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Engineering Journal and Website Resource

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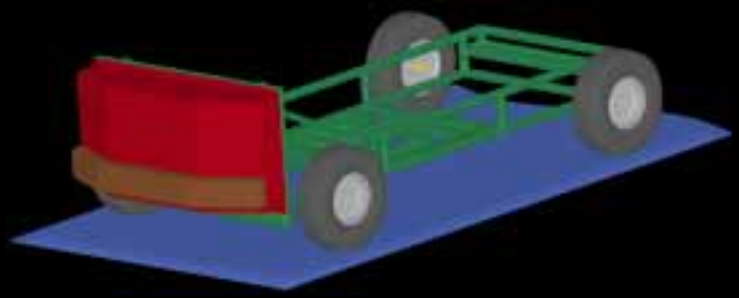
LS-DYNA Barrier & Dummy Models



Welcome to the May edition of FEA Information Engineering Journal and Website Resource.

This month we have many articles/information on LS-DYNA®:

- Barrier Models
- New Features and Enhancements in Version 971 R4.2
- Pipe Network Flow Analyzer
- LS-OPT Version 4
- Distributor Profile for LS-DYNA Sales and Consulting
- China and India updates on LS-DYNA
- LS-DYNA hybrid

Additionally on KRONES AG for Deformation Behaviour Analysis of PET Bottles in a High Speed Labeling Machine, sent in by LS-DYNA distributor CADFEM GmbH.

Information on additional software solutions – profile: SIMPLEWARE

Having returned, last week, from the 7th European LS-DYNA Conference, I will have a review of the conference in our June edition. The presentations and speakers made it a technical and informational success. The atmosphere brought engineers together for many hours of collaboration.

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LS-DYNA® Version 971 R4.2 new features and enhancements

General

- Added new keyword *COMMENT.

ALE

- Added coupling of ALE ambient type 5 elements with *LOAD_BLAST_ENHANCED wherein pressure and velocity BC applied to ambient ALE elements are provided by *LOAD_BLAST_ENHANCED.
- Added *ALE_AMBIENT_HYDROSTATIC and *INITIAL_HYDROSTATIC_ALE for initializing and prescribing hydrostatic pressure in ALE liquids due to gravity.
- Improvements to *AIRBAG_PARTICLE:
    - Support of heat convection in CPM to account for heat loss to ambient.
    - Performance improvement for CPM method.
    - Added option for dynamic particle radius scaling.
    - Added ELA support for *MAT_FABRIC.
    - Added particle-to-structure momentum transfer option

Boundary Conditions

- Added orientation of a rigid body by specifying the time history of components of a body fixed vector. The remaining free rotational degree of freedom (rotation about the vector axis) can be also be specfied as either zero, constant or a function of time. (*BOUNDARY_PRESCRIBED_ORIENTATION_RIGID)
- Added optional death time for *BOUNDARY_PRESCRIBED_ORIENTATION_RIGID.
- Pore pressure analysis for geotechnical models, allowing modeling of drained or undrained pore water, time-dependent consolidation, or calculation of steady-state pore pressures. New keywords:
    - *BOUNDARY_PORE_FLUID
    - *BOUNDARY_PWP_option
    - *CONTROL_PORE_FLUID
    - *DATABASE_PWP_OUTPUT
    - *DATABASE_PWP_FLOW
    - *MAT_ADD_PERMEABILITY
    - *INITIAL_PWP_DEPTH
- Add Birth and Death time to *BOUNDARY_SPC option.
- Nonlinear soil-structure interaction invoked via
    - *INTERFACE_SSI
    - *BOUNDARY_FREE_FIELD_GROUND_MOTION

Constrained Options

- Added MPP support for self piercing rivet. (*CONSTRAINED_SPR, *CONSTRAINED_SPR2)

Contact Options

- Added segment based (SOFT=2) contact options:
    - DEPTH=13. Behavior is similar to DEPTH=3, but it has been tuned to improve energy conservation
    - DEPTH=23. Behavior is similar to DEPTH=3, but contact detection uses a new algorithm intended to improve robustness.
    - Automatically split quad shell segments into 2 triangular segments.
    - Report penetrations of shell mid-planes.
    - Use a moving average of the current time step in the penalty stiffness calculation rather than the initial time step.
- Added new option to automatic tiebreak contact (*CONTACT_..._TIEBREAK) opt 9/11 (Dycoss): Parameters NFLS and/or SLFS can now be negative. The absolute value then defines a load curve for peak traction(s) vs. segment size. This should be helpful in case of coarse meshes.
- Added d3hsp output of DTSTIF from Contact Optional Card C for SOFT=1.
- Consistent thermal contact algorithm for mechanical contact SOFT=2 and in particular for contact with 6-noded segments from 10-noded tetrahedra.
- Segment to segment mortar contact for implicit contact analyses.
- Added friction and energy calculations to *CONTACT_GUIDED_CABLE. Friction is an option in the manual, but was not implemented in the coding.
- Bug fix for thick shells when used with contact entities.

Control Options

- Added the ability to generate superelement representations of parts using Static Condensation, see *CONTROL_IMPLICIT_STATIC_CONDENSATION.
- Extended *CONTROL_IMPLICIT_MODES to include eigenmodes and optionally generate the superelement representation of the part. This enables the LS-DYNA to build the Craig-Bampton linear representation of a part using constraint and eigenmodes.
- Superelements constructed by *CONTROL_IMPLICIT_STATIC_CONDENSATION and *CONTROL_IMPLICIT_MODES are written in either the Nastran extended format for DMIG files or a LS-DYNA binary format, which reduces the size of the file. *ELEMENT_DIRECT_MATRIX_INPUT has been extended to read the binary format.
- *CONTROL_IMPLICIT_TERMINATION has been extended to allow user control over termination the simulation in ways other that the end time. Energy based tests have been added to the original displacement control.

- Enhanced the robustness and speed of the nonlinear solution process for implicit mechanical transient simulation. An area of special focus has been metal forming applications. We have added a contact penetration checking option (see *CONTROL_IMPLICIT_SOLUTION) and a new keyword *CONTROL_IMPLICIT_FORMING.

- A collocation boundary element method is developed based on Burton-Miller formulation, to solve the irregular frequency problem for exterior acoustics. This method is available now for SMP and MPP. (*CONTROL_VIBRO_ACOUSTIC, *LOAD_VIBRO_ACOUSTIC)

- Simple one-step, implicit solution for gravity loading of models which may even include contacts and unattached parts is now possible. Available in SMP and MPP. (*CONTROL_IMPLICIT_FORMING (may be renamed later))

- Implemented new ALE 2D capabilities and mapping to ALE 3D (*CONTROL_ALE2D)

- Pore pressure analysis for geotechnical models, allowing modeling of drained or undrained pore water, time-dependent consolidation, or calculation of steady-state pore pressures. New keywords:

    - *BOUNDARY_PORE_FLUID
    - *BOUNDARY_PWP_option
    - *CONTROL_PORE_FLUID
    - *DATABASE_PWP_OUTPUT
    - *DATABASE_PWP_FLOW
    - *MAT_ADD_PERMEABILITY
    - *INITIAL_PWP_DEPTH

- Steady state rolling analysis is a generalization of *LOAD_BODY, allowing the user to apply body loads to part sets due to translational and rotational accelerations in a manner that is more general than the *LOAD_BODY capability. This capability is useful for initializing the stresses and velocity of tires during dynamic relaxation, and rolling processes in manufacturing. Still undergoing development. New keywords:

- *LOAD_STEADY_STATE_ROLLING

- *CONTROL_STEADY_STATE_ROLLING

- New argument for user friction interface USRFRC (*CONTROL_CONTACT): plastic strain at slave node as average value from surrounding solid or shell elements.

- Enable hourglass control type 6 (*CONTROL_HOURGLASS) for solid element material *MAT_123 (*MAT_MODIFIED_LINEAR_PIECEWISE_PLASTICITY).

- Added a new option c=-cputim. The absolute value of cputim will be used to terminate the restart job based on the cpu time of the current run and not the cumulative cpu time. This negative cputim can be input as a command line option or in the first field of *CONTROL_CPU.

- *CONTROL_THERMAL_SOLVER (2nd optional card, 8th field):

    - TSF = thermal speedup factor (default 1.)
    - This parameter will scale all thermal velocity terms (e.g., heat transfer coefficient) for use with mechanical time scaling (e.g., artificially increasing the punch velocity).
- *CONTROL_CONTACT (6th card, 3rd field):
    - ITHCNT < 0: conduction evenly distributed (pre-R4)
    - = 0: default set to 1
    - = 1: conduction weighted by shape functions, reduced integration
    - = 2: conduction weighted by shape functions, full integration
- *CONTROL_THERMAL_SOLVER:
    - SOLVER = -1: symmetric direct solver (ACTCOL)
    - SOLVER = 1: reset to use solver 11
- Added part option to dynamic relaxation, IDRFLG=3 (*CONTROL_DYNAMIC_RELAXATION).

Damping Options

- Added damping energy calculation for *DAMPING_FREQUENCY_RANGE
- Added SET option to *DAMPING_PART_STIFFNESS and *DAMPING_PART_MASS.
- Fix for secforc (*DATABASE_CROSS_SECTION_...) calculation when tet type 4 is used in the meshing.

Database/Output

- Added binary database for visualizing blast pressures applied to structures. (*DATABASE_BINARY_BLSTFOR)
- Pore pressure analysis for geotechnical models, allowing modeling of drained or undrained pore water, time-dependent consolidation, or calculation of steady-state pore pressures. New keywords:
    - *BOUNDARY_PORE_FLUID
    - *BOUNDARY_PWP_option
    - *CONTROL_PORE_FLUID
    - *DATABASE_PWP_OUTPUT
    - *DATABASE_PWP_FLOW
    - *MAT_ADD_PERMEABILITY
    - *INITIAL_PWP_DEPTH
- Added a new database, *DATABASE_ATDOUT for the automatic tiebreak damage option.
- Added D3HSP output of DTSTIF from Contact Optional Card C for SOFT=1.

- Added IOOPT option for *DATABASE_BINARY_INTFOR (Card 3).
- Added new keyword *DATABASE_EXTENT_D3PART to control the output of D3PART.
- *DATABASE_EXTENT_BINARY (4th optional card, 1st field):
    - DTDT=0, no action
    - DTDT=1, dump nodal temperature rate DT/DT to D3PLOT
- Add t=0 state to D3DRLF database (*DATABASE_D3DRLF).
- Added rigid surface contact output to RCFORC file (*DATABASE_RCFORC).
- Echo *MAT_ADD_THERMAL_EXPANSION data into the D3HSP file.

Define Options

- Added new options for *DEFINE_CURVE_FUNCTION:
    - ELHIST: monitors elemental quantities such as stress and strain
    - RCFORC: monitors contact interface forces
    - Possible to prescribe the acceleration of a rigid body as function of model reresponse.

EFG

- Improvements to EFG (Element Free Galerkin):
    - Added adaptiviity for solid EFG and shell EFG in MPP.
    - Implemented an explicit version of stablized EFG method for 8-noded and 6-noded integration cells.
    - Implemented a formulation switch from stablized method to conventional EFG method controlled by time and other parameters.
    - Implemeneted an EFG fracture formulation for 4-noded integration cell.
    - Added MPP for adaptive EFG method for solid formulation and shell formulation.
    - Included MPP thermal solver in the adaptive EFG formulation for solids.

Elements

- Superelements constructed by *CONTROL_IMPLICIT_STATIC_CONDENSATION and *CONTROL_IMPLICIT_MODES are written in either the Nastran extended format for DMIG files or a LS-DYNA binary format, which reduces the size of the file. *ELEMENT_DIRECT_MATRIX_INPUT has been extended to read the binary format.
- Added capability for a "skew angle" option in sliprings for better friction modeling. It requires the input of an orientation node, and a second friction coefficient (or a user defined friction function), and computes friction based on the wrap angle (as seen when looking "down the slipring axis", ie the cylinder the belt passes over) and the skew angle (how much the belt twists as it passes over the slipring).

- Consistent thermal contact algorithm for mechanical contact SOFT=2 and in particular for contact with 6-noded segments from 10-noded tetrahedra.
- Fix for problem with MCID option on *ELEMENT_SHELL definition.
- Fix spall options 1,2, and 3 in *MAT_015 (*MAT_JOHNSON_COOK) for shell elements.

EOS

- Fix for *EOS_GASKET related to unloading option.

Hourglass Options

- Enable hourglass control type 6 (*HOURGLASS) for solid element material *MAT_123 (*MAT_MODIFIED_LINEAR_PIECEWISE_PLASTICITY).

Implicit

- Extended *CONTROL_IMPLICIT_MODES to include eigenmodes and optionally generate the superelement representation of the part. This enables the LS-DYNA to build the Craig-Bampton linear representation of a part using constraint and eigenmodes.
- Superelements constructed by *CONTROL_IMPLICIT_STATIC_CONDENSATION and *CONTROL_IMPLICIT_MODES are written in either the Nastran extended format for DMIG files or a LS-DYNA binary format, which reduces the size of the file. *ELEMENT_DIRECT_MATRIX_INPUT has been extended to read the binary format.
- *CONTROL_IMPLICIT_TERMINATION has been extended to allow user control over termination the simulation in ways other that the end time. Energy based tests have been added to the original displacement control.
- Enhanced the robustness and speed of the nonlinear solution process for implicit mechanical transient simulation. An area of special focus has been metal forming applications. We have added a contact penetration checking option (see *CONTROL_IMPLICIT_SOLUTION) and a new keyword *CONTROL_IMPLICIT_FORMING.
- Simple one-step, implicit solution for gravity loading of models which may even include contacts and unattached parts is now possible. Available in SMP and MPP. (*CONTROL_IMPLICIT_FORMING (may be renamed later))
- Segment to segment mortar contact for implicit contact analyses.

Include Options

- Added optional thickness scaling for *INCLUDE_STAMPED_PART (new real parameter on Card 3, Column 8).
- Fix for symmetric mapping (*INCLUDE_STAMPED_PART_... with ISYM>0). When mirroring the stress/strain tensor, 2 of the 3 shear stresses change sign. It was changed for all 3 shear stresses before, which was wrong.
- Added option to enable a 'mapping only' run by setting INCOUT=4 in *INCLUDE_STAMPED_PART.

Initial Conditions

- Added *ALE_AMBIENT_HYDROSTATIC and *INITIAL_HYDROSTATIC_ALE for initializing and prescribing hydrostatic pressure in ALE liquids due to gravity.
- Pore pressure analysis for geotechnical models, allowing modeling of drained or undrained pore water, time-dependent consolidation, or calculation of steady-state pore pressures. New keywords:
    - *BOUNDARY_PORE_FLUID
    - *BOUNDARY_PWP_option
    - *CONTROL_PORE_FLUID
    - *DATABASE_PWP_OUTPUT
    - *DATABASE_PWP_FLOW
    - *MAT_ADD_PERMEABILITY
    - *INITIAL_PWP_DEPTH
- Fix for reading of *INITIAL_STRESS_SOLID with EOS history variables.
- New large format for *INITIAL_STRESS_SHELL.

Interface

- Added an optional _ID to *INTERFACE_COMPONENT_....
- Added command *INTERFACE_COMPONENT_FILE to specify name and format (LSDA is now the default format) of interface database that is written. "z=" on execution line will override this command. Similarly, added command *INTERFACE_LINKING_FILE to specify name of interface database that is read. "l=" on execution line will override the command.
- Nonlinear soil-structure interaction invoked via
    - *INTERFACE_SSI
    - *BOUNDARY_FREE_FIELD_GROUND_MOTION

Loads

- A collocation boundary element method is developed based on Burton-Miller formulation, to solve the irregular frequency problem for exterior acoustics. This method is available now for SMP and MPP. (*CONTROL_VIBRO_ACOUSTIC, *LOAD_VIBRO_ACOUSTIC)
- Added empirical pressure loading module for treating multiple blast sources. Also now possible to define the location of the blast using a node ID. Also, a death time for blast can be specified. (*LOAD_BLAST_ENHANCED)
- Added airburst blast loading which takes into account ground reflected waves and formation of a Mach stem wave. (*LOAD_BLAST_ENHANCED)
- Added blast loading from missile delivered warhead (shaped charge or exlosively forged projectile) which produces a non-spherical blast front. (*LOAD_BLAST_ENHANCED)

- Added coupling of ALE ambient type 5 elements with *LOAD_BLAST_ENHANCED wherein pressure and velocity BC applied to ambient ALE elements are provided by *LOAD_BLAST_ENHANCED.
- New keyword *LOAD_THERMAL_VARIABLE_BEAM similar to *LOAD_THERMAL_VARIABLE_SHELL allows temperatures in beam elements to vary piecewise-linearly over the cross-section.
- Steady state rolling analysis is a generalization of *LOAD_BODY, allowing the user to apply body loads to part sets due to translational and rotational accelerations in a manner that is more general than the *LOAD_BODY capability. This capability is useful for initializing the stresses and velocity of tires during dynamic relaxation, and rolling processes in manufacturing. Still undergoing development. New keywords:
    - *LOAD_STEADY_STATE_ROLLING
    - *CONTROL_STEADY_STATE_ROLLING
- Added option to *LOAD_MOVING_PRESSURE to scale the pressure based on the distance between the nozzle and the surface.

Material Models

- Added RTCL damage to *MAT_123 (*MAT_MODIFIED_PIECEWISE_LINEAR_PLASTICITY).
- Added *MAT_220 (*MAT_ORTHOTROPIC_ADVANCED_DAMAGE), for solid elements.
- Added beam spot weld failure option -9 which is like 9 except that beams do not fail.
- *MAT_171 (*MAT_STEEL_CONCENTRIC_BRACE) hysteretic algorithm improved to avoid the possibility of a step change of result for small changes of input. New input field EPTCRIT. Also, fixed bug in loadcurve option.
- *MAT_169 (*MAT_ARUP_ADHESIVE) added new optional input parameter BTHK (bond thickness by default, this is taken from the element dimension). Also, fixed bug that would have prevented wedge elements from working correctly. Also added input parameter THKDIR to allow thickness direction to be taken from element topology rather than smallest element dimension.
- *MAT_172 (*MAT_CONCRETE_EC2) less conservative timestep calculation; enable stiffness-method hourglass control; new option for concrete compressive behaviour following Mander algorithm (TYPEC=6); new input parameter UNLFAC controlling unload stiffness; shear capacity calculations; reinforcement directions may be specified using AOPT inputs.
- End-releases for *MAT_191 (*MAT_SEISMIC_BEAM) now tolerant of being connected to constrained nodes.
- New *MAT_202 (*MAT_STEEL_EC3) for use in fire analysis integrated beam elements only.
- Pore pressure analysis for geotechnical models, allowing modeling of drained or undrained pore water, time-dependent consolidation, or calculation of steady-state pore pressures. New keywords:

    - *BOUNDARY_PORE_FLUID
    - *BOUNDARY_PWP_option
    - *CONTROL_PORE_FLUID
    - *DATABASE_PWP_OUTPUT
    - *DATABASE_PWP_FLOW
    - *MAT_ADD_PERMEABILITY
    - *INITIAL_PWP_DEPTH
- Modifications for *MAT_017 (*MAT_ORIENTED_CRACK). Crack propagation to adjacent elements via two new input parameters: SOFT and CVELO.
- Improvements to *MAT_187 (*MAT_SAMP-1):
    - Handling of strain rates and damage.
    - Bug fix when used with penta elements.
    - New parameter RBCFAC (Card 1, Column 7) is the ratio of yield in biaxial compression vs. yield in uniaxial compression.
- Added new option to cohesive *MAT_138 (*MAT_COHESIVE_MIXED_MODE): parameters T and/or S can now be negative. The absolute value then defines a load curve for now be negative. The absolute value then defines a load curve for peak traction(s) vs. element size. This should be helpful in case of coarse meshes.
- Read reference geometry flag (REF) for *MAT_183 (*MAT_SIMPLIFIED_RUBBER_WITH_DAMAGE): Card 3, Column 2.
- Extension of *MAT_120_JC (*MAT_GURSON_JC): new material parameters KW, BETA, and M are read on new optional Card 7, Columns 1, 2 and 3. KW and BETA are used in Hutchinson model (void growth under shear) and M is for enhanced JC failure (nonlinear damage evolution).
- New options for *MAT_054 (*MAT_COMPOSITE_DAMAGE_ENHANCED) for shells:
    - New parameter PFL (Card 7,Column 1) defines the percentage of layers which must fail until crashfront is initiated (reduced strengths in neighbor elements).
    - Linear damage for transverse shear defined by 3 new input parameters: damage initiation strain, final rupture strain, and transverse shear maximum damage.
- Enable hourglass control type 6 (*HOURGLASS) for solid element material *MAT_123 (*MAT_MODIFIED_LINEAR_PIECEWISE_PLASTICITY).
- Changes to *MAT_077 (*MAT_HYPERELASTIC_RUBBER, *MAT_OGDEN_RUBBER):
    - Enable to work with tet formulation 13.
    - Added reference geometry option (Card 1, Column 8).
- Fix for *MAT_089 (*MAT_PLASTICITY_POLYMER), solids were not eroded after failure.

- Improvements to *MAT_036 and *MAT_133 (*MAT_3-PARAMETER_BARLAT and *MAT_BARLAT_YLD2000):
    - Added Chaboche-Roussilier kinematic hardening.
    - Added consistent viscoplasticity from tables.
- Material parameters defined by load curves in *MAT_006 (*MAT_VISCOELASTIC).
- Improvements to *MAT_103 (*MAT_ANISOTROPIC_VISCOPLASTIC):
    - Multiphase description, i.e., the material can consist of several phases where each has its own set of constitutive parameters.
    - Added consistent viscoplasticity (directly) from tables.
    - User damage available (not only failure).
- Added *MAT_UHS_STEEL, an advanced material for hot stamping simulations including 5 phases, 4 phase transitions and trip effects. This model is available for both for solids and shells.
- Added thermal effects for 2D and 3D SPH elements (*MAT_THERMAL_ISOTROPIC).
- Added viscoplastic model to *MAT_124 (*MAT_PLASTICITY_COMPRESSION_TENSION).
- Added option to *MAT_83 (*MAT_FU_CHANG_FOAM) to reload on original loading curve when damage is active.
- Changed damping in *MAT_181 (*MAT_SIMPLIFIED_RUBBER/FOAM) foam option to correct nonphysical transverse deformation under compression.
- Fix for *MAT_133 (*MAT_BARLAT_YLD2000) load curve option.
- Fixed *MAT_ADD_EROSION to work properly with multiple failure criteria.
- Fix spall options 1,2, and 3 in *MAT_015 (*MAT_JOHNSON_COOK) for shell elements.
- Added rate effects to *MAT_003 (*MAT_PLASTIC_KINEMATIC) for beam elements for the option VP=0.
- Fix for *MAT_105 (*MAT_DAMAGE_2) to fail element on plastic strain as documented in the users manual.
- Echo *MAT_ADD_THERMAL_EXPANSION data into the D3HSP file.
- Perfectly matched layer material for absorbing outgoing waves from a computational domain, thus simulating wave propagation in unbounded domains. Available as
    - *MAT_230 (*MAT_PML_ELASTIC) (Elastic material)
    - *MAT_230_FLUID (*MAT_PML_FLUID) (Elastic fluid material)
    - *MAT_237 (*MAT_PML_HYSTERETIC) (for Biot hysteretic material)
    - *MAT_231 (*MAT_PML_ACOUSTIC) (Acoustic media)

- Biot hysteretic material for modelling frequency-independent damping. (*MAT_232 (*MAT_BIOT_HYSTERETIC))

Parameter

- Added optional _TITLE for *PARAMETER and *PARAMETER_EXPRESSION.

Part Options

- Thermal composite shells available in *PART_COMPOSITE.
- Fix for *PART_MOVE so it works correctly with 10 node tetrahedron elements.
- Fix for *PART_MOVE when used with a part defined by *PART_COMPOSITE.
- Reference surface offsets now work for *PART_COMPOSITE.

Section Options

- Added thick shell formulation 5 (ELFORM=5 on *SECTION_TSHELL). It has 1 integration point per layer and calls 3D stress update routines. It uses an assumed strain field for accurate bending stiffness and improved behavior with layered anisotropic materials.
- Changes to *MAT_077 (*MAT_HYPERELASTIC_RUBBER, *MAT_OGDEN_RUBBER):
    - Enable to work with tet formulation 13.
    - Added reference geometry option (Card 1, Column 8).
- New fully integrated solid elements to reduce transverse shear stiffness for elements with poor aspect ratio (element types -1 and -2) (*SECTION_SOLID).
- Added consistent mass matrix to 10-node tetrahedral element type 16 (*SECTION_SOLID).
- Fix for secforc (*DATABASE_CROSS_SECTION_...) calculation when tet type 4 is used in the meshing (*SECTION_SOLID).
- Fix for energy conservation problem with shell type 16 (*SECTION_SOLID) when warping stiffness is active.
- Bug fix for thick shells when used with contact entities.

SPH

- Added a Lagrangian kernel for 3D SPH elements (IFORM=7 and IFORM=8 for the renormalized lagrangian kernel).

LS-DYNA Pipe Network Flow Analyzer © Arthur Shapiro

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The complete article is archived and can be read at:

Metal Forming Simulation menu link Library

Objective

Calculate the flow rate and convection heat transfer coefficient in each flow passage in the tools for the hot stamping manufacturing process.

Introduction

The tools must be cooled in the hot stamping manufacturing process. The geometry of the cooling passages in the tools runs the gamut from straight single pass pipes to pipes with branches and flow patterns that follow the shape of the stamping. One approach is to use a CFD code to calculate the flow velocity and predict a convection heat transfer coefficient. This heat transfer coefficient, h, is then used in a coupled thermal-stress calculation to predict die cooling and the effect of the cooling rate on the stamping. The advantage of Navier-Stokes CFD is that h is calculated at every node point and can vary with radial and axial position. The accuracy depends on the fineness of the mesh to capture the boundary layer in order to predict a reliable value for h. The main disadvantage is that as the mesh is refined the CPU time increases and may become prohibitive.

An alternative approach it to use a pipe network flow analyzer. This approach is based on an overall energy and mass balance. An average value for h is predicted for the pipe segment. This is a very quick computation and our future plan is to embed this in LS-PrePost with a GUI.

Think about the pipes in your house. The starting point is the valve on the pipe entering your house. We will call this NODE 1. NODE 1 is special and has a boundary condition specified. This BC is the pressure you would read on a pressure gauge attached to the valve or the water volumetric flow rate. The water enters your house and passes through several fittings (e.g., elbows and tees) before it exits through the faucet in your sink. Every pipe fitting is represented by a node. The node representing the faucet is special in that a pressure BC must be specified. The pipe flow code will calculate the pressure at the intermediate junction (fitting) nodes and the flow rate through each pipe. The convection heat transfer coefficient is then calculated for each pipe.

In water hydraulics we use the term "head" as a pressure measurement in units of feet or meters. "Head" can be converted to pressure units of Pa or psi which you are probably more familiar with. However, we need to make a distinction between thermodynamic pressure and the elevation of pipes above the ground. The equations simplify if we add thermodynamic pressure (converted from Pa to m) and elevation (m). This is known as the "total head".

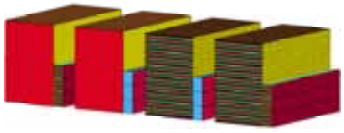
Metal Forming Simulation

menu link Library

LSTC FE ODB Barrier
for use in IIHS 40% Front Offset Vehicle Impact

We are getting ready to release our FE ODB barriers. The development of these barriers is based on over 16 physical tests. We have highlighted some of the important characteristics of the barriers in the following list.

- Barriers are available in shell and solid version
- Adhesive modeling between the cladding sheet and the honeycomb structure is modeling using TIE-BREAK interface
- Average yield stress for the honeycomb material model as a function of off-axis angle
- Shear damage function to simulate punching through the honeycomb core and bumper
- Easy integration into any vehicle environment



For more information on these barriers, you can feel free to contact Suri Bala from LSTC by writing to him at 'suri@lstc.com'

LS-OPT® Version 4: Enhanced Visualization Capabilities for Multi-Objective Optimization

Nielen Stander - *Livermore Software Technology Corporation*

The next generation LS-OPT® postprocessor has just been released as part of Version 4 of LS-OPT®. The new Viewer is based on a redesigned architecture that provides a greatly enhanced environment for the design engineer. The major enhancements are as follows:

- New plot types such as Correlation Matrix, Parallel coordinate plot, Hyper-radial Visualization (HRV).
- A higher level of interactivity in the various plots. E.g. the Correlation Matrix plot allows the user to pop up the scatter plots or histograms for closer inspection while the Parallel Coordinate plot allows bounding of the functions in order to isolate a desirable design set.
- A split-window feature which allows multiple windows to be displayed in the same frame.
- Multiple ways of adding windows: replacing, splitting. Windows are detachable. Visibility can be toggled.
- Multiple simulation points or metamodel points can be selected and displayed in a spreadsheet format.
- The export and printing features have been significantly improved with the availability of most popular file formats.
- Integrated point selection, i.e. selected points are highlighted across multiple plot types.
- Zooming, which is useful for plots with high point density.

A further major feature available in Version 4 is:

- A Post-processor capability featuring the META post-processor (Beta CAE Systems S.A.) for result extraction. In this way LS-OPT can be used with any of the simulation codes supported by the META postprocessor.

Two of the new visualization features are highlighted here:

Pareto Optimal Frontier (POF): The POF represents a set of optimal points generated by solving the multi-objective optimization problem. The purpose of visualizing the POF is to explore the POF domain for suitable designs. The visualization may be complicated by high dimensionality, i.e. a large number of design objectives may be involved. An example of a crashworthiness problem with 4 objectives is used. Figure 1 represents a subset (100 points) of the original Pareto Optimal set determined by the GA algorithm. Three different plot types are shown namely (i) a three-dimensional scatter plot (top left), (ii) Hyper-Radial Visualization (top right) and (iii) the Parallel Coordinate plot (bottom). A thickness parameter value (t5) as a function of each point has been selected as a color attribute on the upper two plots.

The parallel coordinate plot is ideal for displaying points in multiple dimensions. It can also be used to isolate a smaller subset of optimal points. The highlighted subset was obtained by bounding the objective functions using the sliders featured in the plot.

HRV enables the two-dimensional mapping of points in n-dimensional space. The point configuration in the HRV diagram is the result of equal weighting of the objective functions. These weights can be adjusted (see slider feature in control window top left) for finding interesting optimal designs for different scenarios of objective weighting. Multiple points can be selected to be tabulated by drawing a box around the selected group (table shown in Figure 2).

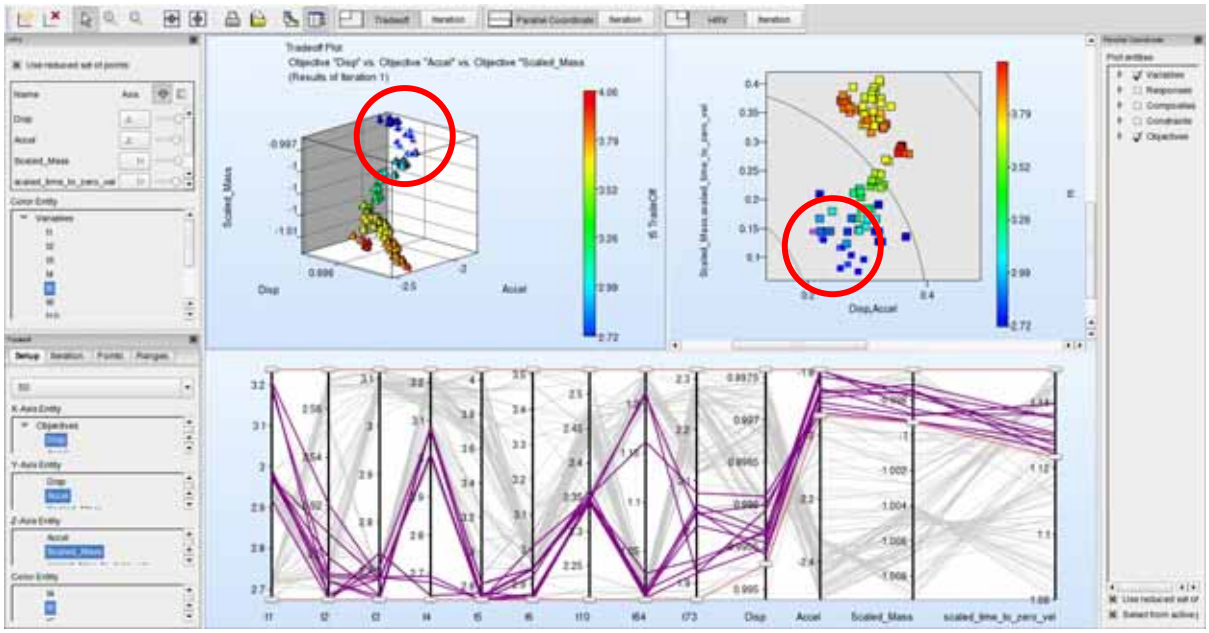


Figure 1: Multi-window display showing three different plot types of the Reduced Pareto Set: Three-dimensional scatter plot (top left), Hyper-Radial Visualization (top right) and Parallel Coordinate plot (bottom) of a few points selected by the user. The grey lines in the Parallel Coordinate plot represent points excluded by the interactive bounding of the constraints using the sliders on the plot (the 4 values on the extreme right of the PC plot are maximized as far as possible). Note cross-highlighting of selected points (circled in red). The point closest to the Utopian point (hypothetical design which minimizes all of the objectives independently) is also highlighted in purple on the HRV diagram. The statistics of the 8 selected points are displayed in the spreadsheet format shown in Figure 2.

Figure 2: Spread sheet format of Pareto Optimal points selected from Figure 1. Points can be added or deleted interactively.

Correlation Matrix: A second major new feature is the Correlation Matrix. Figure 3 displays the correlation matrix of a 1000 simulation points of a full vehicle crashworthiness simulation in which gauges are used as design variables. To be noted in the upper triangle is the low cross-correlation of the input variables as well as some negative (shades of blue) or positive (shades of red) correlations with respect to the performance variables. The lower triangle displays the corresponding scatter plots while the diagonal displays the distribution of the input variables and responses obtained from the simulations. The scatter plots and histograms can be popped up for more detail.

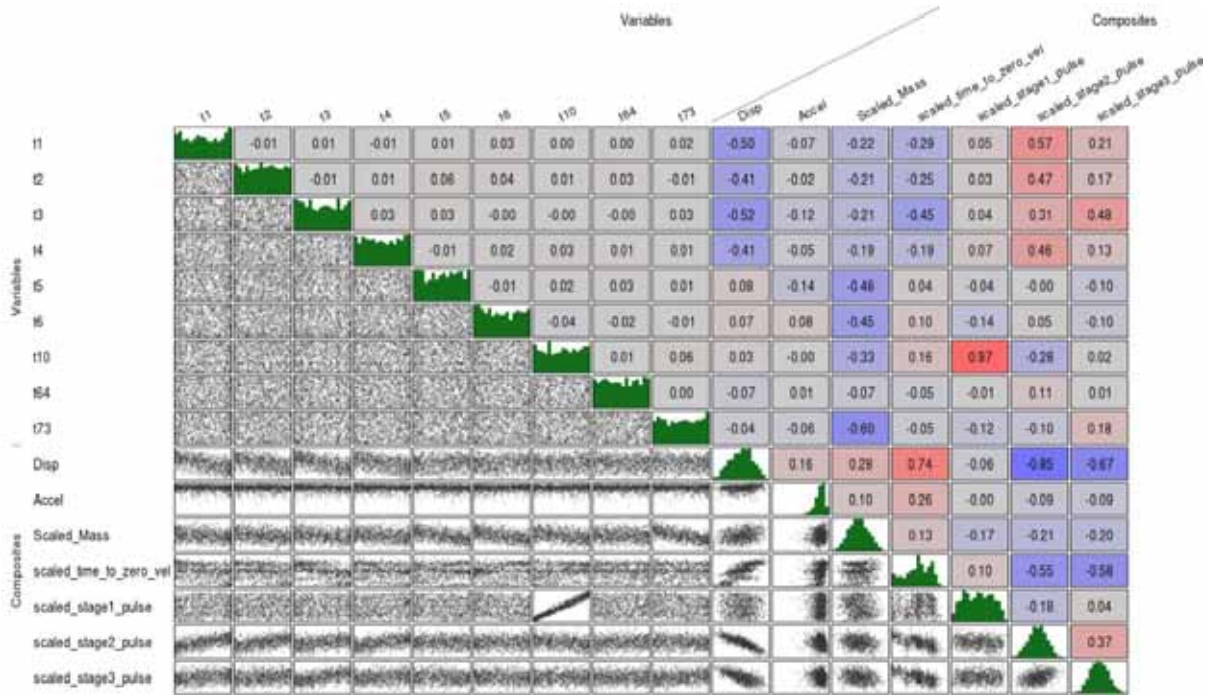


Figure 3: Correlation plot of simulation points. 1000 Point example.

In conclusion, LS-OPT Version 4 presents a significant step forward in terms of new features and enhanced flexibility. The new architecture promises to ease future development and as a result Version 4.1 is advancing rapidly and will include several additional features for visualizing the Pareto Optimal Frontier and other result types. More information about Version 4.0 can be obtained in:

Stander, N., Roux, W., Goel, T., Björkevik, D., Witowski, K., Belestam, C., Reliability-based Multi-Objective Optimization and Visualization using LS-OPT® Version 4, Proceedings of the 7th European LS-DYNA Conference, 14-15 May, 2009, Salzburg, Austria

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Distributor Profile & AVI

STRELA - LSTC's Direct LS-DYNA, LS-OPT, LS-PrePost Distributor

Strela

AVI#23A; Pedestrian Impacting vehicle hood. Courtesy STRELA, Russia

STRELA, founded in 2001, as LSTC's only authorized Russian distributor, is located in the city of Snezhink which is located halfway between the cities of Ekaterinburg and Chelyabinsk in the Southern Ural Mountains – the boundary between Europe and Asia. These two cities are known for their industrial capacity, and scientific and educational centers. The Volga Region of Russia, to the West of STRELA, is known for automotive and aerospace industries.

STRELA is located in close proximity to the All-Russian Scientific Research Institute of Technical Physics (VNIITF).

The most distinguishing feature of STRELA is their ability to integrate many, often disparate, areas of science and engineering to solve complex technical problems. In this way, they can provide customers with a level of technical consulting that can't be found elsewhere within Russia.

In addition to providing LS-DYNA sales and training, STRELA is also in business to provide computer simulations and calculations for industrial organizations on their world class Open Computer Center.

Attending the recent 7th European LS-DYNA conference in Salzburg Austria from STRELA were Olga Voikina and Alexey Abramov.

For sales information on LS-DYNA, LS-PrePost, LS-OPT, LS-DYNA Dummy and Barrier Models contact:

Olga Voikina:

o.v.voikina@mail.vega-int.ru

China Update – Training Courses - Isheng Yeh - LSTC

Airbag Training Course Success

With the increase of LS-DYNA licenses in the automotive industry in China and worldwide LS-DYNA, LS-PrePost and LS-OPT courses are being attended by engineers, from the major automotive industry. China's automotive industry has been and continues to be one of the major LS-DYNA users, for crash simulation, pedestrian safety, and specific applications within automotive such as airbag simulation.
Airbag Simulation is an important automotive engineering field requiring engineers with technical excellence and training.

LSTC, the developer of LS-DYNA and the LS-DYNA distributors, ARUP/ETA/NEC, held a successful Airbag Training Course in China.

Attending were 31 engineers from major China automotive industry leaders: Delphi, Autoliv, Key Safety, TRW, Johnson Control, Visteon, Magna, Faurecia, Jeely Motor, Shanghai Motor, Chang An Motor, Foton Motor and SMVIC.

The course, taught by Isheng Yeh, of LSTC, included aspects of airbag simulation ranging from design, folding, material, contact, folding to deployment using CV, ALE and CPM.

Students had course time as well as time to ask specific questions. A relaxed yet technical atmosphere made this training course one that was heavily attended and will be held again in the future.

Graduating Class - April 22 and 23.

Future Courses:

LSTC, together with all its China distributors, will hold a training on "ALE and MPP" at the end of July. Jason Wang, of LSTC, a key developer of LS-DYNA's ALE and MPP, will be the instructor for this class.

The course will start with the theory and implementation of ALE in LS-DYNA. Description of ALE-related commands and their industrial application will be covered. MPP commands in LS-DYNA will be detailed so that users know how to make the best use of LS-DYNA's latest MPP capabilities. For further details, please contact isheng@lstc.com

If you are interested in a specific course or training at your company designed specifically for your company's needs in an application, please feel free to contact Isheng Yeh, isheng@lstc.com

LS-DYNA hybrid

Tim Prince,
Nick Meng

Intel® Developer Relations Division
May 10, 2009

Description

LS-DYNA hybrid combines the functions of MPP and SMP. Each MPI process includes multiple SMP threads (usually 2 or 4, up to the total number of threads supported on a single node).

Hybrid is available for Linux* OS x86_64, and has been tested successfully also on Windows* X64 OS.

Goal #1: Increase usable cluster size

LS-DYNA/MPP cluster customers have been running jobs across large numbers of nodes.

Basic CPU and node performance has increased with recent hardware, to the point where cluster performance scaling begins to be limited by inter-connect already at 64 MPP processes even for the Infiniband* QDR. By reducing the number of processes to one per multi-core CPU, using SMP threading to take advantage of multi-core, a larger total number of cores may be used effectively.

Under a workstation "pro" version of Windows operating system, the total number of MPI processes may be limited to 10. With hybrid, up to 8 quad core CPUs may be supported. Argonne MPICH2 supports installation on such systems without extra-cost Windows OS options, and Intel® MPI library for Windows should provide an equivalent installation script in a future release.

Goal #2: Consistency with varying number of cores

SMP consistency mode is available in LS-DYNA hybrid. The goal of consistency is to be able to adjust the total number of threads (but not the number of MPP processes) without affecting numerical results.

Demonstration of Consistency Mode

As an example of consistency mode, we run the neon revised and 3cars benchmarks with –n 16 (16 MPI processes, and ncpu values of -1 through -8. We verify that the nodout files produced by the l2a unpack of binout0000 do not change within 4 or 5 significant digits.

Timing results follow:

Neon model 30ms	16MPI x ncpu=-1 Total 16 cores	16 MPI x ncpu=-2 Total 32 cores	16 MPI x ncpu=-4 Total 64 cores	16 MPI x ncpu=-8 Total 128 cores
Elapsed Time	1480s/1.00	789s/1.88	510s/2.9	389s/3.8
Identical result	Yes	Yes	Yes	Yes
3cars model 150ms	16MPI x ncpu=-1 Total 16 cores	16 MPI x ncpu=-2 Total 32 cores	16 MPI x ncpu=-4 Total 64 cores	16 MPI x ncpu=-8 Total 128 cores
Elapsed Time	7831s/1.00	4810s/1.63	3531s/2.22	3397s/2.31
Identical result	Yes	Yes	Yes	Yes
3cars model 150ms	64MPI x ncpu=-1 Total 64 cores	64 MPI x ncpu=-2 Total 128 cores	64 MPI x ncpu=-4 Total 256 cores	64 MPI x ncpu=-8 Total 512 cores
Elapsed Time	2302s/1.00	1464s/1.58	1073s/2.15	1039s/2.22
Identical result	Yes	Yes	Yes	Yes

These results were obtained on a cluster of Intel® Xeon® processor 5500 series, 2.8Ghz, Red Hat, Intel® MPI library for Linux OS.

If an engineer has access to a limited number of nodes during working hours, a job could be run with 1 or 2 threads per MPP process, so as to run on a small number of nodes. When a cluster is put into batch mode, the job could be run faster and efficiently by using more nodes, up to 8 SMP threads per MPP process. As the results above show, performance scaling by adding SMP threads is not as good as would be obtained by pure MPP without consistency, but it is enough to be useful, depending on the model.

The standard number of cores per CPU has gone from 1 to 4 in recent years. In the next 2 years, 6 and 8 core CPUs are expected, so that scalability range of LS-DYNA hybrid will increase.

If a hardware upgrade is performed to CPUs with more cores, an LS-DYNA/hybrid job can be set to take advantage of the additional cores while preserving consistency mode.

Running with Intel® MPI library

Set environment variable

I_MPI_PIN_DOMAIN=omp

Similar hybrid modes are supported by HP and Intel® MPI library, where the MPI takes into account OMP_NUM_THREADS setting to allocate MPI processes and OpenMP threads.

The MPI run-time library allocates the threads appropriately to the number of MPI processes. LS-DYNA parameter ncpu sets number of threads per MPI process. OMP_NUM_THREADS is set to the total number of threads per node (MPI processes times ncpu) for best scheduling.

setenv OMP_NUM_THREADS 8

mpdboot –n 2 -r rsh (set number of nodes for following run; the –r option may be required by your installation)

mpiexec –n 4 mpp971_impi_hybrid ncpu=-4 i=input.k

would run 4 processes, each using 4 cores, consistency mode, on a 2 node dual quad core cluster, 16 cores total. The 4 threads of each process are bound to the 4 cores of a quad core CPU, in order to optimize cache and memory locality. The negative ncpu convention specifies consistency mode (no OpenMP reduction), as in pure SMP.

Performance

In single node tests, hybrid is not expected to perform much different from SMP. Consistency mode adds an additional run time penalty of >20% on neon_refined_revised.

When running on a large cluster, 16 nodes or more, with standard inter-node communication devices such as InfiniBand*, hybrid (not consistency mode) should eventually make a reduction in run time possible, or scale performance up to a larger total number of cores, when compared with pure MPP.

A paper was presented on hybrid performance to be presented at LS-DYNA Europe conference 2009.

Up to now, hybrid is still in a pre-release state. It is only one of several possible means for extending the performance of large InfiniBand* clusters, such as dual rail InfiniBand*, or other high performance hardware options.

Summary

LS-DYNA Hybrid intends to offer advantages over LS-DYNA/MPP in several different usage models.
First, performance of a large job may be scaled to a larger number of nodes by Hybrid.

Second, the SMP consistent model provides for varying number of CPU cores used by a job without introducing numerical variation in results (at some cost in performance).

Third, Hybrid offers opportunity to build a small cluster under an operating system which limits the total number of MPI processes, such as Windows XP64 OS or Vista*-64 OS.

All of these usage models show some promise, but require further work before they could be recommended without qualification.

INDIA NEWS UPDATE - CAE Technology Symposium

Ramesh Venkatesan

CAE Technology Symposium
http://www.easi.com/upcoming-events.aspx

Event Overview

EASi has partnered with ARAI to host this highly technical and educational event for the Indian Automotive industry. This symposium will cover the engineering challenges associated with meeting the increasingly demanding performance expectations from OEMs and progressively stringent safety regulations. Leading industry experts from India and abroad will cover advances in Safety regulations, Testing and Certification, and Simulation technology.

Date: 9th June 2009
Time: 09.30 AM to 6.30 PM
Venue: ARAI
Survey No. 102, Vetal Hill, Off Paud Road,
Kothrud, Pune -
411 038

To learn more, please visit:
http://www.easi.com/upcoming-events.aspx

For Registration:

Contact: Jay Simha

Mobile: +919880433468

Direct: +918066147065

Email: jsimha@easi.com

Session Overview 9:30AM – 6:PM

- Welcome Address
- CAE approach for crash and safety engineering – LSTC
- Tea Break –
- EASi Technology Partnership
- Multi-Disciplinary Design Optimization - b-CAE
- Lunch –
- Bridging physical test and simulation methods - b-CAE
- Accelerated Product Development using CAE Collaboration- VCollab
- Tea Break –
- Improved Vehicle Dynamics – CAR SIM
- Vehicle development programme using Analytical and Experimental tools –ARAI
- Closing Remarks

Deformation Behaviour Analysis of PET Bottles in a High Speed Labeling Machine

The KRONES group designs, develops, manufactures and installs both machines and complete filling and packaging lines, and also a long-term customer of CADFEM. This article describes an explicit LS-DYNA analysis of the deformation behavior of filled and capped PET bottles in the high speed labeling machine.

The increasing use of PET bottles has been and continues to be a dramatic growth story in the packaging industry. Increasing use means an increase in demand and the need for saving time in the process chain of the packaging industry. One area where a high speed process is possible is labeling. Capable of labeling 67,500 containers per hour, KRONES Contiroll HS (high speed) wraparound labeling machine (Fig. 1) is the trend setter in labeling technology.

However in higher output ranges in the labeling technology, PET bottles are subjected to undesirable deformations due to its lower Young's Modulus and much thinner walls compared to glass bottles. For a particular machine speed, information on the deformation behavior early during machine planning will be useful. To obtain this detail, the explicit FEM software LS-DYNA was used for this work.

Objective & Tasks

The sequence of steps carried out is

- Top load simulation & verification of empty PET bottle: To obtain reliable empty PET bottle model
- Top load simulation & verification of filled PET bottle: To obtain reliable filled PET bottle model
- Process simulation of filled PET bottle in the high speed labeling machine: To inspect deformation behavior of PET bottle

Quasi-Static Buckling Analysis of Empty Bottle

Prior to the quasi-static buckling analysis, sensitivity studies were carried out with respect to material, geometry and finite element parameters to obtain an optimized parameter set. This set, when used in the quasi-static buckling analysis, yielded a nice fit of the pre- and post-buckling behaviour with the test data (Fig. 2). This validated the

reliability of the optimized parameter set. The moderate differences observed in the load-displacement curves is mainly due to the usage of simple material model (*MAT_PIECEWISE_LINEAR_PLASTICITY) in LS-DYNA, which does not consider the complex behavior of PET material in reality. Type 16 (fully integrated) shell elements with proper warpage treatment were preferred to Type 2 (reduced integrated) shell elements to avoid non-physical initialization of buckling.

Fig. 2 Structural Response of Empty Bottle

Quasi-Static Buckling Analysis of Filled Bottle

Having now obtained a reliable empty bottle, presence of water & air along with its physics (compressibility, inertia and hydrostatic pressure) need to be accounted for a filled bottle. Control Volume (CV), Smoothed Particle Hydrodynamics (SPH) & Arbitrary Lagrangian Eulerian (ALE) methods were evaluated in LS-DYNA for ease of implementation, computation effort, and most importantly, to simulate the liquid physics accurately. Studies performed on these three approaches have shown the following:

- CV approach: Simplest, most accurate and computationally least expensive method to account for the compressibility effect. Since mass of the liquid cannot be modeled with this approach, inertial effects cannot be accounted for.
- SPH approach: Accounts for the inertial effects, but fails to account for the compressibility effect accurately due to non-realistic gap between the walls of the bottle & water (SPH particles). In addition, modeling of both air and water with SPH is infeasible.
- ALE approach: Computationally, the most expensive. Existence of potential leakage problems and extreme sensitivity of a parameter (PFAC) to fluid-structure coupling leads to an unreliable result.

Since fluid compressibility is the most important effect for predicting the correct buckling load in a quasi-static buckling analysis, CV approach is considered for top load simulation of the filled bottle. The initial slope and the buckling load, which are most important for KRONES, fit nicely with the test results (Fig. 3).

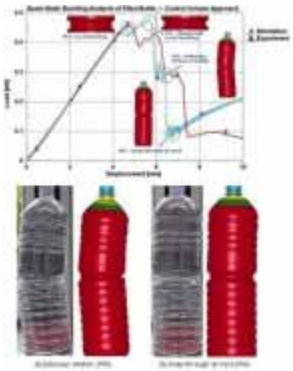

Fig. 3 Structural Response of Filled Bottle

Also the post-buckling shape of the filled bottle from simulation resembles the test (Fig. 3). The postbuckling regime is influenced mostly by the missing inertial effects in CV approach.

Process Simulation in Labeling Machine

The goal of the process simulation is not to check for the bottle labeling procedure, but to predict the deformation behavior of the bottle due to the inertial forces (Centrifugal & Coriolis). The bottle experiences these forces due to the two kinds of rotations (with respect to table and with respect to itself) during the labeling process. Since the inertial forces acting on the bottle are governed mainly by the mass of the water, idealization of water with SPH particles was considered for accurately accounting the inertial effects of water. Moreover CV's for both air and water were retained in the model setup (Fig. 4) to account accurately for the compressibility effects of air and water respectively.

Fig. 4 Model setup for process simulation

Concerning the kinematics, or how the two rotations are described, full rotation approach (where the bottle is physically moved in reality) and load body approach (where imagining that the observer is sitting on top of the bottle, inertial loads are calculated and applied on a motionless bottle) were evaluated. As in reality, liquid (SPH particles) inside a rotating bottle experiences inertial forces only after a certain amount of time once it also starts rotating, full rotation approach was preferred to load body approach to account for this effect naturally.

As the time taken for a single bottle to undergo such a quick and dynamic process is only 803 ms it was very hard for KRONES to obtain any test data about the deformation behavior of the bottle. However, for any machine to be termed reliable it has to fulfill certain requirements. These requirements serve as a means for validating the simulation results. The major requirements which are to be fulfilled are as follows:

- Bottle should not be thrown out of the labeling machine (i.e. machine usage guaranteed).
- Bottle is not allowed to buckle at any point in time within the labeling machine (i.e. usability of the bottle is guaranteed).
- Allowable lateral deformation (Fig. 5) of the bottle for proper label location is very small (i.e. promotion of brand quality guaranteed).

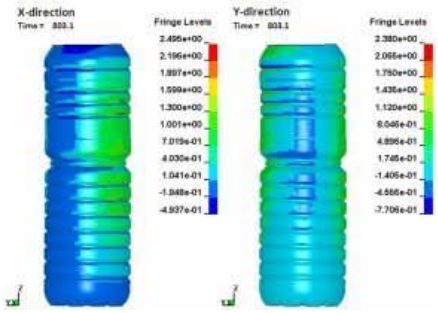

Fig 5 Deformation of the bottle body in mm

In addition, SPH particles represent an inclined free surface of the liquid which is normally expected due to the outward movement of the particles once the bottle starts to rotate with the table (Fig. 6).

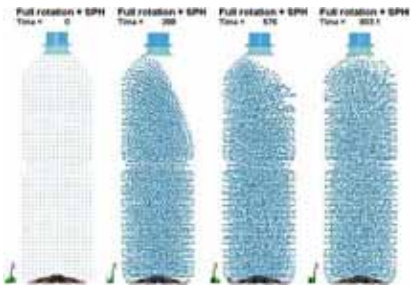

Fig 6. Movement of SPH particles in the bottle (body hidden)

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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. µETA, 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.

PrePost Processing Profile:

SIMPLEWARE & SIMPLEWARE June Workshop

Simpleware

Provides software solutions for robust, fast, and easy conversion of 3D images into high quality meshes, which can be used for:

- Finite Element Analysis (FEA)
- Computational Fluid Dynamics (CFD)
- Computer Aided Design (CAD)
- Rapid Prototyping (RP)

The ease and accuracy with which models can be generated from 3D datasets such as MRI, CT, and MicroCT, have opened up image-based analysis to a variety of applications, including:

- Industrial Reverse Engineering
- Biomechanical Research
- Implant Design & Manufacturing
- Research in Materials and Composites
- Natural Sciences

Simpleware services division provides complete services to convert 3D images into Finite Element and Rapid Prototyped models. Tailored software solutions based on platform technology are also provided.

Simpleware Workshop: Image-based Meshing for Biomechanics, Biomedical and Materials Applications

Friday, 5 June 2009, 1:00 pm
University of Nottingham, Pope Building, Room A16

http://www.simpleware.com/news/events/workshop2009.php

This workshop is aimed at those currently using, as well as those interested in using, 3D image data (as obtained from CT, Micro-CT, MRI and Ultrasound) to generate Rapid Prototyping, CAD, and Finite Element models.

Attend this Workshop to learn:

- about new techniques available in image-based meshing
- how to generate computer models from your 3D image data
- how to import and position CAD files the image data
- how to integrate with Ansys, Abaqus, Comsol, LS-Dyna, or other solvers
- how to use Simpleware software for specific applications in medical engineering or materials science

The workshop is FREE and participants are welcome to attend the whole workshop or any of the three sessions: presentation, demonstration, and hands-on tutorial.

Registration Information: www.simpleware.com/news/events/workshop2009.php

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

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

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*Environement 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.NastranTM 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.

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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.

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

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

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

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

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

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.

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

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

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

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).

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

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.

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

Consulting and Engineering Services

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

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

LS-DYNA® and Related Courses LSTC & Worldwide 2009

Information on LSTC classes contact jane@lstc.com

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

Courses are in Alpha Order	Country	Company	Date
Implicit Training	France	ALYOTECH www.alyotech.fr	24-June

Courses by Paul Du Bois

Blast & Penetration	France	ALYOTECH www.alyotech.fr	8-Oct
Crash Analysis	Germany	DYNAmore www.dynamore.de	1-Dec
Crash Analysis	Germany	CADFEM www.dynamore.de	24-Nov

COURSES BY OASYS – UK

Course Name	Country	Date
Oasys PRIMER - Automatic Assembly of Multiple Crash Cases	UK	15th June 2009 (half day)
Oasys PRIMER – Spotwelds & Connections	UK	15th June 2009 (half day)
Oasys LS-DYNA Environment Automotive Crash Modelling	UK	23rd – 25th June 2009
Oasys PRIMER & Oasys D3PLOT – JavaScripting	UK	29th June 2009
Optimization with LS-OPT (introductory)	UK	7th & 8th July 2009
Stochastic Analysis with LS-OPT (advanced)	UK	9th July 2009
Fluid/Structure Interaction in LS-DYNA	UK	14th & 15th September 2009
Using the Implicit Capabilities of LS-DYNA	*UK*	*(October 2009)*

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

"3rd ANSA & µETA International Conference"

This is an excerpt: For full conference information visit:

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.

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…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

Mrs. Photini Paraskevopoulou

BETA CAE Systems S.A.

tel: +30-2392-021914

fax: +30-2392-021828

email: congress@beta-cae.gr

Abstracts submission:

Final manuscripts submission:

June 20, 2009

Registration until: **June 30, 2009**

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

2nd International Conference on Hot Sheet Metal Forming Of High-Performance Steel -

June 15-17, Luleå, Sweden

The 2nd 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^2. For further information: www.chs2.eu. See also www.ltu.se/tfm/chs2 and www.metform.de. Any questions can be addressed to Lena Olsson, 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, micro-structure 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^2 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.

ICCT09 1st International Conference on Concrete

Tabriz, IRAN

The 1st 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 Retrofiting Center, Tabriz, Iran and will be organized in close contact with the Chair of Structural Design at Dresden Univesity 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:

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
Europe: Dresden, Germany
Europe@icct.ir

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
- Time integration
- Element Technology
- Multiscale analysis
- Isogeometric methods
- Finite elements in fluids
- XFEM and level sets
- Meshfree methods
- Plates and shells
- Fluid-structure interaction

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

J Simo and TJR Hughes:
Computational Inelasticity

TJR Hughes:
The Finite Element Method

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.

Contact Information: If you have any questions regarding this course, please send us an e-mail at info@feshortcourse.com - If you have any questions regarding registration for this course, please send us an e-mail at : registration@feshortcourse.com

For more details see **FE Short Course**

Available for Purchase From Amazon.com

TJR Hughes - The Finite Element Method

T. Belytschko, WK Liu, B Moran - Nonlinear Finite Elements for Continua and Structures

J Simo and TJR Hughes - *Computational Inelasticity*

EnginSoft Int'l Conference and ANSYS Italian Conference 2009

1-2 October, Bergamo – Italy

The EnginSoft International Conference 2009 will feature CAE Technologies for Industry. Leading experts from around the world will highlight CAE applications in automotive, aerospace, energy, marine, oil&gas, consumer goods, environment, biomedicine and other.

The Call for Papers is now open, please visit the conference website:

http://meeting2009.enginsoft.it

Follow the sound of innovation - Get inspired about CAE

Software that will be presented through application cases and in product update sessions include:

- ANSYS
- ANSYS CFX
- ANSYS FLUENT
- ANSYS ICEM CFD
- modeFRONTIER
- LS-DYNA
- FLOWMASTER
- MAGMASOFT -
- FORGE
- FTI
- THIRD WAVE SYSTEM
- ESACOMP ...

Conferences & Events

06/8-10 Portugal	**11th Int'l Conf.- Optimum Design of Structures and Materials Engineering**
06/15-17 Sweden	**2nd Int'l Conf. - Hot Sheet Metal Forming Of High-Performance Steel**
06/16-19 Greece	**NAFEMS World Congress**
06/23-24 USA	**PLM Summit North America 2008**
07/16-19 USA	**10th US National Congress on Computational Mechanics**
09/09-11 Greece	**3rd ANSA & µETA Int'l Conf**
10/01-02 Italy	**Enginsoft International Conference 2009**
11/14/-20 USA	**SC2009**

2010 USA: June 6th-8th - Hosted by Livermore Software Technology Corp.
The 11th International LS-DYNA® Users Conference

The Hyatt Regency, Dearborn, Michigan USA

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Direct Link to the information sign up page.

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ETA	**Panasas**	**Cray**	**SGI Insider Newsletter**

Tutorials and Workshops

Tutorials and Workshop Page Oasys LS-DYNA Environment