NEWS FROM THE VIRTUAL TRY-OUT SPACE

PAM TALK

ISSUE 33

WINTER 2007

Success Story

SRI Sports Ltd. uses ESI Group's RAYON solution to maintain leading edge technology for golf gear design

Success Story

Welding Simulation of Aluminum Automotive Construction Using SYSWELD

PAM-STAMP 2G v2007

Product News

ESI GROUP
THE VIRTUAL TRY-OUT SPACE® COMPANY

contents

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Product releases which make a difference.

As a golf player myself, let me tell you something… To hear the exact sound of a golf club before it even exists? Not a chance! Turn to page 7 to find out how RAYON achieves this feat. To take into account springback in metal stamping or even welding of high strength and dual phase steels? Unlikely, at least, not in the near future! Well, it's currently being done with encouraging results, as related on page 6 and 8. A number of other barriers have been breached as you will find throughout these pages.

The release of ESI Group's leading softwares are unveiling horizons that few would have thought within reach so soon. While PAM-STAMP 2G manages to extend, gain in polyvalence and become more accessible as detailed on page 4, PAM-CRASH 2G reaches out to the aeronautics industry with the revolution of Multi-Model Coupling particularly indicated for large structures (see page 16), and Multi-Scale technology for the handling of high speed phenomenon such as birdstrikes, as illustrated on page 17. Meanwhile, VA One 2006 is recognized as the world's first fully integrated environment for predicting the vibro-acoustic response of complex systems across the entire frequency spectrum (page 16), and EASi-Crash RAD/DYNA succeed in combining both pre- and post-processing in safety-crash simulation while actually accelerating preparation and analysis. Read more on page 13.

editorial

The Casting section starting on page 18 introduces the Semi-Solid Material technology with its specific advantages, and how the challenge of modelizing such a process was met with the help of ProCAST. The numerous Casting events worldwide are summarized on page 20. Check-out www.esi-group.com/News/events for up-coming events in your country.

EuroPAM 2006 proved to be an ideal place to discuss common annual achievements across multiple industries and applications. Find a review of this and other 2006 Asian PAM events on page 21. Join us in Prague, Czech Republic, for the next edition of EuroPAM in June 2008!

Enjoy this issue, and don't forget that more is always available on www.esi-group.com!

Nathalie David-Franc
Executive Editor

Focus on PAM-STAMP 2G Version 2007.0

The new version of PAM-STAMP 2G is due to be released early 2007, and will include innovation like hot forming and significant enhancements in response to request from customers for streamlining and productivity increase. The version focuses on enhancing the entire 2G value chain, with usability & iteration upgrade for PAM-DIEMAKER, accuracy improvements in PAM-QUIKSTAMP, and extended process simulations for 'full line dies' and springback compensation in PAM-AUTOSTAMP.

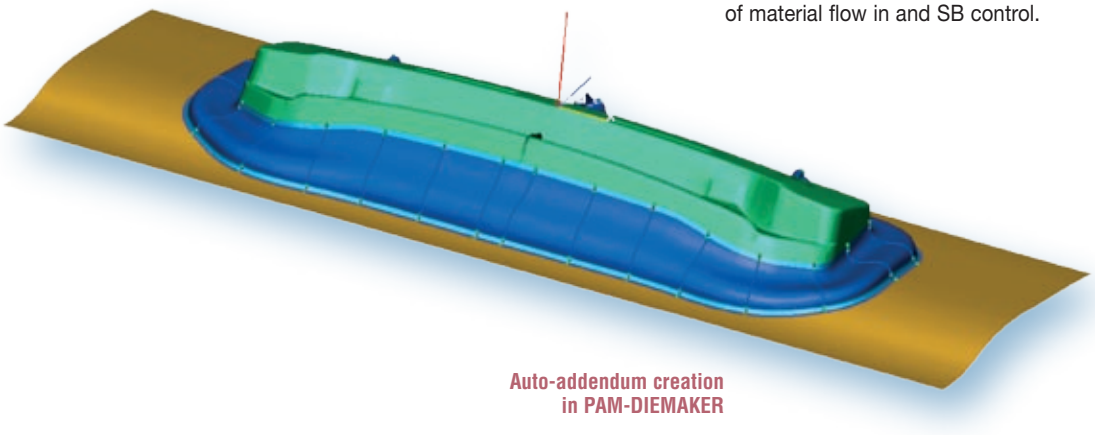
PAM-DIEMAKER

The Diemaker module is updated, with the **focus on usability**. The menu structure has been streamlined to provide a clearer work flow and to simplify selection. The 'Rolling cylinder' option has been upgraded to give better surface definitions using automatic control lines, leading to a higher quality of finished surface.

A new 'Auto-addendum' feature provides the user with an extremely quick and easy way to create an initial die addendum, after which all the usual powerful Diemaker functions are available to parametrically adjust the die to the desired final shape.

Double part functionality has been extended to support 'non-symmetrical' double parts, whereby two different parts can be independently 'tipped' and then combined to be produced in a single draw die.

Gainers can now be quickly added to the die addendum using a simple intuitive dialog. In cases where wrinkling problems appear in an addendum, it will often prove sufficient to add gainers to 'use up' the slack material. Key feature for fined tuning of material flow in and SB control.



Auto-addendum creation in PAM-DIEMAKER

PAM-QUIKSTAMP+

Following the **excellent feedback from the first year of industrial usage** of our new 'Formability solver' PAM-QUIKSTAMP+, some fine tuning has been done to further improve the results, and to broaden the compatibility with PAM-AUTOSTAMP.

From v2007.0, PAM-QUIKSTAMP+ is able to use the same blankholder walls as PAM-AUTOSTAMP, hence the user only has to produce one input model, which can be saved as either AUTOSTAMP or QUIKSTAMP+ according to the needs. Following the improvements of v2007.0, results for 'Draw-in', thinning, and Forming Limit Diagram (FLD), have excellent correspondence between QUIKSTAMP+ and AUTOSTAMP. **This allows the user to make very fast iterations at formability stages, and turn to AUTOSTAMP for the detailed checking** of surface defects and springback, gaining a lot of time in the overall process.

New tools for blank shape modifications and drawbead edition simplify the iteration and optimization process in either QUIKSTAMP+ or AUTOSTAMP. **Powerful new post processing features** such as 'Multi-contour', 'User-defined zones', improved 'Reporting' and 'Draw-in' functions, make result analysis and reporting much easier.

Many nice touches have been added as well in response to user's needs, such as fully customizable keyboard shortcuts, extended color palette, and user defined background color.

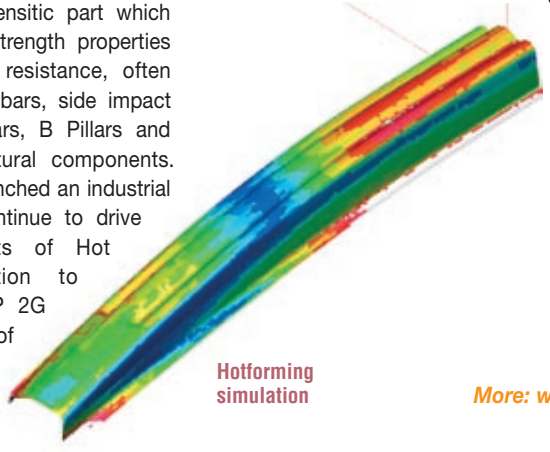
Thinning comparison QUIKSTAMP+ and AUTOSTAMP

Calculation time 30mins vs 3Hours

PAM-AUTOSTAMP

Hot Forming / Warm Forming

PAM-STAMP 2G now offers a new optional module for the simulation of 'Hot' Stamping processes such as hot stamping of boron steels. Typically pressed at very high starting temperatures of around 900°C with tools typically around 250°C, the material behavior is strongly influenced by the elevated temperature. Allowing plastic deformation for shape forming, but quenching in the die, it generates a martensitic part which offers very high strength properties for good impact resistance, often used for bumper bars, side impact re-enforcement bars, B Pillars and other such structural components. ESI Group has launched an industrial consortium to continue to drive the developments of Hot Forming simulation to keep PAM-STAMP 2G at the forefront of this emerging technology.



Hotforming simulation

Warm forming of aluminium is similar in concept, in the sense that the material will exhibit enhanced plasticity at elevated temperature, though without phase transformation.

PAM-STAMP 2G's new option allows the modeling of thermally dependent material behaviors, conduction, thermal contact and thermal dissipation. The temperature of the blank is calculated during the forming, and the material hardening behavior is adjusted accordingly. Tools can be given either constant or varying temperatures. The post processing shows the temperature evolution of the blank sheet, allowing the user to check that the forming is completed before the onset of martensite transformation.

Substructuring

The Substructuring technique has been introduced for PAM-STAMP 2G v2007.0. The concept is to allow local and global modeling in order to investigate local effects and changes. Typically used on large parts such as body-sides, it allows the user to make one global model, and then to have a number of smaller local models on which to iterate with local geometry, with the benefit of these small models running much faster.

Drawbeads

Drawbeads remain one the main tools for tuning of draw die processes, and variations in drawbead force are common between iterations of forming simulations. In PAM-STAMP 2G, equivalent drawbeads are usually used in order to save CPU time, and to be able to make fast modifications. Several enhancements have been made in order to make the use of equivalent drawbeads more efficient, and accurate. Improvements in the drawbead algorithm give better results with high restraining forces, and eliminate the need for additional refinement (as was the case in v2005.0).

'Non-uniform Drawbeads' have been implemented, making life much easier for the user when defining, and subsequently modifying the forces applied by drawbeads in different locations. Interactive links between the 3D window and the input dialog make this a very intuitive process.

Advanced Friction

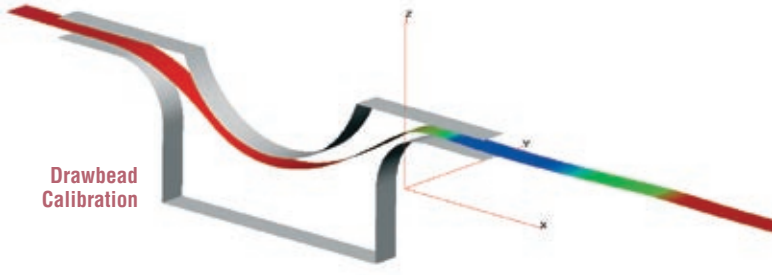
Many experts in formability believe that 'Friction' is one aspect of simulation which is not well understood, and not well modeled. In order to improve this situation PAM-STAMP 2G v2007.0 offers the user a number of **new, more sophisticated options to capture in a more realistic way, the effects of friction in forming simulations**.

Although standard 'constant' Coulomb friction remains the default, the user can chose to define a velocity dependence, a pressure dependence, or a simultaneous pressure and velocity dependence as standard options in v2007.0. For more advanced functions, a 'User Subroutine' can be used, whereby the user can describe their own friction law, and implement it in PAM-STAMP 2G.

Die Compensation

The 'Die compensation' option of v2005 has proved very popular with our customers, and as a result of their feedback some further improvements have been made. Springback control and die compensation remain at the top of the priority list for many of our customers, and we are pleased to provide an update of this functionality to improve the results further.

With the release of this new version, **PAM-STAMP 2G** continues to lead the way in stamping simulation, **delivering rapid die face design, fast feasibility assessment, and accurate validation, offering increased savings in cost & time.**



Drawbead Calibration

More: www.esi-group.com/SimulationSoftware/Stamping_simulation/

Atlas Tool, Inc. Stamps out Springback with PAM-STAMP 2G

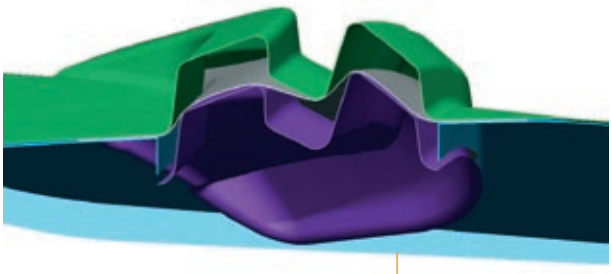
With the help of ESI Group's PAM-STAMP 2G software, Atlas Tool is now able to accurately compensate for the springback effects for high-strength and dual-phase steel for even the most aggressive product geometry.

The use of ultra-high strength and dual-phase steels increases the challenge as these materials tend to spring back three to four times more than low-carbon sheet steel. Dual-phase steel combines two crystalline structures of steel, ferrite and martensite, to achieve greater strength than traditional high-strength steels. Its properties result in improved crashworthiness and weight reduction. However, dual-phase steel provides significant formability challenges. The material tends to work-harden to the point that it cannot be reformed in subsequent operations, and it generates high levels of springback.

Designing the die with incremental simulation

Atlas Tool decided several years ago to acquire simulation software capable of incrementally simulating the forming process. "We evaluated several different software packages and selected PAM-STAMP 2G because we found it to be more accurate and easier to use than the other programs", said Mark Broadworth, Tool Engineer for Atlas Tool.

"Because we drive our design process using PAM-STAMP 2G we are confident we can go directly from "virtual-tryout" to hard tool, knowing we will be better than 95% fit to gage, and thus eliminating the need for prototype tryout tooling. This includes challenges associated with laser-welded blanks, patch-welded blanks and ultra-high strength steel including dual-phase steel", claims Broadworth.



Cross-section of virtual die during forming simulation

Atlas Tool begins by outlining a preliminary die process. A draw-die development is then modeled in Unigraphics CAD software, including the physical drawbeads essential to a successful springback prediction. Physical drawbeads are used in the FEA software in order to take into consideration the work hardening undergone by the material during deformation.

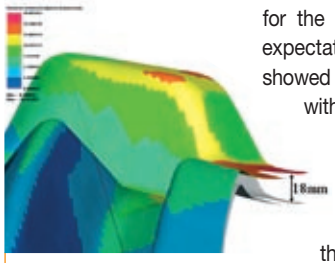
After the formability issues are solved with PAM-STAMP 2G, the task of compensating the CAD model for springback begins, assisted with PAM-STAMP 2G's fully automated springback compensation module. The module provides a mapping of cloud-points to use when compensating the CAD data. These points are used by the thinkcompensator module, a product of think3 Inc, to manipulate the surface data in order to provide the accurate surface model needed to build the tools.

Manufacturing the Tools

The data used in the die-simulation is used for cutting the tooling to ensure faithful representation of the stamping simulation. Once in the press, work is coordinated with the simulation department to make sure all the boundary conditions and settings are the same as in the FEA. Duplicating the parameters of the FEA is critical for a successful process.

A-Pillar example

The A-pillars are the sheet metal columns between the windshield and front windows of an automobile, increasingly built from high-strength and dual-phase steel. The A-pillar modeled here exhibited a 3.5 inch draw depth, which is considered "fairly deep", and required a laser-welded blank consisting of both 600DT dual-phase steel and 50KSI high-strength steel. Early springback analysis using PAM-STAMP 2G showed about 18mm of twist throughout the part after forming and trimming operations were completed. Atlas engineers determined early on the need to compensate the draw-die in order to produce a dimensionally acceptable part. The compensation process using PAM-STAMP 2G and think3 was then put to the test.



An early springback prediction created with PAM-STAMP 2G

Initial part to gage

The operating parameters optimized during the simulation were closely followed when producing the initial parts for the A-pillar. The results exceeded expectations: the first part to gage showed the A-pillar was accurate to within 1mm to the net surfaces on the gage.

In three weeks of simulation work, Atlas developed a design that the simulation predicted would meet all of the customer's requirements. "Advanced high-strength steels and particularly dual-phase steels are being utilized more and more by OEMs to improve safety, reduce weight and lower cost," Mark R. Schmidt, Atlas Tool's President concluded. "The use of an advanced incremental simulation tool enables us to overcome the formability challenges posed by these materials and meet our customers' requirements in as little time as possible. We believe our expertise with PAM-STAMP 2G is a significant competitive advantage."

First part on gauge dimensions

Image courtesy: Atlas Tool, Inc

About Atlas Tool, Inc.

Atlas Tool, founded in 1962, specializes in producing stamping dies and prototype parts for the automobile industry. The company builds prototype parts to suit customer objectives, from simple handmade parts to completely tooled prototype programs that verify manufacturing processes. Atlas has a wide variety of conventional and high-speed machining equipment capable of operating at feed rates up to 600 inches per minute. Among its assets are 40 stamping presses, 38 CNC machines, 10 CMMs, 46 CAD/CAM/CAE seats, and a crane capacity of 70 tons (64 metric tons). Experienced program managers are assigned at the start of a tooling program and are involved in every step of a project. Solid-modeling technology is used for die design and CNC programming.

SRI Sports Ltd. uses ESI Group's RAYON solution to maintain leading edge technology for golf gear design

SRI Sports Ltd. relies on RAYON to improve golf club design, with a direct impact on sound, a paramount criterion for golf gear performance.

Manufacturing a golf club is a work of art. To make this little golf ball fly high, fly far and land softly requires state of the art technology. The sound quality during the impact with the golf ball is one of the most important criteria that makes the quality of a golf club.

In November 2003, SRI Sports Ltd. delved deeper in the science of ball and club impact, and chose RAYON as their investigating tool. After two years of development, the collaboration between SRI Sports Ltd, MTS-Ideas Pro and ESI Group led to the implementation of a system used to predict the impact sound. This meant that, from now on, SRI Sports Ltd. would be able to provide not only the core performances of 'direction' and 'distance', but also the additional value of a pleasant impact sound to its customers.

"The success of this project had been achieved by the synergy between the structural analysis methodology for the impact between golf ball and golf club head, which was established by SRI Sports Ltd., the ESI Group's expertise for acoustic simulation with RAYON, and the experimental technique provided by MTS-Ideas Pro. The synergy of technologies and methodologies was the key factor for the success of this project", related SRI Sports Ltd. Spokesperson.

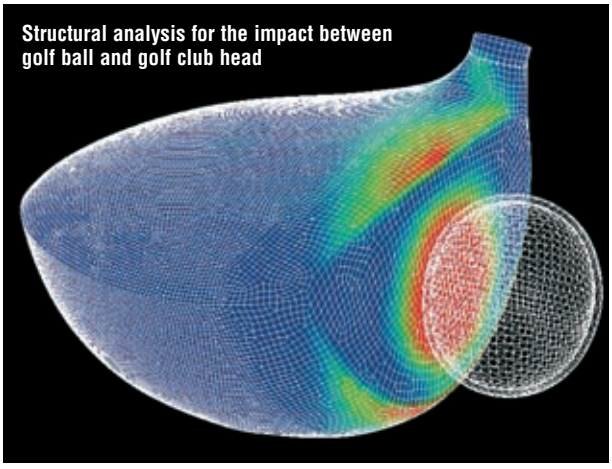
RAYON offers a better understanding of the science of ball and golf club impact

Concerning steady states, periodic sound simulation techniques had already been established. However, for transient sound such as club and ball impact, there was little acoustic simulation until now.

The objective in using RAYON was to have a CAE simulation for the prediction of impact sound between a golf ball and a wooden golf club head. The sound quality could then be controlled without having to build costly prototypes, allowing golfers to evaluate pleasantness of sound by listening to high fidelity speaker output.

The sound quality of the impact depends on the vibration behavior of the club head. To reach a suitable accuracy of regenerated sound, SRI Sports Ltd. experimented with various modeling techniques before finding an optimum modeling method.

As a consequence of working with RAYON, the impact sound of golf clubs can now be predicted. Today, by establishing a system to foresee the sound quality of the impact between the golf club and the ball, SRI Sports Ltd. is able to provide its customers a first class golf club with a pleasant impact sound.



Structural analysis for the impact between golf ball and golf club head

The Challenges

- To accurately synthesize golf ball and wooden golf club head impact sound.
- To predict the vibration behavior of a golf club head and ball impact using non-linear structural analysis.
- To find an optimum modeling method to obtain right regenerated sound quality.

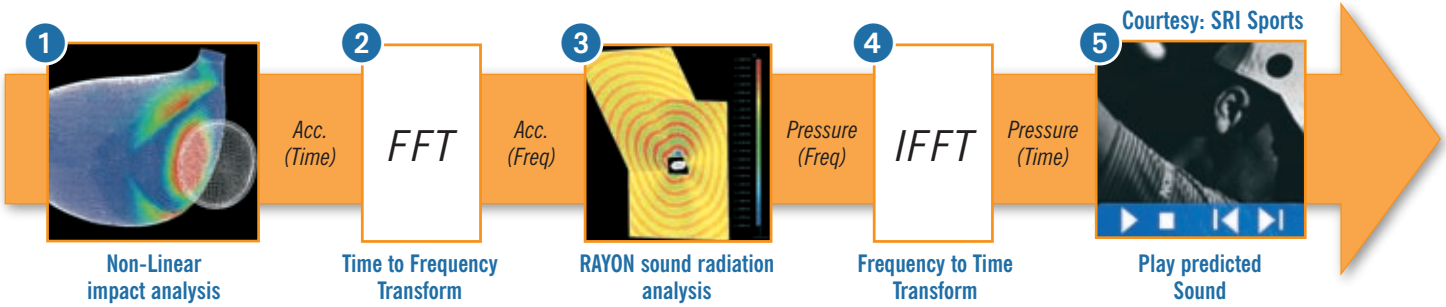
The Benefits

- Improved product quality.
- 2 to 4-month reduction in development time.
- Confidence in the results thanks to proven methods and methodology.

About SRI Sports Ltd.

In the sport industry, SRI Sports Ltd. manufactures and markets SRIXON brand golf clubs and balls. As a golf equipment company with a 70-year winning tradition, SRI Sports Ltd. is a recognized and trusted brand as a world leader in golf ball and golf club technology.

SRI Sports Ltd. and ESI Group succeeded by applying the following procedure:



Welding Simulation of Aluminum Automotive Construction Using SYSWELD simulation solution

A successful lightweight construction is the result of an optimized combination of material selection, design and manufacturing. When the lightweight components are made from aluminum alloys, welding is one of the most widespread joining technologies available.

In order to avoid costly trial-and-error experiments and to improve the in-service quality of assemblies, numerical simulation of welding can be a powerful tool. The Fraunhofer Institute for Mechanics of Materials (IWM), in partnership with automotive industrials, has been investigating the capabilities of ESI Group's SYSWELD finite element (FE) analysis solution for the simulation of the welding distortion. The spaceframe of the Audi A2, consisting of a structure of aluminum extrusions and castings, represented challenging grounds for this study. Experimentation provided the appropriate material data needed to feed the simulation, from the relevant aluminum materials as well as from different zones in laser welds.

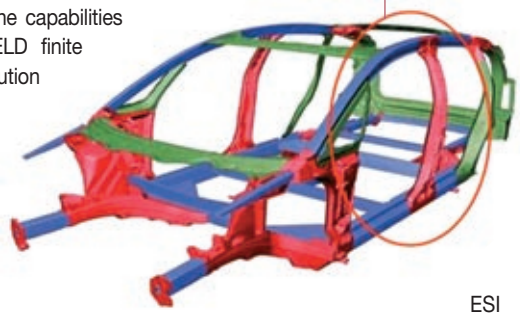


Figure 1:
Spaceframe of the Audi A2 – detail of the roof profile and B-pillar

The results of the numerical simulation in terms of temperature, distortion and residual stresses during and after welding were compared to data measured on the physical component. The study of the numerical parameters outlined the influence of the heat input, clamping conditions, welding sequence and material specific input data on the components' behavior, and indicated how it could be influenced in a favorable way. The outcome of the study validated the numerical simulation of the welding process as a useful tool for supporting advanced manufacturing.

Modeling the welding of a Spaceframe Structure

Illustrated here is the welded roof profile and B-pillar of the Audi A2 spaceframe. The component has already been qualified and runs in mass production. It consists of a hydroformed extrusion profile and a die-cast B-pillar, respectively made from lightweight aluminum alloys AlMgSi0.5 (AW 6060) and Aural-2. The laser welding process was applied using AlSi12 consumables, without any post-weld heat treatment.

ESI Group's SYSWELD finite element code was used for the numerical simulation, including its thermo-metallurgical and mechanical analysis package. The FE model for the specific geometries of each part and the welded joints consisted of 8-node solid elements, while 4-node shell elements were used to model the heat transfer by convection and radiation as a function of temperature. The heat input was modeled by an equivalent moving heat whose source geometry and intensity had to be adapted to measurements from the real welding process.

Numerical Results and Experimental Verification

The calculated displacements between the original component and the unclamped component after welding are shown in Figure 2 for selected positions. In parallel, distortion measurements were performed on a component taken from mass production. The agreement between simulation and experiment was very good, especially due to the heat source input that was adjusted to experimental data of temperature profiles during welding and macro-sections of the weld geometry.

Conclusion

The target of this investigation was to predict residual stresses and distortion for welded aluminum alloy components using FEM. The successful modeling of the welding process largely depends on an accurate knowledge of the material properties, as well as a careful modeling of heat source and a realistic representation of the clamping conditions during welding. The results show that prediction of distortions and of the quantitative distribution of residual stresses can be achieved with good precision, while the calculated amount of residual stresses induced by the welding process may differ with the measurements because of the unknown initial stress state from the manufacturing process.

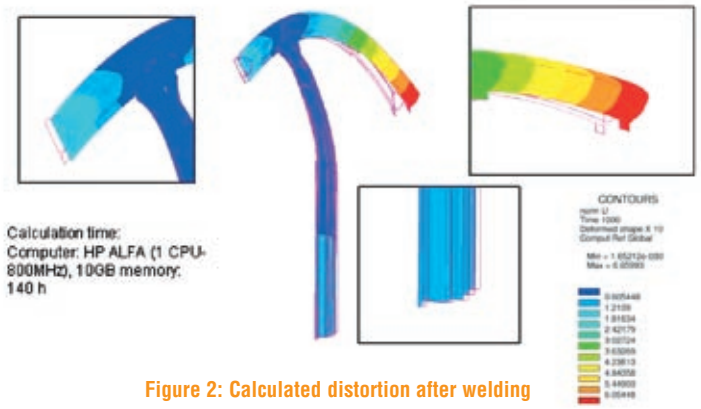


Figure 2: Calculated distortion after welding

About Fraunhofer Institute for Mechanics of Materials (IWM)

The Fraunhofer Institute for Mechanics of Materials IWM in Freiburg and Halle develops solutions to increase the safety, availability, and lifespan of components and systems ranging from microelectronic devices to power plant components. The Institute develops concepts to make optimum use of new materials as well as cost-effective and environmentally compatible shaping and precision-machining processes.

The main research and development topics include the deformation and failure behavior of materials and components, the way their strength properties depend on temperature and other ambient conditions, and concepts for assessing defects. Static and highly dynamic impact loads are the most important parameters here. Further topics are machining and surface modifications processes, and developing material models to describe more adequately the processes of production and damage.

More: www.iwm.fraunhofer.de

ESI GmbH offers Training for Optimal Results and Higher Productivity

ESI GmbH, ESI Group's German subsidiary based in Eschborn, has become expert over the years in providing training on our various software solutions. Thanks to this highly effective training combined with our engineers' industrial expertise, **users learn to obtain the best possible results in an optimal time span**.

"With our **German training catalogue and ESI GmbH´s training center,** we have acquired many years of experience in providing training that is dedicated to our customers' needs. Our training courses last from 1 to 5 days, depending on the solution. In addition to basic training courses, we offer dedicated advanced trainings tailored to our customers' needs", said Manfred R. Müller, ESI GmbH's training manager.

"Our trainers are highly qualified engineers or scientists with a good knowledge of industrial applications. They all have extensive experience with our software applications, as well as the various methodologies.

"At very affordable rates, small groups of 3 to 6 people are trained in our modern training facilities equipped with new dedicated workstations.

"In recent years, over 300 customers have attended our standard training courses in Eschborn.

"In addition, we provide **on-demand dedicated individual training** either at our customers' facilities or in our training rooms in Eschborn. All the topics covered in these dedicated training courses are individually coordinated with the customer."

Manfred R. Müller manages ESI GmbH's training center

ESI GmbH releases a yearly training program and schedule, with courses ranging from the Finite Element Method to material modeling for PAM-CRASH, Vibro-Acoustics, Casting or CFD simulation, and springback simulation in PAM-AUTOSTAMP. These affordable courses make it possible for new users to quickly become proficient and for all users to expand their know-how, keep up-to-date with changes in the software and in the industry, and to share expertise with their peers.

To learn more about ESI Group's expansive international and German training offer, please visit our websites ***www.esi-group.com*** *and* ***www.esigmbh.de*** *(for Germany, Austria, and Switzerland) or order a copy of our training catalogue by sending an email to:* ***training@esi-group.com***

What our customers say:

"The standard training offer in ESI GmbH´s German training brochure allows us to train new colleagues on the basics of crash simulation; it's fast, effective and at reasonable cost. When we have special demands, ESI GmbH provides us with tailored training covering our needs."

Mr. Christian Stender, Volkswagen Group

"The individual trainings offered in Germany by ESI GmbH make it possible for us to get a quick start on new and innovative applications, such as the Finite-Point-Method (FPM) for airbag simulation."

Mr. Jens Schlönvoigt, Delphi Deutschland GmbH, Vehicle Safety Laboratory Berlin

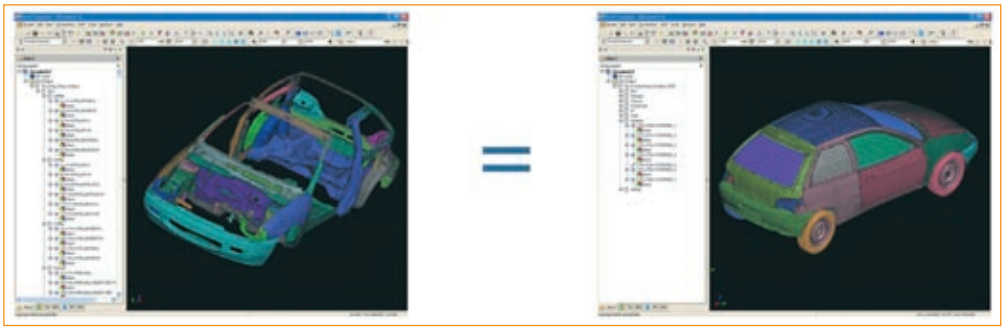
Simulation Data Management with ESI Group Enterprise Solutions

Nowadays, simulation activities have become common in all industries. It is recognised as a way of shortening product development and reducing costs, by limiting the necessary number of physical prototypes. **Simulation based design is aiming to become the way to design right the first time round**, by orienting decisions early in the development process. Such design decisions have to be taken according to multi-disciplinary parameters and functional objectives. These may even involve optimization simulations generating a large amount of data.

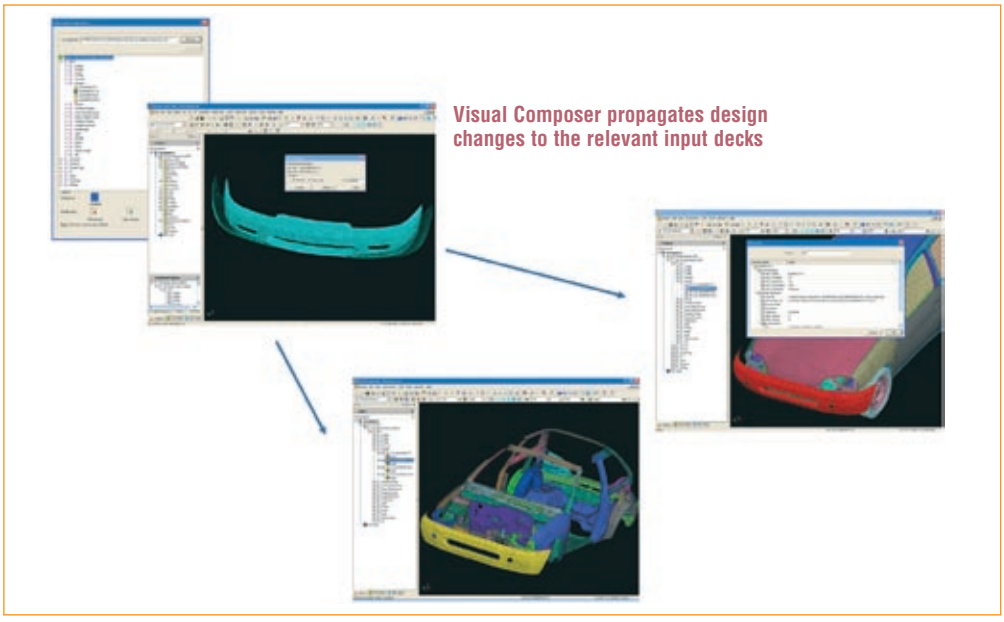
As a matter of fact, simulation data volume is increasing considerably, and its traceability and easy reuse has become crucial. On the other hand, data has to be in sync with the different disciplines to ensure the integrity of the complete simulation of the product, so that technical choices can be made.

In December 2006, ESI Group released **Visual Environment 3.0** with a first version of its Simulation Data Management Enterprise Solution. Simulation Content Manager (SCM) along with Visual Composer are the building blocks of this solution.

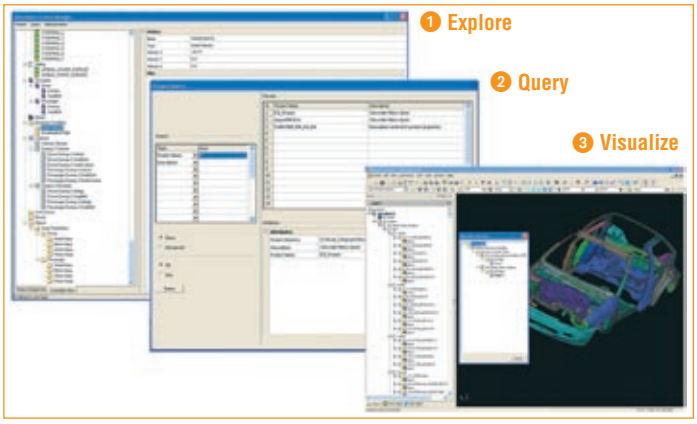
Visual Composer aims to build and maintain the link between CAD data and simulation disciplines. It allows engineers to start from the design specifications of the product, build the different models corresponding to the desired load cases, and maintain the link to the design definition of the product as it evolves, as well as the link between the simulation disciplines. Among the main capabilities of Visual Composer are: the ability to manage logical and physical connections between the parts of the product, the management of several meshes for a single part (the meshes being generated by Visual Mesh or 3rd party applications), the update of the simulation assemblies according to the evolution of the design specifications and more.



Visual Composer manages different simulation views of the same product



Visual Composer in addition to Simulation Content Manager provides a unique solution to manage simulation data



Simulation Content Manager (SCM) is a simulation data persistency environment, which gathers the simulation data from the different applications used during the complete simulation lifecycle. It manages their integrity, traceability and reuse. SCM is based upon IBM DB2 Content Manager technology which has been providing the industry with technical and security features developed and proven in many business areas for many years. This allows SCM to integrate within the IT and data architecture of every customer, giving for example the ability to link easily to standard or corporate databases or PLM systems.

Image courtesy: ESI Group

ESI Group launches a Consortium to establish VA One Modeling Guidelines

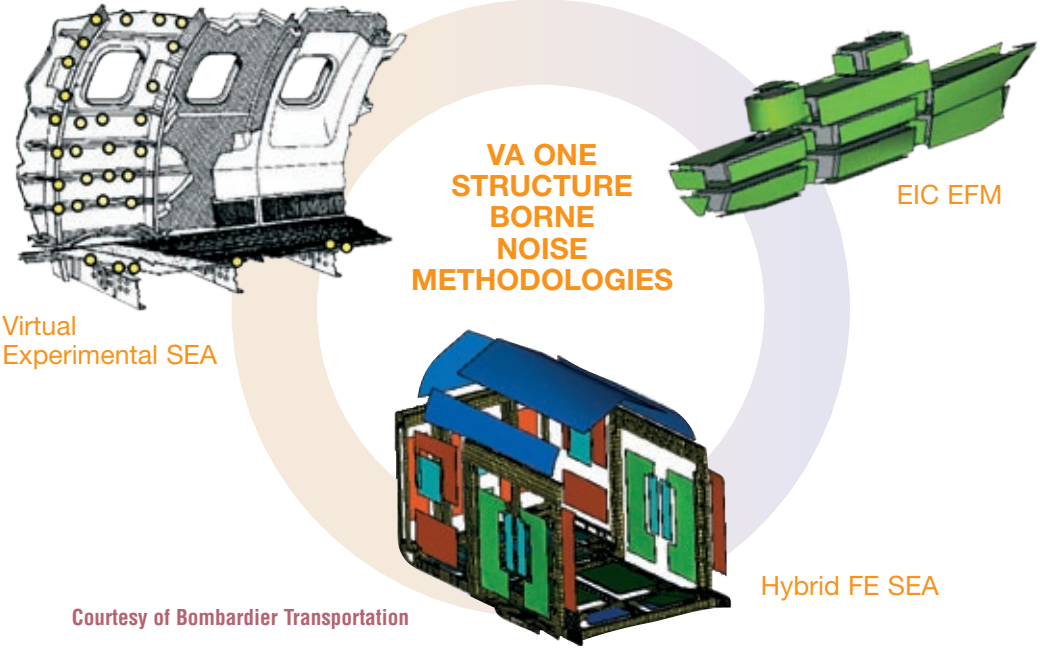
> VA One triggers the interest of leading European companies in the sector of Marine, Aero, Rail and Industrial vehicles

*ESI Group announces the launch of the European **M**arine, **A**ero, **R**ail and **I**ndustrial structures (MARI) Consortium. Participants of the MARI Consortium include renowned industry leaders such as Alstom, BAE Systems, Bombardier Transportation, QinetiQ, Volvo Group and VTT.*

The objectives of the MARI Consortium are to define modeling guidelines and investigate aspects related to the automation of the model building process for the creation of coupled Finite Element Analysis / Statistical Energy Analysis (FEA /SEA) models within the VA One environment. These objectives are set in the context of a technology transfer between ESI Group and the participants. VA One is the first simulation environment to integrate multiple predictive methodologies for vibro-acoustic (VA) simulation, including FEA, SEA and Boundary Element Method (BEM) within one single user environment. The underlying coupling theory contained in VA One allows the user to transparently deploy these different methodologies, making VA One a powerful innovative solution for structure-borne noise analysis.

The MARI Consortium was launched with a kick-off meeting held in Paris, France, in September 2006, and will continue until June 2008. The inaugural meeting provided a forum where each of the members shared details of target applications and objectives. Several intermediate sessions will follow allowing participants to share knowledge and experience gained from executing the modeling tasks and report the progress made towards the mutually agreed objectives. As a consortium member, each participant is provided with comprehensive training on an individual basis. ESI Group provides project supervision and support to ensure that efforts are focused on the primary objectives of creating effective modeling guidelines and defining productivity enhancements that will facilitate cost and time effective coupled FEA/SEA model creation for mid-frequency applications.

"The MARI Consortium is a great opportunity for each member to share experience in using VA One to model complex industrial structures for structure-borne noise prediction. The expertise gained from such activity and the interaction between members will help define commonly accepted modeling guidelines and provide ESI Group with valuable information to improve VA One's model building capabilities and automation. The MARI Consortium is another example of ESI Group's commitment to provide Vibro-Acoustic industrial solutions across the full frequency range." declares Denis Blanchet, ESI Group.



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Software Update

EASi-CRASH DYNA 5.5 and EASi-CRASH RAD 5.5 versions for Crash and Safety Applications

EASi-CRASH is a set of CAE (Computer Aided Engineering) environment software for pre- and post-processing data for **LS-DYNA, RADIOSS and MADYMO** users. It has been developed over several years by EASi Engineering, and integrated in the ESI Group application portfolio three years ago.

New versions of this software are available on a regular basis, in order to satisfy our continuously growing customer installed base. Our main customers appreciate the current EASi-CRASH software suite thanks to its capabilities, usability and the continuous enhancement and support of most recent evolutions of corresponding solvers. Moreover, some of our main customers use the **EASi-Process** application in addition, in order to automate some of their tasks performed in EASi-CRASH or coupling LS-DYNA or RADIOSS and MADYMO data to do their job. Process templates developed and customized for such customers help them **speed up the setup time of the models by up to 6 times,** reducing cumbersome and automating repetitive tasks that have to follow corporate or regulation rules.

EASi-CRASH applications, as well as EASi-Process are evolving by being progressively integrated in the next applicative generation of solutions, called as Visual-Environment, and will be available as **Visual-Crash Dyna, Visual-Crash Rad, Visual-Safe Mad, and Visual-Process**. As building blocks of the ESI Group Enterprise Engineering Solution portfolio, those applications increase the customers' benefit by a reinforced integration with the enhanced product portfolio and capabilities, like simulation data management and Product Lifecycle Management (PLM) connection, CAD/Simulation connectivity and synchronization, or unified post-processing and reporting applications.

Customization of process templates allows customers to enhance productivity and quality of their tasks by performing fully suited automated actions that follow internal procedures and are repeatable. Process automation allows for example huge speed up rates in developing models and reports for a regulatory test simulation.

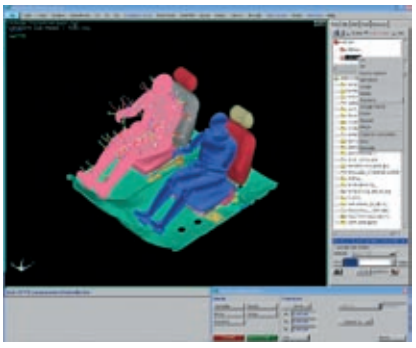
Three process execution levels are available:

- **Process Guidance:** A step by step guiding by the tool itself from start to finish. This helps the user to understand the corporate practice or regulatory procedure. It also helps to educate new users on standard practices and regulations.
- **User Driven:** Users can drive the process step by step to be able to add/edit engineering parameters or manipulate the model simultaneously.
- **Full Automation:** Automating the complete model construction without user interaction to achieve mass production of iterations (productivity), repetitive modelling and simulation, consistency of results and to reduce human errors.

Available template process examples:

- Pedestrian Safety (EUNCAP/ACEA)
- ECE-R 21 / FMVSS 201
- FMVSS 203
- FMVSS 208
- The bumper test, FMVSS 581, ECE-R 42
- Pothole analysis

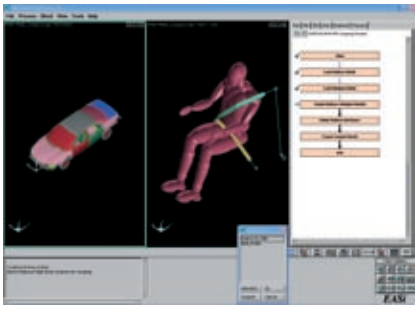
More: www.esi-group.com/SimulationSoftware/EASi_CRASH_RAD/
www.esi-group.com/SimulationSoftware/EASi_CRASH-DYNA/



EASi-CRASH DYNA 5.5

EASi-CRASH DYNA 5.5 new features are:

- *Basic coupling of LS-DYNA structure with Madymo 6.3 dummy;*
- *Identification and correction of initial penetration and intersection between shell and solid elements;*
- *Support of an additional 971 LS-DYNA keywords.*



EASi-CRASH RAD 5.5

EASi-CRASH RAD 5.5 now provides:

- *Basic coupling of RADIOSS 4.4 structure with Madymo 6.3 dummy through Process;*
- *Identification and correction of initial penetration and intersection between shell and solid elements;*
- *An enhanced Time Saver functionality to make PART ID = MATERIAL ID = PROPERTY ID;*
- *Support of additional RADIOSS 4.4 keywords.*

Highlights

- *A seamless integrated environment for crash-safety simulation;*
- *The only environment solution which combines both pre- and post-processing in one package;*
- *Time compelling benefits in dataset preparation: a guided approach assists in the detection and correction of intersection/penetration. A smart tool is available to replace parts and resolve connections and references. This feature boosts productivity gains by accelerating model analysis and validation. Other major advances include safety tools for seatbelt creation, dummy positioning in just a few clicks, and welding capabilities to validate the welding from CAD to FE data.*
- *User friendly EASi-CRASH data model allows intelligent sorting and global control of CAD and CAE data. A plugged "CHASE Iterations" automates recurrent actions for both test and CAE data, generating productivity gains up to a factor 10.*
- *The enhancements in model organization functionalities improve the manipulation of complete vehicle models without losing information.*

Modeling Atomic Layer Deposition (ALD) Processes using CFD-ACE+

Why ALD is so important for industries?

Atomic Layer Deposition (ALD) has been shown to provide excellent film thickness uniformity in addition to the ability to control film thickness much better compared to other deposition processes. The uniformity of deposition and control over thickness can be attributed to the "self limiting" mechanism of the film growth, with the film being deposited one monolayer at a time. Because of this, ALD is a viable technique to deposit ultra-thin films for diffusion barriers and conformal films in high aspect ratio features found in modern integrated circuit fabrication.

Challenge in modeling ALD technique

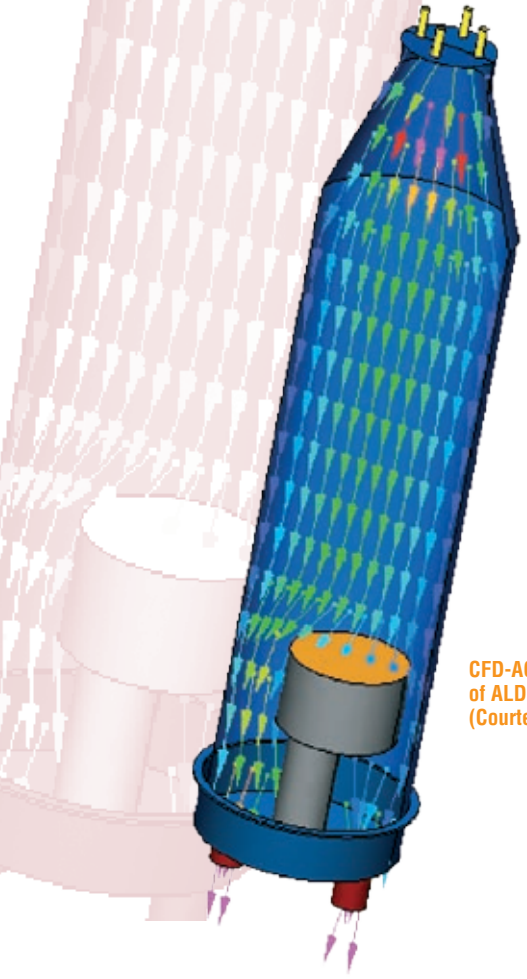
ALD is a process of depositing highly uniform and conformal thin films by alternating exposures of a surface to vapors of two reactants. The surface reactions in ALD processes are "complementary" and "self limiting". In the first step of ALD cycle, a gaseous species is fed into the system which is absorbed on the surface preparing it for the next step. Then a gaseous reactant is fed and the absorbed surface species reacts with it by depositing a layer of film. This ALD cycle repeats until a desired thickness is achieved. Modeling challenge is to accurately handle the transient species fluxes and surface chemistry.

CFD-ACE+ model for ALD: Features and Benefits

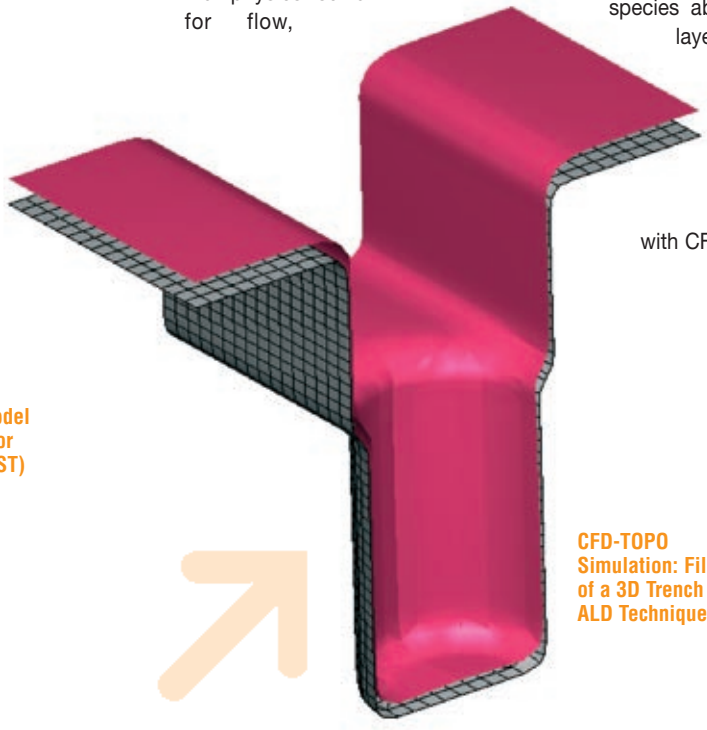
CFD-ACE+ is a powerful simulation tool which has a truly coupled multiphysics solver for flow, heat transfer, species transport, gas phase and surface chemistry. Using a user defined function, it can simulate the transient pulsed species flux at the system inlet. It also can accurately model the complementary and self limiting surface chemistry. CFD-ACE+ ALD model is extremely useful to design the reactor chamber and optimize the operating conditions. It also helps to properly configure the ALD cycle to achieve uniform and controlled deposition as well as enhance the reactor efficiency.

CFD-TOPO, a Feature Scale Model for ALD

CFD-TOPO provides a powerful feature scale simulation tool that accurately simulated the 2D and 3D shape evaluation by thin film deposition and etching of the wafer surface. The advanced feature called "time accurate surface chemistry" is specially developed to simulate ALD processes in feature level. Using this model, users can visually track the species absorption and layer by layer growth of the thin film. It is also applicable for high aspect ratio trenches. Users can apply CFD-TOPO as a "standalone" tool as well as it is coupled with CFD-ACE+.

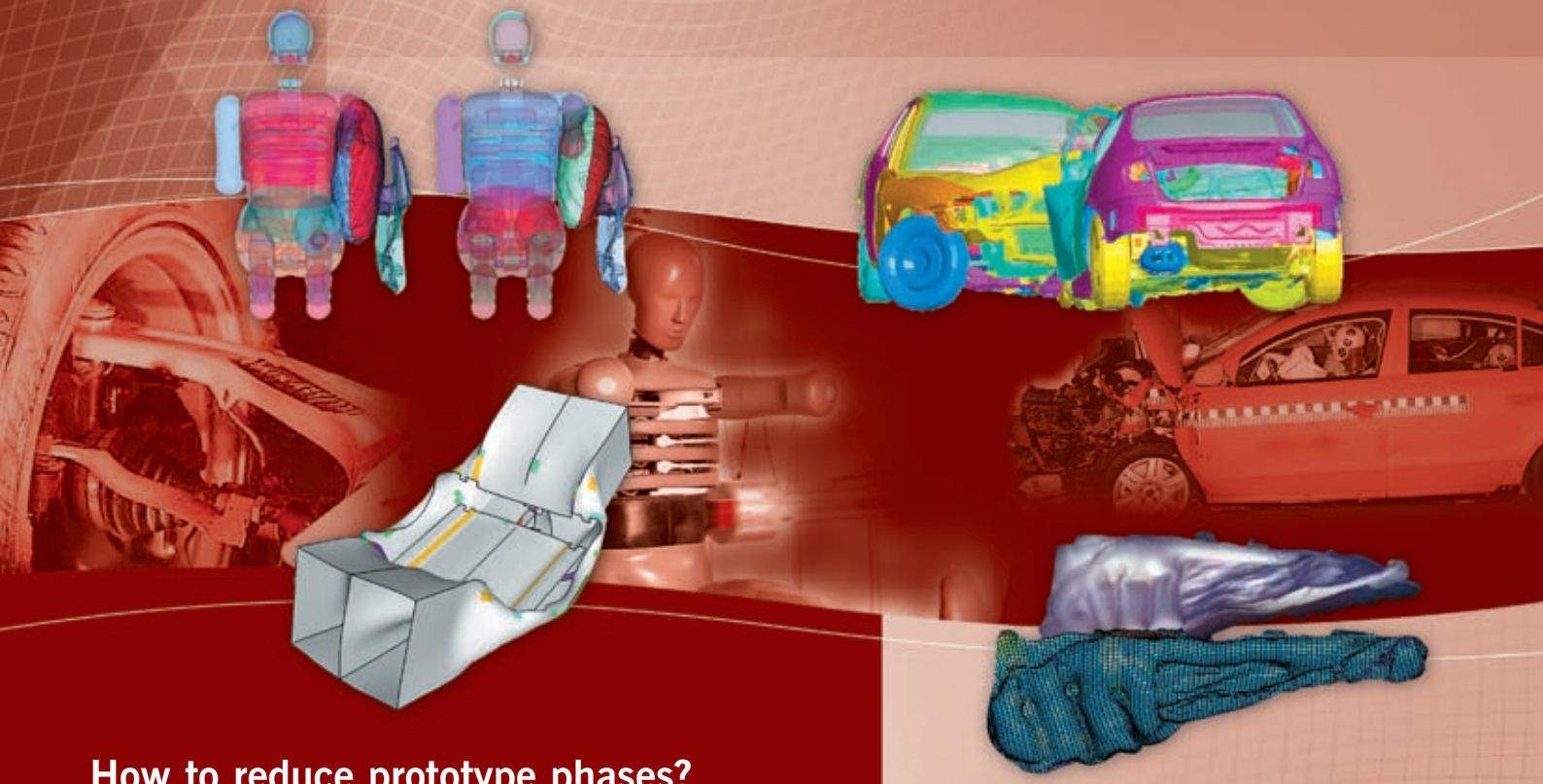


CFD-ACE+ Model of ALD Reactor (Courtesy: NIST)



CFD-TOPO Simulation: Filling up of a 3D Trench using ALD Technique

Get into Predictive Virtual Testing with ESI Group Crash & Safety Simulation Solution!



How to reduce prototype phases?

Use PAM-CRASH 2G for crash and safety simulation!

As safety requirements continue to increase, car designers are asked to save on weight and costs while rolling out a highly diversified product portfolio.

Using PAM-CRASH 2G physics-based technology engineers get an in-depth understanding of multiple crash scenarios. The full range of PAM-CRASH 2G advanced features cover design and time critical issues:

- New models for rupture prediction of hyperelastic alloys
- Mesh-free solution for advanced airbagsimulation
- Highly scalable parallel version for fast and robust computation of refined models.

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PAM-CRASH 2G V2006

PAM-CRASH 2G V2006 addresses the full transport industry and especially aeronautics by taking into account the permanent concern of weight reduction and sustaining strict impact performances. It provides increased accuracy with the modeling of advanced materials, honeycomb structures, super-elastic alloys, plastics, adhesive bonding and offers advanced technology for the design of adaptive restraint systems.

The major evolution of PAM-CRASH 2G V2006 solver resides in the implementation of Multi-Model Coupling (MMC). By allowing locally refined meshing with smaller time-steps, this integrated feature enhances impact crash simulation details while effectively reducing computing time.

"With the need to obtain in given areas precise geometry of the deformation, or reliable rupture prediction, PAM-CRASH 2G V2006 offers fast turnaround with very detailed model", explains Peter Ullrich, Impact, Crash & Safety Product Manager ESI Group. "Instead of imposing a small time step to the whole structure, the software isolates the local areas with refined mesh".

The PAM-CRASH environment, part of Visual Environment product range, is an advanced enterprise solution providing seamless integration with upstream process simulation such as stamping, as well as downstream into Crash and Safety applications and process automation. This new solution abolishes traditional walls between Pre-processor/Solver/Post-processor, with the advantage of preserving the continuity of the compute model, a key to the Simulation Based Design concept.

PAM-CRASH 2G V2006 integrates the most efficient solver on the market today. Providing state-of-the-art physics-based models for automotive crash and other impact predictions. It now offers an improved mesh-free CFD method for airbag modeling, and a highly scalable parallel solution.

In addition, a library of industrially validated compute models fully optimized for PAM-CRASH 2G V2006 is available from ESI Group: crash test dummies, impactors, barriers, and a unique family of human body models. These models are built using state-of-the-art Finite Element or Multi-Body modeling techniques.

PAM-CRASH 2G V2006 is available on computers running 32 and 64 bit versions of the Windows, Linux, and UNIX operating systems. It runs as a massively parallel application on computer systems supporting this capability.

For more information, please visit
www.esi-group.com/SimulationSoftware/NumericalSimulation/

ESI Group releases VA One 2006,

The ONE Simulation Environment for Vibro-Acoustic Analysis and Design

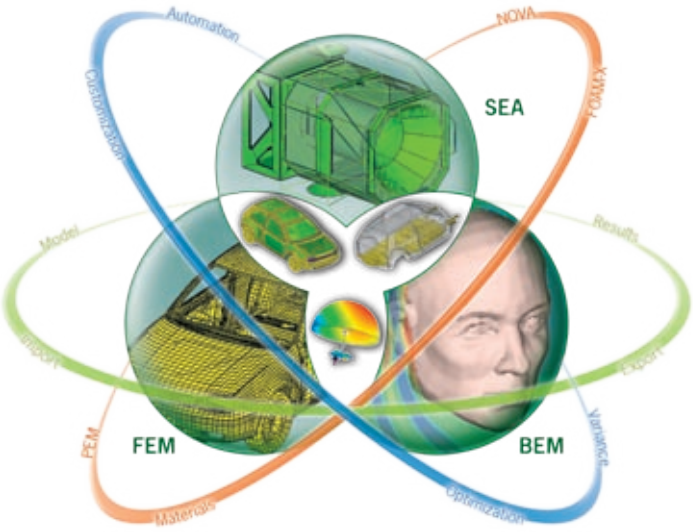


Image courtesy: NASA, VW, ESI Group

VA One 2006 is the world's first fully integrated environment for predicting the vibro-acoustic response of complex systems across the entire frequency spectrum. This major product release represents ESI Group's latest innovative solution for vibro-acoustic simulation, analysis and design.

Based on the industry standard software for mid and high frequency noise and vibration design AutoSEA2, and extended to encompass low and mid frequency methods (making use of the RAYON solver), VA One 2006 is the only simulation code on the market that contains the complete frequency spectrum of vibro-acoustic analysis methods in one common environment.

Furthermore, not only are the Finite Element Method (FEM), the Boundary Element Method (BEM) and the Statistical Energy Analysis (SEA) Method integrated into one single environment, but what makes VA One 2006 so unique is its ability to rigorously couple these methods together. This opens up brand new application domains to the vibro-acoustic simulation world. **It is now possible to integrate into one single model the different modeling methods, couple them together and directly compute the vibro-acoustic response of the system.**

The core functionality of VA One 2006 is split into five main modules: Structural FEM, Acoustic FEM, Acoustic BEM, SEA and the Solver Coupling module. The Solver Coupling module is a state-of-the-art functionality that enables the user to solve fully coupled FEA/SEA models. This major theoretical breakthrough significantly extends the types of vibro-acoustic problems that can now be addressed with simulation.

Towards predictive simulations for birdstrike with PAM-CRASH 2G's Multi-Scale technology

Predictive rupture simulations necessitate not only the correct modeling of the "physics" (intrinsic material models) but also a consistent representation of the pertinent "details" of the problem in question (full 3D meso-micro scale modeling). This is an issue that is often underestimated in the effort to achieve predictive results with a given class of problem discretization.

A typical case would be to attempt to extract predictive results from a fine shell mesh when the problem-controlling details would actually require full 3D modeling (eg. rivets, rivet holes, spotwelds or other means of assembly, etc…). The dilemma is to mix in the same model both shell and solid modeling discretizations, with the obvious consequent penalty in solution time. Indeed, the very small time step controlled by the 3D elements would be imposed upon the shell elements during the computation, since both exist in the same model.

A practical remedy to this problem is the application of **PAM-CRASH 2G's Multi-Scale capability where, in such a case, the 3D model is solved separately, in parallel to the shell mesh model**. Each model is attributed its own pertinent solution time step which interact during the solution. This technique has been extensively presented in PAM TALK 31 Spring issue by Dr. Stefanos Vlachoutsis and Dr. Lars Greve, and has been successfully applied in automotive crash problems.

A typical counterpart in aeronautics is predictive simulations in vulnerability, and particularly bird impacts upon wing leading edges. In the case of a metallic leading edge, the intrinsic physics can be achieved by the EWK rupture model in PAM-CRASH 2G, which postulates rupture starts when damage above a critical level has saturated a material volume of a given threshold size (critical volume). This model is based upon the Wilkins rupture model.

Within the European Commission Research project CRAHVI (Crashworthiness of Aircraft for High Velocity Impact) and by using the Smoothed Particle Hydrodynamics (SPH) option in PAM-CRASH 2G, **ESI Group developed a realistic bird model representation capability by calibrating the Murnahan Equation of State for the available hydrodynamic results of instrumented birdstrike experiments on flat plates at different speeds and angles of impact.**

Simulations of experiments where the bird impactor was modeled with the SPH bird and the metallic target was modeled with the EWK rupture model provided very good agreement with reality, as presented at EuroPAM 2006 in Toulouse, France. So did the simulations of impacts upon aircraft wing leading edges where rupture did not occur, but only large deformations.

However, simulations of impacts upon aircraft wing leading edges at speeds where rupture occurred could not be predicted by the shell element model of the wing leading edge. This can be explained by the fact that the rivet holes which precipitated the stress concentrations where rupture initiated (figure 1) were not present in the Finite Elements (FE) shell model. When the shell elements encompassing the region where the rivet holes existed were artificially weakened in the FE model in question, the correct failure pattern was recovered (figure 2).
This is a typical case where Multi-Scale technology could have been beneficial, to allow the presence of the rivet holes in the model, which were completely absent in the original shell model. Unfortunately at the time of the project Multi-Scale technology did not exist, so this postulate could not be tested.
However, the underlying concept was tested more recently for a case of birdstrike upon a complex curved panel, where the crack propagation after the bird had penetrated the curved panel was not uniquely captured when the panel was modeled in shell elements only. However, when the part of the panel underneath the bird impact was modeled in solids and the rest of the panel in shells, the correct crack propagation was observed (figure 3).

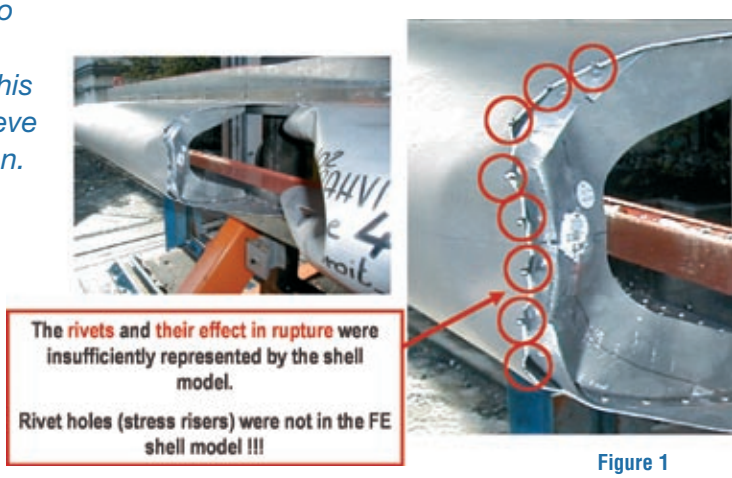


Figure 1

Figure 2

"Therefore, the **Multi-Scale capability in PAM-CRASH 2G can definitely be considered as a relevant tool for the industrial approach and treatment of birdstrike upon aeronautical structures**" explained Argiris Kamoulakos, Scientific Director, ESI Group.

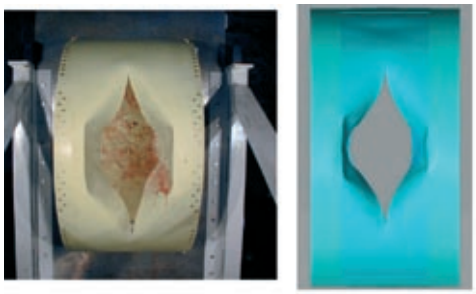


Figure 3

Image courtesy: Airbus

Panel in Solids
1.2 Million elements

Application of Casting and Mechanical modeling in the redesign of an automotive component for industrial rheocasting process

The Council for Science and Industrial Research of South Africa has developed and patented a rheocasting process. The process involves the preparation of semi-solid slurries from liquid metal, by controlled cooling and MHD stirring using induction coils. An industrial prototype was designed and built to test the system. An engine mounting bracket originally designed for liquid A356 HPDC was redesigned for semi-solid casting using a commercial structural FEM software and ProCAST which allowed to take into consideration the complex non-Newtonian flows and thermal behavior of semi-solid rheology. Several numerical iterations were done between casting for SSM and mechanical engineering design to verify that the final component was structurally sound in fatigue operating conditions. The integrity of the components produced in the industrial environment was tested by means of tensile tests and microstructural evaluations.

Figure 1: "Kitchen knife" test

What is Semi-Solid Material (SSM)?

Conventional casting requires the casting material to be in liquid state before casting. Semi-solid material (SSM), also referred as thixotropic material, is casting between the solidus and liquidus temperature range with a liquid fraction ranging from 30-50%. From a macroscopic point of view thixo materials have the consistency of toothpaste - Figure 1 shows a typical "kitchen knife" test on a A356 aluminium billet to demonstrate its consistency. On the microscopic level, whereas liquid casting forms dendrites (Figure 2a), semi-solid material on the other hand forms globular grains suspended in a liquid metal matrix (Figure 2b) during solidification. Thixotropic material exhibits very complex thermo-mechanical behavior difficult to predict. When this class of material is sheared it flows, when allowed to stand it thickens up again - their viscosity is shear rate and time dependent. One of the processes used to produce semi-solid material for casting is rheocasting.

Why SSM casting?

The main attractiveness of using the semi-solid route for casting is that turbulence, porosity and shrinkage are considerably reduced. This process can be used to produce near-net shape components with close dimensional tolerances, reducing mechanical machining. As the casting temperature is lower, less energy is required for processing, die life is increased and gas entrapment is reduced due to predominantly laminar flow. Therefore the integrity of the components produced is higher. Cycle time is also reduced between 20-25% in comparison to conventional HPDC casting processes. However, the SSM casting process typically requires tight process control as well as careful optimization of casting die design and process parameters. Numerical modeling of the SSM casting process can significantly reduce the time and cost required to develop and optimise new product applications.

Design for SSM casting

Due to the highly complex behavior of thixotropic materials the known rules for HPDC die design cannot be applied. The gating position, size of runner and gate, the venting position, overflows and processing parameters are different to HPDC and they are also component specific. As the automotive component of interest here was not originally designed for semi-solid casting, the component could not be cast in its original form as will be discussed below. The redesign of the component necessitated several close loop iterations between ProCAST simulations (castability) and Finite Element Structural Analysis (engineering design) to ascertain that the final component met the fatigue requirements. Once all the conditions were satisfied, the final mechanical engineering design model and the casting die model were produced.

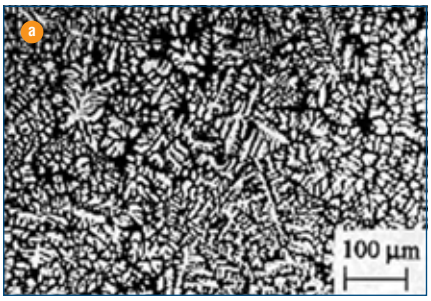
Results

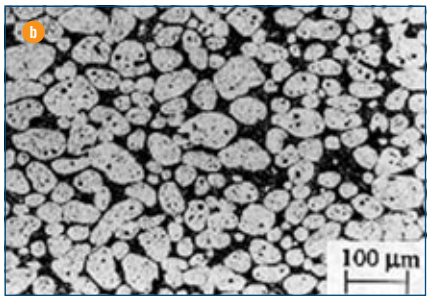
Simulation results for die design

Figures 3 show the filling patterns of the redesigned automotive component during different stages of the filling. The filling is typical for a thixotropic process showing a predominantly laminar filling behavior if compared to high pressure die casting.

Figures 4a and 4b show the temperature distribution on the surface and a cross section inside the component respectively. It is clearly seen that there is a localized temperature drop in the delta area due

Figure 2:
Dendritic structure of liquid metal shown in (a) and globular structure of a SSM shown in (b)





to the large surface area and thin section. As a result this section will become a prospective shrinkage porosity area. Furthermore the feeding to the annular section **A** will be restricted resulting in the shrinkage porosity in the centre of the annular section. This is shown by the solid fraction contour plot in Figures 4c and 4d. The latter show that there is no semi-solid material from the gate section through the delta area to feed the annular section as the material has already solidified in the delta area. The redesigned component of Figures 5 show that there is still a path of semi-solid material from the gate to feed both the delta area and the annular section during the solidification phase, and for the consolidation stage of the casting process.

Component evaluation

Microstructural evaluation of the castings (Figure 6a) in critical areas, for instance section **A** showed a globular primary grain structure and a very fine eutectic. After T5 heat treatment the eutectic structure changed to a fine globular type structure (Figure 6b). This was in line with the simulation work of the redesigned part, confirming that there was no shrinkage porosity in the critical areas.

The microstructure also showed that the preparation of the slurry was very effective and that the CSIR Rheocasting system produced slurries with the appropriate microstructure.

Tensile specimens were prepared from the section shown in Figure 7 and the mechanical properties were evaluated as cast, T4, T5 and T6 conditions. Table 1 shows the mechanical properties of the tested samples. These results compared very favorably with the minimum requirements for the component.

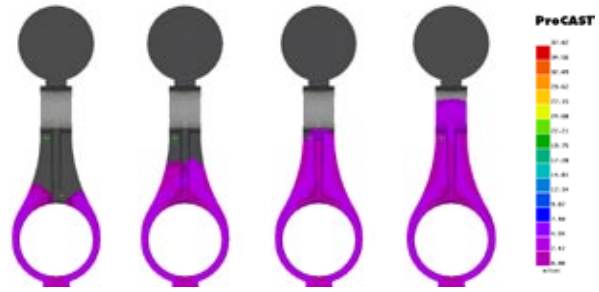


Figure 3:
Filling profiles of redesigned component at different time steps

Figure 4:
Temperature and solid fraction plot of original component

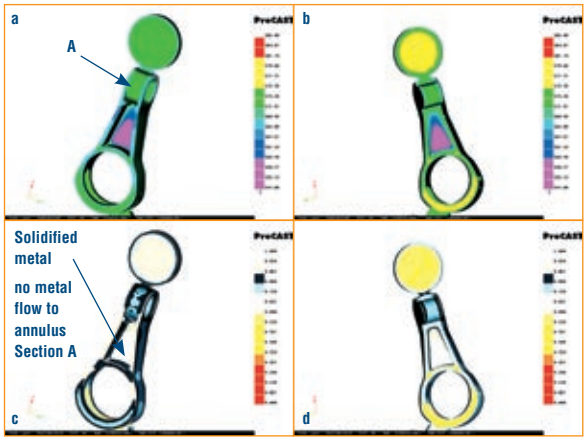
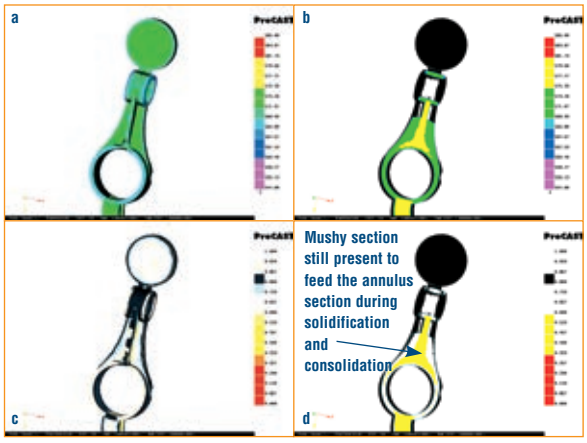


Figure 5:
Temperature and solid fraction plot of redesigned component



Conclusions

Not every component can be cast through the semi-solid route. It is often necessary to redesign the component both for castability and structural integrity. This was successfully implemented and demonstrated in an industrial environment by using close loop iteration in the numerical simulation environments before the final product was cast. It is therefore possible to redesign a component to improve its castability through the semi-solid route and to benefit from all the advantages of a component cast through this route.

This article is an adaptation of the paper published by N. Jahajeeah[1] , Dr G. Govender[2], Dr L. Ivanchev[2], and R. Bëan[2] at the 9th International Conference on Semi-Solid Forming of Alloys and Composites, Busan, Korea, 11-13 September 2006

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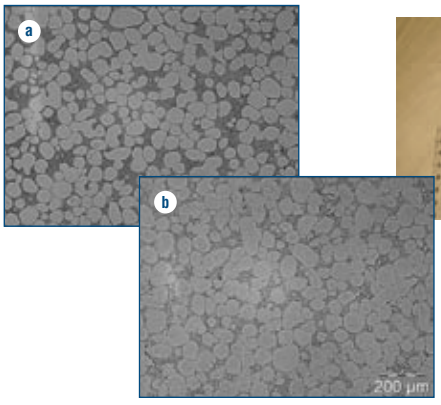

Figure 6:
Microstructure of component in (a) as cast condition and (b) T5 heat treated condition

Figure 7:
Sample casting showing section from which tensile specimen was manufactured

Table 1:
Summary of Mechanical Properties from selected castings

Condition	HB	YS, MPa	UTS, MPa	A, %
F	71.2	104.3	180.0	5.2
T4	84.0	144.3	255.4	13.3
T6	109.7	255.5	315.2	5.38
T5	91.6	194.0	262.3	4.7
Minimum requirements	85	167	275	1.5

ESI Group Casting Seminars and Users' Meetings Around the World

May 20, 2006 - South Africa

Calcom ESI presented ProCAST 2006 software solutions in the University of Johannesburg, South Africa. This seminar was the opportunity to better understand the needs and expectations about ProCAST 2006, and led to several new projects.

May 31 - June 1, 2006 - France

The seminar was organized with HP in order to present the latest innovations of ProCAST 2006. The first day focused on improvements made on new versions. Two of ESI Group's customers, Tamaris and CTIF (Technological Transfer Centre) have contributed to the success of the event by sharing their experiences. The following day harbored debates among users of ProCAST 2006 and QuikCAST 2006 new versions.

June 4-9, 2006 - Switzerland

For the fifteenth consecutive year, Calcom ESI, in collaboration with the Swiss Federal Institute of Technology of Lausanne (EPFL), organized the solidification course with the participation of renowned lecturers from Swiss, French, Austrian and USA universities. 39 participants from 16 different countries together with 8 speakers were involved in this 15th edition. The next Solidification Course will be held from May 20 to 25, 2007.

June 6-8, 2006 - Japan

In collaboration with HP Japan, two seminars took place in Tokyo and Nagoya. The presentations highlighted the capabilities of the complete set of ESI Casting Solutions including the new version of ProCAST 2006. A new meshing technique and a unique physical approach of modeling porosity in nodular cast iron by taking into account graphite expansion phenomena were demonstrated. HP Japan presented its partnership with ESI Group and the use of their platforms with our software.

June 28, 2006 - Germany

Around fifteen ProCAST users from renowned German companies and technical universities attended the User Group Meeting 2006 in Staufenberg, north of Frankfurt. ESI GmbH and Calcom ESI presented the latest innovations of the ProCAST 2006 release, including improved meshing techniques, graphite expansion effects, and visual environment. Practical sessions based on real models helped emphasize the relevant product enhancements in full detail. An overview of future product developments completed the presentation, and a final discussion allowed the users to share their personal experiences and suggest further improvements related to their specific processes.

July 6, 2006 - China

The first China Casting Seminar took place in Beijing and attracted participants from casting companies, including one of China's leading steel producers. This seminar focused on continuous casting, investment casting and ferrous sand casting.
The second seminar was held in Shenyang (north of Beijing) and focused on investment casting only. Calcom ESI and ATE-ESI presented ProCAST 2006 capabilities for the aeronautics market. China's first jet-propelled aircraft engine manufacturer was also present at the event.

July 28, 2006 - Czech Republic

MECAS ESI presented the new version of ProCAST 2006 in Brno University of Technology. After a presentation of ProCAST 2006 improvements, practical sessions were held with GEOMESH & MeshCAST.

September 21, 2006 United Kingdom Frost & Sullivan Industrial Excellence Awards Banquet

Over 30 companies were invited to the Industrial Excellence Awards Banquet on the 21st of September 2006 in London, UK. For more than 40 years, Frost & Sullivan gives recognition to companies which demonstrate best practices in their respective industry. The digital simulation software technology leadership of the year rewarded ESI Group for ProCAST 2006 finite element software for foundry simulation. "It's a privilege for us to receive this prize which honors our company for its accomplishments over the past few years" said Marco Gremaud, Calcom ESI Casting Solutions Product Manager.

September 21-22, 2006 - Italy

The 3rd International Conference High Tech Die Casting 2006 (HTDC) took place in Vicenza, Italy. During two days, 68 papers, 11 technical sessions and contribution from a large panel of experts coming from 18 countries have been presented. Held every two years, the first HTDC began in 2002 and hopes to become one of the most outstanding international casting events.

September 27-29, 2006 - Poland

Devoted to the foundry industry, the METAL Fair is one of the largest events in Poland, organized by the Global Association of the Exhibition Industry. For this 12th edition more than 2700 specialists were registered at the fair. Most of the attendees were from Ukraine, Russia, Czech Republic and Germany. The international status of this event brought 340 companies from around the world. MECAS ESI was also present.

October 17-18, 2006 - Austria

More than 150 delegates, mostly from Austria and Germany, participated in this technical conference. The 4th edition was focused on the state-of-the art application of light metal in different industrial sectors. Acting as a sponsor, ESI Group presented its range of products to the participants highlighting new advanced solutions in modeling. Interesting discussions were followed by a well appreciated evening with classical live music from Mozart.

November 2 - 5, 2006 - India

"Emerging Technologies & Strategies" was the main theme of this international event which covered three concurrent conferences: (1) ALUCAST 2006 the conference on Die casting, (2) ALEX 06 Conference on Extrusion and (3) DIMO'06 conference on Die and Mould technology. Initiated in 1995, the 12th edition had a participation of 21 different countries, 600 delegates from India and more than 50 technical presentations. ESI India did not miss the opportunity to promote ProCAST and all the other products sharing ESI Group experiences with visitors and exhibitors.

November 6-12, 2006 - Turkey

Ankiros 2006 exhibition was made up of 3 main venues : The 8th International Iron - Steel & Foundry Technology Fair, the Machinery & Products Trade Fair and the 3rd International Foundry congress where 28 lectures were presented including a lecture from Calcom ESI on Advanced Casting Simulations. This international Foundry congress has become a well-known yearly event in Turkey. This year's event welcomed more than 600 exhibitors from 35 different countries including China, Germany, Italy, UK, USA and of course Turkey. ESI presence was essential not only for the investment in the metallurgy industry in the Eurasian region but for Turkey as it is becoming one of the major suppliers for metallurgical products such as iron & steel, castings as well as forgings. Our Engineers took this occasion to tighten relationships with existing customers to gain new leads and to sell engineering services.

EuroPAM 2006 TOULOUSE

16th European Conference and Exhibition on Digital Simulation for Virtual Engineering

enterprise engineering simulation solutions

Simulation Based Design for Virtual Product Development

EuroPAM 2006, the 16th European Conference and Exhibition on Digital Simulation for Virtual Engineering was held on October 10-12, 2006 in Toulouse, France. In parallel to the PAMfair exhibition, it featured three major events: Users' Meeting, Industry Day and Enterprise Engineering Simulation Day.

Presidential Address

EuroPAM 2006 proved an ideal place to discuss mutual annual achievements across multiple industries and applications.

Stamping, Tube Bending & Hydroforming

There were a wide variety of presentations to the PAM-STAMP 2G user's community of recent industrial successes with the software. ESI Group's PAM-STAMP 2G product management team highlighted the new features in the software delivered during 2006.

With the release of PAM-TUBE 2G in March 2006, its first user conference was held where customers shared their experience. Siegen University presented its research on thin-walled tube bending. New prototype solver developments and a preview of PAM-TUBE 2G V2007 were presented.

Crash & Safety & Impact

The Crash, Safety & Impact Conference covered the current state-of-the-art in crash simulation technology through technical papers from industry experts and workshops on PAM-CRASH 2G 2006.

Vibro-Acoustics

ESI Group presented the evolution of its vibro-acoustics software, and participants got to experiment the new version of VA One and learn more about RAYON family products RAYON VTM, and AutoSEA2. Customers presented their projects and shared their experiences.

Casting

Three presentations from ESI casting team focused on ProCAST. Prestigious companies & institutions shared their experiences and challenging tasks.

CFD

The product news and master class presentations given by ESI Group staff informed about the new features and upcoming plans for the CFD product line, as well as modeling procedures for certain applications. Presentations were given about the Fuel Cell industry from Ballard Power Systems, and the state of high performance computing from Silicon Graphics, Inc.

Open VTOS

The "Visual Environment" simulation data management, cross domains CAD/CAE data synchronization, simulation process automation, meshing tools, Compute Model, Editing and Transport, as well as pre- and post-processing applications, open to ESI Group and third party's applications were presented.

Welding

The welding session included a presentation on the numerical welding simulation of aluminum structures by Franhofer Institute, the simulation of welding distortion by Fugetechnologien, and the simulation of Realiter industrial parts by UAM.

Composites

This session illustrated how academic world actively fosters the composite value chain in order to deliver sound, reliable and proven software in the virtual development of composite parts.

The conference closed with the Enterprise Engineering Simulation Solutions day with the Partner Panel session and the participation of SGI, Dassault Systèmes, UGS, BULL, Intel, HP, IBM and Microsoft.

The next EuroPAM will take place in Prague, Czech Republic, in May 2008. See you there!

Partner Panel session

The gala evening took place in the Cité de l'Espace (City of Space)

ASIAN PAM EVENTS 2006

PUCA 2006

The 17th PAM users' conference gathered over 200 people in Tokyo, Japan, on Nov. 9-10, 2006. 43 papers were presented, and 13 partners exhibited their respective products.

Day 1: ESI Group's position and strategy were introduced in general session, followed by parallel CRASH and STAMP sessions.

Day 2: The Manufacturing session introduced the Flex Tools Consortium, while the Safety/Comfort/Vibro-acoustic session proved of great interest.

Throughout the conference, many spontaneous meetings took place to discuss/exchange users' experiences.

ChinaPAM 2006

Over 150 people attended the 5th China PAM 2006, which took place in Wuhan, China, from November 13-14, 2006.

30 papers were presented. 2 keynote speeches were given, from China Aerospace Science and Technology Corporation and from the National Automobile Quality Supervision Test Center. Product news updates and advanced concepts were developed, deepening the understanding of ESI Group's high quality products and their industrial applications, as well as enhancing the confidence in products and services.

HanPAM 2006

The 12th HANPAM 2006 took place in Seoul, South Korea, on November 7th, 2006. Over 200 participants attended the conference where 24 papers were presented. Half of these dealt with Crash and Stamping, outlining the growing interest in ESI Group's solutions in these fields and their applications.

Image courtesy: ESI Group

ESI Group Member of the French Industrial Delegation during State Visit French President Chirac in China

On October 24-28, 2006, our company had the honor of being selected as participant in the official visit of the French President and First Lady to the People's Republic of China. The chairpersons or CEO's of thirty large French companies were warmly welcomed in Beijing and Wuhan by the official Chinese delegations. This nomination acknowledges ESI Group's presence and development in China today in order to promote the use of digital simulation at the best level.

"I am confident that this new visibility conferred to ESI Group will contribute to the strengthening of our renown among software editors worldwide. It will lead to the reinforcement of «harmonious partnerships based on trust», as phrased by President Chirac, with key French industrial accounts in order to reach additional markets in China and elsewhere."

Alain de Rouvray, ESI Group Chairman and CEO

IIW Kenneth Easterling Best Paper Award

The 8th International Seminar on Numerical Analysis of Weldability was held on 25 - 27 September in Graz, Austria. 19 papers were submitted where the work has been carried out in parts with ESI Group's SYSWELD software. The Kenneth Easterling Best paper award went to **Mr. Christopher Schwenk from Volkswagen Group, who carried out the simulation work with SYSWELD** on Sensitivity Analysis of Welding Simulation depending on material properties value variation.

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GIFA 07

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www.esi-group.com/News/events

ESI Group participates in the following events:

Date	Event		Place
January 8-11	45th AIAA Aerospace Sciences Meeting & Exhibit	Forum on state-of-the-art topics in aerospace sciences	Reno, NV, USA
January 30-31	ShipTech 2007	Shipbuilding Technologies Information Exchange	Biloxi, MS, USA
February 2-4	55th Indian Foundry Congress (IFC)	Foundry Congress	Agra, India
February 7	Stamping Seminar	Industial day of stamping processes	Paris, France
March 20-22	Semi-Therm 23	Semiconductor Thermal Measurement, Modeling and Management Symposium	San Jose, CA, USA
March 25-28	MetalForm 2007	Stamping and Fabricating Exposition and Conference	Chicago, IL, USA

Information and registration on www.esi-group.com

HONDA Engineering visits ESI Group for its PAM-STAMP 2G stamping simulation solution

On August 28, 2006, a delegation from HONDA Engineering visited ESI Group in Rungis in order to provide valuable feedback about their use of the PAM-STAMP 2G stamping simulation solution. Following a general presentation from HONDA and a focus about their "Design One By One" activity, ESI Group revealed the latest features and improvements under development for the coming release of PAM-STAMP 2G v2007. HONDA then described their expectations based on day to day experience with PAM-STAMP 2G in production use. HONDA Engineering and ESI Group agreed to the need of further discussions and collaboration in order to offer additional features within PAM-STAMP 2G for production use.

"We highly appreciate that PAM-STAMP 2G is one of the most significant tools to manufacture automotive body parts with outstanding quality. This collaboration will greatly help us to build a future framework to solve stamping formability issues" said Hideki Taoka, Senior Manager of Stamping and Molding for Auto Body Dept., HONDA Engineering.

"This meeting has been a great opportunity for us to build the framework for ESI to work more closely with HONDA Engineering over the coming months and years, ensuring that our software solutions are a perfect fit with the ever changing requirements of the Automotive industry as it continues to evolve" said Dave Ling, Stamping Solutions Product Manager, ESI Group.

FY2006/07 sales up: H1 +4%, Q3 +4.7%

ESI Group's sales for the second quarter of FY2006 totaled € 13.6 M, up +14.6% on the same period last year and up +16.4% on a constant exchange rate basis. This significant increase in activity is a combination of buoyant growth in license sales of +18.7% and slight growth in services of +2.2%.

Total sales for the entire first half-year reached € 26.4 M, up +4% in real terms and +4.3% on a constant exchange rate basis.
License sales, up +4.9% over the first half, were up +5.3% on a constant exchange rate basis. The 77% contribution of licenses sales to total sales remains high over the period, while the repeat rate of license sales reaches a good level of 79% (vs. 77% for the same period last year).

The proportion of half-year sales recorded abroad remained stable at 83%. The geographical breakdown in sales was as follows: Europe 42%, Asia 43% and America 15%. Organic growth was particularly strong in Asia, and notably in Korea and China, where the Group recently increased its position through the integration of the service and distribution engineering teams of IPS International and ATE Technology. The strategic partnership signed with ATE Technology during the first half of this year enabled to rapidly share a valuable complementary know-how which resulted in the winning of a significant first contract in the aeronautical sector in composite materials simulation.

Turnover for the third quarter of financial year 2006 totaled € 12.6 M, up 4.7% organically on the same quarter of the previous financial year. At constant exchange rates, the increase was +7.3%. The performance of License activity over the third quarter was marked by very dynamic growth (+ 17.9% at constant exchange rates), thus continuing the trend noted the previous quarter. The weakness of Consulting & Services activity (-18.4%) is essentially due to project delays in the Asian zone, notably with a significant fall in Japan associated with the halting of low value-added projects.
Consolidated turnover for the first 9 months of the year totaled € 39.0 M (+4.2%). The surge in Asia has been reaffirmed.

Outlook

Alain de Rouvray comments: "Our sector's growth drivers are currently moving to emerging zones such as China and India. ESI Group's participation in the French State's recent visit to China reflects the quality and soundness of our relationships in Asia. Despite structural and situational difficulties in Consulting & Services, the ongoing dynamism of our License activity and the intensification of our S&M efforts – notably in Asia – should, in the short term, allow an acceleration in growth".

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