benchmark

the international magazine for engineering designers & analysts

analysing the atmosphere

using CFD to model our surroundings

also in this issue . . .

Simulation Data Management I EASIT² Update I NAFEMS Regional Conferences 2012
Transient Coupled-Field Simulation of a Power Electronic Module I Icons of CFD

april12

NAFEMS

Explore, Discover, Improve...

In today's competitive business environment, improving product efficiency, safety, and reliability—while reducing time and costs—are mission critical goals. Our customers are achieving these goals by leveraging Isight for simulation automation and design optimization.

Isight enables the integration of CAD, CAE, test data, and other applications into consistent and repeatable simulation process flows. By automating simulation execution, Isight enables you to use powerful design of experiments and optimization tools to quickly—and affordably—explore and improve product performance.

Download Customer Papers on Isight at www.simula.com/isight

SIMULIA

Stop. Stop what you're doing for a second please. Go get a cup of coffee, tea, or your favourite tipple, and take 2 minutes to relax.

Is that better? Are you with me now? Good.

It's one of the prevailing facts of modern life that we always try to do too many things at once. It's as if we're trying to keep up with computers. They can multitask, right? So why can't we? Why shouldn't we do 10 things at once?

Because you'll get one of them wrong. Guaranteed.

Apparently, mono-tasking is the next big thing. Concentrating on one task until completion, and then moving on to the next. You're not a computer – you don't have hyperthreading technology built-in. You haven't suddenly had an upgrade to the latest and fastest chipset, enabling you to carry out more complex tasks than you could before. You're the same person you were 10 years ago (probably with more likelihood of 'bluescreening' than you did back then too...). So, if like me you read editorials like this whilst replying to emails, organising your 'to-do' list, or driving (ok, not driving, but you get my point), perhaps it's time to change the way you work, and in doing so, become more productive.

We all know the feeling of having multiple lists of things to do, juggling several projects at one time, and having to constantly re-prioritise your day until it becomes no more than a fire-fighting exercise. It's just one of those things. But sometimes, it's good to try something different, to try a new way of working or a new process to make your day, hell make your life better and more fulfilling.

Remember why you got into engineering? Our own *CAE guy* has discussed this in articles *passim*, but really – how often do you refer back to the very reasons you got into this business? Not very often, I'll wager.

If we lose track of why we got into this industry, of what excited us or moved us to make this career choice, it makes it very difficult to work out how to encourage the 'next generation' of simulation engineers. At a recent internal meeting, we discussed how NAFEMS can help to encourage young students to view analysis and simulation as a viable, and exciting, career option. Yes, we all know that our work can be more than a little monotonous, but some of the projects we work on, some of the areas we specialise in, really are exciting. We need to harness that excitement, in order to bring new engineers into our community and continue to push the technology forward. Ok, perhaps kindergarten isn't the right place to start promoting a career in engineering analysis, but you get my point – most young people don't even know what analysis is, and at NAFEMS we see it as our role to promote not just the safe and reliable use of the technology, but the technology *itself*.

Within this issue, you'll see a progress report on the EASIT2 project (www.easit2.eu), and an outline of plans to create a new recognised certification program for all those involved in analysis and simulation. It's through initiatives like this that we can truly develop the role of the engineering analyst and/or 'simulation engineer', into a 'visible' career option with a professional accreditation program to 'prove' competency and track professional development.

It's all about people – it's all about you – and it's all about the people who you will mentor and train to take the next steps in the future of simulation and analysis. So let's, as a community, concentrate on one thing at a time, and look to develop our own 'career ladder' that those entering the profession can aspire to be part of.

You may now resume whatever you were doing. Thanks for your attention. ☺

David Quinn | Editor | david.quinn@nafems.org | twitter.com/benchtweet

contents

Editorial

Editor
David Quinn
david.quinn@nafems.org

Deputy Editor
Nicola McLeish
nicola.mcleish@nafems.org

Design/Production
d2 print
info@d2print.com

Advertising
Paul Steward
paul.steward@nafems.org

Subscriptions
Christine Bell
christine.bell@nafems.org

Membership
For information on membership of NAFEMS, contact Paul Steward on paul.steward@nafems.org

ISSN 0951 6859

Publisher

NAFEMS
Beckford Business Centre
Beckford Street
Hamilton, Lanarkshire
ML3 0BT
UK

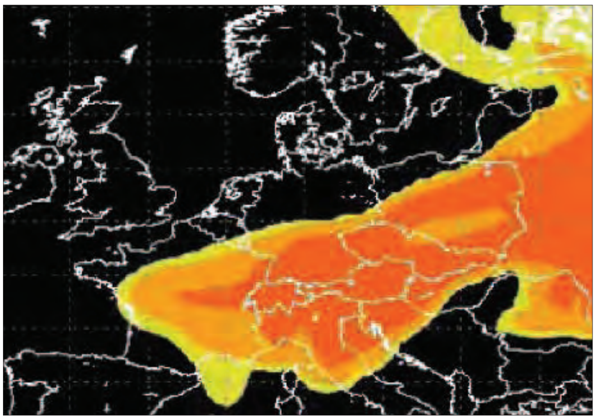
t +44(0)1355 225688
f +44(0)1698 823311
e info@nafems.org

Errors & Omissions: While every care is taken in compiling benchmark, neither the Editors, nor NAFEMS, can be held responsible for the consequences of any errors in, or omissions from, the contents. The views expressed by contributors are their own and all information is accepted in good faith as being correct at the time of going to press. The Editors will not accept any advertisement considered by them to be misleading or otherwise unsuitable for inclusion in benchmark, however, the presence of any advertisement should not be considered to convey or imply any form of commendation by NAFEMS.

benchmark

the international magazine for engineering designers & analysts

april12



regulars

Regional Conferences: Agendas Released

In the next few months NAFEMS will be hosting several regional conferences. These events will give many of our members the opportunity to attend a NAFEMS conference in their local region, complementing the World Congress held in alternate years.

NAFEMS DEUTSCHSPRACHIGE KONFERENZ '12
8. – 9. MAI | BAMBERG, DEUTSCHLAND
BERECHNUNG UND SIMULATION – ANWENDUNGEN, ENTWICKLUNGEN, TRENDS

NAFEMS NORDIC CONFERENCE '12
22 – 23 MAY | GOTHENBURG, SWEDEN
ENGINEERING SIMULATION: BEST PRACTICES, NEW DEVELOPMENTS, FUTURE TRENDS

NAFEMS UK CONFERENCE '12
30 – 31 MAY | GRANTHAM, UK
ENGINEERING SIMULATION: REALISING THE POTENTIAL

NAFEMS FRANCE CONFERENCE '12
6-7 JUIN | PARIS, FRANCE
SIMULATION NUMÉRIQUE: MOTEUR DE PERFORMANCE

This issue of benchmark contains the full agenda for the upcoming DACH, Nordic and UK Conferences as well as the latest information for NAFEMS French Conference on pages 17-28.

We hope to see as many of you as possible at these events. As the only independent organisation dedicated to engineering and simulation, NAFEMS regional conferences offer a unique opportunity to connect with like-minded individuals involved in analysis and simulation.

Full details for all of the conferences can be found at
www.nafems.org/2012

NAFEMS NORTH AMERICA CONFERENCE '12
11-12 SEPTEMBER | WASHINGTON, DC
ENGINEERING SIMULATION: A 2020 VISION OF THE FUTURE

Call for Presentations

Benchmark is pleased to announce a North American addition to the NAFEMS 2012 series of regional conferences. Taking place during September 11-12 in Washington, D.C.; the North American conference will bring together the leading visionaries, developers, and practitioners of CAE-related technologies and business processes. In this neutral forum, attendees will be able to share relevant trends and roadmaps, explore common themes, and address these issues. Entitled 'Engineering Simulation: A 2020 Vision of the Future ', the goal of the conference will be to provide attendees with thought provoking content to carry out engineering simulation today and in coming years.

This event will be of interest to end users, visionaries, researchers, educators, industry managers, and simulation software and hardware developers - all of whom have relevant experience and viewpoints that can help shape the future of the technology. All are invited to participate, but more importantly to articulate, interact, and evolve their thinking and planning of future activities proactively, so they can realise the full potential of their use of simulation now and in the future.

Further information including the Call for Presentations for the conference can be found on page 26.

www.nafems.org/na2012

NAFEMS Iberia

Annual Seminar

NAFEMS Iberia will be holding its 2012 Awareness Seminar on 10th May in Madrid at scuela de Ingenieros Aeronáuticos, Universidad Politécnica de Madrid. Entitled 'Numerical Methodologies and Modeling of Coupled Systems' this seminar examines a topic highlighted in previous seminars. This upcoming seminar aims to share and enhance the knowledge of users in the simulation of coupled systems. It will attempt to cover this broad subject from varying points of view such as fluid structure interaction, multi physics and multidisciplinary simulation and co-simulation.

The seminar will conclude with a plenary presentation given by an invited speaker from the NAFEMS community, Dr. Henrik Nordborg. Chairman of the NAFEMS MultiPhysics Working Group and Professor of Physics, Institute for Energy Technology (IET) & Microsoft Technical Computing Innovation Centre.

This event is free to attend. To register please contact
diane.duffett@nafems.org

NAFEMS & INCOSE Collaboration

NAFEMS and INCOSE have agreed to proceed with a mutually beneficial strategy to develop a collaborative relationship.

As a result of a meeting between the leadership teams from NAFEMS and INCOSE, the leadership committees of both organizations have agreed, in principle, to proceed with a collaboration initiative and form a small subcommittee with representatives from both organizations to study the benefits of the organisations working together for the mutual benefit of their members.

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organisation founded to develop and disseminate the interdisciplinary principles and practices that enable the realisation of successful systems. Its mission is to share, promote and advance the best of systems engineering from across the globe for the benefit of humanity and the planet.

For the purpose of this initiative, NAFEMS is represented by Edward Ladzinski and INCOSE is being represented by Ralf Hartmann, to develop a simple benefits analysis that the leadership committee from both organizations can review and potentially execute. The study is close to completion and is currently being reviewed and refined.

Specifically, the study contains recommendations in shared projects, mutual assistance and support for international standards, integration of activities, among other recommendations. Stay tuned to further developments from these two global ‘thought leaders’.

Potential for Seismic Working Group

Today, seismic engineering is applied to buildings (new and existing), bridges, civil works, infrastructures, power plants, dams, ground excavations, tunnels and geotechnics. Many National and International Codes (such as Eurocodes) provide instructions on analysis as well as design procedures where the usage of computer code procedures has become unavoidable. As this topic is clearly of increasing interest, NAFEMS is investigating the potential for a Seismic Working Group whose primary focus would be to develop guidelines for the practical application of numerical methods in seismic engineering.

It is thought the following areas would form the initial focus of the working group:

- **Input parameters for common analysis types and materials and how they should be obtained**
- **Case studies, illustrated with real examples for typical applications**
- **Guidance on mesh type & extent, boundary conditions; and their influence on the seismic analysis.**
- **Verification and validation guidance**
- **Benchmarks**

Those interested being part on this potential working group should contact Paulo Segala (segala@cspfea.net).

To keep up-to-date with the latest developments visit **www.nafems.org**

North America SDM Symposium

NAFEMS’ Simulation Data Management Working Group will present this one-day symposium on May 2nd in Cincinnati, Ohio. Examining this breakthrough technology, this event aims to help participants better understand the benefits to be gained from implementing a Simulation Data Management system such as increased efficiency, reduced development costs, and improved time-to-market.

The primary focus of the symposium will be companies sharing their experiences, lessons learned, and benefits gained from breakthrough improvements in simulation throughput, analyst productivity, product performance, and information traceability.

NAFEMS members can attend this event at a discounted rate.

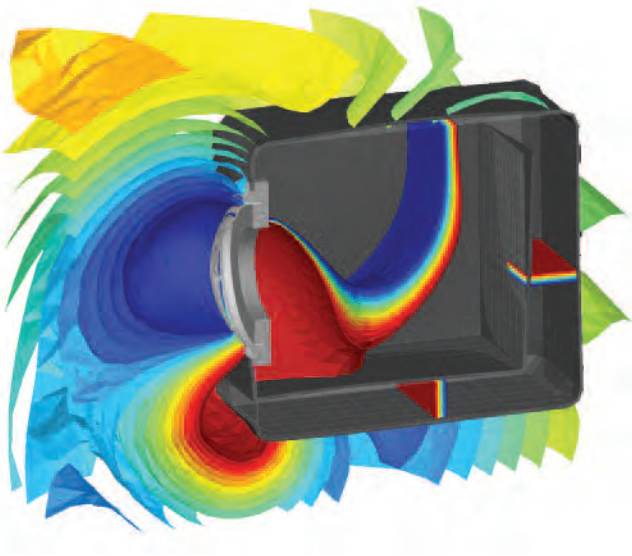
Those with sufficient seminar credits may attend the event for free.

Being held in conjunction with 'CIMdata’s Simulation & Analysis Council Workshop' on Tuesday May 1st, these two unique one-day events will explore in-depth, the latest thinking and practice relating to the critical issues facing members of the simulation and analysis community. A discount is available for those wishing to attend both events.

Full details on page 13. Register at **www.nafems.org/sdm12**

May 1 2012	Elements of Turbulence Modeling	e-learning course	Online
May 2 2012	North American SDM Symposium	symposium	Cincinnati, Ohio
May 7 2012	Einführung in die praktische Anwendung der Finite-Elemente-Methode (FEM)	course	Bamberg, Germany
May 8 2012	Practical CFD Analysis	e-learning course	Online
May 8 2012	DACH Konferenz 2012	conference	Bamberg, Germany
May 10 2012	Numerical Methodologies & Modeling of Coupled Systems	seminar	Madrid, Spain
May 22 2012	Nordic Conference 2012	conference	Gothenburg, Sweden
May 30 2012	UK Conference 2012	conference	Lincolnshire, UK
Jun 4 2012	Méthode des Éléments Finis appliquée au dimensionnement et à la validation de pièces industrielles	course	Paris, France
Jun 4 2012	Introduction au Calcul de Structures, aux Éléments Finis et à la Simulation Numérique	course	Paris, France
Jun 6 2012	Congres France 2012	conference	Paris, France
Jun 19 2012	Practical Introduction to FEA	course	Stratford-upon-Avon, UK
Jun 27 2012	Practical Introduction to Non-Linear Analysis	course	Nottingham, UK
Jul 11 2012	Using Variability in Simulation: A Practical Workshop	workshop	Teddington, UK
JuL 23 2012	Practical Introduction to FEA	course	Irvine, CA, USA

www.nafems.org/events



NAFEMS TRAINING

As the only independent, international association dedicated to engineering analysis and simulation, NAFEMS provides a range of training courses which are open to all, in both face-to-face and e-learning formats.

Non-Linear Analysis
e-learning course, online
5 April 2012

Elements of Turbulence Modeling
e-learning course, online
1 May 2012

Introduction to CFD Analysis: Theory and Applications
training course, Bamberg, Germany
8 May 2012

Methode des Elements Finis appliquee au dimensionnement
training course, Paris, France
4 June 2012

Introduction au Calcul de Structures, aux Elements Finis et a la Simulation Numerique
training course, Paris, France
4 June 2012

Einfuehrung in die praktische Anwendung der
training course, Bamberg, Germany
11 June 2012

Practical Introduction to FEA
training course, Stratford upon Avon, UK
19 June 2012

Practical Introduction to Non-Linear FE Analysis
training course, Nottingham, UK
27 June 2012

Practical Introduction to FEA
training course, Irvine, CA, USA
23 July 2012

New courses and dates are announced regularly – visit
www.nafems.org/training
for full details

Dear CAE Community,

Last December my younger brother got married for the first time (this is important to note since he is also in his 40s, it's easily possible for him to be on his second or third marriage). As one of two brothers of the groom, I was invited to say something at the wedding reception. I confess to having had difficulty coming up with something appropriate: I am not his best friend (man); I am his brother and older brother at that. The day before the wedding, I was discussing this topic with our other brother (the groom's fraternal twin) and discovered that he had not really figured out anything either. I mentioned it might be nice if we could do something that was different than the usual "brother of the groom" speech, but do it together. He had a few ideas, one of which was some kind of phone call. I liked this concept and after a little more discussion, we settled on a tag-team phone call to our Mom, where the audience would only hear our side of the conversation (yes, this is a common bit on TV, but it's an oldie-but-a-goodie, so we went with it). For a little background: my Mom is the "worrier" in the family and would go on-and-on to my Dad, a retired engineer, about this whole situation regarding of whether our brother would ever get married or not. When the time came at the reception, I would go first.

"Hello"

"Oh, hi Mom, what's up?"

"What about him?"

"Yes, I know they've been dating quite awhile."

"Me too, Mom, I like her a lot. I think she's great"

"No, I do not know if he'll propose, we don't talk about these things. What do you think?"
Long pause with me rolling my eyes dramatically, holding the phone[1] up to my chest, me hanging my head and shaking it ever so slightly, and finally interrupting her with a *"Mom … Mom … MOM…"*

"I know they live close to us, but I can tell you what I've said to him."

"I told him that if he ever gets married and has a wedding ceremony, I expect to be invited."

"Yes, that's it."

"Because I'm an engineer"

This line absolutely killed[2], mainly because it's so true: we like thing simple and logical. My 15 year-old nephew would later ask me why the "engineer" line was so funny (I answered that engineers like things "just so" and he probably needed to get a little older to truly understand). I would go on with my part of the speech a little longer and then "hand off" to my brother by suggesting that Mom call him. He did a great job as well and we both got compliments all night. However, the best man was also in his 40s and I was struck by how sincere, funny and thoughtful his speech was – it was, frankly, remarkable. Then over the course of the evening, it occurred to me that the vast majority of weddings I had been to were for couples in their 20s, accompanied by speeches of people in their 20s, and I realized that, like in many aspects of life, experience matters. I can say with confidence that, short of the one at my own wedding, this was the single best toast by the best man that I have ever heard in person.

Fast forward to a few weeks ago and I was given some "assigned" reading by my wife (if you'll recall, she's also an aeronautical engineer and while I am an extrovert, she is an introvert)3. In this book, there is a whole section on chapter on open office environments4. References to engineers, writers, and professors form a common thread throughout the book. It was a great read for anyone that is an introvert and for anyone dealing with introverts, of which half (or more) of engineers are. I would go further and judge that the majority of CAE engineers are introverts as well.

When I thought about these three concepts together: engineers, experience, and introverts, it led me to believe that I am somehow not quite tapping the full potential of our new CFD group. Is there something more – or better yet – different that I (and by extension engineering companies) should be doing to get the most out of CAE engineers, that – let's face it – would probably prefer to be at their workstation rather than some meeting? Perhaps fewer meetings and more e-mail questionnaires? I know I'd like to go to fewer meetings – I am still trying to figure out which meetings to go to and which not to, so I typically go to them all. My manager wants me to get more of the group talking at our weekly group meetings, but that may not be the best idea for introverts. It seems to me that engineering management could also be working "smarter" and not "harder".

In any event, what are your thoughts on this? What is a better way to leverage the experience and natural "quietness" of a CAE engineers? Drop me an e-mail at: **thecaeguy@nafems.org**

-The CAE Guy

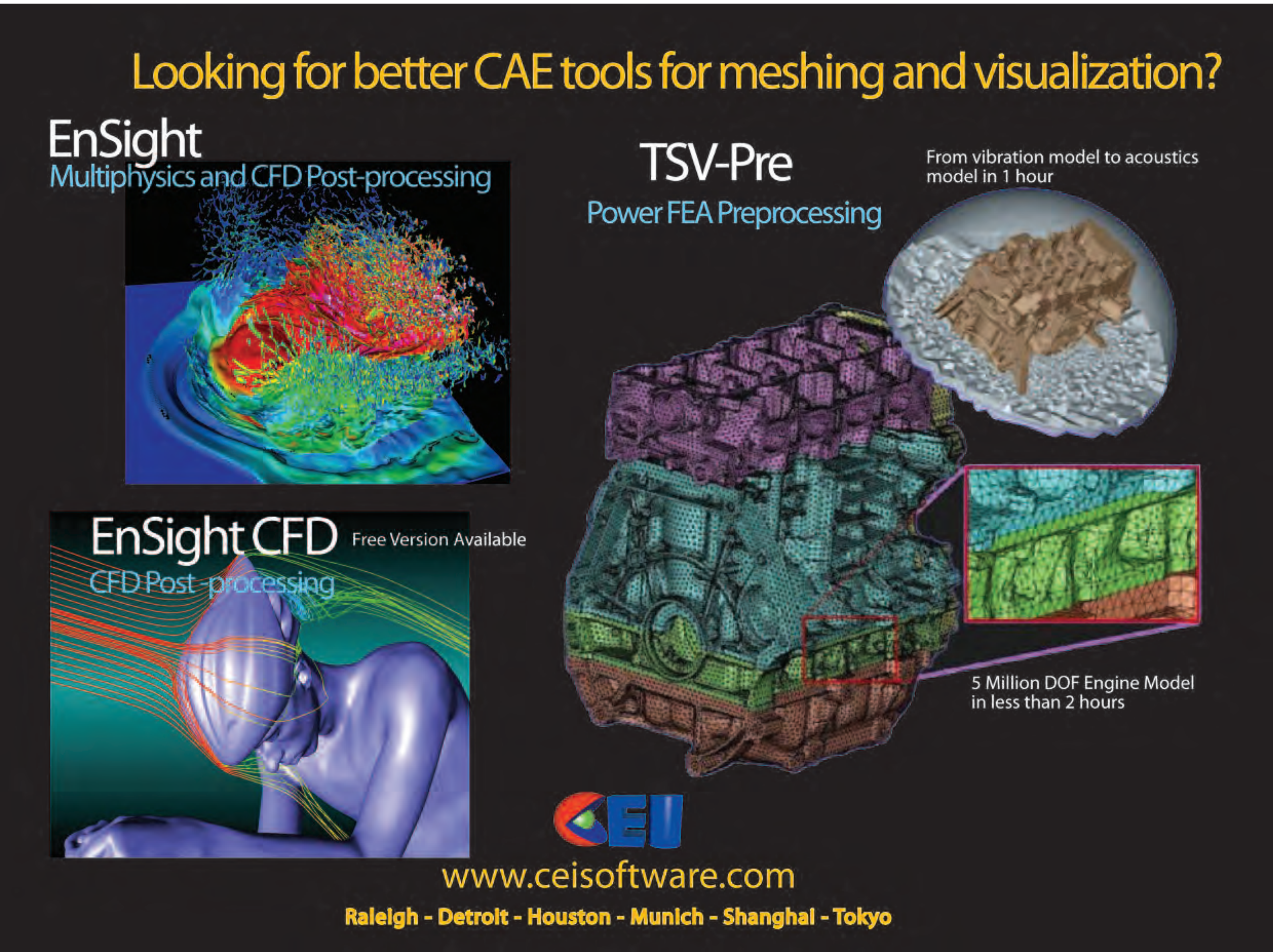
References

[1] As I would have to explain to my daughters later when they pointed out that's not how you hold a phone that having your thumb and pinkie finger extend is basically the international sign for "on the phone".

[2] I, of course, mean figuratively, not literally….

[3] Quiet: The Power of Introverts in a World That Can't Stop Talking, Susan Cain, Crown Publishing, 2012. http://www.thepowerofintroverts.com/

[4] Executive summary: like brainstorming sessions, open offices stifle creativity; introverts know this but don't speak up and extroverts think they're great, but they're not. In our company, co-locating employees of similar functions in the same area is known colloquially as "within shirt grabbing distance".



Simulation Data Management - Enabling Engineers to do More Engineering

Mark Norris, of the NAFEMS Simulation Data Management Working Group, Discusses the Challenges and Successes of SDM.

Keeping track of our simulation data and results becomes more challenging every year as the number of files we need to manage grows at an ever increasing rate. Audi (1) estimate that their analysts are generating a hundred and twenty times as many files as a decade ago while model granularity has grown by an order of magnitude. So we are all drowning in data. We can do more and more sophisticated simulations to more closely represent the physics of the problems we are studying. But the bad news is that this is going to create even more data and more complex, interlinked data sets. Simulation data sets are also becoming harder to manage manually. It's difficult to keep track of what we changed in a complex data set for each iteration that we made.

Technology for managing large simulation data sets has been around for a long time. The first COTS SDM platform was put into production by BMW(2) more than a decade ago. So there is now a substantial body of knowledge describing what early adopters have achieved. However the survey carried out by the NAFEMS Simulation Data Management Working Group found that SDM is not widely deployed, with less than half of all companies using any SDM at all. Neither were respondents using other types of systems to manage their simulation data. NAFEMS members cited a lack of evidence demonstrating the benefits of SDM for not adopting this technology, so the NAFEMS SDMWG has developed a White Paper on the Value of SDM to address this issue.

The good news is that SDM solutions can off load analysts of many routine data manipulation and data management tasks. Audi and BMW applied SDM to automatically document which input files were used in a particular vehicle simulation. They also automated the extraction of key results, the storage of these results in the SDM system and insertion of the key results into report templates. This has enormously reduced repetitive, tedious and error prone work, enabling engineers to do more engineering. The CAE guy rightly pointed out in last July's issue of benchmark that it would be really helpful to automatically create both a report and a presentation of a set of results. The core capability of an SDM solution to programmatically access the all simulation data in context enables any type of report or presentation template to be populated for any simulation or set of simulations. Several vendors now offer report generation modules for their SDM solutions.

I have avoided implying that reports can be created automatically because it's definitely necessary for the analyst to add their interpretation of the results. But it's great for the solution to perform the basic chores of extracting and inserting all the standard sections, curves and even 3D viewables into a report or presentation template. An SDM solution also enables you to annotate information items, for example to add comments to qualify results. This means that it becomes less necessary to generate a report as a document since the results of a simulation and the analysts' comments can be consulted directly from the database.

While the core capability of a PDM system is to manage tree structures of assemblies, parts, documents and data items, the core capability of an SDM solution is to manage complete sets of simulation items and the linkages which connect them. This is known as a graph structure in data-management-speak. For a finite element analysis,

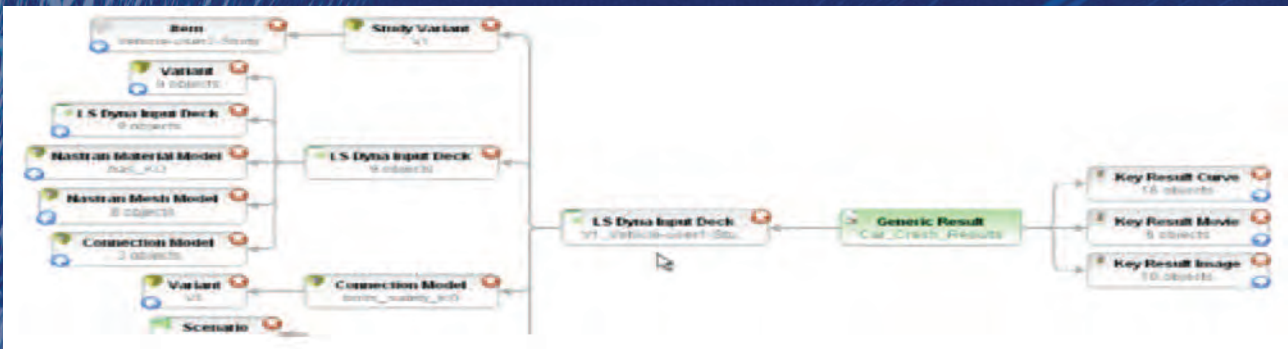


Figure 1: Display of a Set of Simulation Data in an SDM Solution (Courtesy of MSC Software)

this graph structure starts with geometry, loads and materials on the left, progressing through meshing, assembly into an input deck, solution, post-processing, key results and finally reporting on the right side of the screen. The graph structure provides traceability and enables you to navigate from input data through process steps to results.

Like PDM solutions, SDM solutions track information items and associated metadata as well as the data files. Several representations of the same data can be attached to, and accessed from an information item. For simulation outputs, in addition to the bulk data file, these representations can include numeric values stored as metadata, viewable graphs, an Excel file, a lightweight viewable 3D file and a compressed version of the output file. The original bulk data file can be archived or even deleted whilst retaining the information derived from the simulation and the traceability back to the inputs through the graph structure.

An SDM solution provides the capability to provide controlled access to simulation data sets so that they can be consulted by anyone with appropriate access rights, inside or outside the organisation. This can lead to significant time savings in searching for and imparting information. Different studies (3) (4) have found that analysts spend between 30 and 50 % of their time searching for or imparting information. So an accessible and largely self-explanatory mechanism for searching, navigating and accessing sets of simulation data allows engineers to do more engineering.

Typical early adopters of SDM are CAE departments in Aerospace and Automotive OEMs developing complex, high performance products which are refined iteratively. Multiple iterations make it worthwhile to invest in a solution that enables automation and reduces the effort to re-run simulations with modified inputs. Early adopters have been able to retain the Intellectual Property(IP) from their simulation-based experimentation just as they retain their test results. Audi (1) reported that they had accumulated the results of 500,000 vehicle simulations by the end of 2010 and can access both physical and numeric test results for any simulation through a web browser. The NAFEMS SDM Business Value White Paper incudes an extensive bibliography of papers describing end user experiences. In addition, the papers from the 2011 European SPDM conference are now available to NAFEMS members.

So is SPDM the same as SDM? Growing interest in getting simulation data under control has led to acronym wars around what is an SDM system. The NAFEMS white paper sets out the core capabilities of an SDM system based on the experience of early adopters. These include the capability to capture process information which is the necessary complement to the input data files to fully define what was done and why. A range of CAE process implementation solutions are widely used in industry, from scripting through process definition solutions to stochastic iteration engines. The author argues that it's the ability to integrate an analyst's preferred CAE automation solution and capture the inputs and outputs that matters, rather than the need to contain a process manager. It's clear that the capability of an SDM solution to enable process automation can yield large productivity gains.

The world of simulation is highly heterogeneous with many organisations using tens to hundreds of applications, whereas the CAD world is now reduced to a handful of systems. So another core SDM capability is to deal with a diverse range of data types and applications. Peter Bartholomew presented an interesting paper (5) on the topic of the capabilities required to manage simulation data to the RAeS in 2009. He pointed out that the capabilities required of SDM by an analyst investigating complex aerospace phenomena are very similar to the capabilities required by an Aerospace OEM.

Since the SDM solution requirements are similar from the OEM to the individual consultant, it's in the OEM's interest to provide access to their SDM system to their suppliers to ensure the traceability of externally sourced simulation work. In the case of Audi, half the analysts registered on the SDM system are external third parties. In aerospace, a 50M€ project led by Airbus called CRESCENDO (6) is investigating the implementation of SDM solutions across the virtual enterprise. CRESCENDO is demonstrating the feasibility and value of SDM to improve aircraft development processes. Another key benefit of SDM is the ability to access remote simulation resources (7), both physical and human, with lower supervision and collaboration costs.

If SDM can deliver all these benefits, why are relatively few organisations using SDM today? One reason has been solution costs. In the PDM space, capable and affordable PDM solutions like Smarteam emerged to meet the needs of small and medium businesses; even open source PLM solutions are available. Because of the complex requirements of an SDM solution and the relatively small number of analysts worldwide, compared to CAD designers for example, few dedicated SDM solutions have been developed and not all PLM vendors propose an SDM solution on their platform. Some CAE vendors offer data management solutions tightly integrated with their solutions. These latter solutions are attractive as long as you only need to manage the data types included in the integrated SDM solution. Nissan (8), Ford (9) and Petrobras (10) reported significant gains from such specific, mono-vendor implementations.

Continued vendor investment in OOTB core functionality and value-added capabilities is decreasing the costs of implementation and increasing Return On Investment. BMW (11) announced that they are swapping out their custom developments for OOTB SDM applications. This means that other organisations will now be able to acquire as configurable applications, high end SDM capabilities such as simulation generators that previously had to be built as bespoke developments. Simulation generators are an advanced, add-on, SDM capability that enables load-cases and data-sets to be organised so that simulations can be re-run on modified input data with minimal effort. This is extremely valuable for iterative investigations on complex data-sets or problems like pedestrian impact on cars where many possible positions of the pedestrian need to be considered.

SDM is a dynamic and evolving domain that can bring real value to analysts and enterprises alike. NAFEMS has an SDM conference planned for the USA this year where end users will present their experiences. The NAFEMS SDM Business Value White Paper that was distributed in draft form at the 2011 SDM conference will be published shortly. Watch this space.

Mark Norris is an Industry Principal with Infosys, an engineering, simulation & PLM services provider and systems integrator. He has too many years' experience of PLM consulting and solution design around Teamcenter, ENOVIA and SimManager. He is the author of the SDMWG White Paper on the Business Value of SDM and can be reached at em_norris@infosys.com

Bibliography

[1] REICHENEDER, Josef GRUBER, Karl. Experience with 7 Years SDM at Audi. NAFEMS SDM Conference 2010.

[2] HAGELE, J HANLE, U KROOP, A STREIT, M KERNER, C SCHLENKRICH, M. The CAE-Bench Project – A Web-based System for Data, Documentation and Information to Improve Simulation Processes. s.l. : MSC VPD Conference, 2000.

[3] KRASTEL, Marcus. SimPDM – Integration of Simulation and Computation in a PDM environment. ProSTEP iViP Symposium 2008.

[4] ROBINSON, Mark. An empirical analysis of engineers' information behaviors. Journal of the American Society for Information Science and Technology, Wiley, 2010.

[5] Bartholomew, Peter. The use of Metadata to maintain the Integrity of the Analysis Process. RAeS Certification and Validation Seminar 25 May 2010.

[6] COLEMAN, Peter. Developing the Behavioural Digital Aircraft. Aerodays 2011 www.aerodays2011.org.

[7] MINTER, Steve VALINE, Glenn. Simulation Knowledge Management in GKN Driveline. NAFEMS Wiesbaden, Germany 2009.

[8] KIM, Daniel. Implementation Frameworks of SDM (Simulation Data Management) in Nissan Technical Center, NA. CPDA Cincinnatti 2011.

[9] MCCOY, Robert. Automated Rollover Test Simulation Tool. CPDA Detroit 2010.

[10] Simulation Data and Process Management with ANSYS Engineering Knowledge Manager at Petrobras. Bhide, S Largura, L C. NAFEMS SPDM conference 2011 : s.n.

[11] SCHLUTER, Wolfgang THAM, Carsten. BMW 2nd Generation Simulation Data Management – Experience, Infrastructure and Migration. NAFEMS SDM Conference Franfurt 2010.

AUTHOR INFORMATION

Mark Norris | Infosys

em_norris@infosys.com

NAFEMS North America

SDM Symposium

Wednesday May 2 2012 | Cincinnati, Ohio

Faced with competitive and regulatory pressures, many manufacturers want to take advantage of the falling cost of computer hardware and simulate increasingly to evaluate, optimize and validate their products in the virtual world and so minimize physical testing.

In order to increase their simulation capacity, companies need to increase the productivity of their analysts and disseminate simulation best practices to enable non-specialists to carry out simulations successfully. And companies need to find a way to manage the ever increasing avalanche of Terabytes of Simulation Data generated by more and more complex simulations.

NAFEMS SDM Symposium

The NAFEMS Simulation Data Management Working Group will present this symposium with the aim of helping participants to better understand the benefits gained from implementing a Simulation Data Management system such as increased efficiency, reduced development costs, and improved time-to-market.

The primary focus of the symposium will be on companies sharing their experiences, lessons learned, and benefits gained from breakthrough improvements in simulation throughput, analyst productivity, product performance, and information traceability.

Technology Leaders Share Experiences

Visionary companies have embraced the new technology of Simulation Process and Data Management up to a decade ago. They have achieved breakthrough improvements in simulation throughput, analyst productivity, product performance and information traceability. Such companies will share their experiences, lessons learnt and benefits obtained at this landmark synposium.

Why should I attend?

This momentous symposium addresses the breakthrough technology of SDM and will help participants better understand the benefits gained from implementing a Simulation Data Management system and how to save time, reduce development costs, and improve time-to-market.

This event is open to members and non-members. NAFEMS members with sufficient seminar credits may be able to attend this event for free.

Register Today at www.nafems.org/sdm12

This event will be run in conjunction with 'CIMdata’s Simulation & Analysis Council Workshop' on Tuesday May 1st to provide two unique one-day events that will explore, in-depth, the latest thinking and practice relating to the critical issues facing members of the simulation and analysis community.

Attend both events to receive a 10% discount on the NAFEMS SDM Symposium.

EASIT²

Engineering Analysis Simulation Innovation Transfer ²

update

NAFEMS is a key partner in the EASIT² project, which now has 6 months to completion. From October 2012 NAFEMS will assume exclusive rights for the maintenance and development of the project deliverables, for the benefit of members and the wider analysis and simulation community.

As shown in Figure 1, the project will produce several important deliverables forming a sound educational platform for future developments.

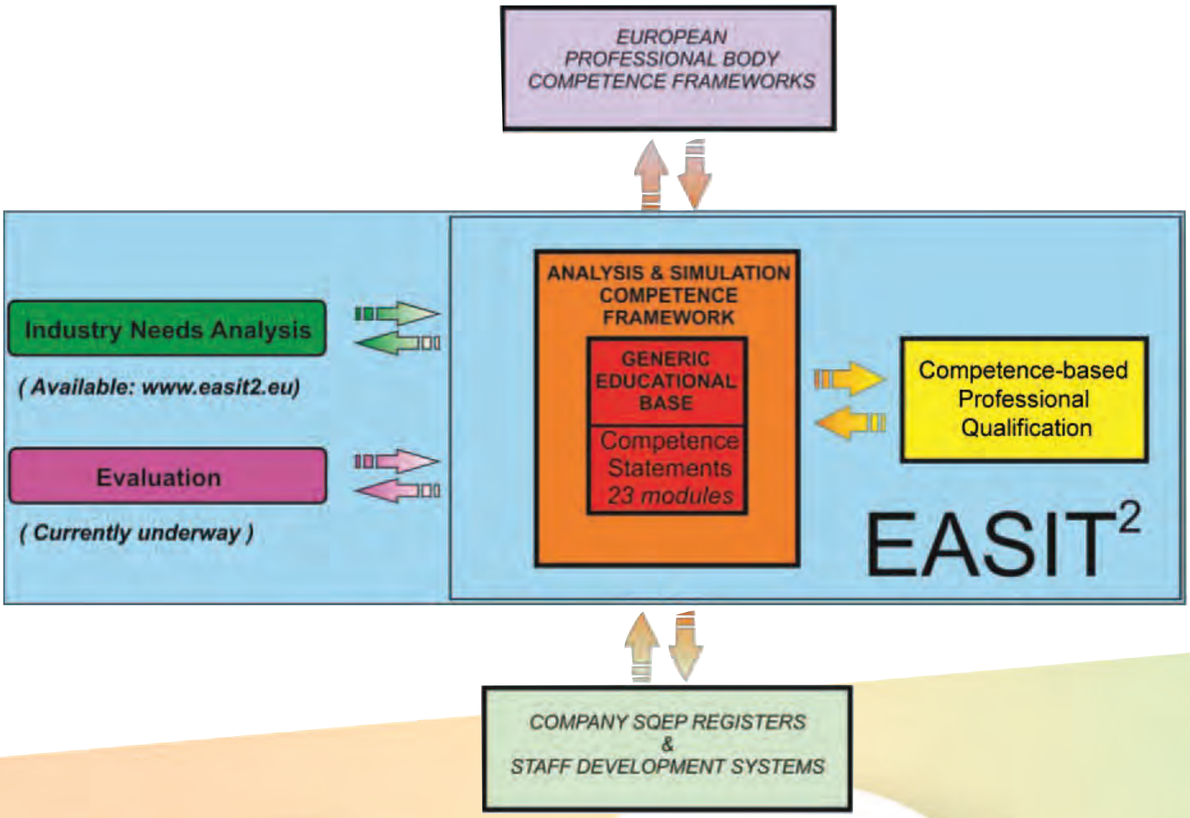


Figure 1: The EASIT Project Deliverables

The key project deliverable is a web-based ***Competence Framework*** that will allow individuals to direct their personal development. In addition, companies or managers will be able to document the analysis and simulation-related competences and experience of groups of staff. It is anticipated that such a framework will prove useful to organisations required to demonstrate the availability of suitably qualified and experienced personnel (SQEP) to clients and regulatory authorities. The reporting tools within the framework will provide the necessary details.

At the heart of the Competence Framework will be a freely available ***Educational Base*** consisting of non-industry-specific statements of competence covering the following areas:

Fatigue (64);
Electromagnetics (48);
Optimization (80);
Simulation Management (184);
Finite Element Analysis (89);
Dynamics and Vibration (92);
Multi-physics Analysis (24);
Plasticity (63);
Multi-Scale Analysis (45);
Buckling and Instability (43);
Multi-body Dynamics (58);
Probabilistic Analysis (44).
Mechanics, Elasticity & Strength of Materials (54);
Materials for Analysis and Simulation (38);
Flaw Assessment and Fracture Mechanics (51);
Nonlinear Geometric Effects and Contact (29);
Beams, Membranes, Plates and Shells (51);
Composite Material and Structures (52);
Computational Fluid Dynamics (39);
Fundamentals of Flow, Heat & Mass Transfer (122);
Noise, Acoustics and Vibro-acoustics (59);
Thermo-Mechanical Behaviour (44);
Creep and Time-Dependency (38);

The number of statements in each module is shown in brackets for each topic and each one has a link to identified sections within one or more references that can be used by individuals to develop understanding. The Educational Base is "open" and modules, statements of competence and references can be added, modified or deleted. For example, new industry or company specific statements of competence can be added or the entire text can be translated.

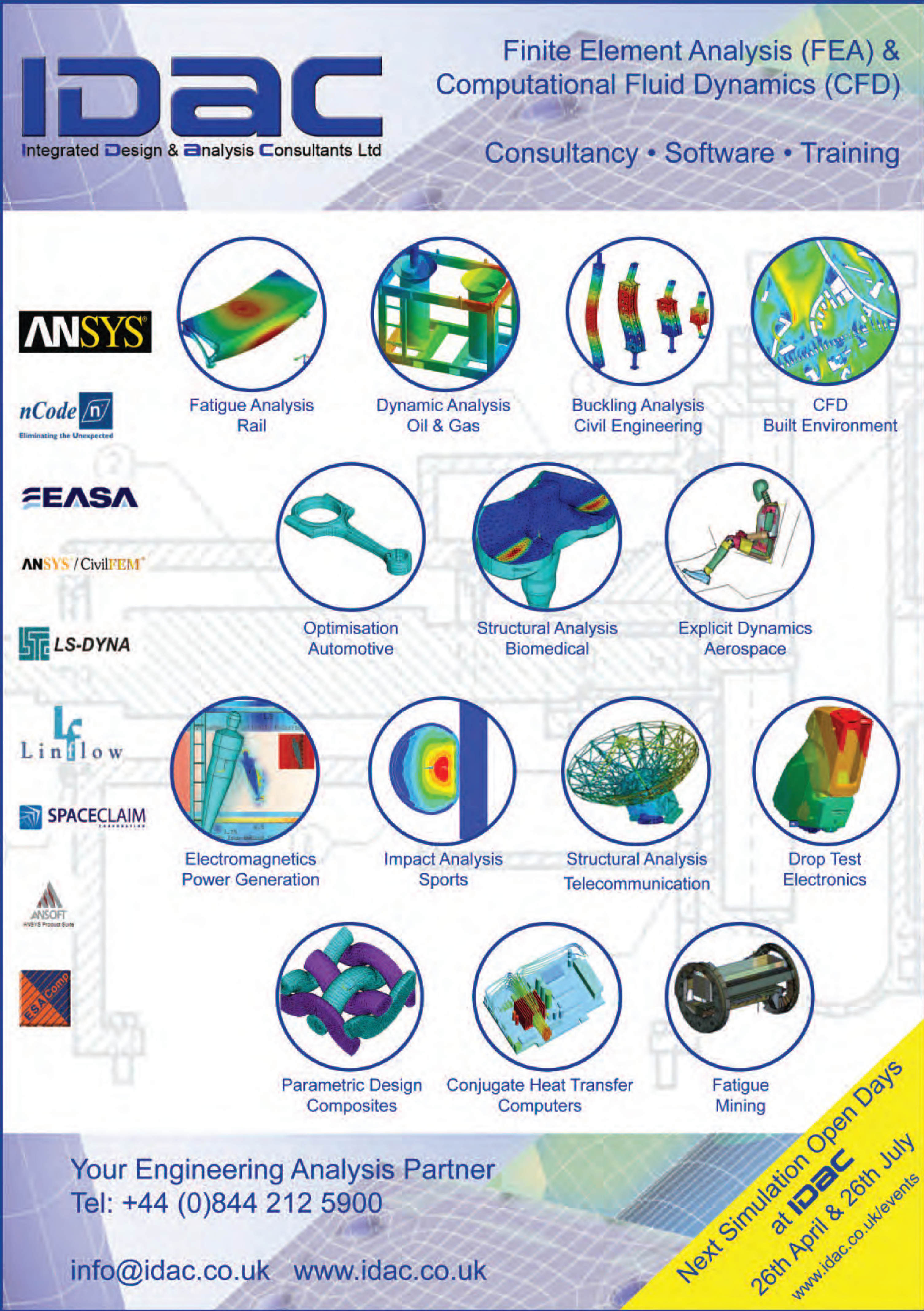
In addition to proving valuable for informal personal development, these competence statements will provide useful information for the development of short courses, web-based learning, text books and even formal masters level modules, aimed at delivering these competencies.

In each of the above technical areas there will be a small number of key competences that will be used in a new accreditation scheme to be launched by NAFEMS. In essence, the intention is that the scheme will be a modern and competence-based replacement for the existing points based Registered Analyst Scheme.

On completion of EASIT², the above developments will be taken forward under the auspices of the various NAFEMS Working Groups, in collaboration with industry partners, sector bodies and regulators as appropriate.

for more information visit

www.easit2.eu


IDAC
Integrated Design & Analysis Consultants Ltd
Finite Element Analysis (FEA) &
Computational Fluid Dynamics (CFD)
Consultancy • Software • Training
ANSYS
nCode
Eliminating the Unexpected
FEASA
ANSYS / CivilFEM
LS-DYNA
Linflow
SPACECLAIM
ANSOFT
ANSYS Product Suite
ESAComp
Fatigue Analysis
Rail
Dynamic Analysis
Oil & Gas
Buckling Analysis
Civil Engineering
CFD
Built Environment
Optimisation
Automotive
Structural Analysis
Biomedical
Explicit Dynamics
Aerospace
Electromagnetics
Power Generation
Impact Analysis
Sports
Structural Analysis
Telecommunication
Drop Test
Electronics
Parametric Design
Composites
Conjugate Heat Transfer
Computers
Fatigue
Mining
Your Engineering Analysis Partner
Tel: +44 (0)844 212 5900
info@idac.co.uk www.idac.co.uk
Next Simulation Open Days
at IDAC
26th April & 26th July
www.idac.co.uk/events

NAFEMS DEUTSCHSPRACHIGE KONFERENZ '12

8. – 9. MAI | BAMBERG, DEUTSCHLAND

BERECHNUNG UND SIMULATION – ANWENDUNGEN, ENTWICKLUNGEN, TRENDS

Die Welt steht derzeit vor wahrhaft globalen Herausforderungen. Die ökologischen Wandlungen mit nicht abzusehenden Folgen, die Suche nach neuen Energiequellen und ein schier unbegrenztes Wachstum der Erdbevölkerung erfordern auf allen Gebieten die Bereitschaft, neue Wege zu gehen.

Diese gravierenden Veränderungen führen auch zu neuen Herausforderungen im Ingenieurbereich und verlangen nach Entwicklung und dem Einsatz neuer Technologien. Eine große Chance bieten Simulationsverfahren, die sich aufgrund der rasch fortschreitenden Leistungsfähigkeit von Computern und dazugehörender Anwendungssoftware an vielen Stellen etabliert und den Nutzeffekt überzeugend bewiesen haben. Der Fortschritt dieser Verfahren erlaubt es, immer genauere Ergebnisse zu liefern und immer stärker in Design-Entscheidungen einzugreifen.

Die Finite-Element-Methode ermöglicht es, beispielsweise die Lebensdauer dynamisch beanspruchter Bauteile zu prognostizieren, aber auch das Crashverhalten komplexer Fahrzeugstrukturen. In Verbindung mit immer schnelleren Rechnern können verlässliche Aussagen zu Strömungsphänomenen, z. B. für die Auslegung von Windkraftanlagen, gewonnen werden. Schwingungseigenschaften und akustische Effekte spielen beim Betrieb von Maschinen eine wesentliche Rolle; mittels des Einsatzes von Finite-Element-Verfahren und Mehrkörpersystemen können diese immer besser analysiert und beherrscht werden. Stark in den Vordergrund gerückt sind infolge aktueller Anforderungen Simulationen von elektromagnetischen Effekten. Die angeführten Methoden können gekoppelt werden, um die Wechselwirkung zu simulieren, wodurch eine weiter verbesserte Aussagekraft erreicht wird.

Auch für die Fertigungsvorbereitung spielt die Computersimulation eine bedeutende Rolle, z. B. für Ur- , Umform- und Fügeprozesse. Die Medizintechnik ist ein weiteres Gebiet, in dem diese numerischen Verfahren in immer stärkerem Maße einsetzt werden.

Im industriellen Umfeld muss die Simulationstechnologie in die Arbeitsprozesse integriert werden. Die Arbeitsabläufe müssen so gestaltet sein, dass die für die Berechnungen benötigten Informationen (Geometrie, Belastungen, Material usw.) aktuell und zeitgerecht verfügbar sind. Eine wesentliche Voraussetzung dafür sind sorgfältig festgelegte Prozesse, die die Schnittstellen zu CAD, zu den Analyse- bzw. Auswerteverfahren und den Testergebnissen berücksichtigen. Eine besondere Bedeutung kommt dabei dem Datenmanagement zu.

Mit der Konferenz bietet NAFEMS eine Plattform, auf der neuen Techniken und Tools präsentiert werden sollen und den Teilnehmern die Möglichkeit geboten wird, auf breiter Basis erfolgreiche Anwendungen und Trends mit Spezialisten aus Forschung und im besonderen Maße aus der Industrie zu diskutieren.

NAFEMS

www.nafems.org/dach2012

Agenda

Dienstag, 8. Mai 2012

9.00 - 19.15 Uhr

PLENARVORTRÄGE – KEYNOTES

Begrüßung und NAFEMS Einführung
W. Dirschmid (Vorsitzender des NAFEMS Lenkungsausschusses für Deutschland, Österreich, Schweiz)

Vorstellung des Platin Sponsors: Siemens PLM Software
E. Niederauer (Siemens Industry Software GmbH)

Keynote-Vortrag:
Ist die Berechnung vorbereitet auf die aktuellen Herausforderungen der Automobilindustrie?
R. Sundermeier (Volkswagen AG)

Keynote-Vortrag: Mehrskalige Materialmodellierung
P. Wriggers (Univ. Hannover)

Raum 1

CFD 1

CFD in der Entwicklung modellgestützter Regelungskonzepte
M. Schumacher, M. Hufschmidt, M. Weng (aixprocess PartG); U. Küssel, D. Abel (RTWH Aachen)

Ein Verbrennungsmodell für entwicklungsbegleitende Strömungssimulationen
G. Dumnov, V. Streltsov, I. Weinhold (Mentor Graphics GmbH)

Einsatz von FloEFD.V5 in der Motorenentwicklung bei Porsche Engineering
V. Bevilacqua, M. Benz (Porsche Engineering Services GmbH)

CFD 2

Anwendungsbezogene Berechnungswerkzeuge versus „Multi-Purpose Codes": Neue Möglichkeiten im CFD Einsatz durch OpenSource basierte Modellentwicklung
U. Heck (Dhcae Tools UG)

Implementierung eines 3D Vortex-Particle Berechnungsmoduls
D. Langmayr, B. Lechner, M. Lieschnegg, V. Wippel (Kompetenzzentrum - Das Virtuelle Fahrzeug Forschungsges. mbH); A. Domaingo (Bentley Systems Austria GmbH)

Gasfluss- und Plasmasimulation für Niederdruck - Beschichtungsreaktoren
A. Pflug, M. Siemers, T. Melzig, B. Szyszka (Fraunhofer IST)

Simulation und Validierung einer Fahrzeugdurchströmung mit OpenFOAM
O. Herz, C. Mielke (Merkle & Partner GmbH)

CFD 3

Sensitvitätsanalyse verschiedener Anströmungsgeometrien für ein Verdampfersystem eines Clausius-Rankine-Zyklus zur Abwärmenutzung
M. Kley (Hochschule Aalen)

Simulationen von Mehrphasenströmungen für hydraulische Maschinen
F. Muggli (Sulzer Markets & Technology AG); S. Krüger (Sulzer Pumps AG)

Steigerung der Leistungsfähigkeit von hydrodynamischen Bremsen durch Geometrieoptimierung
C. Bartkowiak (Hochschule Aalen)

Inverse Modellparameterbestimmung für die Simulation von Schüttgutströmungen
M. Hufschmidt, M. Weng (aixprocess PartG)

ELEKTROMAGNETISCHE FELDER

Anwendung von Finite-Element Verfahren zur Berechnung gekoppelter magneto-mechanischer Probleme
H. Landes, A. Hauck (Simetris GmbH)

Simulationsgestützte Auslegung von Lineardirektantrieben mit Maxwell, Simplorer und ANSYS
M. Ulmer, W. Schinköthe (Univ. Stuttgart)

Partikelbasierte Simulation magnetorheologischer Flüssigkeiten für die Anwendungen in Kupplungen
H. Lagger, C. Bierwisch, J. Peguiron, M. Moseler (Fraunhofer IWM)

Raum 2

BETRIEBSFESTIGKEIT 1

Regelwerkskonforme Bestimmung von Erschöpfungsgraden auf Basis allgemein elastisch-plastischer Finite Elemente Analyse
J. Rudolph, A. Götz, R. Hilpert (Areva NP GmbH)

Sensitivitätsanalyse zyklisch belasteter Strukturen mit ANSYS und nCode DesignLife
F. Mailänder (Cadfem GmbH)

Spektrale Schädigungsanalyse für multiaxial stochastisch belastete Komponenten
W. Hinterberger, O. Ertl, C. Gaier (Engineering Center Steyr); H. Fleischer (BMW AG)

OPTIMIERUNG 1

Das Screening – Ein Prozess zur strategischen Einbindung von Optimierungstechnologien in der Produktentwicklung
A. Wischnewski (Altair Engineering GmbH)

Optimierung und stochastische Analyse auf vielen Anwendungsgebieten
M. Kellermeyer (Cadfem GmbH)

Bauteilauslegung durch einen automatisierten Optimierungsprozess
*T. Swinden, I. Wendling, S. Hildenbrand (TWT GmbH); A. Strobel (Daimler Trucks North America LLC); F. R. Klimetzek (Daimler AG) **

Schwingungsgerechter Entwurf von Sicken
R. Helfrich, J. Müller (Intes GmbH)

OPTIMIERUNG 2

Materialparameter-Optimierung für die Crashberechnung in frühen Entwicklungsphasen
G. Gruber, D. Klein, S. Wartzack (Univ. Erlangen-Nürnberg)

Simulation und Ansätze zur Parameteridentifikation eines 1D elektrochemischen Modells von Lithium-Ionen-Zellen
M. K. Scharrer, F. Pichler, B. Suhr (Kompetenzzentrum - Das virtuelle Fahrzeug Forschungsges. mbH)

Methodikentwicklung für die multikriterielle Optimierung eines Verbrennungsmotors unter Verwendung von Meta-Modellen und genetischen Algorithmen
R. Wohlgethan, G. Buccilli (EnginSoft GmbH); J. Silvestri, J. Zenker (Gamma Technologies Inc.)

CAE-basierte Robust Design Optimierung in der virtuellen Produktentwicklung
J. Will (Dynardo GmbH)

BETRIEBSFESTIGKEIT 2

Hochdruckventiltechnik für automobile Wasserstoff- applikationen – Anforderungen und Übertragbarkeit von Konzepten zur Betriebsfestigkeitsrechnung
S. Sellen, S. Maas (Univ. Luxemburg)

Ermüdungsanalyse von geklebten Metallverbindungen
S. Vervoort (Hottinger Baldwin Messtechnik GmbH)

Berücksichtigung von großen Nichtlinearitäten in einer Betriebsfestigkeitsberechnung in Form von Verschiebungen und Kontakt am Beispiel eines Kugelgelenks
T. Kroschwald (Tecosim GmbH)

Raum 3

STRUKTUR 1

Strukturmechanische Berechnungen am Sonnenteleskop ATST (Advanced Technology Solar Telescope)
W. Feickert (Ingenieurbüro Huß & Feickert GbR mbH)

Ein effizienter Ansatz zur Modellierung und Simulation von Spiralseilen
R. Baumann (Hochschule Luzern)

Homogenisierung bei zylindrisch-periodischen Bauteilen
D. Kreuter, M. Beitelschmidt (TU Dresden)

COMPOSITES 1

Composite Tool Chain „As-Built"
T. Wille, R. Hein (DLR Deutsches Zentrum für Luft- und Raumfahrt e.V.)

Kopplung von Formfüllanalysen und Strukturanalyse zur Festigkeitsberechnung von kurzfaserverstärkten Spritzgussbauteilen
R. Klawatsch (dTech Steyr – Dynamics & Technology Services GmbH)

Management von Composite Werkstoffdaten zur Unterstützung des CAE Prozesses
T. Weninger, W. Marsden (Granta Design Ltd.)

FACC Analysis ToolSuite: Effizientes FEM Post-Processing von Luftfahrtstrukturen aus Faserverbundwerkstoffen
M. Fleischmann, J. Noisternig (FACC AG); M. Luxner, C. Schücker (Luxner Engineering ZT GmbH)

COMPOSITES 2

Vorhersage der Festigkeit von kurzfaserverstärkten Kunststoffen mittels Prozess-Struktur-Kopplung
J.-M. Kaiser, M. Stommel (Univ. des Saarlandes); S. Pazour, W. Korte (Part Engineering GmbH)

Schnelles Lösungsverfahren der Lippmann-Schwinger-Gleichungen für die Multiskalensimulation von Composites
H. Andrä, M. Kabel, J. Spahn, S. Staub (Fraunhofer ITWM)

Zur Verallgemeinerung gängiger mikromechanischer Modelle: Der Quermodul einer UD-Schicht
A. Bleier (Karl Mayer Textilmaschinenfabrik GmbH); H. Schürmann (TU Darmstadt)

Modellierung des Einflusses von Unregelmäßigkeiten in der Mikrostruktur auf das Versagen von UD-Composites
S. Kilchert, M. May, S. Hiermaier (Fraunhofer EMI)

COMPOSITES 3

Micromechanical Modeling of Failure in Plain and Open Hole Test Coupons under Tensile and Compressive Loading
S. van der Veen (Airbus); J. Seyfarth, R. Assaker (e-Xstream engineering)

Efficient Nonlinear Multi-Scale Modeling of Composite Structures
J. Seyfarth, R. Assaker (e-Xstream engineering)

Diskussion
Leitung: K. Rohwer (DLR Deutsches Zentrum für Luft- und Raumfahrt e.V.)

Raum 4

CO-SIMULATION

Robuste (Co-)Simulation gekoppelter Probleme mit einem Fokus auf Fluid-Struktur-Wechselwirkung
C. Gravemeier, W. Wall (AdCo Engineering GmbH)

Zielsichere Auslegung und Gestaltung von komplexen mechatronischen Systemen mittels Modellbibliothek und Co-Simulation
J. Zehetner (Kompetenzzentrum - Das Virtuelle Fahrzeug Forschungsges. mbH)

Co-Simulation elektromechanischer Systeme am Beispiel eines wirbelstrominduzierten Linearaktors
C. Simonidis, G. Stengel, R. Schmoll, B. Schweizer (ABB AG)

Optimierung eines 3D elektro-thermischen Batteriemodells
M. Koplenig, M. K. Scharrer, B. Suhr, T. Heubrandtner (Kompetenzzentrum - Das virtuelle Fahrzeug Forschungsges. mbH)

CAD / METHODEN

Neue Ansätze zur effizienten Erstellung von CAD-Geometrie und Simulationsmodellen für die Simulation und Optimierung in der Konzeptphase
C. Fritz (Contact Software GmbH)

Kann das nicht automatisch gehen? Theorie und Entwicklung einer Skriptsprache für Z 88 Aurora
M. Zimmermann, F. Rieg (Univ. Bayreuth)

Eine Implementierung einer Algebra zur Handhabung von fraktionalen Differentialgleichungen in Matlab/Simulink
R. Herlein (Fraunhofer LBF)

UMFORMUNG

Zerspannungssimulation – vom „bunten Bildchen" in der Forschung zum Handwerkszeug in der Industrie
J. Leopold, S. Usui, T. Marusich, K. Marusich, H. Elangovan (Third Wave Systems)

Prozesskettensimulation - Berücksichtigung der Umformhistorie bei strukturmechanischen Analysen
T. Menke (Cadfem GmbH)

NAFEMS DEUTSCHSPRACHIGE KONFERENZ '12
8. – 9. MAI | BAMBERG, DEUTSCHLAND
BERECHNUNG UND SIMULATION – ANWENDUNGEN, ENTWICKLUNGEN, TRENDS

Agenda

Mittwoch, 9. Mai 2012

8.15 - 16.15 Uhr

NAFEMS DEUTSCHSPRACHIGE KONFERENZ '12
8. – 9. MAI | BAMBERG, DEUTSCHLAND
BERECHNUNG UND SIMULATION – ANWENDUNGEN, ENTWICKLUNGEN, TRENDS

Raum 1

CFD 4

Ein Beitrag zu CFD-Simulationen von Fertigungstoleranzen
P. Farber, K. Farber, N. Kroppen (Hochschule Niederrhein)

Kavitationssimulation für industrielle Anwendungen
G. Dumnov, A. Muslaev, V. Streltsov, B. Marovic (Mentor Graphics GmbH)

Vergleichende visuelle Analyse von Simulationsdaten
H. Doleisch, W. Freiler (SimVis GmbH)

Visuelle Analysemethoden für das Durchströmungsverhalten einer zentrifugalen Pumpe
M. Otto, A. Kuhn, W. Engelke, H. Theisel (Univ. Magdeburg)

CFD 5

CFD Topologie Optimierung einer automobilen Abgasreinigungsanlage
M. Stephan, M. Böhm (FE-Design GmbH); V. Schaika (Albonair GmbH)

Aeroakustische Berechnung eines generischen Seitenspiegels unter Verwendung eines hybriden CFD-CAA Ansatzes
A. Reppenhagen (Kompetenzzentrum - Das Virtuelle Fahrzeug Forschungsges. mbH); A. Hüppe (Univ. Klagenfurt); M. Kaltenbacher (TU Wien)

Adjoint Methods in Fluid Mechanical Applications – Examples for Optimization and Data-Assimilation
J. Sesterhenn (TU Berlin)

Diskussion
Leitung: G. Müller (Consultant, ehemals Siemens AG)

AKUSTIK

Computational Experience with Substructuring in Vibroacoustic Simulations
F. Ihlenburg (HAW Hamburg)

Neue Simulationsansätze zur Vorhersage des akustischen Verhaltens von Ansaug- und Abgassystemen
Y. Elnemr, R. Veloso, J. Girstmair, F. Reich, E. Nijman (Kompetenzzentrum - Das Virtuelle Fahrzeug Forschungsges. mbH)

NVH Performance Optimization of Full Vehicles in Automotive
H. Gruber, J. Guan (Altair Engineering GmbH)

Berechnung von Schallabstrahlung mit akustischen Finite Elemente: Leistungsfähige Simulation mit dem PML/AML Verfahren
P. Segaert, K. Vansant (LMS International)

Raum 2

OPTIMIERUNG 3

Struktureller Leichtbau durch innovative Formoptimierung
M. Firl (FEMopt Studios GmbH)

Erweiterte Topologieoptimierung zur Steigerung der Energieeffizienz bei dynamisch bewegten Systemen
C. Sander (Karlsruher Institut für Technologie)

Strukturelle Optimierung der Aufhängung von heckinstallierten und parametrisierten Turbofantriebwerksmodellen
A. Zuchlinski (TU Cottbus)

Strukturoptimierung für gewichtsminimale Systemauslegung
F. Heinrich (FE-Design GmbH)

METHODEN

System-Simulation based System Engineering Development Methodology
M. Mahler (Siemens Industry Software GmbH)

Isogeometric Analysis: Aktuelle Entwicklungen und Trends in LS-Dyna
S. Hartmann (DYNAmore GmbH); D. J. Benson (University of California)

Mathematische Analyse einer Verzweigung in Crash-Simulation
V. Iza Teran (Fraunhofer SCAI)

Solving Bottlenecks in Powertrain FE Analyses
I. Makropoulou, A. Perifanis, A. Fassas (BETA CAE Systems S.A.)

OPTIMIERUNG 4

Geometrieoptimierung eines Radialkompressorlaufrades im Hinblick auf CFD- und FEM-relevante Zielgrößen mit Hilfe von automatisierten Optimierungsmethoden
A. Rybacki, M. Geller, C. Schemmann (FH Dortmund)

Optimierung von Krafteinleitungselementen in Kunststoff- Metall - Hybridverbunden
N. Majic, A. Albers, M. Spadinger (Karlsruher Institut für Technologie); H. Paul (Fraunhofer IWM)

Stochastische Simulation – Ein Abgleich mit Versuchs- ergebnissen am Beispiel der Deformation eines Vierkantrohrs
C. Eichmüller (Volkswagen AG); M. Meywerk (Hochschule der Bundeswehr Hamburg)

Effiziente Sensitivitätsanalyse in der industriellen Produktentwicklung
T. Most, J. Will (Dynardo GmbH)

Raum 3

STRUKTUR 2

Bewertung von Kerbgrundbelastungen mit Ansys und LS-Dyna
H. Beck (Ingenieurbüro Huß & Feickert GbR mbH)

Transient dynamische Simulation der Kollision eines Schneepfluges mit einem Hindernis auf der Straße
M. Züger (pinPlus AG)

Fußgängerinduzierte Schwingungen auf Brücken und deren Bedämpfung am Beispiel des Salzachsteges
N. Romen (HFR Ingenieure GmbH)

Automatisierte Simulation von Elastomerdichtungen
I. Nitsopoulos, G. Sukarie (ISKO Engineers AG)

MATERIAL

Entwicklung eines vereinfachten Ersatzmodells für strukturierte Bleche mittels Homogenisierungsmethode
T. de Silva, A. Kühhorn, M. Golze (TU Cottbus)

Praxisgerechte Messung von Materialkarten am Beispiel eines unverstärkten Kunststoffs und eines Glasfaser-Gewebes
R. Paßmann (Beratender Ingenieur); J. Förster, E. Preis (EDAG GmbH & Co.KGaA)

Entwicklung einer Datenbank mit fortgeschrittenen Werkstoffeigenschaften
J. Heinemann, V. Pozeit (Key to Metals AG)

Gewinnung von Fließkurven aus 3-Punkt-Biegeversuchen mittels analytischen und numerischen Ansätzen
C. Wehmann, F. Rieg (Univ. Bayreuth); E. Böhm (Hochschule Ravensburg-Weingarten)

STRUKTUR 3

CAE-Analyse der Gleitlager moderner Hochleistungsröntgenröhren
M. Hainke, W. Schäff, W. Strob (Siemens AG Healthcare Sector)

Beschleunigung der Kolbenberechnung durch hochgradige Prozessautomatisierung
R. Meske (Federal-Mogul Nürnberg GmbH)

Das Verhalten und die Modellierung von Bauteilen aus Beton bei hohen Belastungsgeschwindigkeiten
J. Ozbolt (Univ. Stuttgart);
A. Sharma (Bhabha Atomic Research Centre)

Kontrollierte Faltenbildung an Funktionsoberflächen technischer Systeme und ihre numerische Analyse
M. Achenbach (Parker Hannifin Manufacturing Germany GmbH & Co. KG)

Raum 4

SIMULATIONSDATENMANAGEMENT - SDM

Aktuelle Standards und Empfehlungen für die CAE Daten- und Prozessintegration
J. Boy (ProStep AG)

Eine virtuelle Entwicklungsplattform zur gekoppelten Simulation am Beispiel Gesamtfahrzeug
S. Bindick, C. Lange, C. Lund (Volkswagen AG)

Herausforderung XIL-Datenmanagement
S.Thiel, T. Gruber (Audi AG)

Material Lifecycle Management - Drivers and Requirements
R. S. Sadeghi, U. Heinzel (HD Solutions GmbH); E. Niederauer (Siemens Industry Software GmbH)

MEHRKÖRPERSIMULATION - MKS

Simulation und Optimierung von Großdiesel und -gasmotoren innerhalb eines Simulations Workflows
A. Rieß, S. Sprengler, A. Linke (MAN Diesel & Turbo SE); R. Hoppe (Univ. Augsburg/Univ. Houston)

Virtuelles Testen zur Risikominimierung bei hochdynamischen Tests von Hochauftriebssystemen
T. Ulmer (Airbus Operations GmbH); A. Frenzel (EADS Deutschland GmbH)

Genaue Modellierung von Wälzlagern in der Mehrkörperdynamik für effizientes virtuelles Testen
J. Beuse, T. El-Dsoki, C. Rachor, J. Zeischka (MSC.Software GmbH)

Das Interface der neuen Simpack Version 9 zu Finite-Element Programmen
S. Dietz (Simpack AG)

PLENARVORTRÄGE

Predictive Lifecycle Assessment
H. Sippel (CAEvolution GmbH); M. Küssner (Consultant)

Green CAE – Simulationstools für die Mobilität von Morgen
E. Schelkle (Automotive Simulation Center – asc(s e. V.)

Abschlussworte
M. Zehn (TU Berlin, Vice Chairman NAFEMS Council und Mitglied des NAFEMS Lenkungsausschusses für Deutschland, Österreich, Schweiz)

www.nafems.org/dach2012

NAFEMS NORDIC CONFERENCE '12

22 – 23 MAY | GOTHENBURG, SWEDEN

ENGINEERING SIMULATION: BEST PRACTICES, NEW DEVELOPMENTS, FUTURE TRENDS

The NAFEMS NORDIC Conference 2012 will be held at the Radisson Blu Hotel in Gothenburg, Sweden on 22 - 23 May 2012. Entitled "Engineering Simulation: Best Practices, New Developments, Future Trends", the conference will give delegates an unrivalled independent insight into best practices and state-of-the-art which consequently show upcoming trends, tendencies and necessary future needs in FEA, CFD, MBS and associated technologies.

The two-day conference aims to increase awareness and provide a discussion forum for topics that are important and relevant to engineering industrialists and academics.

If you are an analyst, engineer, team leader or manager that has a responsibility for ensuring that a fit-for-purpose engineering solution is obtained from the use of modern simulation software, then you should attend.

The event is open to both members and non-members of NAFEMS, with members able to attend the event for free, as part of their membership benefits package.

We are looking forward to welcoming you in Gothenburg.

www.nafems.org/nordic2012

Sponsors

Gold Sponsor

Altair

Silver Sponsors

CEI

SIMULIA

MSC Software
Simulating Reality, Delivering Certainty

Jotne

NAFEMS www.nafems.org/nordic2012

Tuesday 22 May

Welcome and NAFEMS Introduction T. Morris (NAFEMS)

Keynote presentation:
Structural Optimization in Early Development Phase at Volvo Cars H. Hasselblad (Volvo Car Corporation, SWE)

Keynote presentation:
Multiphysics Solutions for Industrial Applications M. Moatamedi (Narvik University College, NOR)

Parallel 1

SESSION 2 – DATA, REPORT, SYSTEMS

Data and Process Management for NVH Analysis Pre-processing in Volvo
B. Ratama (Volvo Car Corporation, SWE); I. Makropoulou (BETA CAE Systems, GRE)

The Design, Development, and Testing of an Open Standards-Based Simulation Data Management and Archival System
K. Bengtsson, J. Haenisch, O. Liestol (Jotne EPM Technology, NOR); K. Hunten, C. Johnson (Lockheed Martin Aeronautics, USA)

Integrated Modeling and Analysis to Support Model-Based Systems Engineering (MBSE)
L. Chec, H. Kim, D. Freid, P. Menegay, G. Sorekun (Phoenix Integration, FRA)

Building Simulation Reports Efficiently
T. Alstad, H. Hansen (Ceetron, NOR)

SESSION 4 – ROTOR/ASSEMBLIES

Trends in Rotordynamics: Towards 3D-Modelling on Rotating Machinery
M. Karlsson (AF Sound & Vibration, SWE)

Modeling, Simulation and Experimental Validation of Tilting-Pad Combi-Bearing I Vertical Rotating Machines
J.-C. Luneno (AF Sound & Vibration, SWE)

On Multi-Stage Cyclic Symmetry Applied to Rotor Dynamics
N. Kill, P. Morelle (LMS Samtech, BEL)

Simulation of Part Assemblies under Various Loading Conditions
M. Klein (Intes, GER)

Parallel 2

SESSION 3 – COMPOSITES

Micromechanical Modeling of Failure in Plain and Open Hole Test Coupons Under Tensile and Compressive Loading
S. van der Veen (Airbus France, FRA); J. Seyfarth, R. Assaker (e-Xstream engineering, BEL)

Using Programming and Simulation to Develop Optimized Processes for Automated Fiber Placement (AFP) CNC Machines
T. Shrewsbury (CGTech, GBR)

Efficient Nonlinear Multi-Scale Modeling of Composite Structures
J. Seyfarth, R. Assaker (e-Xstream engineering, BEL)

Discussion

SESSION 5 – PASSENGER SAFETY

Interior Head Impact Analyses at Volvo Cars Safety Centre
A. Högberg (Volvo Car Corporation, SWE)

Development of a Tool Chain to Support Automotive Integrated Safety Design
R. Lancashire (TASS, NED)

An improved Initial Metric Method (IMM) for Airbag Modeling
E. Septanika (TASS, NED)

Coupling FE Structural Codes to Analyze and Optimize Occupant Safety Designs
H. Tazammourti (TASS, NED)

Wednesday 23 May

SESSION 6 – OPTIMIZATION

Optimization Driven Innovation
M. Hallstedt (CAE Value, SWE)

CFD Optimation via Sensitivity-Based Shape Morphing
H. Haliskos (BETA CAE Systems, GRE)

An Accurate, Extensive, and Rapid Method for Aerodynamics Optimization: The 50:50:50 Method
T. Virdung, A. D. Khondge, S. Sovani (Ansys, SWE)

Intelligent Simulation Technology Delivering Weight Efficient Vehicles
P.-O. Jansell (Altair Engineering, SWE)

SESSION 8 – CFD/MULTIPHYSICS

Next Generation, Particle-Based CFD Software
M. Andreasson (MSC Software, SWE)

Design of Environmental Friendly and Energy Efficient Buildings – CFD Analysis to Calculate the Combined Effects of Natural and Forced Convection on the Combined Global Heat Transfer Rate in Building Interiors, Envelops and the Attics
V. Shankar (AF Sound & Vibration, SWE)

Democratizing CAE with Interactive Multiphysics Simulation and Simulators
K. Bodin (Algoryx Simulation, SWE)

New Hydrodynamic Effect and its Possible Application
V. Burtseva (Bureau of Technics (BTC), RUS)

SESSION 7 – MATERIALS

Development of a Database of Advanced Material Properties
V. Pozeit (Key to Metals, SUI)

Finite Element Analyses of the Strain Energy Release Rate in an Iron-Epoxy ENF-Specimen
K. Dufva, T. Karttunen (Mikkeli University of Applied Science, FIN); A. Nemov, A. Novokshenov, A. Borovkov (St. Petersburg State Polytechnical University, RUS)

Numerical Modeling of the Creep Behavior of Hydrogenated Zircaloy-4
B. Veluri, V. Mallipudi, H. Jensen (Aarhus School of Engineering, DEN)

Discussion

SESSION 9 – METHODS

Experimental and Numerical Study of Buckling of Vacuum Chambers for Fast-Cycling Synchrotrons
L. Bräuner (Aarhus School of Engineering, DEN)

Constitutive Modeling and Finite Element Simulation of Multi Pass Girth Welds
P. Lindström (DNV, NOR, and Chalmers University of Technology, SWE); B. Josefson (Chalmers University of Technology, SWE); T. Borrvall, M. Schill (DYNAmore, SWE)

A Mathematical Model for Cell Deformation Driven by Chemotaxis
F. Vermolen (Delft University of Technology, NED); A. Gefen (Tel Aviv University, ISR)

Discussion

PLENERAY SESSION

Advances in Computer Aided Engineering M. Feyereisen (IBM, USA); E. Weibust (IBM, SWE)

Predictive Lifecycle Assessment H. Sippel (CAEvolution, GER)

Iterative Simulation Driven Design Implemented at Scania M. Bergman (Scania CV, SWE)

FAREWELL & END

NAFEMS UK CONFERENCE '12

30 – 31 MAY | GRANTHAM, UK

ENGINEERING SIMULATION: REALISING THE POTENTIAL

Simulation has the potential to transform a company's engineering processes – providing unprecedented insight into product performance and inspiring innovation by allowing novel concepts to be explored and evaluated.

NAFEMS, the independent association for the engineering analysis community, is holding its UK conference during 30-31 May 2012 with the primary aim of helping attendees realise the full potential of their engineering simulation and analysis. The 2012 NAFEMS UK Conference will explore the extent to which this potential has now been realised, and what more can be achieved.

The two day conference will focus on existing best practices as well as state-of-the-art FEA, CFD and associated technologies – ensuring delegates receive a fully comprehensive overview of the technology available to them. The conference intends to increase awareness and provide a discussion forum for topics that are important and relevant to engineering industrialists and academics, with an educational theme throughout.

This is the fourth NAFEMS UK conference to date, with each being undeniably bigger and better than its predecessor. Following on from the extremely successful 2010 conference, the 2012 event will certainly be the UK's leading event on simulation technology aimed at the engineering analysis community – bringing together leading industrial practitioners, consultancies, academic researchers and software developers in a neutral forum.

Venue & Location

The 2012 UK Conference will be held at Belton Woods in Lincolnshire. Being in the heart of the UK, the conference is easily accessible from anywhere in within the UK and Europe:

- 10 minutes from the A1
- 3 miles from Grantham station
- Lincoln is 23 miles
- Nottingham is 28 miles
- Close to M1

The conference is extremely easy to access by car, rail or air.

Why Should I Attend?

The conference will be of interest to all analysts, engineers, team leaders and managers who have a responsibility for ensuring that a fit-for-purpose engineering solution is obtained from the use of modern simulation software. Those involved with the manufacturing and design process at any level will benefit from attendance.

The event is open to both members and non-members of NAFEMS.

Attendance is free for NAFEMS members, subject to sufficient remaining seminar credits.

Register TODAY at

www.nafems.org/uk2012

Principal Sponsor

MSC Software — Simulating Reality, Delivering Certainty™

Sponsors

Altair · ANSYS · ITI TranscenData · LMS Engineering Innovation · sharc · Wilde

NAFEMS

www.nafems.org/uk2012

Agenda

30-31 May 2012

KEYNOTE PRESENTATIONS

Pat Symonds Neutrino Dynamics

Robin Wilson Lead Technologist, High Value Manufacturing, Technology Strategy Board

Cashing the Benefits of Realistic Simulation
Roger Keene, SIMULIA Worldwide Operations, Dassault Systèmes, SIMULIA

Business Value from Simulation Data Management – Key Lessons from Early Adopters
Mark Norris, Infosys

Getting Ready for the Explosion
Bert Knops, MSC.Software Limited

TURBULENCE & UNSTEADY FLOW

When Advanced Turbulence Modelling becomes an Industrial Practicality
Althea de Souza, Quesada Solutions Limited

Applications of Unsteady Simulation in Automotive Aerodynamics
Adrian Gaylard, Jaguar Land Rover

Simulation of Combustion-Generated Noise and Vibration in Gas Turbine Combustors
Phil Stopford, ANSYS UK Ltd.

ACOUSTICS

Development of Aeroacoustic CFD at Jaguar Land Rover
Claire Freeman, Jaguar Land Rover

Numerical Computation of Tyre Radiation Noise: A Comparative Study of Different Techniques
Karthik Balachandran, LMS International N.V.

Validation of a Hybrid Aeroacoustic Strategy Using aCombination of CFD and FEM
Edwin de Vries, MSC.Software

TBA
Fred Mendonca, cd-Adapco

COUPLED

Fully Coupled Thermal/Structural Analysis of Railway Wheel/Axle
Richard Llewellyn, Bombardier Transportation UK Ltd

Fluid Structure Interaction Coupling CFD and FEA
Douglas Marriott, MSC.Software

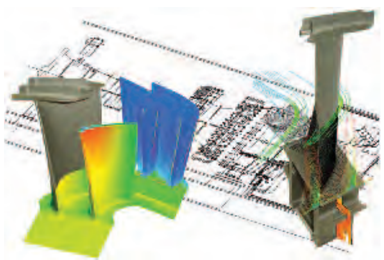
Simulating the Dynamic Behavior of Composite Wind Turbine Blades using Fluid-Structure Interaction (FSI)
Bhushan Thakar, Dassault Systèmes, SIMULIA

IMPACT

Development of a Bespoke Bridge Parapet and Safety Fence
David Norman, Tata Steel Automotive Engineering

Developing a Crashworthy Rail Seating System using Finite Element Analysis
Peter Snape, MIRA Ltd.

Modelling the Load Path from Under-Vehicle Explosion to Injury: FEA of a Traumatic Injury Simulator, a Combat Boot and the Lower Limb
Spyros Masouros, Imperial College London



Day 1
30 May 2012

www.nafems.org/uk2012

SIMULATION DATA MANAGEMENT

Core Requirements of SDM
Peter Bartholomew, MDAO Technologies

Working Group Discussion

TRAINING & SKILLS MANAGEMENT FOR SIMULATION ENGINEERS

EASIT2 European Project
Jim Wood, University of Strathclyde

NAFEMS e-Learning Courses
Tony Abbey, NAFEMS

MULTIPHASE

Modeling and Simulation of Fire Suppression Systems of Warehouses
Mahmoud Fouad, Cairo University

Performance Comparison of a Single and Triple Tangential Inlet Gas Separation Cyclone: A CFD Study
David Winfield, Swansea University

CO2 Scrubbing to Condition Gas By-Products for Aircraft Fuel Tank Inerting
Joseph Lam, Airbus

THERMAL

Virtual Vehicle Thermal management at Jaguar Land Rover
Daniel Wellman, Jaguar Cars Limited

The Effect of Hot Mill Processing Temperature Variations on Final Coil Properties of Hot Rolled Steels
Michael Ryan, Swansea University

OPTIMISATION

Recent Advancement in Non-liner Optimisation - Enabling Technology and Development Opportunities
Warren Diaz, Altair Engineering Ltd.

Designing Flood Relief Schemes Using Smart Optimisation
David Moseley, EnginSoft UK Ltd.

Multidisciplinary Design Optimization of Car Bonnet Using Implicit/Explicit Finite Element Analysis
Gasser Abdelal, University of Liverpool

TASTER COURSES

- Fatigue & Fracture in FE Analysis
- Dynamic FE Analysis
- Composite FE Analysis
- Non-linear FE Analysis
- Optimisation in FE Analysis

Day 2
31 May 2012

NAFEMS UK CONFERENCE '12

PIPEWORK

A Comparison of Simple Analytical Methods for Evaluating Local Stresses at Pipe Support Attachments with Finite Element Analysis Results
Anindya Bhattacharya, CB&I

Local Stress Evaluation at Pipe Wall due to Pipe Support Attachments – A Comparison of Finite Element Based Approach and Analytical Methods
Suraj Kunder, Costain Energy & Process Ltd

COMPOSITES

Composite Honeycomb Bird Strike Test and Analysis Programme
Richard Gibbon, Frazer-Nash Consultancy Ltd

Micromechanical Modeling of Failure in Plain and Open Hole Test Coupons under Tensile and Compressive Loading
Elodie Maurer, e-Xstream

Working Group Discussion

CONNECTIONS

Fracture Modelling Correlation Study for Spotwelded Coupons with DP600 and Boron Steel Sheet
David Norman, Tata Steel

Evaluation of Novel Joining Techniques for Chassis and Suspension
Ed Carter, Swansea University

Numerical and Experimental Investigation of Aircraft Panel Deformation during Assembly Process
Gasser Abdelal, University of Liverpool

Development of Dissimilar Material Brazed Joint Modelling Strategies Based on an Understanding of the Mechanics and Metallurgy of the Joint
Niall Hamilton, University of Strathclyde

MATERIALS

A 3D Nonlinear Finite Element Analysis Simulation of an Ethylene Propylene Diene Monomer (EPDM) Hydraulic Diaphragm Accumulator Bladder at 3:1 Compression Ratio
Richard Kennison, Race-Tec Sealing Limited

The Importance of Materials Data Characterisation & Standardisation at Jaguar Land Rover
Mark Blagdon, Jaguar LandRover

Development of a Database of Advanced Material Properties
Neil Baumann, Key to Metals AG

An Insight into Material Model Optimisation
Stuart Nixon, Dassault Systèmes, SIMULIA

METHODS

Generating Electrically Large Surface Meshes with Dielectric Regions for Radar Cross Section or Antenna Placement Simulation
Rob Cook, SELEX Galileo Ltd

Seismic Qualification of HVDC Thyristor Valves Using FEA Modelling
Xian Lu, ALSTOM Grid UK Limited

Streamlining the Development of Complex Systems through Model-based Systems Engineering
Peter Hoffmann, IBM Rational Software

NAFEMS FRANCE CONFERENCE '12

6-7 JUIN I **PARIS, FRANCE**

SIMULATION NUMÉRIQUE: MOTEUR DE PERFORMANCE

état de l'art I pratiques I tendances I impact industriel

2 jours 100% simulation numérique pour faire le point, évaluer, progresser

un évènement labellisé par AFM

ASSOCIATION FRANÇAISE DE MÉCANIQUE

Centre de Conférence NOVOTEL Charenton,
5 place des Marseillais,
94200 Charenton, France

Le Congrès de référence pour la communauté simulation numérique industrielle en France

Le congrès NAFEMS France 2012 est **LE** Congrès de référence pour la communauté simulation numérique industrielle en France. Il a pour objectif d'aider les entreprises à mieux évaluer l'apport des technologies de simulation numérique pour le développement de produits plus innovants, plus performants, optimisés.

Le Congrès traite l'ensemble des domaines d'étude liés à la **Mécanique des Solides** (FEA) et la **Mécanique des Fluides** (CFD) y compris **Simulation Multiphysique** (MP), **Matériaux et Procédés, Méthodes Avancées** et applications **multi-domaines**,...

Pour en savoir plus, rendez-vous sur

www.nafems.org/fr2012

Un évènement qui concerne toute la communauté industrielle

- Le Congrès NAFEMS s'adresse à tous les ingénieurs, concepteurs, scientifiques, managers et décideurs impliqués dans le choix, la mise en œuvre et l'utilisation performante des outils de simulation numérique dans l'entreprise
- Le congrès est centré sur l'industrie et s'attache à favoriser les échanges productifs industrie–recherche–offreurs. Une occasion unique de découvrir, approfondir, confronter et débattre des problématiques de simulation numérique dans un contexte neutre et résolument professionnel
- Études de cas, témoignages d'experts, débats et échanges informels permettront à chaque entreprise de mieux cerner l'impact de la simulation numérique sur son innovation, sa performance et sa compétitivité

Une opportunité unique de contacts et de progrès pour chaque entreprise

NAFEMS

www.nafems.org/fr2012

Thèmes du Congrès

NAFEMS FRANCE CONFERENCE '12
6-7 JUIN | PARIS, FRANCE
SIMULATION NUMÉRIQUE: MOTEUR DE PERFORMANCE

Méthodologies et bonnes pratiques

- Conception pilotée par la Simulation
- État de l'art des Techniques et Applications
- Benchmarking, V&V, Confiance dans la Simulation Numérique
- Optimisation, Conception Robuste
- Éducation, Formation, Gestion des Compétences, Coopération Industrie-Recherche
- Impact industriel de la simulation numérique, Processus Qualité

Technologies et domaines d'études

- Mécanique des Solides
- Mécanique des Fluides
- Simulation Multiphysique
- Matériaux et Procédés
- Méthodes Avancées
- Intégration CAO-Calcul, Outils logiciels

Avec des contributions de :

- AIR LIQUIDE
- AIRBUS
- ALTAIR
- AREVA
- ARMINES ARTAL
- AUTODESK
- CEA
- CEDRAT
- CEDREM
- CENAERO
- CSDL
- DANIELSON
- DANONE
- DASSAULT SYSTEMES
- EADS IW
- EC LYON
- EC NANTES
- EDF R&D
- ENS CACHAN
- ESI Group
- ESTECO
- FAURECIA
- G-SCOP
- GAMMA POINT
- HUTCHINSON
- HYDROCEAN
- ICEA
- ICAM
- ID4CS
- IMPETUS
- IMT
- INRIA
- INSA
- IRISBUS
- IRIT
- IRSEEM
- ISAE
- LAFARGE
- LNE
- LOGILAB
- MATIS TECHNOLOGIES
- METEXO
- MOSART
- ONERA
- PHIMECA
- RENAULT

SAFRAN

- SCHNEIDER Electric
- SIEMENS
- SIMconcept
- SNECMA
- STRUCTURE COMPUTATION
- THERENVA
- TOTAL
- TURBOMECA
- UTC
- UPETECVALEO
- VIBRATEC...

PLATINUM Partners

Altair Autodesk esi get it right® SIEMENS

GOLD Partner

LMS ENGINEERING INNOVATION

Partenaires
Vous êtes éditeur de logiciels, revendeur, société d'ingénierie, laboratoire universitaire?

Devenez Partenaire de l'évènement et bénéficiez dès maintenant du programme de communication du Congrès!

Demandez le dossier Spécial « Partenaire du Congrès 2012 » à francois.costes@nafems.org

NAFEMS

www.nafems.org/fr2012

NAFEMS NORTH AMERICA CONFERENCE '12

11-12 SEPTEMBER | WASHINGTON, DC

ENGINEERING SIMULATION: A 2020 VISION OF THE FUTURE

Where is engineering analysis and simulation going to lead our world in the next decade? Where should it be going, and how will we all help get it there? What are the business, technological, and human enablers that will carry the past successful developments, applications, and business impact of Computer Aided Engineering (CAE) to higher plateaus during the next decade and beyond?

The Event

NAFEMS, the only global organisation dedicated to the advancement and improvement of engineering simulation, is hosting the 2012 North America Conference just outside of Washington D.C. on September 11-12, to bring together the leading visionaries, developers, and practitioners of CAE-related technologies and business processes to share relevant trends and roadmaps, to explore common themes, and to address these issues in an open forum. The Conference's goal is to provide attendees with insightful content and perspective on how to position their organizations to realize the full potential of CAE now and in the future. The 2012 North America Conference will also feature a number of short training courses led by Tony Abbey on September 10.

Call for Presentations

There are many facets associated with maximizing the value of using engineering analysis and simulation in addressing the ever-increasingly complexity of products and their life cycles. The 2012 North America Conference will include keynote speakers, exhibits, and breakout sessions exploring the following subjects:

Commercial impact of CAE investments

- Development and deployment of CAE roadmaps
- Integration of simulation data within Product Lifecycle Management (PLM)
- The roles of CAE software and hardware developers

Innovations in Simulation Technology
("the purpose of computing is insight, not numbers")

- High-Performance Computing (HPC) systems for CAE (further synergies between hardware architectures, non-traditional platforms, and software algorithms)
- Capturing the relevant physics well enough to gain engineering insight through multifunctional and multiphysics simulations
- Material characterizations including multiscale modeling
- Driving design improvement and optimization from smart simulations
- Real-time virtual simulations
- Design uncertainty quantifications and non-deterministic optimization
- Innovative approximation methods and evolutionary optimization

Engineering Simulation Processes

- Experimental errors vs. CAE foibles – which data set do you trust?
- Regulatory affairs: Gaining acceptance of quality CAE data in approval of products and designs
- How to accomplish validation with complex systems

Human Issues

- Intelligent engineering collaboration environments
- Teaching simulation as part of the basic engineering curricula
- Evolving engineering processes and organizations to leverage CAE advances

Futuristic Considerations

- Simulation strategies and tools for "Emerging Complex Adaptive Systems and Cyber –Physical Systems"
- Intelligent interfaces for modeling and simulation software
- Interactive, immersive 3D modeling and simulation tools/facilities
- Potential of using Virtual and Augmented Reality, and Virtual Worlds in engineering simulations

Call for Presentations

NAFEMS openly requests presentations which provide case studies on the effective use of simulation for a particular application. Presentations from all areas of simulation can be submitted and will be considered, however, contributions which highlight one or more of the themes above are particularly welcomed.

You are invited to participate to tell the engineering analysis community how simulation is being used in your organization. The impact of simulation, and the extent to which it is deployed, can vary considerably depending on company size, and the industry sector in which you operate. The conference committee is keen to encourage input and participation from a wide range of organizations – large and small, across all sectors.

Please note, as an independent and vendor-neutral organization, NAFEMS kindly requests that all submissions avoid any overt commercialism.

Submission Requirements

In the first instance, abstracts of 300-600 words should be submitted for consideration by April 2nd 2012. Abstracts should be clearly marked with the presentation title, author's name, organisation, address, phone number(s) and email address.

E-mail your abstract to na2012@nafems.org

Authors whose abstracts are accepted will be asked to prepare an extended abstract (typically 2-4 pages) and a PowerPoint presentation - full written papers will not be required.

Deadline for abstract submissions is May 14th 2012

Who Should Attend?

CAE end users, visionaries, researchers, educators, industry managers, and CAE software and hardware developers, all have relevant experience and viewpoints that can help shape the future of CAE. All are invited to participate, but most importantly to articulate, interact, and evolve their thinking and planning of future activities proactively, so as to incorporate all the ingredients necessary to maximize the impact of CAE in tomorrow's product design environment.

The event is open to both members and non-members of NAFEMS. Members with sufficient seminar credits may be able to attend this event for free.

Sponsorship and Exhibition Opportunities

We would like to extend an invitation to your company to be part of the NAFEMS North America 2012 Conference - Engineering Simulation: A 2020 Vision of the Future.

There are several outstanding opportunities available for your company to sponsor or exhibit at the conference, giving you maximum exposure to a highly targeted audience of delegates, who are all directly involved in simulation, analysis, and design.

For more information on these opportunities visit

www.nafems.org/na2012

INTRODUCTION TO ATMOSPHERIC MODELLING

Dr Amita Tripathi, FLUIDYN France

It is obvious, even trivial, to every living being on the surface of the earth that the medium we are living in has an activity on its own (called weather) with which we deal on a daily basis and which impacts widely many of our activities, including the economy.

Atmospheric motions are seemingly random on various scales. Though different in nature, randomness appears on the planetary scale and time scales of the order of days, months (climate and global weather) in chaotic, but to some extent, predictable structures. It appears also for flows at the microscale in the meteorological terminology (i.e. flow scales of the order of tens of metres and seconds to minutes on domains of the order of several kilometres). The attempt to predict the seemingly random flow of the air in our atmosphere dates back to early in the last century when Lewis Fry Richardson worked on numerical methods for weather prediction at the Meteorological Office in the UK [1]. The first numerical solutions provided for atmospheric flows are obtained from simplified and projected formulations of the fluids equations on a sphere in the rotating frame. The simplification retains the largest equilibrium terms producing the so-called barotropic and baroclinic balanced equations for planetary scales motions. Similarly, given the large horizontal to vertical aspect ratios of the geometry and flow motions on such scale, a shallow water version was used. Since then, the basics for meteorology analysis and forecast have relied on a common set of equations known as primitive equations applied for geostrophic stratified flows.

Much more detailed phenomena are included in the mesoscale modelling tools (on much shorter scales than planetary scales) with e.g. non-hydrostatic motions, cloud micro physics, local flows patterns related to either terrain features, heat sources or small scale active weather systems (storms, squall lines..etc). Both large scale and mesoscale models exploit closure schemes to represent sub-grid scale turbulence with semi-empirical laws for turbulent diffusivity. However, neither of these application types employs fine enough resolution for the modelling of atmospheric flow patterns induced by local/microscale features in the surface layer: such as buildings, obstacles, strong localised momentum and mass sources, as required for flow and dispersion simulation of impact or risk studies for industrial activities. Indeed, for atmospheric dispersion modelling, in 1955, the US military also worked to simulate the weather through the simplified Navier-Stokes equations in order to predict contaminant spread over time and space in the context of nuclear and chemical warfare under the Joint Numerical Weather Prediction Unit (JNWPU), a joint project between the U.S. Air Force, Navy and Weather Bureau. The complete history of weather prediction models can be found at the Atmospheric General Circulation Modelling website [2].

With the advent of faster digital computing, new ideas were advanced on how to solve the challenging Navier-Stokes equations governing the atmospheric flows on the largest scale that could possibly be experienced on Earth for fluids. Soon, weather predictions became an important aspect of our everyday lives. Technologically, adding the solution of a transport equation on these weather models, to represent the evolution of concentration of a pollutant in the air was only a very small additional step.

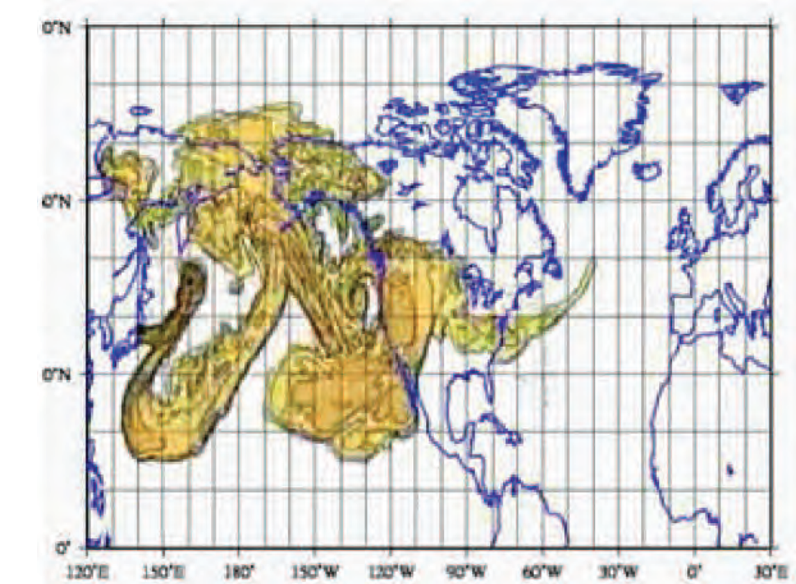


Figure 1: Example of simulated radioactive component dispersion contours following Fukushima accident [3]

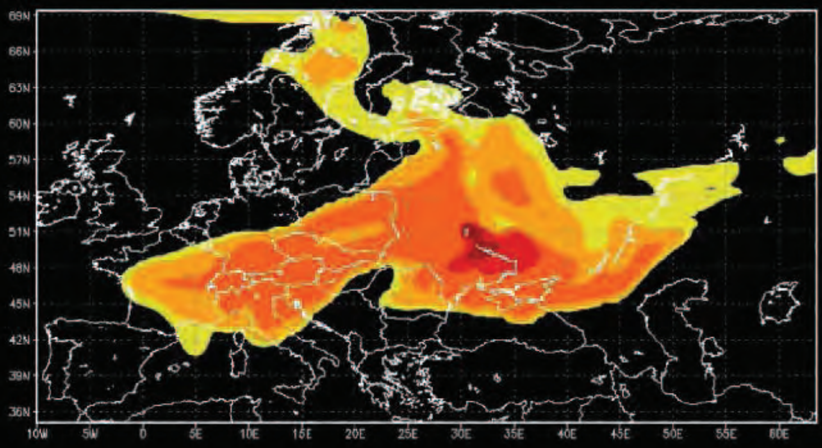


Figure 2: Example of Recent Simulated Radioactive Component Dispersion Contours Following Chernobyl accident [4]

Over the years – and usually in response to major natural events or industrial accidents - the general public at large has become quite accustomed to comprehending dispersion through modelling. Recent - and unfortunate - examples of this are the Fukushima accident or the Eyjafjallajökull volcano eruption, in which prediction of contaminant plumes were available within days or even hours of the event with severe consequences on the local population including evacuation and grounding of flights.

This rapid response capability compares this with the situation in 1986 with Chernobyl accident, when the French government could affirm - with no real scientific challenge at that time - that the cloud did not cross the French borders.

On a less dramatic note and away for the public eye, the economic and social development of developed countries is now greatly influenced by the regular use of atmospheric modelling, through the current awareness of environmental impact and health issues related to pollution. Indeed, besides weather forecast and exceptionally large events/accidents, atmospheric modelling is used by regulatory bodies to assess the compliance of existing or proposed industrial facilities with respect to environment norms and public safety. The technology can also be used for emergency response planning in anticipation of potential accidental chemical releases.

The software tools used to predict atmospheric flow and the spread of pollutants were restricted for quite some time to analytical and 2D tools based on Gaussian models. With improved computer capabilities and the development of advanced numerical models and schemes, atmospheric modelling has finally come of age with the use of Computational Fluid Dynamics (CFD).

The current use of CFD for any kind of flows still requires a fair amount of assumptions to be made in order to break down the problem into manageable pieces solved in a reasonable period of time. In much the same way, atmospheric modelling can be categorised according the level of accuracy required and the type of assumptions to be made. Depending, for example on the length scale (local, regional or continental), the simulation would require a different set of models and assumptions. In the remainder of this article, the main focus will be on solving atmospheric CFD Reynolds-Averaged Navier-Stokes (RANS) modelling on a local scale (also called micrometeorological scale).

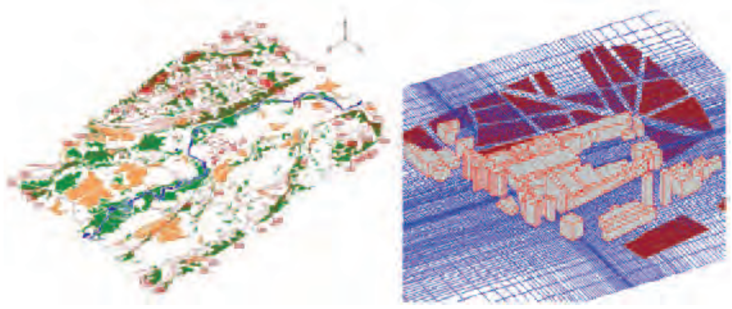


Figure 3: Example of a Numerical Model of Terrain Including Land Usage (left) and Buildings (right)

The steps required to successfully complete an atmospheric dispersion simulation will be very familiar to any person working with CFD on a regular basis. They are:

1. Collection and analysis of data
2. Set up of assumptions
3. Creation of model geometry
4. Grid generation
5. Definition of Source terms
6. Imposition of Boundary conditions
7. Specification of Initial conditions
8. Execution of the numerical solution
9. Analysis of the results

In the interests of brevity, each of these items will not be discussed in detail here. However, for further information on the subject the reader is expected to revert to the excellent Best Practice Guidelines issued by the COST732 action [5] as well as to the extensive internet link list on the NAFEMS website [6].

A person undertaking simulations in this area will, of course, be aware that the numerical accuracy expected in the simulation of atmospheric flows is, of course, less important than the one expected for, say, aeronautical studies, due to the lack of control one has over input data accuracy. Depending on the type of study to be carried out, the importance of the above data will change. An impact analysis in which the annual average concentration of a pollutant is to be assessed, will require the input data to be as realistic as possible but will adhere to average values and situations. An industrial hazard assessment on the other hand will generally seek to take into account the worst-case scenario by setting all variables towards the most adverse effect. The minimum data required for an atmospheric dispersion modeling:

- Terrain elevation and altitude often obtained from Land Geographic Surveys, either in digital or hard copy format. Satellite data, now freely available, can also be of help.
- Site map with obstacles, heat sources etc.
- Weather data: wind velocity, temperature and atmospheric stability from meteorological services often represented by a windrose.
- Source emission : from the industrial unit or from some general data (e.g. vehicles/day for road emission).

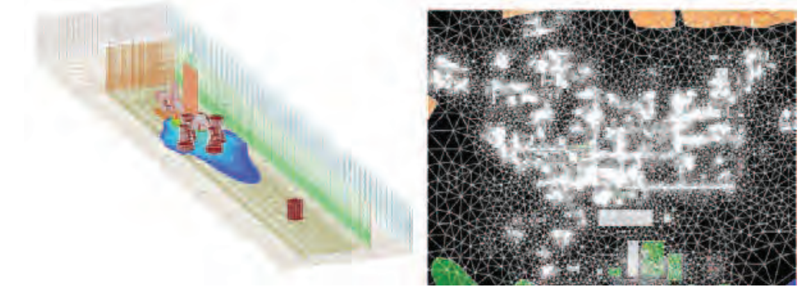


Figure 4: Example of Embedded Structured Mesh (left) and of a Unstructured Mesh (right)

Among the data listed above; atmospheric stability might be a new concept to analysts coming from a more conventional CFD background and is therefore worthy of further discussion. Atmospheric stability is the resistance of the atmosphere to vertical motion and is a function of vertical variation of temperature. A large decrease of temperature with height corresponds to an "unstable" condition which promotes vertical currents and mixing. A reduction in termperature with height corresponds to a "stable" condition which inhibits vertical motions. Many local factors influence atmospheric stability, such as wind speed, local heat sources/sinks and surface characteristics. Atmospheric stability also varies during the day and according to the season and can therefore not be an output of the simulation and yet the behavior of a pollutant plume will depend on it.

The atmospheric stability will therefore take the form of a set boundary condition which will be designated by a stability class, as developed by Pasquill in 1961. The air flow simulation will start in the numerical domain according to the chosen Pasquill stability class and the flow solution will then be influenced locally by the presence of buildings and other obstacles like large equipment or terrain elevations as well as heat sources/sinks. The wind coming from various directions will develop along preferred paths through and around obstacles. Thus it is important to not only have an accurate representation of plant layout under consideration but also the neighbouring buildings with their heights. This numerical model of terrain should also include a representation of the vegetation in order to capture the effect of its drag on air flow and water bodies like lakes, rivers etc, for their influence on air flow by temperature variation. The solution domain boundaries have to be far enough from the emission point, so that the assumed boundary conditions have a minimal impact the local wind patterns, including in those in the vertical direction.

Indeed, in the specific case of atmospheric flow modelling with CFD, one has to take into account both an accurate description of the atmospheric boundary layer with background profiles for winds, temperature and turbulence (all varying with altitude), and simultaneously, solving the local (internally produced) turbulence from mechanical processes (shear layers, wakes, momentum sources) and thermal sources related e.g. to industrial processes or urban heating.

The former are prescribed with appropriated formulations based on modified Monin-Obukhov profiles that relies on key micrometeorological parameters (Energy budget at ground, roughness length, friction velocity, M-O length, mixing length.....etc). Several formulations based on similarity theory and prognostic 1D closure model for the turbulence profiles and on the aggregate of atmospheric boundary layer (ABL) measurements for various experimental sets spanning as much as possible the diverse atmospheric stability regimes.

The locally produced turbulence must be calculated in the RANS CFD approaches with closure equations - the most frequently used being the k-ε model for turbulent kinetic energy k and its dissipation rate ε. Again in the various versions of the k-ε formulations (standard, RNG, low Reynolds...etc). One has to take care regarding the specific conditions of the flow in the ABL and thermal stratification on the sink and sources terms in the turbulence equations. All these specific properties and processes influence the atmospheric turbulence and may have an impact on the RANS mean flow solution through the turbulent diffusivity which in turn has a direct and significant influence on contaminant dispersions.

Atmospheric flow applications can also be quite a challenge to mesh. The pollutant release can be quite small and, in the case of accidental releases, the speed and momentum associated with it can be quite large, which in turn requires a fine mesh with cells that can be a few centimetres wide. On the other hand, if the plume is expected to reach a height of a few kilometres the scale of the affected region will be very much larger. Despite the rapid advances in computational hardware, simulations incorporatring fine cells of the order of centimetres cannot be carried out over such a a large extent. Solutions include working on the mesh (structured, unstructured, non-uniform or even embedded) or on the source term by taking a step away from the emission and considering a large area or volume as emission source.

The choice of the wind direction and magnitude to impose as a boundary condition is once again dependent on the type of study to be carried out. If an annual impact on air quality is sought for, a large number of wind conditions reflecting the windrose need to be considered. This could include up to 3 to 5 different velocities for each wind sector amounting to 30-100 weather conditions. If an industrial risk assessment is to be performed, then the critical wind conditions need to be investigated, keeping in mind that criticality will be a function of the

Pasquill class	Definition
A	very unstable
B	unstable
C	slightly unstable
D	neutral
E	slightly stable
F	stable

Table 1: Definition of Pasquill Atmospheric Stability Classes

Surface windspeed		Daytime incoming solar radiation			Nighttime cloud cover	
m/s	mi/h	Strong	Moderate	Slight	> 50%	< 50%
< 2	< 5	A	A – B	B	E	F
2 – 3	5 – 7	A – B	B	C	E	F
3 – 5	7 – 11	B	B – C	C	D	E
5 – 6	11 – 13	C	C – D	D	D	D
> 6	> 13	C	D	D	D	D

Table 2: Occurrence of Atmospheric Stability Classes

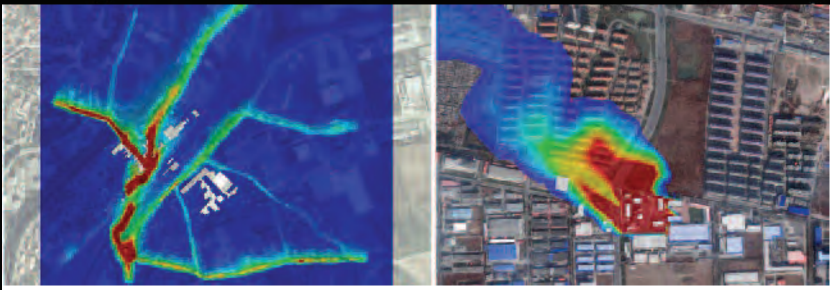


Figure 5: Example of Pollutant Concentrations on a Road Network (left) and from an Industrial Source (right) at 1.5 m high

source characteristics (cold/hot, violent/mild) and of the target (far/close, below/above the release point).

The source terms used in the simulation also require an extensive discussion, if only to correlate them to the mesh used, although it is only possible to provide an overview here. It could be a point source (stack or pipe rupture), a line source (road), an area source (pool evaporation or dust fly-off), a volume source (complete collapse of a tank) or jet-like (pressurized emission). The choice of solver will be based to a large extent on the type of source that needs to be accounted for: a transient compressible solver for a high-jet accident emission, a steady-state incompressible solver for traffic pollutant, for example.

As obvious as it may sound; the results have to be analysed keeping in mind the ultimate objective of the simulation. The concentrations of each pollutant need to be compared to thresholds in air quality if the aim is to look for environmental impact and in toxicological effects if accidental releases are being considered. The thresholds for these two major types of studies are not defined in the same way. For environmental impact studies, the thresholds will usually be annual average (requiring that all results specific to one wind condition are weighted with the occurrence frequency of that wind and summed up) or percentiles (the percentage of measures below a certain level which requires a cell-by-cell analysis). For risk assessment studies, one common way to analyse the results are doses, which are the integration of pollutant concentration over the time for which an individual would be exposed to it. This integration is not linear, however, as the degrading response of the body over time is taken into account.

Other possible applications of CFD in atmospheric modelling include its use as an operational decision-making tool. Examples are given below among many others.

Sensor Location Optimization

A major immediate economic benefit of 3D modelling is in the optimisation of detector/ sensor positioning, so that they don't need to be positioned intuitively in large numbers on a complex site. For a classical sensor network, conventional strategy relies upon prior identification of the potential leaks (from processes, storage, pumps and manifolds). Then, a usually dense and close range set of sensors is located with as many patches as necessary to cover all possible locations of leakage. Such empirical methods result in an expensive sensor network without any guarantee of its efficiency. Furthermore for equipment such as long pipelines or storage tank parks, with the potential for multiple source leakages, there are never enough sensors. One has to distribute a limited number of detectors over a large area with no way of knowing which way the pollutant will go in the event of release.

CFD could be put into use by simulating the release of pollutants from all likely leak sources and in all likely wind conditions. Such simulations are done with generic unitary emissions such as puffs of pollutants. Streamlines for pollutant dispersion over the site are established in 3 dimensions and the optimal sensor mapping is done using a composite turbulence map and the pollutant stream line map. Locations where turbulence is minimal and stream lines from most likely sources or most severe leaks pass, represent the most appropriate detection sites. Alternatively, using the adjoint solution of the advection-diffusion equations from all positions of the sensors on a predefined network and for relevant 3D flow patterns, one can construct a visibility function depicting the spatial coverage of the network and the time lags/delay for detection.

Source Retrieval by Retro-Tracing from Sensor Network to Leak Source and Real-Time Management

Techniques used for identifying the source from the sensor, such as retro-trajectories or adjoint methods, are based on inverse CFD modelling of flow and dispersion. For any given network of sensors, these methods provide a measure of "visibility" ensuring a proper mapping of the area - both for process locii (i.e. known possible locations) and for diffuse/distributed emission zones. With such an optimised network, any gas detection by one or more sensors can be quickly traced back to the likely leak source automatically in a matter of minutes after the leakage initiation. Coupled with in situ weather measurements and/or external data from weather services for forecasting in the following hours, the evolving dispersion of the toxic gas could be simulated and used for evacuation and emergency actions undertaken on the identified source.

This article is only intended to provide a flavour of atmospheric modelling and is not intended to address all of the issues facing the analyst in an exhaustive manner. All interested readers are encouraged to gain further insight into this fascinating subject through the links listed in NAFEMS website [4]. This article owes much to the authors in this list.

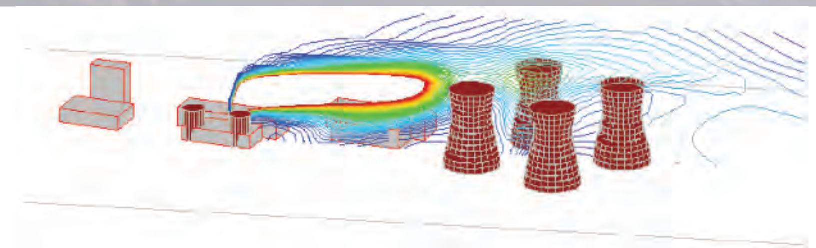


Figure 6 : Example of a Plume Dispersion on a Vertical Plane

References

[1] Icons of CFD Benchmark article Jan 2012, NAFEMS publication.
[1] http://web.archive.org/web/20080325084036/http://www.aip.org/history/sloan/gcm/
[2] http://www.irsn.fr/FR/popup/Pages/irsn-meteo-france_19mars.aspx
[3] http://www.irsn.fr/FR/popup/Pages/tchernobyl_video_nuage.aspx
[4] http://www.mi.uni-hamburg.de/COST-732.464.0.html
[5] http://www.nafems.org/tech/cfd/links/

AUTHOR INFORMATION

Amita Tripathi I Fluidyn
amita.tripathi@fluidyn.com

Transient Coupled-Field Simulation of a Power Electronic Module

Jean-Louis Blanchard, VALEO GEEDS
Laurent Dupont, IFSTTAR LTN

This article presents a two-physics finite element model of an electronic module, in order to illustrate how the inclusion of electrical effects enables to improve significantly the accuracy of the thermal simulation. For this purpose, the study context is first introduced, followed by the description of the experimental device and simulation model that equally make the thermal analysis basis. Inspection of the thermal maps illustrates the impact of the current distribution in the die bondings. Then, it is shown how one of the key parameter driving the power dissipated in the die by Joule effect can be finely tuned from the comparison of the measured and simulated tension drop. Finally, the thermal results yielded by the simulation are checked against the maps produced by an infrared camera and the measurements recorded by thermocouples.

Experimental Setup

The purpose of the study is to investigate the transient thermal behaviour of an electronic module whose geometry, sketched in Figure 1, is basically made of four bare dies (MOSFET transistors) brazed on two leadframes glued on a backplate. For carrying out the measurements, this backplate is mounted in vertical position on a heat sink with an intermediate layer of thermal grease. With respect to the final product, the plastic parts and potting of the module are removed for allowing the die temperatures to be recorded by means of a high-frequency acquisition infrared camera (1kHz) on a test bench designed and built at the IFSTTAR laboratory. As shown in Figure 2, a thin layer of black paint is sprayed on the module, the low emissivity of aluminium (approximately 0.05) preventing otherwise infrared measurements from being made. This method raises the emissivity to a value greater than 0.9, as checked by a specific open thermocouple of K type placed on the high side leadframe next to the MOSFET chip. Other thermocouples measure the temperature under the chip to assign the right boundary conditions to the FE model, and to control the temperature of connections. From the electrical viewpoint, tension probes placed at various locations of the circuit, in particular at the plus and phase connections, complete the experimental setup fully described in [1].

Finite Element Model description

The thermal investigation being targeted on a high intensity transient profile, coupled-field elements where electrical and thermal physics are concurrently dealt with are used, in order to accurately compute the Joule effect ([2], [3]). Ref. [4] uses similarly a 3D electro-thermal FE model for studying the behaviour of a power MOSFET. Thus, the required material properties not only include the thermal characteristics (density ρ, thermal conductivity λ and heat capacity cp in Table 1) but also the electrical resistivity σ of conductors (Table 2). All material properties are intrinsic, with one major exception. Indeed, the resistivity of the silicon layer is an equivalent value computed from the RDSon

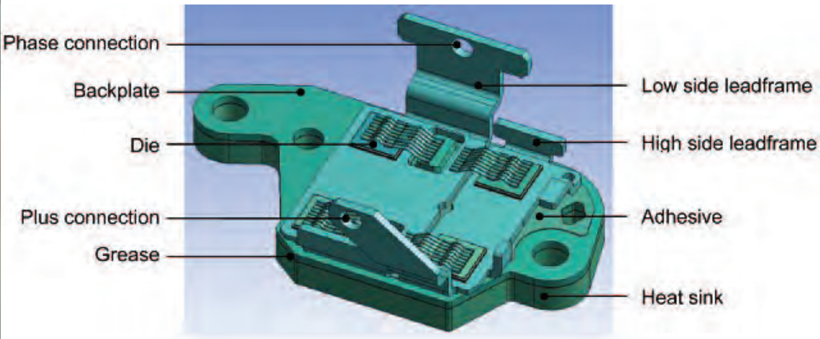


Figure 1: Module geometry

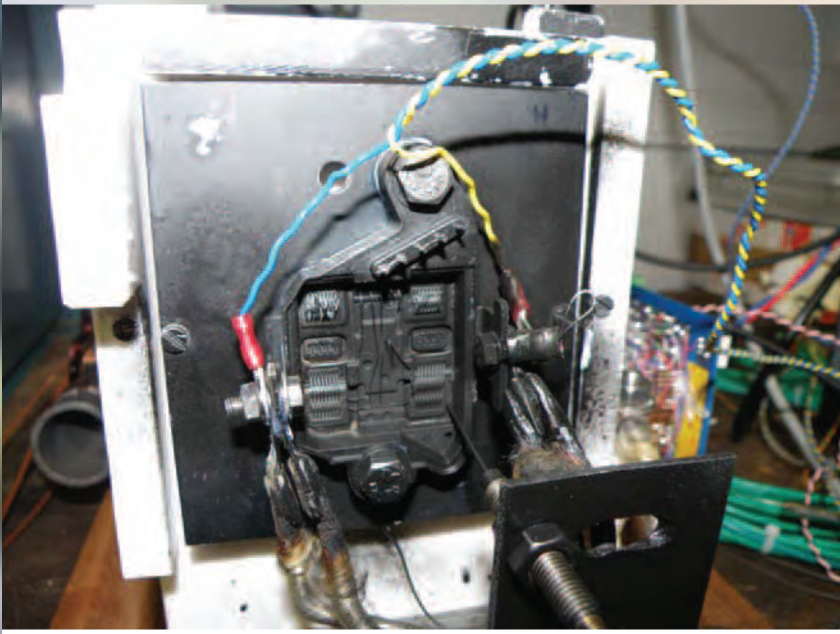


Figure 2: View of the module on the test bench
Finite Element Model description

Material (Properties at 25°C)	ρ (kgm^{-3})	λ ($Wm^{-1}K^{-1}$)	c_p ($Jkg^{-1}K^{-1}$)
Aluminium (radiator)	2700	120.0	1300
Aluminium (backplate)	2700	148.0	870
Aluminim (layer)	2700	200.0	910
Aluminium (bondings)	2710	230.0	910
Grease	2000	0.4	700
Adhesive	2710	1.9	700
Copper	8960	390.0	380
Braze	11100	32.7	150
Invar	8125	14.7	385
Silicon	2330	148.0	710

Table 1: Thermal material properties

Material	T (°C)	σ (Ωm)	T (°C)	σ (Ωm)
Aluminium	0	$2.412\ 10^{-8}$	900	$1.366\ 10^{-7}$
Copper	0	$1.384\ 10^{-8}$	1000	$9.384\ 10^{-8}$
Braze	25	$1.9\ 10^{-7}$		
Invar	25	$8.2\ 10^{-7}$		

Table 2: Electrical material properties

resistance (drain to source resistance when the transistor is fully conducting) provided by the component manufacturer, and the silicon layer cross-section and thickness. Owing to the anticipated high gradients, this equivalent value, as well as most intrinsic electrical resistivities, is specified as temperature dependent.

Following the two-physics nature of the model, two kinds of boundary conditions have to be specified. For the electrical side, a zero-volt value on the phase connection acts as the tension reference, whereas a current step of 500A during 100ms is applied on the plus connection. For the thermal side, the back of the heat sink is assumed to be at a constant prescribed temperature (23°C). This value is also the uniform initial temperature of the module.

Similarly to the test module employed for the experiments, a single die is bonded in the simulation model. However, in addition, the dies located on the low side leadframe are also removed to reduce the mesh size. This approximation is justified and checked a posteriori by the spatially limited diffusion of heat during the very short duration of the transient. By contrast, as shown in Figure 3 and Figure 4, care is taken to represent accurately the geometry of the bondings and stack of the powered die, since these parts play the central role from the electrical and thermal standpoint. The mesh density is refined consistently, with a fine hexahedron dominant mesh used in particular for the die stack.

Comparison of Measurements and Simulation Results

A first noticeable result comes from the fact that the FE model predicts that one of the bonding is hotter than the other (Figure 5a), as perfectly confirmed by the infrared image (Figure 5b) taken at the end of the current step. Such a result can only be produced by a two-physics simulation since the computation of the current distribution is in this case performed by the software. By contrast, a reasonable assumption for a conventional approach based on a volume heat source would probably lead to dividing equally the current among them. Actually, the slight unbalance of the current distribution detailed in Table 3 probably stems from the larger area through which bonding #1 captures the current. Filling this table requires the help of a script computing the flux of the electric field vector across the plane surfaces where the bondings connect to the leadframe near the phase connection.

Indeed, the two-physics nature of the simulation allows for the generation of electrical results. The path of the current can for instance be visualised as vectors depicting the magnitude and direction of the electric field vector. But from a quantitative viewpoint, the generation of tension maps is particularly useful. Admittedly, from a practical standpoint, electrical measurements are as a matter of fact more convenient and accurate than thermal measurements, and this feature significantly facilitates the simulation check against experiment.

Such a possibility is best illustrated by the adjustment of the RDSon resistance, provided by the manufacturer datasheet within some uncertainty interval. For fine tuning this value, the experimental tension drop across the module is plotted, as shown by the plain solid line in Figure 6. The first important information comes from its ascending slope, directly reflecting the increase of resistivies with temperature, since the applied current is constant. The role played by this effect fully explains why material properties must be specified as temperature dependant. Secondly, from Figure 6 where the line with square marks refers to the simulation, the RDSon value can be conveniently and accurately adjusted by minimizing the distance between the experimental and simulated curves. For the measured sample, this leads to check that the actual RDSon value is close to the maximum given in the datasheet.

The adjustment of the RDSon value ensures the right level of heat dissipation by Joule effect within the model, which is a primary factor for the accuracy of thermal results. This fact is demonstrated by the temperature curves displayed in Figure 7 that point out the excellent overall agreement between the temperatures noted from the infrared camera software (Figure 5b) and those produced by the simulation. Part of the discrepancies could stem from a small overcurrent at the step start and a slight misalignment of the comparison locations, whose effect is for instance amplified by the steep temperature decrease near the die corners (Figure 8). This figure also stresses the die temperature rise caused by the bondings.

In passing, it is worth noting that the die actual temperature exhibits a sudden temperature rise on current switch off (Figure 7). The cause of this phenomenon comes from the circuit self inductance combined with the very high value of the current derivative with respect to time. The produced overvoltage briefly puts the transistor in avalanche mode, which yields the temperature peak. So far, the simulation model cannot take this effect into account, since the component then no longer behaves as a pure resistor.

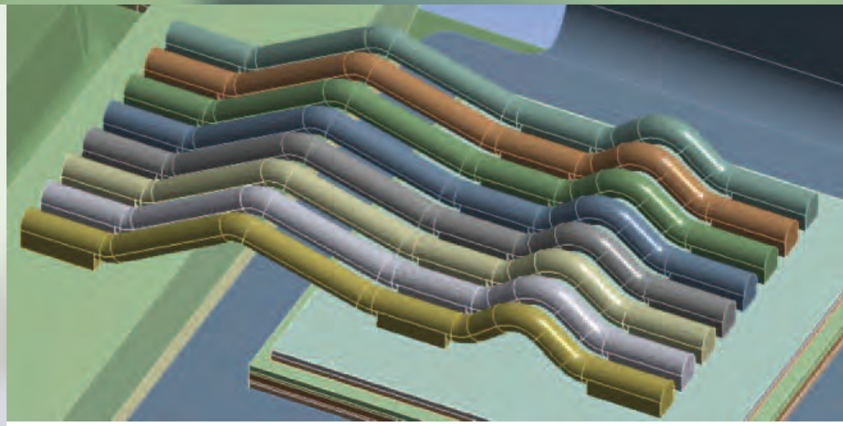


Figure 3: Geometry of bondings

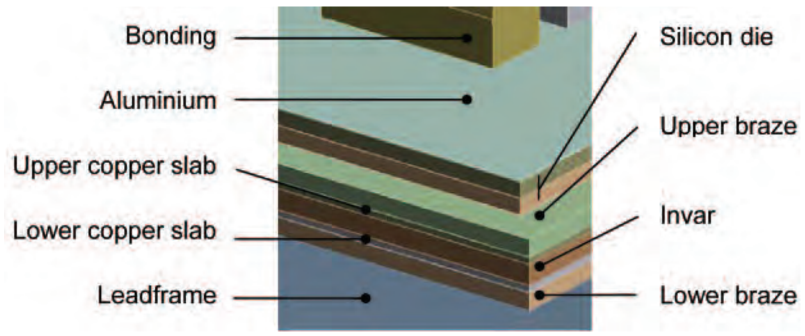


Figure 4: Geometry and constitution of the die stack

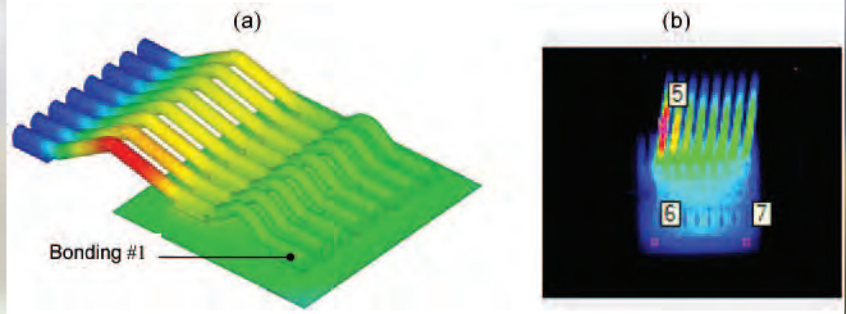


Figure 5: Simulated (a) and experimental (b) temperature map in bondings

Bonding no.	1	2	3	4	5	6	7	8
Intensity (A)	72.793	67.218	63.220	60.682	60.074	59.925	61.020	64.067

Table 3: Distribution of the current intensity in the bondings

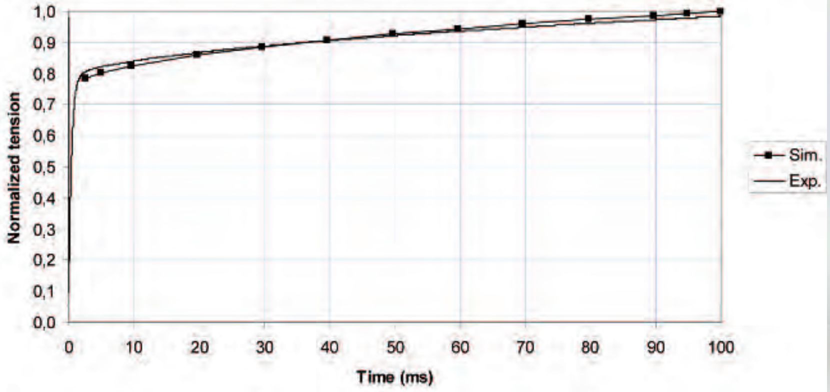
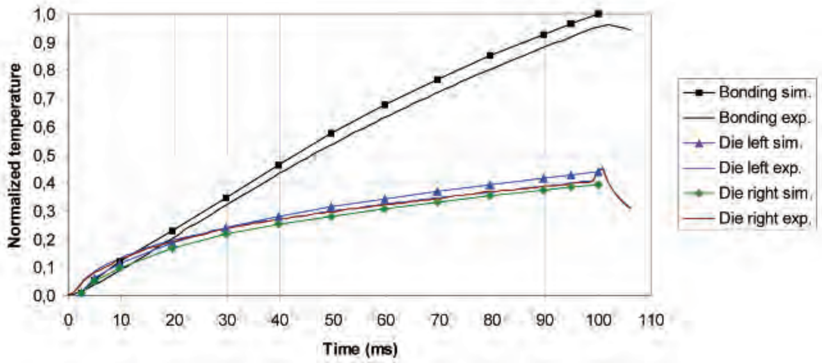
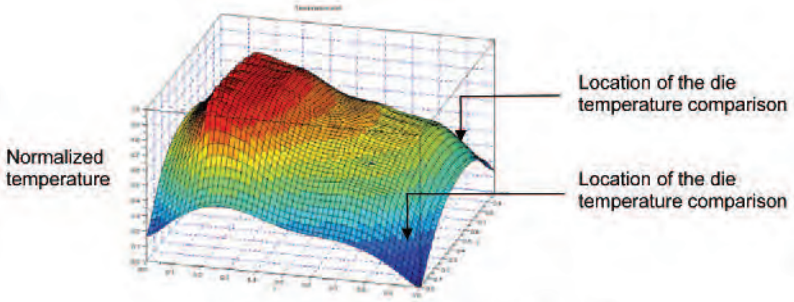


Figure 6: Comparison of the experimental and simulated tension drop across the module



The curves correspond to the locations given in Figure 5b.

Figure 7: Comparison of the experimental and simulated bonding and die temperatures



The top aluminium layer is oriented as in Figure 5a.

Figure 8: 3D-temperature map on the top aluminium layer

Conclusion

The thermal behaviour of the electronic module described in this paper is inherently driven by Joule effect. Consequently, the simulation is best processed through a two-physics model based on electrical and thermal coupled field elements, as evidenced by the excellent agreement between experimental measurements and simulated results. The accurate modelling of the Joule effect and the computation of the current distribution across the bondings enables in particular to predict that one of those is hotter than the others. In addition, the comparison of the voltage drops across the module is a primary factor for fine tuning the RDSon value modelled with the help of an equivalent temperature-dependent resistivity assigned to the silicon die. Finally, in practice, the possibility to produce tension and current maps provides also an accurate and convenient means for checking simulations against experiments. In this framework, future work will consist in investigating the modelling of the MOSFET behaviour in avalanche mode.

References

[1] L. Dupont, J.L. Blanchard, R. Lallemand, G. Coquery, J.M. Morelle, G. Blondel, B. Rouleau. Experimental and numerical results correlation during extreme use of power MOSFET designed for avalanche functional mode. Microelectronics Reliability 50 (2010), pp.1804—1809.

[2] C. Dehning, K. Wolf. Why do Multi-Physics Analysis? 2006, NAFEMS Ltd.

[3] Coupled-Field Analysis Guide. ANSYS Corp. April 2009, Release 12.

[4] T. Azoui, P. Tounsi, Ph. Dupuy, L. Guillot, J.M. Dorkel. 3D Electro-thermal modelling of bondings and metallization for reliability improvement of power MOSFETs. Microelectronics Reliability 51 (2011), pp.1943—1947.

AUTHOR INFORMATION

Jean-Louis Blanchard I Valeo
jean-louis.blanchard@valeo.com

NAFEMS European Conference MULTIPHYSICS SIMULATION2012

16 - 17 October 2012 Frankfurt I Germany

Call for Papers

Multiphysics modelling and simulation has a number of constitutive components: numerical methods, physical models, software issues and application areas. Contributions to this NAFEMS Multiphysics Conference should deal with these different aspects and clearly demonstrate how different models, numerical representations and scientific domains have been combined for the targeted application.

Multiphysics Combination Methods

Multiphysics simulation means that data, models, and software from a variety of engineering or scientific domains need to be combined in a single solution environment. Depending on the available tools and methods, there are different levels of multiphysics solution integration:

- **Model Integration:** In system or functional modelling, it is quite common to export physical models and import them into other simulators for execution. This integrated solution provides a strong coupling of all integrated models and very stable runtime behaviour. Such a physical model export/import however cannot be done for all domains and software tools.
- **Strong Co-Simulation:** New concepts which deal with the exchange of solution matrices between coupled models. The expected advantages would be in the stability of both, the solution process and the coupling convergence behaviour when compared with loosely coupled systems.
- **Weak Co-Simulation:** For most commercial software packages such an exchange of solution matrices will not be possible. The standard co-simulation technique is based on communication of boundary conditions in a loose coupled scheme (explicit or iterative).
- **Multi-Scale Parameter Coupling:** If local material properties depend on the ongoing solution at the macro level, the micro-scale (or MD) code performs sub-scale modelling whose results are repeatedly incorporated into the macro-scale simulation.
- **Coupled Process Chains**: The simplest but nevertheless probably the most widely used method of multiphysic simulation is the 1-way transfer of results in an integrated simulation workflow. Such integrated workflows may require compatible material models to be used in the 'coupled' simulation steps.

Simulation Domains

Various computational science branches and simulation paradigms have been developed over the last decades and have reached a sufficient level of acceptance in the engineering community (both industrial and research). However it is still a fact that combining software solutions, physical models and even numerical methods from different domains is still a difficult task and is limited to a (small) group of 'multiphysics experts'. One major goal of this conference is to show how such interactions between the domains have been solved successfully:

- Domains at the system level: hydraulics, multi-body kinematics, electric networks, control systems, fluid pipelines, etc
- Continuum level: structural analysis, fluid mechanics, electro-magnetics, hydro-dynamics, crashworthiness, manufacturing codes, NVH, etc
- Micro models: friction, diffusion, tribology, micro-fluidic, etc
- Material design: nano-scale materials, smart materials,….

General Issues

Multiphysics modelling and simulation in general raises a lot of challenges and questions at different levels:

- Numerical methods applied in a coupled simulation context need to be re-investigated with respect to their convergence and stability properties.
- Physical models need to be compatible to each other such that the coupled model gives a more realistic representation of natural behaviours.
- Software modules should either provide open programming interfaces or, even better, follow available software standards for co-simulation and model integration.
- Application expertise from various engineering domains (and different departments inside a company) needs to be coordinated to reach the common project goals.

Your Presentation

Abstract

Deadline for receipt of abstracts: 14 May 2012

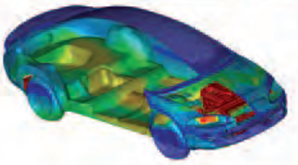
Please send by e-mail to roger.oswald@nafems.org

Manuscript

After review and acceptance of your presentation, we will ask you to send an extended abstract (2-4 pages) for the conference proceedings. Deadline: 17 September 2012.

www.nafems.org/mp2012

icons of CFD



Harvey Rosten

By David Tatchell, PhD

In science and technology, as in other fields of endeavour, it is seldom the case that progress is made steadily over a period of many years. Rather, one often observes periods of intense productive activity during which the foundations are established for a subsequent period of consolidation - progress is made via a series of step changes, rather than a steady monatonic progression.

In CFD we can observe one such period of step change in the decade from the mid 1960s to mid 1970s - and it is noticeable that the "Icons of CFD" covered in this series so far made their major contributions during this period. Prior to the mid 1960s CFD even in its most rudimentary form barely existed – yet by the mid 1970s the main foundations of practical CFD had already been established. The finite-volume approach, the SIMPLE solution method, and the two-equation k-epsilon turbulence model, were devised and proven during this period - and by the mid 1970s had been successfully applied to a range of practical three-dimensional flows, both steady and unsteady. The foundations of present day CFD had been established.

As a result of this progress, the potential for CFD to provide invaluable inputs to engineering design across a wide range of industrial needs was becoming increasingly recognised. However, the CFD software available in the mid 1970s was still far from providing engineering design tools of the kind required to satisfy this need. Most software was being developed in academic and research establishments, for in-house use only. CHAM Limited, the commercial offshoot from Professor Spalding's research activities at Imperial College, had begun providing commercial CFD services in the early 1970s. However, any provision of software to customers was confined to bespoke software developed for specific needs, provided to the customer in open source form at the conclusion of a project.

Clearly (with the benefit of hindsight) this approach was not the best way to put good quality CFD software into the hands of users in industry. Because each development was effectively a one-off, there were no "economies of scale". Rigorous testing was uneconomic, and, because the user could modify the source code, would have been a waste of time - and any systematic after sales support, maintenance or updating was impracticable, and was not attempted.

These deficiencies were recognised, and addressed, during the 1980s - the second "great leap forward" in the history of CFD. This decade saw the blossoming of "CFD as a software business", with the creation of a number of commercial CFD software products (starting with CHAM's PHOENICS in 1981), and the emergence of a number of CFD businesses, focused on developing, supplying, and supporting commercial CFD software packages.

It is during this phase of the evolution of CFD that Harvey Rosten, the subject of this article, made his contributions. Uniquely, Harvey played a leading role in the creation of two of the major CFD products released the 1980s - first PHOENICS, and then Flomerics' FLOTHERM/FLOVENT product.

Harvey studied Theoretical Physics at Queen Mary College, London (1967-71), and then completed an MPhil at the Rutherford High Energy Laboratory (1972-4), on the analysis of the magnetic fields of superconducting magnets for particle generators. On the completion of his MPhil in 1974, Harvey joined CHAM Limited - and entered the world of CFD. This was when I first met Harvey.

As was explained in the earlier "Icons of CFD" article on Professor Brian Spalding, Concentration Heat and Momentum (CHAM) Limited was set up by Spalding as a means of making the outcomes of his CFD research activities at Imperial College available to industry - a direct reflection of Spalding's insistence on the early practical application of his research activities. CHAM started as a consulting operation within Imperial College in about 1970, and grew, and separated from Imperial College, during the 1970s.

Harvey undertook and led a number of projects at CHAM, including (as leader of the Environmental and Process Group) fires and smoke in buildings, glass smelting, cooling towers, gas/liquid flows in undersea pipelines, and the Hall Cell process for aluminium smelting. This range of applications (undertaken by only one of the four groups into which CHAM's work was organised) illustrates both the breadth of demand for CFD services in the 1970s, and the challenge of achieving consistent good-quality outcomes using the "bespoke software development" business model.

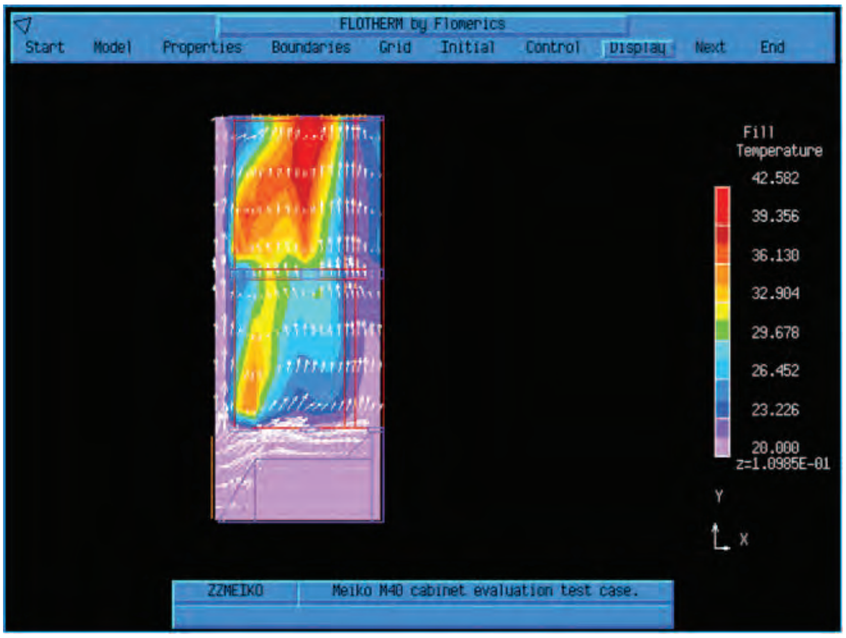
By 1979 Spalding recognised the need to create a single CFD code to replace the multiplicity of codes being worked on at CHAM at that time, and which could be marketed to users as a "general-purpose CFD code". This revolutionary decision resulted in the release of PHOENICS, the world's first commercial CFD code, in October 1981.

As CHAM's Software Development Manager, Harvey led the development of PHOENICS, working in tandem with Spalding. The challenge was to incorporate the best techniques that CHAM had developed over the years into a single piece of software, that would cover all of CHAM's then current needs. This meant that the technical requirements for the first release were, to say the least, challenging. The name tells part of the story - PHOENICS stands for Parabolic, Hyperbolic Or Elliptic Numerical Integration Code Series - meaning that it had to work well for one-way boundary-layer flows, for supersonic flows, and for elliptic recirculating flows. It had to handle 3D flows, steady and transient, laminar and turbulent flows, heat transfer, combustion and chemical reaction, and dispersed two-phase flows. Quite a list by any standards!

Another challenge was designing the user interaction with the software so as to achieve the conflicting requirements for a) a single code which could be developed, tested and supported centrally, and which would not be available for the user to modify, and b) the need for users (at CHAM or in customer organisations) to adapt the code to their specific problems and needs. This led to a novel arrangement, in which PHOENICS comprised three parts:

- The "Earth" program - containing all of the general CFD and physical modelling capabilities, and which was developed and maintained by CHAM. All users used identical Earth programs - interacting with it via the other two parts.
- "Satellite" programs - which were where the user specified input data, which was then transferred to Earth as a data file.
- "Ground Stations" - which were user accessible attachments to Earth where users could insert their own coding to interact with or modify the functionality of Earth in any required way. Clearly the key to this was providing access via the Ground Station to what was happening in Earth at the appropriate stages in the solution sequence, and to enable the user to make modifications in as controlled a way as possible.

In view of the ambitious specifications for PHOENICS, it is surprising that Harvey, with Spalding and the handful of developers working with them, completed the first release so quickly. The first installation was at Century Research Centre in Tokyo, on their newly-installed Cray 1 computer. As the only CFD software available at the time, PHOENICS attracted considerable interest, and use grew rapidly during the early 1980s. And, following CHAM's lead, other commercial CFD packages followed - FLUENT from Creare, FIDAP from Fluid Dynamics International, FLOW3D (later renamed CFX) from AEA Harwell, and STAR CD from Computational Dynamics, among others.



By the late 1980s CFD was becoming established alongside other CAE methodologies as an engineering tool with enormous potential, and was attracting interest from an increasingly diverse range of industries and applications. Naturally much of the demand was from the traditional CFD "core markets" of aerospace, defence, power generation, chemical process, automotive, and so on. But in addition, interest was being generated in newer CFD markets, such as building ventilation, electronics cooling, food processing, and consumer goods. However, for such "new applications", while the potential of CFD was clear, what the software of the day would deliver was disappointing.

The difficulty was not with the capabilities of the CFD technology itself - rather, with the accessibility of the software then available. Unlike the CFD core markets, these newer industries were unwilling to invest in CFD specialists able to master the complexities of working in their own coding in, for example, the PHOENICS Ground Station. Rather, what was being sought was CFD-based solutions that could be used by design engineers as a routine part of their day-to-day activities.

This recognition led, in 1988, to the formation of a new CFD business, Flomerics Limited, of which Harvey was co-founder and Technical Director.

Flomerics set out to address the needs of these "new industries" by focussing on selected applications, and developing software addressing only the specific problem in question - specifically, electronics cooling in FLOTHERM and building ventilation in FLOVENT. It was intended that, by focussing in this way, it would be possible to create software that could be used successfully by design engineers with virtually no knowledge of CFD.

This led to a software design using a single self-contained graphical user interface through which the user performed all input, control, and post-processing operations, with no other user access whatsoever to data or to coding. Crucially, only what was required was provided, and so in contrast to the approach of other CFD developers – who at the time were delivering general-purpose CFD software - the user's choice of CFD options was kept to the absolute minimum.

Harvey led the Flomerics Development Team from the company's initiation in mid 1988 - indeed the development team (him and two others) operated initially from the top floor of the Rosten family home in New Malden. Harvey played a major part in the design of the software, he led the development of the software, and he himself developed the core solver.

FLOTHERM was released late 1989 and FLOVENT early 1990. The GUIs and the underlying functionality were tailored to the each application, so that they appeared as two separate codes, but the bulk of the code was common to both, so that development and testing could be shared.

FLOTHERM was by far the more successful. Interest was driven by trends in the electronics industries beginning in the 1980s, and continuing to the present day, for accelerating increases in system power and functionality (Moore's Law), and for more compact equipment. These lead inexorably to escalating power densities (more watts/cubic metre), and hence challenges in cooling system design, which were beginning to be recognised in the late 1980s. Typically the mechanical engineers in computer, telecoms and avionics companies who were tasked with (among other things) devising cooling system designs, were finding that past experience and hand calculations were not enough. Prototype equipment was failing thermal testing - and causing expensive delays in product release.

FLOTHERM was designed to satisfy this need - and was increasingly adopted by electronics companies both as a solution to critical problems revealed in testing - and, longer term, as a means of "designing in" the thermal solution, by using thermal analysis at an early stage in the design process, in a manner consistent with the idea of "concurrent engineering" which was emerging at that time.

Harvey continued to lead FLOTHERM/FLOVENT development until 1992, when his work took an unexpected, but related, turn.

It turns out that, in analysing the thermal behaviour of electronics equipment, the modelling of the electronics packages themselves can be crucial. These deceptively simple looking objects have complex internal structures - driven by electrical, mechanical and thermal needs. The main heat sources in electronics equipment are the silicon chips at the heart of these packages - and the main thermal problem is generally the overheating of these chips. The thermal design requirement is thus often expressed as a "maximum junction (i.e. chip) temperature".

Consequently, by the early 1990s the need was being recognised within the electronics industries for a reliable, efficient, standardised way of representing the thermal behaviour of the multitude of package types in use at that time. Harvey took up this challenge.

This resulted in a series of EU-funded collaborative research projects, involving a number of major European electronics companies. Harvey coordinated these, and led Flomerics' contributions. The outcome was an agreed standard methodology for creating and verifying "behavioural models" of electronics packages(Ref 1), which has now been widely adopted as the "industry standard" (Ref 2).

A long way from CFD? To a purist possibly. But in practice, just as a new combustion model (for example) might open up new CFD applications in furnace or fire modelling, so these advances in package-level modelling have proved to be an essential part of realising the full potential of CFD in electronics thermal design.

Tragically Harvey died in 1997 after a short illness. He was posthumously awarded the 1998 IEEE SEMI-THERM THERMI Award in recognition of his contributions to electronics thermal modelling. The annual Harvey Rosten Award for Excellence in the Physical Design of Electronics was instituted in 1998 in his memory (Ref 3).

Harvey once expressed his contribution as "making good science available to industry" - which seems to encapsulate his career nicely. Uniquely, Harvey played a leading part in the creation of two major, innovative, world-leading CFD software products - which have made CFD techniques ("good science") available to many thousands of users in industry and academia throughout the world.

References

[1] Harvey Rosten et al "Final Report to SEMITHERM XIII on the European-Funded Project DELPHI - the Development of Libraries and Physical Models for an Integrated Design Environment", Proc. Of IEEE SEMITHERM XIII, 20-30 Jan 1997, pp 73-91.

[2] 'DELPHI Compact Thermal Model Guideline' JEDEC Document JESD15-4, October 2008. www.jedec.org/sites/default/files/docs/JESD15-4.pdf

[3] www.rostenaward.org.

AUTHOR INFORMATION

David Tatchell
david.tatchell@tiscali.co.uk

with thanks for the contribution from John Parry, Mentor Graphics.

Date	Event	Location
Apr 17 2012	Vibro Acoustics User's Conference & Aero-Vibro Acoustic Special Interest Group	Dusseldorf Germany
Apr 26 2012	ANSYS Austria Conference & 7th CADFEM Austria Users' Meeting	Vienna Austria
May 2 2012	2012 ASME Verification & Validation Sympsium	Nevada USA
May 2 2012	Siemens PLM Connection Americas' User Conference	Nevada USA
May 7 2012	Nastran User Meeting 2012	Munich Germany
May 8 2012	Adams User Meeting 2012	Munich Germany
May 15 2012	SIMULIA Customer Conference	Rhode Island USA
May 20 2012	13th International Conference on Pressure Vessel Technology	London UK
Jun 11 2012	ECCM 15 – 15th European Conference on Composite Materials	Venice Italy
Jun 25 2012	FLOW-3D European Users Conference	Munich Germany
Jun 27 2012	Forum TERATEC 2012	Paris France
Jun 28 2012	LMS UK Engineering Conference	Grove UK
Jun 30 2012	ANSYS Swiss Conference 2012 & 16th Swiss CADFEM User Meeting	Zurich Switzerland
Jul 19 2012	PLM 2012	Montreal Canada

www.nafems.org/industryevents

ONE
ASSOCIATION
1000 MEMBER ORGANISATIONS

ONE
VISION
300 TECHNICAL GROUP PARTICIPANTS

ONE
COMMUNITY
OVER 3000 EVENT ATTENDEES

ONE
NAFEMS
THE INTERNATIONAL ASSOCIATION FOR THE ENGINEERING ANALYSIS COMMUNITY

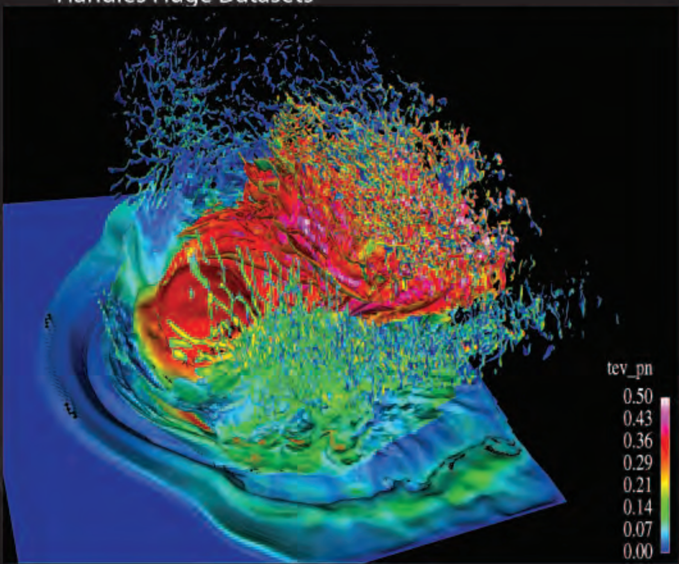
NAFEMS

www.nafems.org

EnSight
CFD, FEA, Multiphysics Post

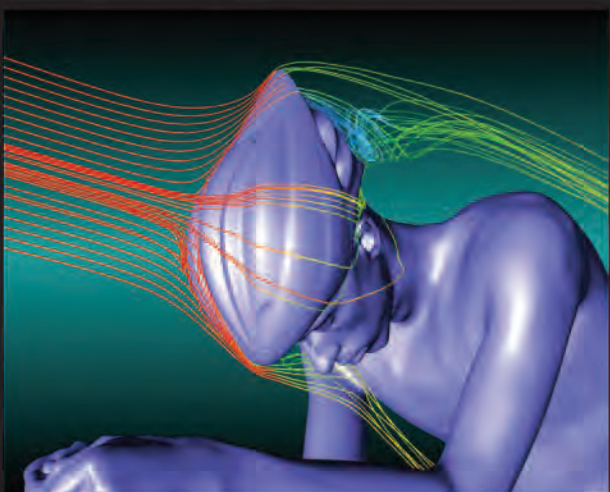
EnSight
Multiphysics Post-processor

Broadest range of data input and data output, over 30 formats
Strongest in Animation, 3D, and Transient Results
Highest quality images and animations
Textures, Volume Rendering, and Keyframe Animation
Handles Huge Datasets



EnSight CFD
CFD Post -processing

Free and Paid Versions
Native Mac, Windows, and Linux
Interactive data exploration

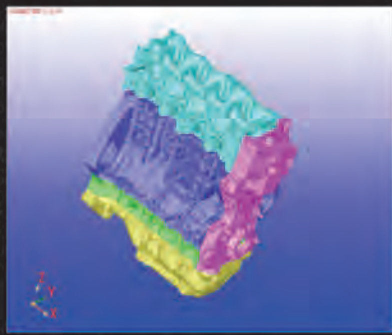


TSV
FEA Pre & Post

TSV-Pre
Powerful FEA Preprocessing

CAD Import, CAD cleaning, Meshing, LBCs and...

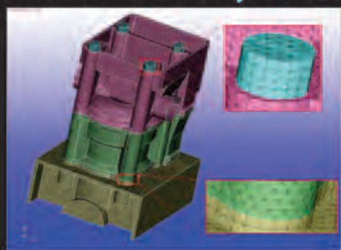
CAD IMPORTING
UG
ACIS
CATIA
PRO/E
PARASOLID
SOLIDEDGE
SOLIDWORKS
TRIBON
IGES, STEP, STL, MORE



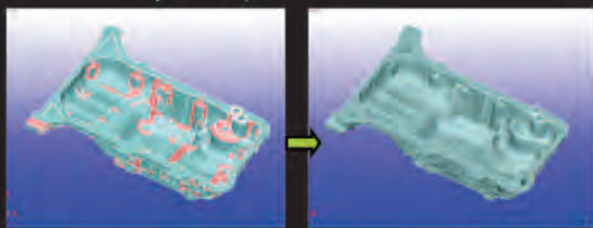
SOLVERS
ADVC
ANSYS
ABAQUS
LS-DYNA
MSC MARC
MOLDEX 3D
NX NASTRAN
MSC NASTRAN

Powerful Assembly Meshing
5 Million DOF Engine Model in < 2 hours

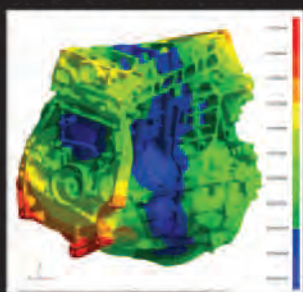
Automatic Assembly Meshing



Geometry Simplification



TSV-Post
Power Post for FEA



SOLVERS
ADVC
ANSYS
ABAQUS
LS-DYNA
MSC MARC
MOLDEX 3D
NX NASTRAN
MSC NASTRAN

Visualize, Plot, Report, and Export to 3D
Custom Tools Can be Implmented for Your Needs

www.ceisoftware.com