	O	N	T	R	O	L	_																				
C	O	N	T	R	O	L	_																				

### QUESTIONS

- Line 1: In which card can you specify that a highly distorted shell element will be deleted if its Jacobian is negative?
- Line 2: Where can you set a flag for additional NaN checks in the force and moment arrays?
- Line 3: Which material in LS-DYNA has a hyphen in the name?
- Line 4: What is the name of material 181?
- Line 5: In which card can you switch bulk viscosity for shells on?
- Line 6: What is the variable (flag) name to force the contact algorithms to take the initial penetrations during the simulation into account, instead of moving the nodes to a non-penetration position at the beginning of a simulation?
- Line 7: In which card can you switch the time-stepping scheme? E.g. from explicit to implicit?



# Answer to Question #1

LS-DYNA Users

Challenge  
Your Knowledge

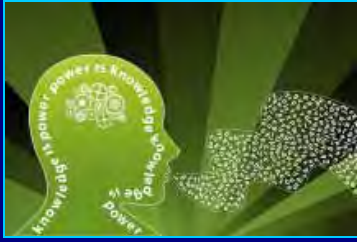
ANSWER Question #1:

## QUESTION BOX

C	O	N	T	R	O	L	_																	
C	O	N	T	R	O	L	_																	
M	A	T	_																					
M	A	T	_																					
C	O	N	T	R	O	L	_																	
C	O	N	T	R	O	L	_																	

Answers:

C	O	N	T	R	O	L	_	S	H	E	L	L													
C	O	N	T	R	O	L	_	S	O	L	U	T	I	O	N										
M	A	T	_	M	O	O	N	E	Y	-	R	I	V	L	I	N	_	R	U	B	B	E	R		
M	A	T	_	S	I	M	P	L	I	F	I	E	D	_	R	U	B	B	E	R	/	F	O	A	M
C	O	N	T	R	O	L	_	B	U	L	K	_	V	I	S	C	O	S	I	T	Y				
I	G	N	O	R	E																				
C	O	N	T	R	O	L	_	I	M	P	L	I	C	I	T	_	G	E	N	E	R	A	L		



## Question 2

### LS-DYNA Users

### Challenge Your Knowledge

#### 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:

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

LS-DYNA:  $dt = 0.17372 \text{E-}02$

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





### Question 3

#### LS-DYNA Users

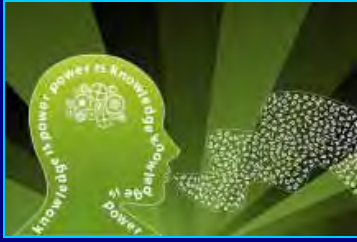
#### Challenge Your Knowledge

Quiz:

Taking a closer look on the material models in LS-DYNA, one can distinguish between two different kinds of material laws. On the one hand, one can find material laws, which relate stresses to strains. Keeping thereby in mind that there exist several stress and strain measures, care must be taken on the interpretation of force vs. displacement or stress vs. strain diagrams. For example, the basis for a parameter identification of an elastoplastic material model in LS-DYNA is typically a true stress true strain curve, cf. <http://www.dynasupport.com/tutorial/computational-plasticity>. On the other hand, there exist material laws, which relate directly forces to displacements or moments to rotations, respectively. These types of material laws are known as discrete material laws and require other element formulations in LS-DYNA, cf. the keyword \*SECTION\_DISCRETE or beam element form six.

Please download the LS-DYNA input file beam2.k ([http://www.dynasupport.com/links/fea-information-examples/beam2.k/at\\_download/file](http://www.dynasupport.com/links/fea-information-examples/beam2.k/at_download/file)) and answer the following questions. The exercise intends to give a better understanding of the above mentioned two classes of material formulations:

1. Take a look on the force vs. displacement relationship of the beam. Why can you find a nonlinear relation between these two variables, although an elastic material law is chosen? How can you check this?
2. Reference within the part keyword of the beam the material and section keywords with the id two. Carry out the simulation and take a further look on the force vs. displacement curve. Why is there a linear relation between these two variables now?
3. Define a further node at the origin of the coordinate system and replace the second node of the beam by this new node. Carry out a simulation and take a look on the force vs. displacement curve of the beam. Why can you observe no difference in comparison with the beam of finite length?
4. Take a look on the critical time steps of the discrete beams with and without a certain length. Why can you find the same value for both configurations?
5. Divide the mass of the beam in halves. What is the consequence for the critical time step?



## Answer 3

### LS-DYNA Users

### Challenge Your Knowledge

Solutions:

- 1.) \*MAT\_ELASTIC provides a material formulation between true stresses and strains and not between engineering stresses and strains or forces and displacements. If you plot true stresses vs. strains, you will find the linear relation between them.
- 2.) Now a discrete material law is used, whereby the force is directly related to the displacement.
- 3.) As a discrete material law relates forces to displacements and not to strains, where generally the displacement is related to the length of an element, the resulting force depends only on the displacement between the two nodes of the beam element and not on the length between them.
- 4.) The critical time step of an element with a discrete material law is independent of the length of the element.
- 5.) The critical time step decreases. The critical time step of a element with an discrete material law depends on the mass and the stiffness.



## 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) -



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- USA**                            SE&CS  
                                    Contact: len@schwer.net
- USA**                            Predictive Engineering  
                                    Contact: george.laird@predictiveengineering.com
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                                    Contact: support@engineering-group.com
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**ITALY**                EnginSoft SpA  
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**Netherlands**        Infinite Simulation Systems, B.V  
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**Sweden**             Engineering Research AB  
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**UK**                    OVE ARUP & PARTNERS  
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## 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:  
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Thank you for your interest in our products!

**Best regards, LSTC Models Development Team**



## News Release

SGI

[http://www.sgi.com/company\\_info/newsroom/press\\_releases/2011/july/swinburne.html](http://www.sgi.com/company_info/newsroom/press_releases/2011/july/swinburne.html)

### **Swinburne University of Technology Selects SGI to Accelerate Astrophysics Research - Hybrid CPU- and GPU-Based System Will Serve as National Facility for Astronomers**

Fremont, Calif. — July 13, 2011 — SGI (NASDAQ: SGI), a trusted leader in technical computing, today announced that the Swinburne University of Technology in Melbourne, Australia, has selected an SGI® Rackable™ and Altix® UV 10 high performance computing (HPC) solution to accelerate the study of astrophysics for astronomers, students and other researchers.

The chosen solution consists of 69 Rackable C3108 computer servers and four Altix UV10 systems as large-memory nodes with over 975 total processor cores built with both Intel® Xeon® processor 5600 series and E7 product family and NVIDIA® Tesla™ C2070 and M2090 GPUs. The networking technology connecting the systems is a Qlogic QDR Infiniband non-blocking network. For storage, the solution has 13 SGI IS5000 storage arrays, providing 1.8PB of Lustre storage. This phase of the system, known as gSTAR for GPU Supercomputer for Theoretical Astrophysics Research, will have a direct link to the Australia Telescope National Facility (ATNF) in Parkes, NSW, to process telescope data outputs.

"This new SGI system will deliver more than 130 teraflops of computing power, making it over 10 times more powerful than the Green Machine, our existing supercomputer," said Dr. Jarrod Hurley, manager of Swinburne's supercomputer. "This addition opens many new avenues for cutting edge simulations and rapid processing of telescope data."

"The interest in combining CPU and GPU processing in HPC solutions is increasing," said Bill Mannel, vice president of product marketing at SGI. "It's critical that research institutions such as Swinburne have the ability to quickly and accurately capture, process and share this kind of data."

The first phase of the system is expected to be operational in September 2011, and will be housed in Swinburne's new Data Center. Phase two of the project, which will focus primarily on CPU-based compute nodes, is expected to be completed by early 2012.

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.

**Contact Information:** Ogilvy Public Relations, Analisa Schelle, 415-677-2721, [SGIPR@sogilvyr.com](mailto:SGIPR@sogilvyr.com)

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# Highlights

2011

April	LS-TaSC™ Version 2 - Topology Design using LS-DYNA® <b>LS-Dyna - Topology And Shape Computation</b>
May	Release of LS-OPT® Version 4.2
May	LS-PrePost Update
June	AVI Showcase – rubber powered airplane propeller using *MAT_OGDEN_RUBBER AVI: <a href="#">Rubber Plane.avi</a> 2.86MB LANCEMORE Corp. Tokyo, Japan