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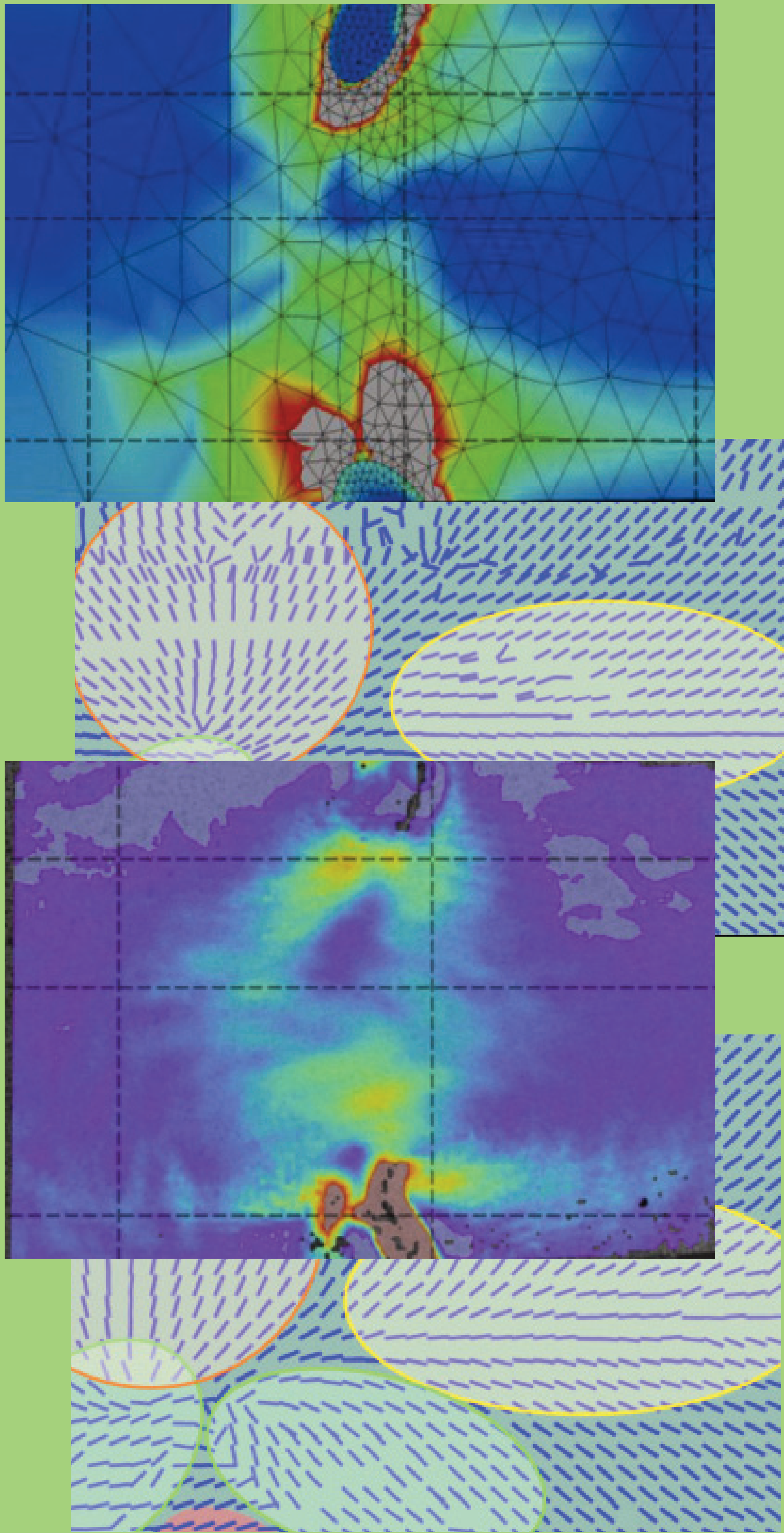

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contents

editorial

This issue of IACM Expressions is released at the time of the celebration of the 13th World Congress on Computational Mechanics of the IACM. The WCCM XIII will be held in conjunction with the 5th European Conference on Computational Mechanics (ECCM V) and the 6th European Conference on Computational Fluid Mechanics (ECFD VI). Both, the ECCM V and the ECFD VI conferences are regular events of the European Community on Computational Methods in Applied Sciences (ECCOMAS). The joint WCCM XIII/ECCM V/ECFD VI event will take place in the city of Barcelona (Spain) on 21-25 July 2014, under the organization of the Spanish Association for Numerical Methods in Engineering (SEMNI), an IACM affiliated organization, and the technical support of the International Center for Numerical Methods in Engineering (CIMNE).

The statistics of participation in the Barcelona meeting indicate that this will be the largest event held under the auspices of the IACM so far. Out of the over 4000 abstracts received, some 3200 papers will be presented at the joint congress. This includes some 150 posters which is a novelty in the format of previous IACM and ECCOMAS conferences. Papers will be distributed over 225 minisimposia, 8 special technological sessions and 20 thematic sessions. The congress topics cover most disciplines on the theory and applications of computational methods in a broad number of areas in engineering and applied sciences. The technical programme includes 6 Plenary Lectures, 30 Semi Plenary Lectures (including an Industrial Lecture and several Young Investigator Lectures), as well as an Opening and a Closing Lecture. Full details of this landmark event can be found at http://www.wccm-eccm-ecfd2014.org

The size and scope of the joint WCCM XIII/ECCM V/ECFD VI congress is another evidence of the vitality of the international computational mechanics community. Some 4000 scientists, academics, researchers and engineers from 52 countries will gather in Barcelona for presenting their work, listening to the latest developments in the many different topics and, over all, meeting old and new colleagues. This will hopefully be an excellent occasion for reinforcing existing cooperation links and also for opening new career opportunities for younger scientists.

Indeed the best “expressions” of the IACM today is the massive response of the international computational mechanics community to the Barcelona meeting. From these lines I thank all those who have contributed to make this event possible and express my best wishes for the success of the congress, with the hope that this will be premonitory of other successful joint activities of IACM and ECCOMAS in the future.

Eugenio Oñate
Editor of IACM Expressions

Predictive Computational Science

by
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The last decade has seen great interest and activity in a subject some call predictive science: the scientific discipline concerned with the forecast of events that take place in the physical universe -- the prediction of the future including the prediction of the behavior of engineered systems under design conditions.

One's first reaction to predictive science is to ask "Why?" – has not the purpose of science always been to explain physical phenomena and, once explained, to use the knowledge to predict the occurrence of related events in the future? Predictivity is at the heart of inductive reasoning – a foundational pillar of science itself, involving the development of hypotheses to explain physical observations and then extrapolating those explanations to similar events happening in the future, or in the past. Prediction of the response of engineered systems under design conditions has been undertaken for centuries.

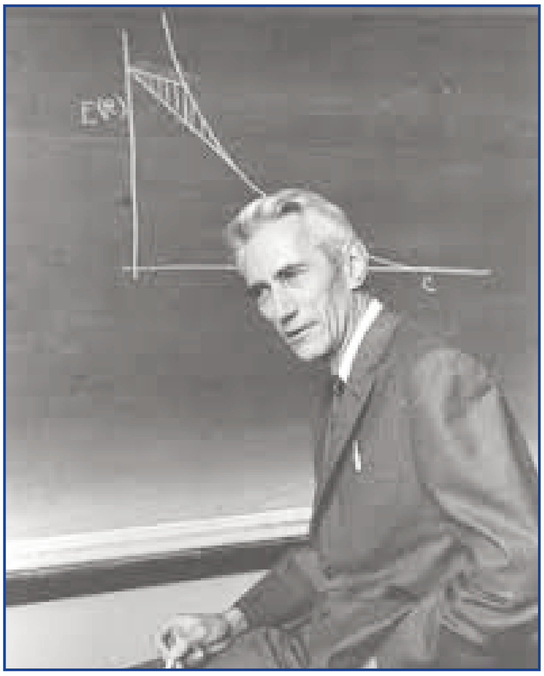
" Predictivity is at the heart of inductive reasoning ... "

But what has happened in recent times, say within the last three decades or so, is that dramatic advances in computational science have enabled the scientific community to push its predictive capabilities to the limit, and the result has often been disappointing, humbling, and even disastrous. Not only have we found that our favorite theories of mechanics cannot be applied with brute-force to prediction, but also that every phase of prediction faces overpowering uncertainties – in the models, their parameters, the physical observational data, and in numerical implementations. Another factor is that advances in algorithms and computing capabilities have gradually moved computer modeling from a qualitative endeavor, designed to only determine trends and qualitative features of the response of a system, to a quantitative science in which specific answers are needed to make important and sometimes life and death decisions. This is at a time when the great promise of the predictive power of computational sciences has been heralded as a boon to mankind, making possible tremendous advances in such areas as climate prediction, predictive medicine, the design of new materials, manufacturing processes, drug design, and many other subjects.

Predictive science has emerged in an attempt to dissect, formalize and understand all the aspects of science and engineering that truly influence the reliability of predictions. The anatomy of predictions is well known: one first has a model of the event in question that is generally represented by a mathematical characterization of a theory or a surrogate of a theory generated by special assumptions and approximations. Then, there are physical observations that supply data that bring the model into closer touch with reality by calibrating model parameters. Then, there is the discretization of the model to render it into a form that can be processed on a computer, and, finally, there is the prediction itself, which must be made in a way that takes into account all of the uncertainties met at every phase of the process.

To address these uncertainties, we choose to embed predictive science in the framework of probability theory and, therefore, to seek probabilistic characterizations of answers to what is to be predicted: the quantities of interest, which are the target goals of the simulation. Now we must face the fact that these quantities of interest are not numbers. They are, within the framework of probability theory, random variables or probability distributions. There are, of course, other ways to quantify uncertainty outside of probability, but we subscribe to the widely held view that the logic of science indeed finds a comfortable fit within the framework of logical probability.

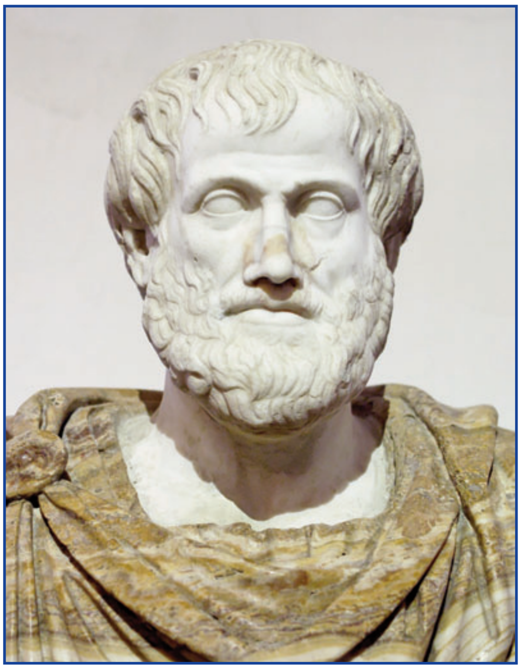
Figures 1:
Claude Shannon



One approach to predictive science is to embark on a very basic journey going back to the primitive foundations of logic, human reasoning and philosophy, that attempts to make clear how scientific knowledge is obtained, and how one copes with uncertainties as epistemic uncertainty, randomness due to ignorance. At the very beginning of scientific thought, one finds deductive logic, top-down reasoning, the establishment of rules to distinguish truth in propositions. These form the rules of mathematics; they are infallible and exact (modulo concerns in closedness and consistency embedded in Gödel's Theorem). But inductive logic, which is bottom-up reasoning, is, according to some, the basis of all scientific discovery. So, the next question is: what fundamental logical system can be developed that naturally extends Aristotelian deductive logic and accounts for uncertainties, and lays the foundations that underline predictive science?

I believe that a fundamental component of the answer is the theory of logical probability advanced by R.T. Cox in 1946 and expanded by E.T. Jaynes in his treatise, Probability Theory: The Logic of Science and formalized and interpreted by K.S. van Horn and others. The basic result is this: the natural extension of Aristotelian logic that includes uncertainty is Bayesian. By accounting for prior knowledge in constructing plausibilities and employing at the outset rules for conditional probability, the Bayes application domain far exceeds that of classical Kolmogorov probability and frequency-based statistics, while providing results in agreement with these approaches when they are applicable. The debate on Bayesian approaches has gone on for 250 years and still persists. Sharon McGrayne calls Bayes' rule "The Theory That Would Not Die", while recent literature calls attention to the paradoxes that may infect infinite parametric spaces and underline the so-called the brittleness of Bayesian approaches in extreme cases. Jaynes dispenses with such paradoxes by saying, "they cannot arise from correct application of our basic rules".

Bayes rule, which actually predates the work of Bayes himself, is now known to be a fundamental axiom of logical probability emanating from the product rule of the conjunction of two propositions, where, for the random events A and B, we have $P(A \mid B) = P(B \mid A)\ (P(A))/(P(B).$) Bayes himself appreciated the chilling power of this simple formula. To him, it captured "cause and effect": given information from past experiences, thrusting forward with a theory of physical behavior informed by experimental observations, now deduce new information about the phenomena under study—a remarkable process. To Bayes, a clergyman, it undoubtedly had a spiritual aura.



Figures 2
Aristotle

"...it will provide the guidance to construct very useful models and their calibration and validation ..."

What does it take to make a science-based prediction taking into account uncertainty? The prediction cannot be done without experimental data or without a model based on inductive hypotheses. To this we add prior information on the model parameters calibrated statistically by direct use of Bayes' rule for the probability of the likelihood function and the prior, with the likelihood measuring the discrepancy between the parameter-to-observation map provided by the model.

With this done, we sample the product distributions to determine the posterior distributions for the parameters. In this step, we call on an appropriate sampling algorithm such as the Metropolis Hastings version of the Markov-Chain Monte Carlo method. We use the model to solve the forward problem, projecting the particular parameters into a prediction of a quantity of interest, which itself is a probability distribution. Along the way, we must ask the question of whether or not the model is a valid model for this purpose, and this requires intermediate experimental observations to determine if the model can predict, with sufficient accuracy, the behavior of subsystems relevant to the quantity of interest.

Figure 1:
Edwin T. Jaynes

The most important components of these steps are: 1) calculation of priors, 2) calculation of likelihoods, which embrace the model used for the predictions, and 3) the design of the validation experiment that best informs the user of the model's ability to predict the quantities of interest.
All these steps are discussed in the literature, even though exactly how each of these steps is interpreted and implemented is still under debate.

One thing is certain; the Bayesian framework is not, in itself, sufficient to perform model validation. Additional tools are needed. One important tool is the notion of information entropy and other information theoretic ideas that are fundamental to decision theory and experimental design. For example, it can be argued that the optimal quantification of uncertainty in a probability distribution is the information entropy first introduced by Claude Shannon. The principle of maximum entropy can be used to generate priors in many cases. The Intellectual process of constructing likelihoods is still an area of active research and in current applications is most typically based on Gaussian approximations of experimental noise and model inadequacy. Beyond that, how does one design the validation experiment? The key, once again, is information theory: design the experiment so that there is a high enough information gain between the calibration posteriors and the posteriors in the validation experiments. The design of those validation tests to best reflect the influence of the choice of the quantity of interest is an illusive issue and is very much a topic of current research.

What does predictive science hold for the field of computational mechanics in the future? I believe it will provide the guidance to construct very useful models and their calibration and validation so that the field will, indeed, move towards a more truly quantitative science, in which predictions can be made with a measureable level of confidence and, based on model prediction, decision makers can make the right decisions about natural events or about the behavior of engineered systems. ●

Some Reflections on Big Data and Computational Mechanics

by
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January in Rio is summer vacancies and things, of course, slow down a bit. I take this opportunity to try to clear my pile of technical papers and leisure books. I came across of a very interesting book, "Uncharted: Big Data as a Lens on Human Culture", by Erez Aiden and Jean-Baptiste Michel [1]. Big Data is one of the current buzzwords, and we, computational mechanics practitioners, are producing enormous quantities of data, particularly with the popularization of enabling technologies on hardware, storage, visualization, data analytics and the emergence of stochastic, multiphysics and other approaches for the simulation, understanding and decision-making of increasingly complex man made devices or natural phenomena. Nevertheless, as humans, we have our own sub-culture, which, perhaps, might be explored with the same lens. In the upcoming WCCM, in Barcelona, there will be two mini-symposia dedicated to similar themes: "Integrating Big Data and Big Compute for Mechanics Applications" and "Enabling Technologies and their Application for Advancing Computational Mechanics", which reflects the growing interest in our community for these issues [2].

Computer science (particularly databases) has for some years recognized that the 4th paradigm of science is Data-Intensive Scientific Discovery, exploring the seminal work of the late Jim Gray [3]. I believe that the pioneer on trying to use database technologies in computational mechanics is Carlos Felippa [4], back in 1979! It will be interesting to know his view of what was big data at that time. Since then, data grows exponentially. To try to tackle such explosion, new facilities are being deployed worldwide. One example is TACC's Wrangler system, the most powerful data analysis system allocated in XSEDE, with 10PB replicated, secure, high performance data storage (at TACC and Indiana University) [5], to be operational by 2015.

Figure 1:
What are the most popular numerical methods?

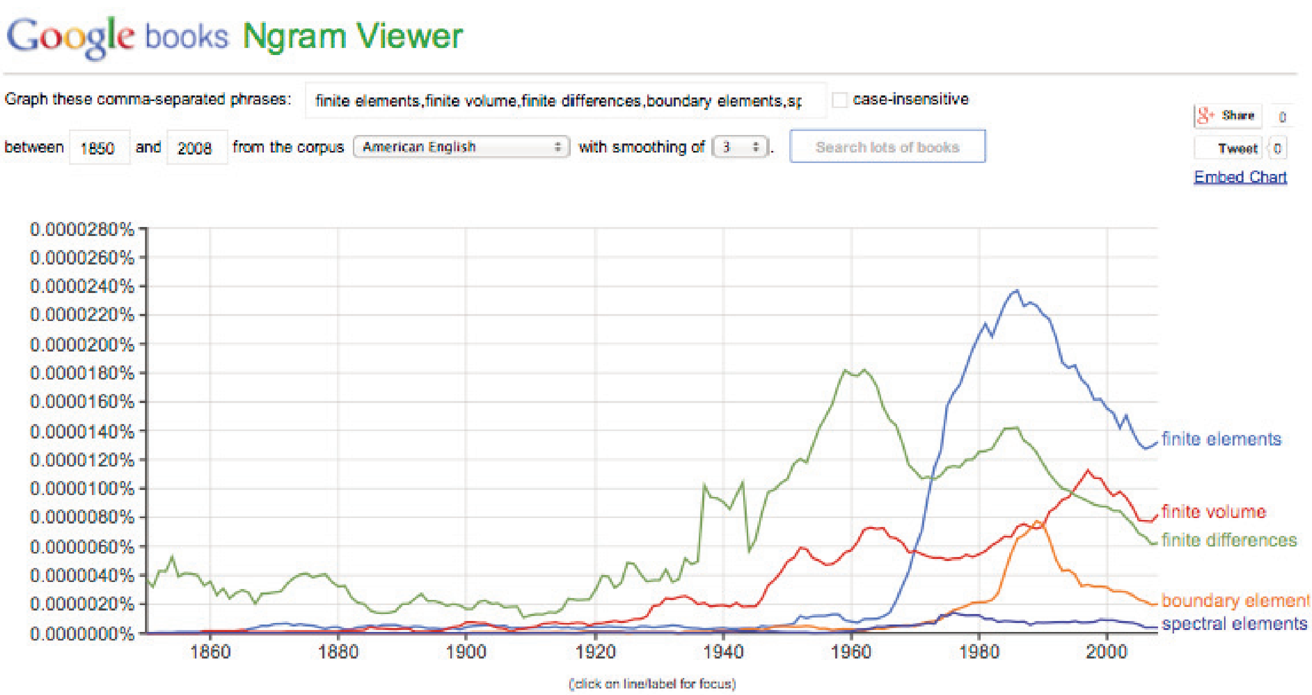


Figure 2: Computational Mechanics or Computational Sciences?

Coming back to my book, it is based on insights made possible by Google's Ngram Viewer, the revolutionary tool that allows anyone to search for the frequency of words over man's written history (at least within the 30 million books Google has digitized since 2004) [6]. It's based on the concept of a n-gram that is within computational linguistics and probability, an n-gram is a contiguous sequence of n items from a given sequence of text or speech. The items can be phonemes, syllables, letters, words or base pairs according to the application. The n-grams typically are collected from a text or speech corpus. The graphs lists on the horizontal axis the time frame and on the vertical axis the n-grams appearances on the whole database.

The application is freely available on the web, for anyone to try [7]. I could not resist and try to pose some questions revolving around our field:

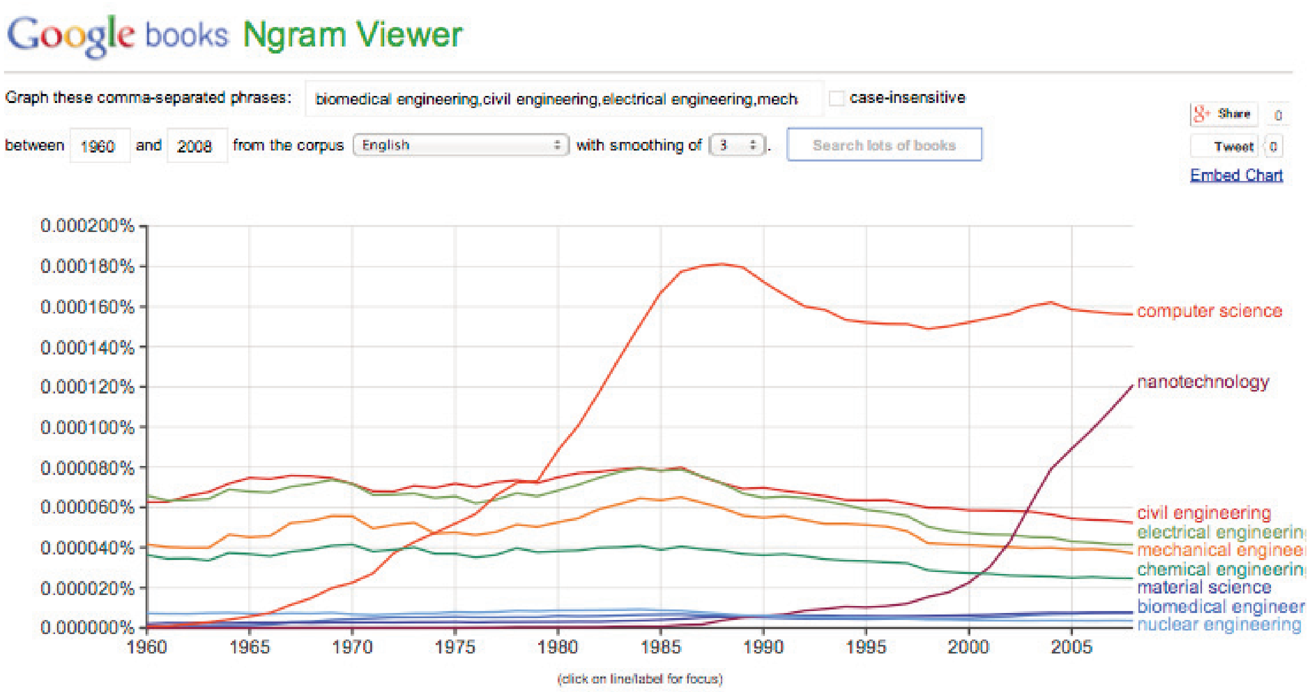
Most popular numerical methods

We can clearly see (*figure 1)* that before and during the early digital computer era, finite differences dominated. Finite elements have boomed since the 60's and are still the dominant method. What will be next?

Computational disciplines

Our field is becoming more and more multidisciplinary and perhaps is evolving

Figure 3: What about traditional and emerging engineering fields?



towards a more general computational science perspective *(figure 2)*. That is fine, but with the data available, this is not yet the reality. Our field seems to be alive and well, but there's a clear tendency on the growth of computational sciences. Are we going in the same direction?

Engineering fields

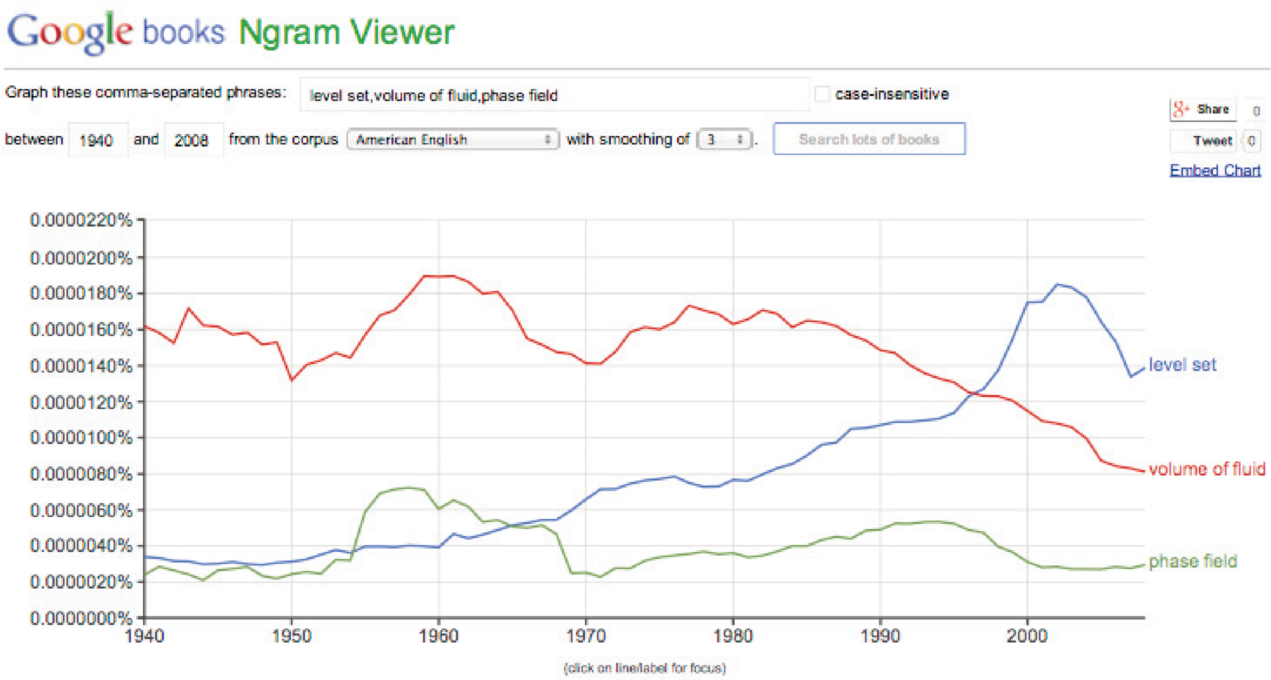
Compared to computer science, all traditional engineering fields present a slow decrease *(figure 3)*. Nanotechnology exhibits a spectacular growth, but this query does not reflect the multidisciplinary approach that is now almost prevalent in any engineering research or project. Somehow data does not reflect this (or I did not pose the right question). More important, our education system is still based on the traditional view of the different engineering fields. How to change this?

Finally, since lately I'm doing a lot of work on multiphase flows, I was curious to know what are the most common methods along time. The answer is charted below *(figure 4)*.

As we can see, volume-of-fluid and phase-field methods appeared around the same time, but with the seminal works on the 90's on level-sets, they are dominant now. However, phase-fields are gaining momentum due to their good mathematical properties. Again, how this will evolve?

All those remarks are very personal and of course subjected to strong criticism. The main purpose here is to call the attention of our community that data can provide a lens on the past and insights on the future. This, I firmly believe, associated to the predictive capabilities of our science has a tremendous transformative power. ●

Figure 4:
What are the most common methods along time



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A Comprehensive Mechanical Modeling Approach for the Design of Wood-Based Products

by
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Introduction and Motivation

Wood is a naturally grown material with excellent mechanical properties. Comparing mass density to representative strength value ratios of different common building materials, wood is a factor of three better than steel, considering tensile strength, and about ten times better than concrete, even with respect to compressive strength. Nevertheless, wood as structural bearing material is often countered with skepticism and therefore it is not used as extensively as its very good material behavior would suggest. Besides building physics and construction reasons, the main cause of this skepticism is the quite complex material behavior of wood, the huge variety due to hundreds of species and its strong inhomogeneity, resulting from branches and growth irregularities. Considering a sample of conventional timber beams of a certain grading class, the coefficient of variation (relative standard deviation) of its bending stiffness is about four times greater than that of steel and greater by a factor of six with regard to bending strength. Thus, to strengthen confidence in wood as load bearing material and to increase the competitiveness in comparison to other building materials, the following challenges can be formulated:

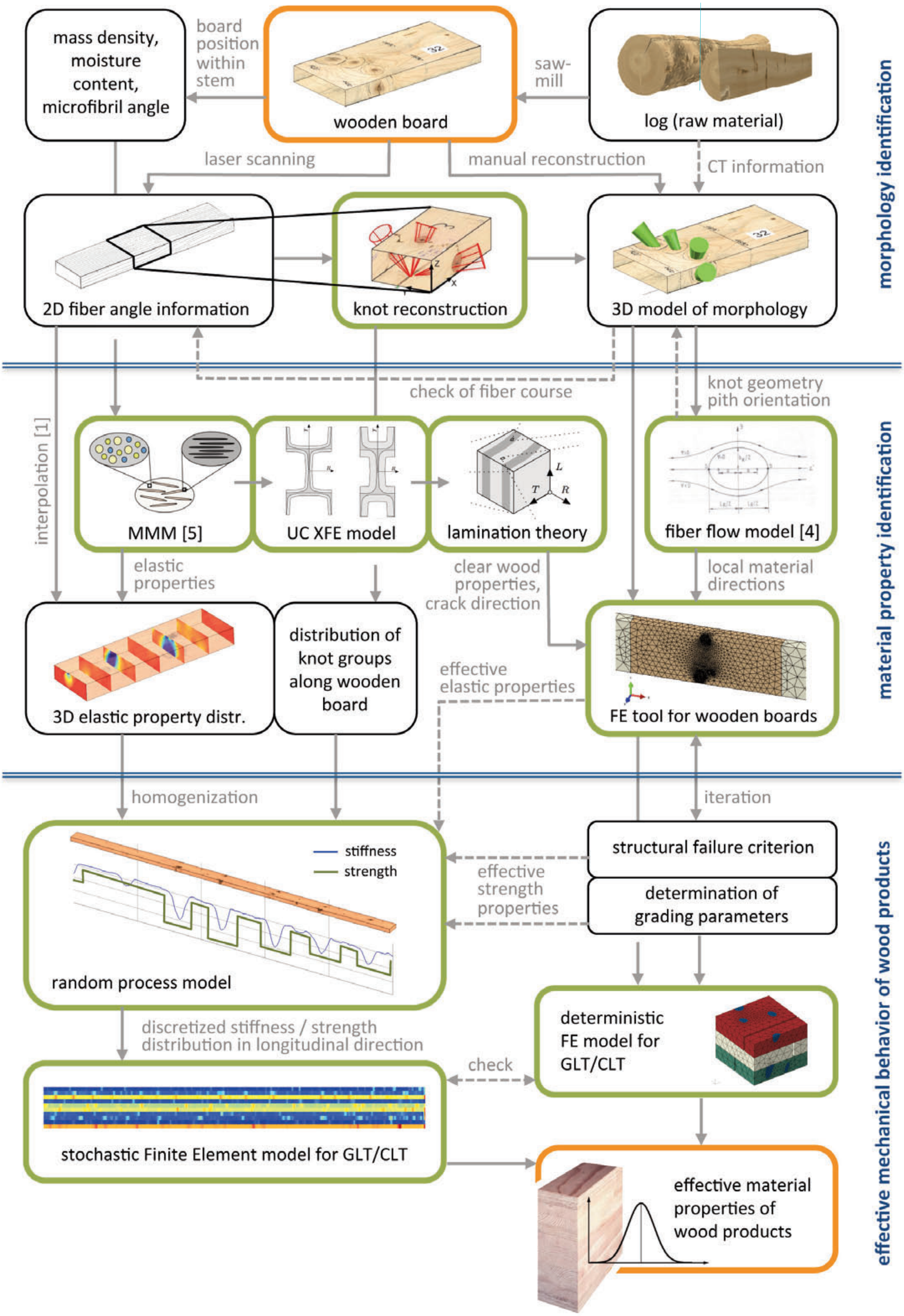
- Determination of the mechanical clear wood properties as a function of wood species and the location in the stem.
- Quantification of the influence of inhomogeneities (knots and knot groups) and growth irregularities (global and local fiber deviations) on the effective mechanical properties of timber boards.
- Consideration of the material variability within timber boards in general, and linking this variability to stochastic information of the effective properties of wood-based products.

Modeling Approach

A comprehensive modeling approach, covering all these points, was developed at the Institute for Mechanics of Materials and Structures of Vienna University of Technology (TU Wien). It is shown in *Figure 1* and explained in the following in more detail. Basically, the whole concept can be divided into three parts: (i) the identification of the timber board morphology, (ii) the identification of material properties at different scales of observation, and (iii) the determination of the effective behavior including variability of wood products.

The starting point of the proposed scheme is an individual wooden board (orange-framed box), produced in sawmills by cutting of logs (raw material), and the goal of the first part is a reconstruction of the board morphology as accurately as possible. This can be done in two different ways. On the one hand, 2D fiber angle information on all four surfaces of wooden boards was extracted from laser scanning data. From that surface information, a 3D fiber distribution can be approximated with appropriate interpolation methods (natural or nearest neighbor [1]).

Figure 1: *Modeling strategy of wood-based products at the Institute for Mechanics of Materials and Structures, TU Wien, Austria. Green-framed objects represent modeling tools, and black-framed objects input parameters, results, or processes. The two orange-framed objects indicate the starting point and the final goal, respectively*



mass density, moisture content, microfibril angle
board position within stem
wooden board
saw-mill
log (raw material)
laser scanning
manual reconstruction
CT information
2D fiber angle information
knot reconstruction
3D model of morphology
morphology identification
check of fiber course
knot geometry
pith orientation
interpolation [1]
MMM [5]
UC XFE model
lamination theory
fiber flow model [4]
material property identification
elastic properties
clear wood properties, crack direction
local material directions
3D elastic property distr.
distribution of knot groups along wooden board
effective elastic properties
FE tool for wooden boards
homogenization
iteration
stiffness
strength
random process model
structural failure criterion
determination of grading parameters
effective strength properties
discretized stiffness / strength distribution in longitudinal direction
check
deterministic FE model for GLT/CLT
stochastic Finite Element model for GLT/CLT
effective material properties of wood products
effective mechanical behavior of wood products

On the other hand, about 90 knot groups were reconstructed manually by scanning the board surfaces digitally and approximating knots with rotationally symmetric cones by means of a CAD program. A detailed description of this procedure can be found in [2,3]. A link between these two identification strategies is established by an algorithm which allows to extract the 3D knot geometry directly from surface fiber angle information, and thus, making the manual reconstruction obsolete. With the fiber flow model in [4], a 3D fiber course around the identified knots can be generated and finally a 3D model of the wooden board morphology is obtained. To verify the accuracy of this approximation, the fiber course at the surfaces could be compared to the derived values from laser scanning measurements. Using 3D morphological information as input to further analysis tools makes perfect sense with respect to the application of high-speed computed tomography for logs in future.

The second part of this concept aims at identifying mechanical properties of wooden boards based on the morphological information gained within the first part. From this point on, two different modeling strategies with different priorities must be distinguished. On one side, focus is laid on the stochastic nature of wooden boards, requiring simplifications regarding morphology and material behavior, and on the other side, the complexity of the material and the 3D geometry is taken into account very accurately, at the cost of material variability.

Without considering random variables, a numerical finite element (FE) model [2] was developed based on the 3D model of morphology described before. Within this model, the orthotropic elastic clear wood material properties with respect to the principal material directions are determined by means of a micromechanical model developed by Hofstetter et al. [5].

Figure 2: *Comparison of (a) numerically and (b) experimentally obtained maximum principle strains (upper images) and maximum principle strain directions (lower images)*

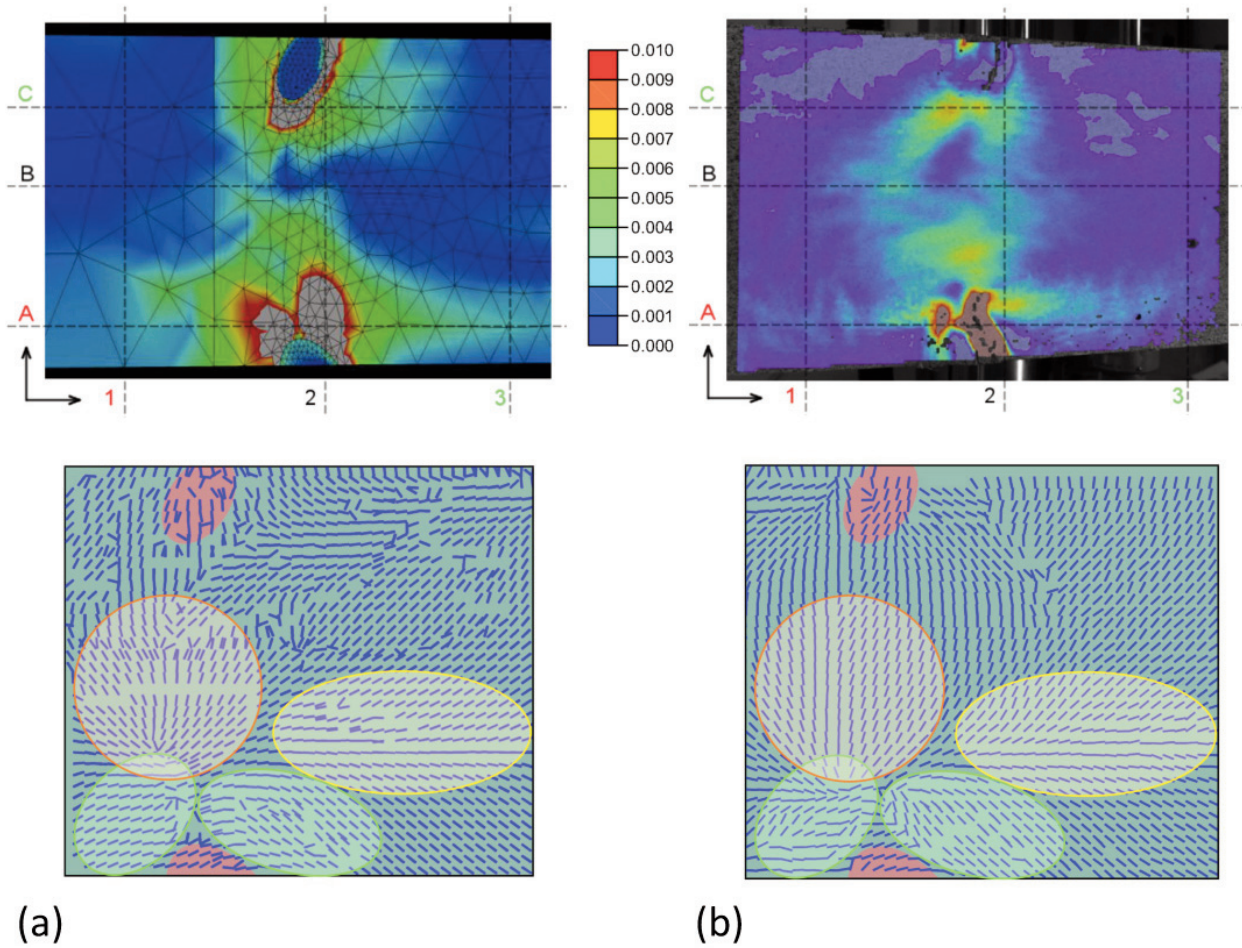
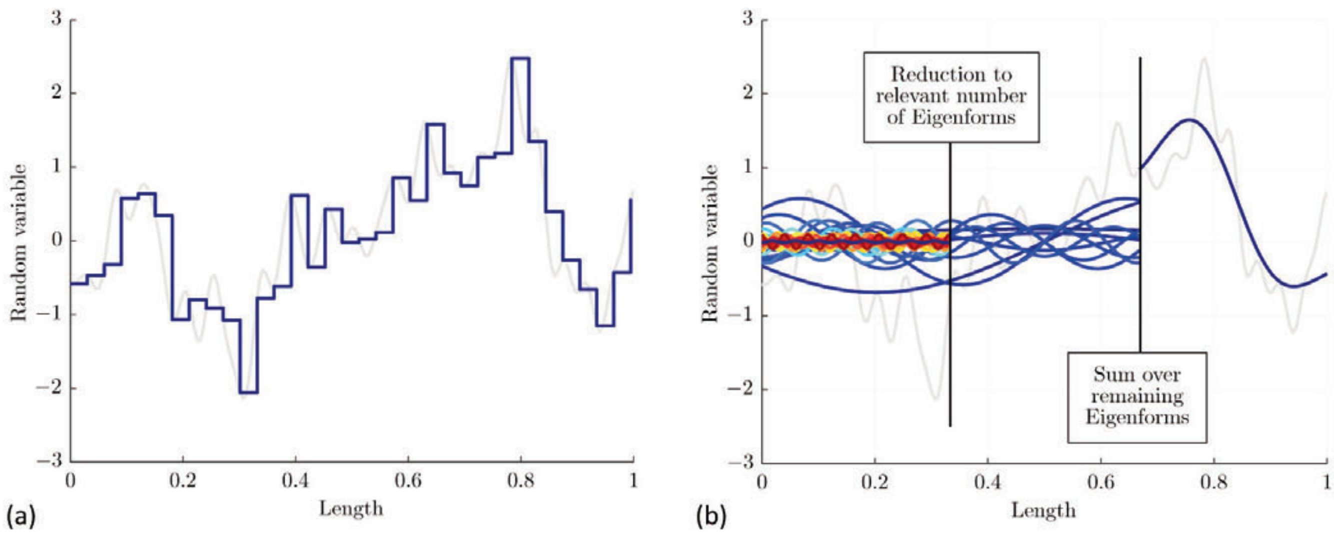


Figure 3:
Realization of a random process and its discretization using
(a) the midpoint method, and
(b) the Karhunen-Loéve expansion.



It allows the calculation of the stiffness tensor from a few universal nanoscaled constituents and from microstructural characteristics, such as mass density, moisture content, microfibril angle and volume fractions of hemicellulose, cellulose, lignin, and water. The failure criterion of Tsai and Wu for orthotropic materials is used to define local failure at the integration point level with perfect plastic behavior, using an associated flow rule. A comprehensive validation of this numerical simulation tool by means of full-field

deformation measurements is presented in [6]. In *Figure 2* a comparison between numerically and experimentally obtained principle strains and principle strain directions of a section of a timber board under four-point bending is exemplarily shown. Taking the high complexity of the material into account, strain peaks as well as the qualitative strain distribution could be reproduced very well.
For the prediction of structural failure a criterion based on the idea of mean stress approaches was developed, whereas the qualitative change of plasticized regions in the vicinity of knots is used as failure indicator and supposed to signal structural failure of the considered wooden board. In [2] this failure criterion is proposed and assessed by means of approx. 90 tests on wooden boards to failure, showing an error of R^2=0.79. To avoid such phenomenological-based approaches, current research focus lies on the implementation of crack initiation and evolution into the existing numerical simulation tool by means of the extended Finite Element (XFE) method. Preliminary results have already shown that crack initiation and crack directions can appropriately be identified by means of a unit cell (UC) XFE model at the cell level [8], and by considering the annual year ring structure of softwood this information can be upscaled to the wooden board level.

For the second modeling strategy, with the material variability as the main focus, the elastic stiffness tensor from the micromechanical model (MMM) is directly linked to an approximation of the 3D fiber course, obtained through interpolation of the 2D fiber angle information, leading to 3D elastic property distributions within wooden boards *(illustrated in Figure 1)*. Moreover, the knot reconstruction algorithm, mentioned within the first part, can be used to identify knot group distributions along wooden boards. Both distributions serve as input to a stochastic analysis tool, which will be described in the following.

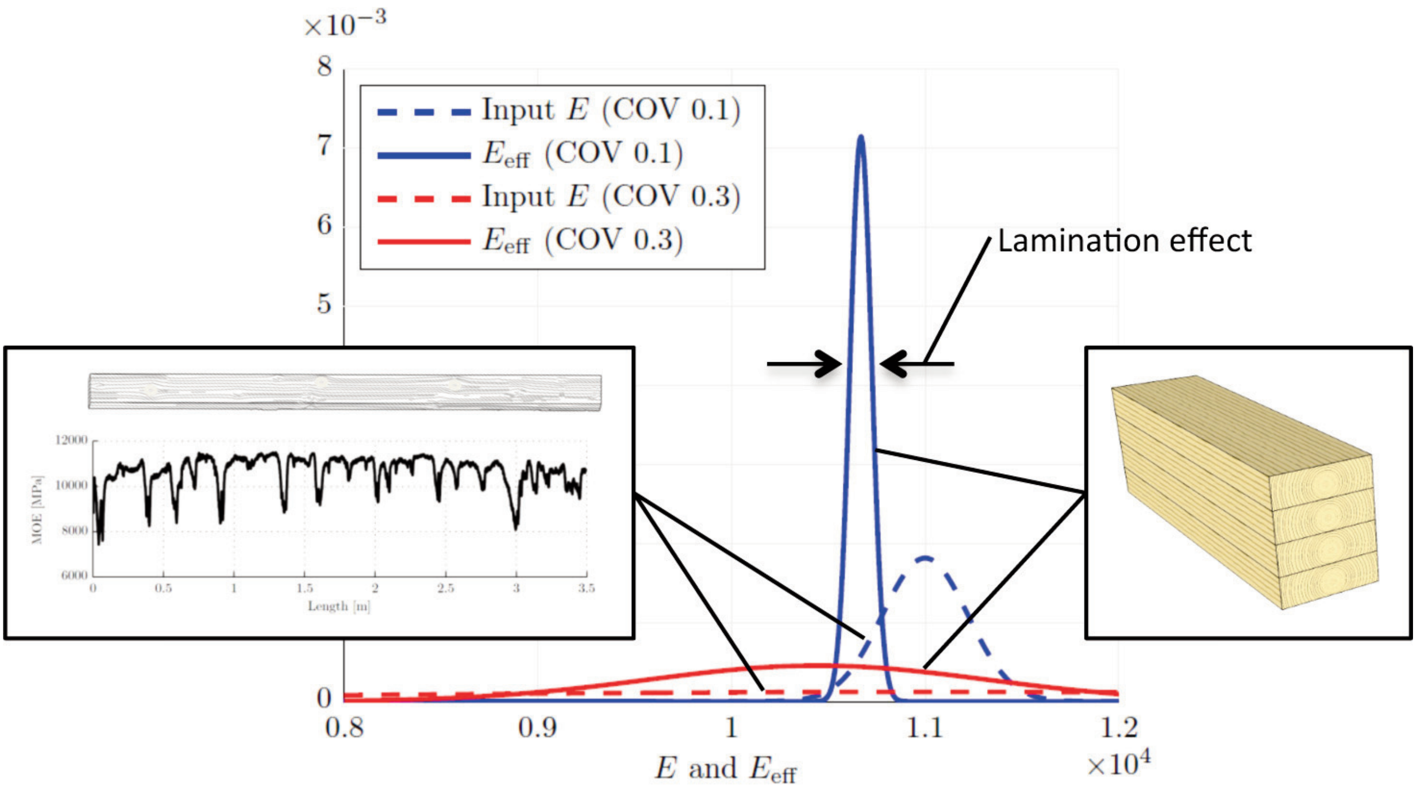
Part three of the concept *(the lower part of Figure 1)* deals with the determination of effective material properties and related stochastic information of wood-based products, such as glued-laminated timber (GLT) and cross-laminated timber (CLT). The stochastic approach consists of two parts: (i) The development of an appropriate random process model based on previously acquired data (realizations), in our case stiffness or strength distributions, and (ii) the implementation into a stochastic FE model where the mechanical and stochastic problem is coupled. The discretization of the generated random process can be done either with a spatial discretization method *(see Figure 3(a))* or using a serial expansion *(see Figure 3(b))*. These discretization methods were implemented into two different 'closed' stochastic FE formulations, (i) the perturbation method, where the stochastic system matrix and the response vector are expressed as Taylor series expansions, and (ii) a spectral approach, where the stochastic part of the system matrix is written as a sum of certain 'basis functions'. The application of these methods to a GLT element [7] has shown that both methods are able to capture important effects, such as lamination effects *(see Figure 4)*, and deliver appropriate effective stochastic information, similar to the Monte-Carlo simulation, but with much less computational effort.

Parallel to this, the deterministic FE model for wooden boards was extended to GLT and CLT elements. The more sophisticated material behavior and morphology considered in that model allows for a detailed investigation of failure modes and load transfer mechanisms within wood products. Furthermore, it makes a mechanical performance valuation of the stochastic FE model possible and allows an estimate of errors introduced by simplifications.

Summary and Conclusions

A mechanical modeling approach for wood-based products, depicting a comprehensive strategy from the log as raw material to the final GLT or CLT product, was proposed. Main focus was thereby laid on the identification of the 3D morphology of wooden boards, the determination of material properties at wooden board level and the stochastic modeling of wood products. Referring to the challenges mentioned within the motivation the following conclusions can be drawn:

Figure 4:
Longitudinal stiffness probability density functions (PDFs) for two classes of wooden boards and the corresponding PDFs for 4-layered GLT elements, showing much smaller coefficient of variations (COV), and thus, reflecting the so-called lamination effect.



- The application of a micromechanical model at cell wall level as well as an unit cell FE model at cell level allows for the determination of material properties depending on (micro) structural characteristics and therefore as a function of wood species. Additionally, the influence of clear wood density variations within a stem on the material properties can be taken into account.

- The performance of a 3D numerical model for wooden boards was validated by means of full-field deformation measurements on four-point bending tests to failure, showing that both, elastic strain fields as well as structural failure, can be predicted very accurately. The determination of effective material properties, taking the inhomogeneity of wooden boards into account, is thus possible.

- An automated identification of wooden board morphologies, using laser scanning data or possibly in the future data from computer tomography, delivers appropriate input for stochastic FE models. The error influenced by required simplifications regarding material behavior or morphology, respectively, should be assessed with deterministic models. A strong interaction between these two approaches ensures that reliable effective properties, including stochastic information, of wood products are obtained.

Continuous refinement of each tool, utilization of interactions, and exploitation of synergies between them, accompanied by thorough experimental validations, will finally lead to a comprehensive modeling approach, which can serve as strong basis for design concepts of wood-based products. ●

".... application of a micromechanical model at cell wall level as well as an unit cell FE model at cell level allows for the determination of material properties ...."

Acknowledgement
The authors gratefully acknowledge the financial support of the Austrian Research Promotion Agency (FFG) and the timber industry platform Building with Wood within CEI-Bois for funding the research project MechWood 2.

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Application of VR Technology to Computational Mechanics

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Introduction

The year 2010 was called as "the first year of 3D", because many 3D products such as 3D TV, 3D PC, 3D camera and so on have been developed and also many 3D contents have been released. This is based on the development of VR (virtual reality) technology related to binocular vision.

The application of VR is very wide such as in visualization, training, medical care, art and so on. The VR is also very useful for computational mechanics not only for visualization but also for all aspects in computational mechanics. This paper presents several application systems based on VR technology for computational mechanics to realize the high quality computing.

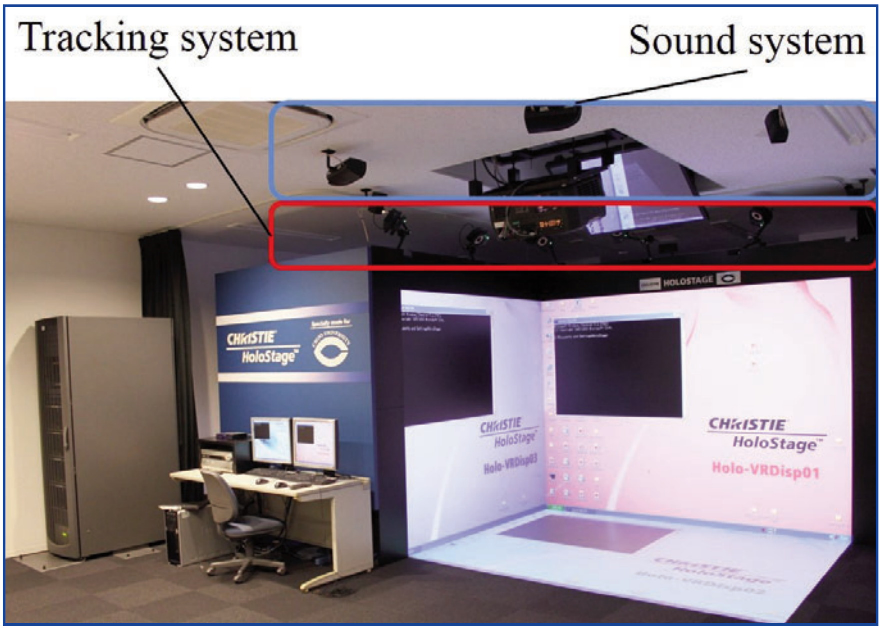
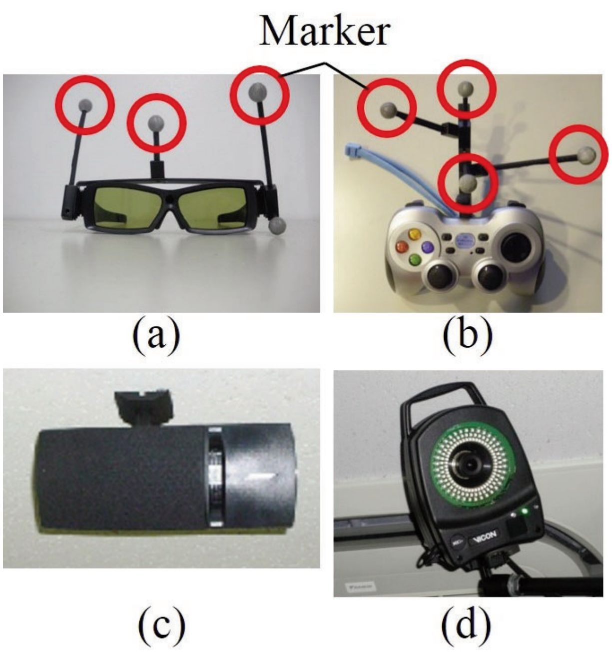


Figure1:
VR system "HoloStage"

VR Environments

The VR system based on binocular vision can be classified into two categories, HMD (Head Mounted Display) [1] and CAVE (CAVE Automatic Virtual Environment) [2]. Each system has merit and demerit. We introduced a CAVE system because it is easy to share the common VR space with multiple people. *Figure 1* shows the exterior view of the VR system "Holostage" of Chuo University, which consists of a PC cluster (one master-PC and four-slave-PC), three projectors, three large screens, a position tracking system and a sound system (7.1 ch.).

Figure 2 shows subsidiary devices
(a): liquid crystal shutter glasses,
(b): controller,
(c): speaker,
(d): tracker device.
The tracker device tracks the position of markers fitted to the liquid crystal shutter glasses and the controller. The stereoscopic image and sound from the arbitrary viewpoint of user are created in VR space.



Application to Pre- and Post-Processing

The large scale three dimensional simulations are becoming more powerful and popular in accordance with the development of computer hard- and software. However, the following problems are pointed out in pre- and post-process for practical computations as:

Figure 2:
Subsidiary devices

Figure 3:
A seen verifying the mesh quality

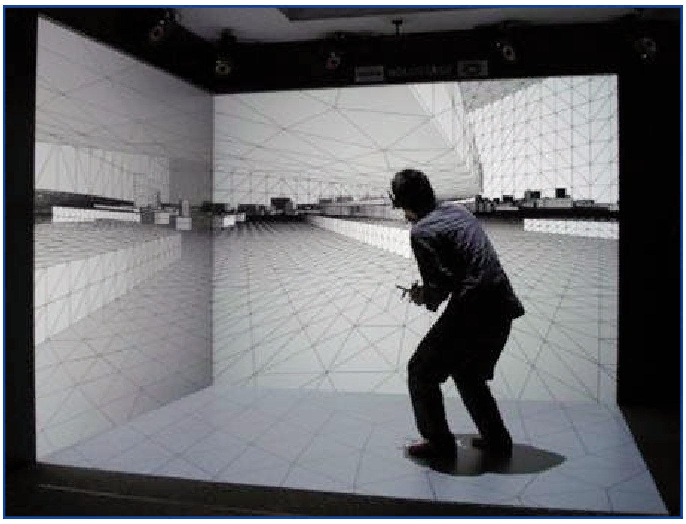
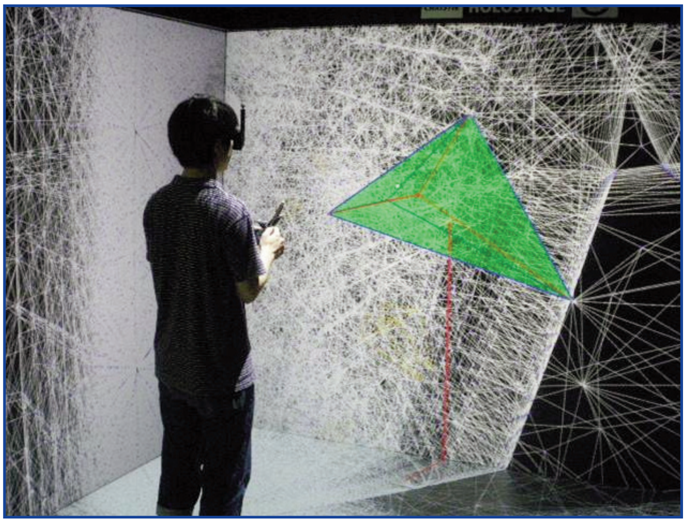


Figure 4:
Mesh modification by mesh refinement



1) it is difficult to check and modify the quality of mesh for the complicated spatial domain,

2) it is difficult to understand the three dimensional flow field accurately, especially to the depth direction, since the computational results normally express on the 2D screen or display.

We developed interactive pre- and post-processing systems based on VR technology for large scale three dimensional simulations in order to overcome above problems [3].

Those systems were developed by C++, Open GL and CAVE library.
A mesh modification system using node relocation and mesh refinement methods has been developed for the pre-processing system based on VR technology.

Figure 3 shows a seen user verifies the quality of surface mesh. *Figure 4* shows a scene user modifies the mesh idealization manually using the mesh modification system. Users can check the details of three dimensional mesh structures and modify the shape of mesh interactively in VR space. The numerical accuracy and stability can be improved by the mesh modification system.

On the other hand, a visualization system for unstructured grid has been developed for the post-processing system based on VR technology. The major visualization methods implemented to the system are

Table 1:
Major visualization methods

For Vector data	For Scalar data
Field Lines	*Isosurface*
Particle Tracer	*Local Slicer*
Local Arrows	*Ortho Slicer*
Spotlighted Particle	*Volume Rendering*
Strem Surface	*Probe&Graph*
Line Advector	
Probe&Graph	

Figure 5:
Visualization by using several methods

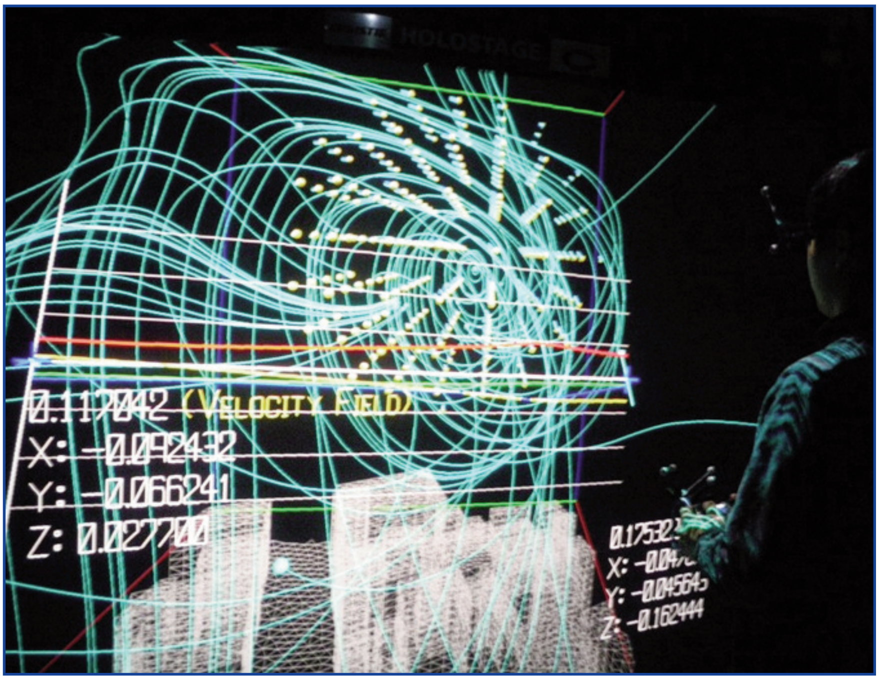


Figure 6:
Observation of Tsunami in VR space

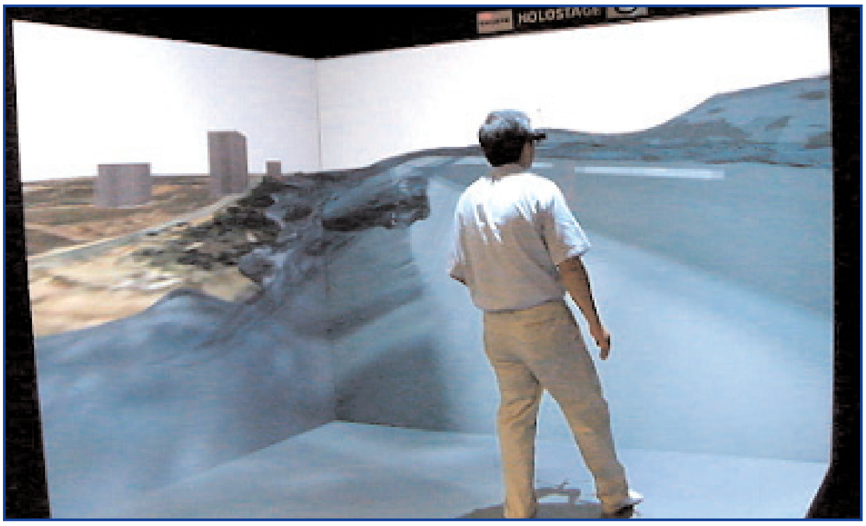
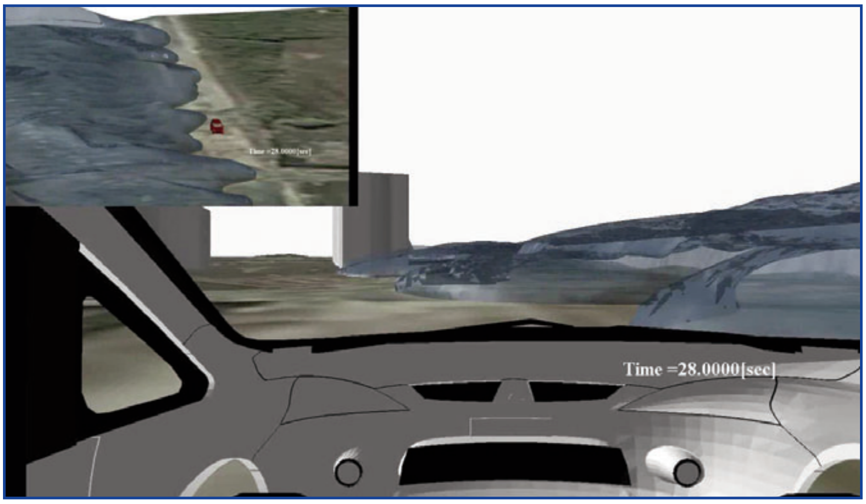


Figure 7:
View from the refugee by car



"... VR technology provides useful tools ... for large scale three-dimensional simulations, especially for safety and environmental problems."

listed in *Table 1*. For the visualization based on unstructured grid, it is necessary to find the element where the designated point is included quickly. A first search algorithm using bucket method and generalized coordinate system has been developed.

Figure 5 shows a scene user investigate the three dimensional vortex occurred behind the building by using several visualization methods "Field line" (which shows streamline), "Local Arrows" (which shows velocity vector) and "Probe&Graph" (which show vector and scalar values with graph function). Users can understand the three dimensional flow phenomena quantitatively by using the visualization system based on VR technology.

Application to Safety and Environmental Problems

A visualization system linked to evacuation simulation for tsunami disaster has been developed [4]. *Figure 6* shows a seen that the observer in VR space uses the system. The sound data of Tsunami wave has been implemented in the system.

Figure 7 shows the view from the driver's eye who evacuate by car. Users can experience the Tsunami disaster and understand the feeling of refugee. The present system is useful for the education to know the power of Tsunami and the importance of the evacuation.

We also developed an interactive simulation system for traffic noise using VR technology [5]. This system provides two presentation functions for computed road traffic noise level, visualization function and auralization function.

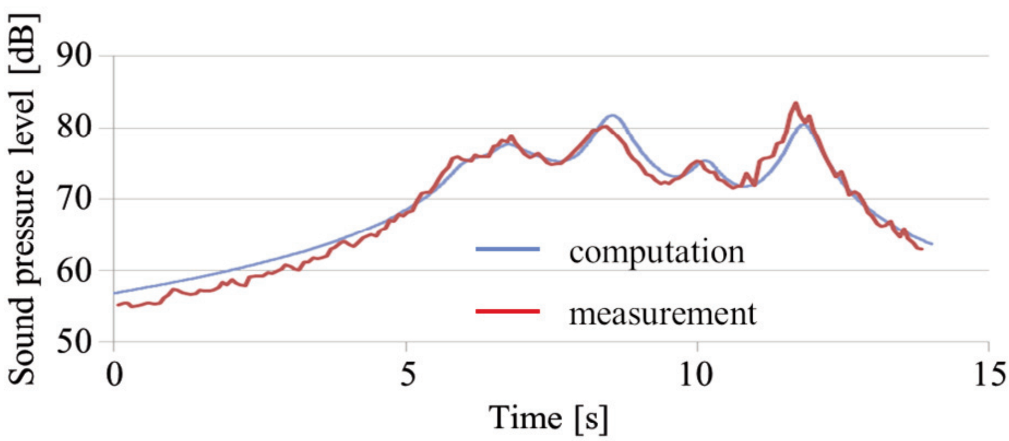


Figure 10:
Comparison of computational and measured results

The ASJ RTN-Model 2008, which is the Japanese standard model for road traffic noise, has been employed for the model based on the geometric acoustic theory. The auditory information of road traffic noise has been created using a visual program language MAX/MSP. The sound source data for the auralization in VR space has been prepared from the various vehicle driving tests.

The present system is applied to the traffic simulation with various type of vehicle as shown in *Figure 8* (vehicle velocity: 100km/h, pavement of road: drainage pavement, passage years of pavement: 0 year).

The computed results are compared with the measured results by the noise level meter (see *Figure 9*) as shown in *Figure10*. From this figure, it can be seen that the computational results are good agreement with the measurement. Users can easily understand the noise level by using the system. The present system is useful for planning and designing tool for road environment, consensus building for the local residents.

Figure 8:
Numerical conditions

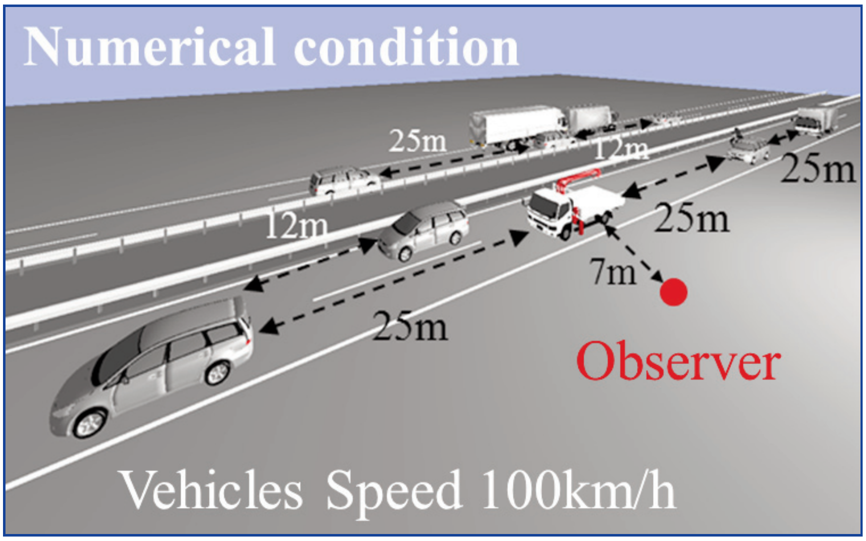
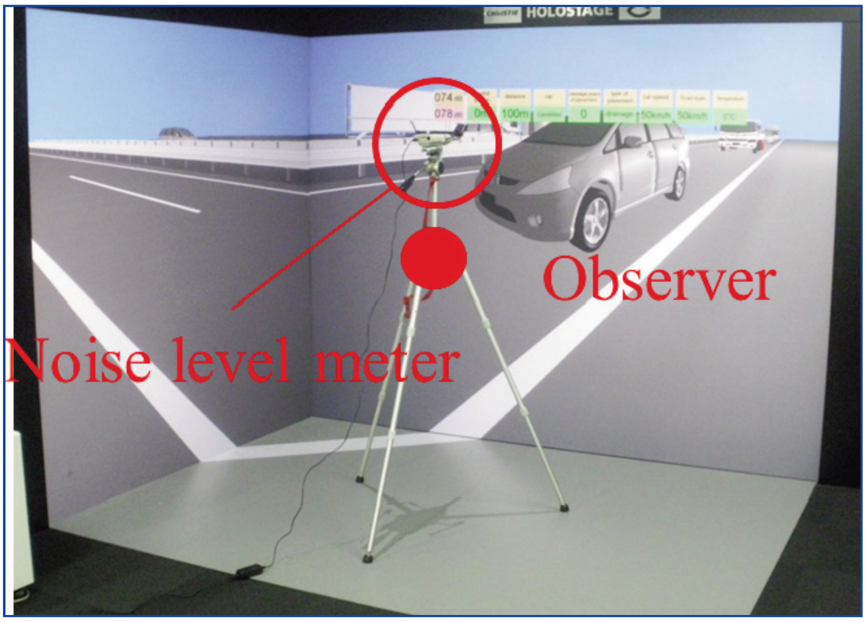


Figure 9:
Simulation in VR space



Conclusions

Several interactive application systems based on VR technology for computational mechanics have been presented. The VR technology provides useful tools to realize the high quality computing for large scale three-dimensional simulations, especially for safety and environmental problems. ●

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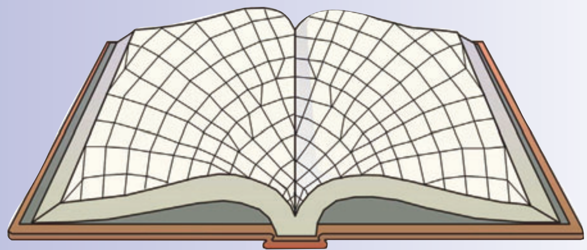
Computational Fluid-Structure Interaction: Methods and Applications



Yuri Bazilevs, Kenji Takizawa & Tayfun E. Tezduyar
Wiley, UK, 2013

BOOK REVIEW

ISBN: 978-0-470-97877-1, 384 pages, hard cover, £81.50 (List Price).
Contents: Preface; 1. Governing Equations of Fluid and Structural Mechanics; 2. Basics of the Finite Element Method for Nonmoving-Domain Problems; 3. Basics of the Isogeometric Analysis; 4. ALE and Space–Time Methods for Moving Boundaries and Interfaces; 5. ALE and Space–Time Methods for FSI; 6. Advanced FSI and Space–Time Techniques; 7. General Applications and Examples of FSI Modeling; 8. Cardiovascular FSI; 9. Parachute FSI; 10. Wind-Turbine Aerodynamics and FSI; References; Index.

I have always been impressed with the problems attacked and solutions obtained by the group of the third author, Tayfun Tezduyar, in Rice University. This group has been one of the leading groups that solve extremely complicated and important real life problems using sophisticated computational techniques. Their particular expertize has been Fluid-Structure Interaction (FSI) problems with moving boundaries and interfaces. Whenever I want to show students what computational mechanics can achieve today, I advise them to look up Tezduyar's web site. The second author has belonged to this group since 2007, and is also an independent researcher in Japan. The first author is an expert in isogeometric analysis, who is based in UCSD and has been collaborating with this group in recent years. Both are young researchers who already have a sophisticated and impressive volume of work under their names.

As expected, the book includes many impressive examples of this work. It can roughly be divided into three parts. Chapters 1 to 4 cover the infrastructure needed for the methods discussed. Chapters 5 and 6 present the computational techniques recommended for solving FSI problems. Chapters 7 to 10 discuss a variety of applications, including the process of balloon inflation, the flying of an insect, various cardiovascular problems, the behavior of parachutes of various kinds and wind turbine aerodynamics. These last chapters are scattered with results that exhibit a tour de force. Samples from the many beautiful figures that appear in these chapters are shown here. In fact, the entire book is very nicely edited, is full of illustrations, and has an extremely pleasing appearance.

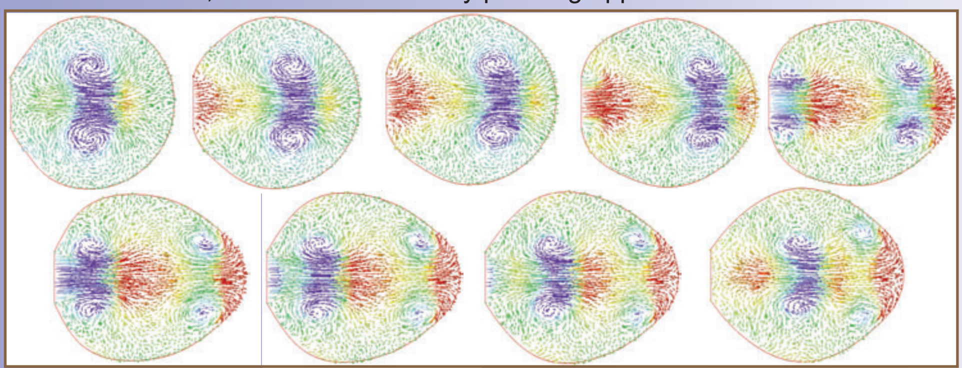
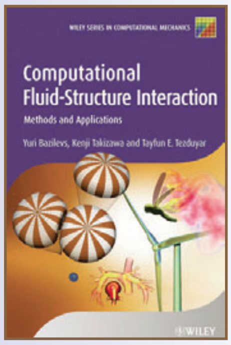


Figure 1:
Inflation of a balloon: velocity vectors colored by air pressure, from 2 to 4 sec. This figure appears as Fig. 7.12, p. 180, in the book



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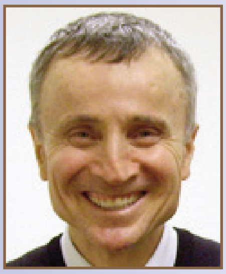


Tayfun Tezduyar

Figure 2:
Flight of an insect: vorticity at eight instants during the flapping cycle.
This figure appears as Fig. 7.26, p. 189, in the book

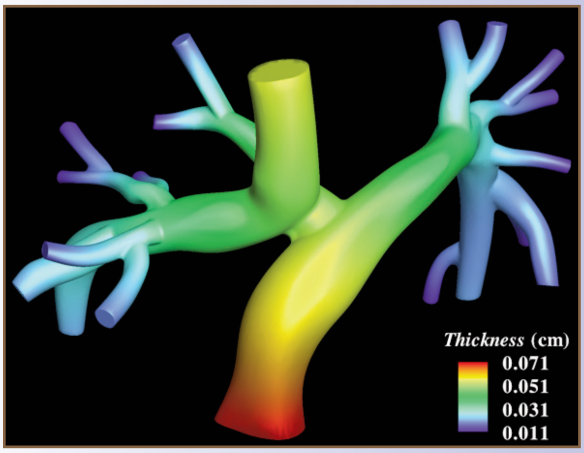


Figure 3:
Cardiovascular FSI analysis: reconstructed thickness distribution from inlet and outlet data for a patient-specific Fontan surgery configuration.
This figure appears as Fig. 8.3, p. 203, in the book

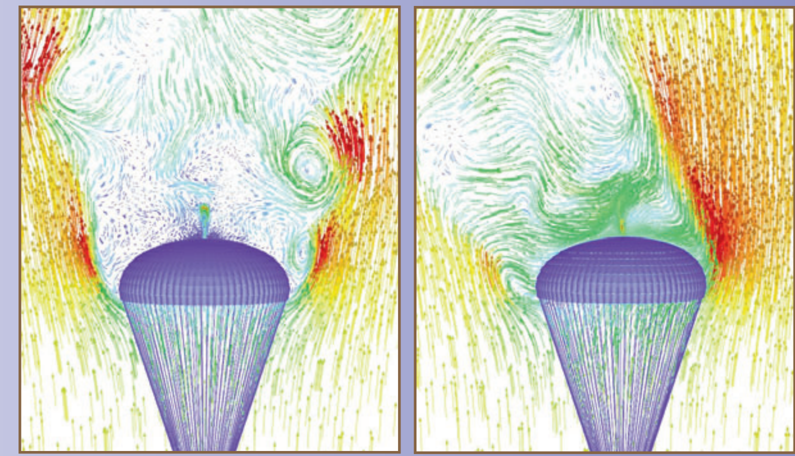


Figure 4:
Parachute shape and flow field at an instant during symmetric FSI (left) and asymmetric FSI (right).
This figure appears as Fig. 9.15, p. 276, in the book

The Preface summarizes very nicely the challenges entailed in computational FSI. It is remarked that the fluid mechanics modeling in this book is restricted to incompressible flows, due to the research interests of the authors. I have not found in the Preface a statement concerning whom this book is intended to and what background is needed. On the back cover it is stated that this book is a "comprehensive reference for researchers and practicing engineers…, (and a) text for graduate and senior-level undergraduate courses…"

My own judgment is that the reader is required to have basic knowledge of fluid mechanics (and the Navier-Stokes equations), of nonlinear solid mechanics (called here "structural mechanics"), of tensor notation (for example, the meaning of the tensor product symbol), and of the standard finite element method. It is true that Chapter 1 covers the "governing equations of fluid and structural mechanics,'' and that Chapter 2 covers the "basics of the finite element method.'' However, these chapters are written in a way that serves to *remind* the reader of these subjects, and to introduce the notation used later, rather than to *teach* these subjects to a reader who has never been exposed to them.

I will give a couple of examples to demonstrate this. The symbol S appears first in the principle of virtual work, eq. (1.79), and the text states: "Here S is the second Piola-Kirchhoff stress tensor which is symmetric and work conjugate to E." I suspect that for a reader who has never studied continuum mechanics this sentence would be almost cryptic, and the need for introducing this "strange" stress tensor S, which seems to be different than the familiar Cauchy stress σ, would be unclear. A second example is the presentation of the weak form of the Navier-Stokes equations, on p. 11. The text simply says "To derive the weak form of the fluid mechanics equation, following the

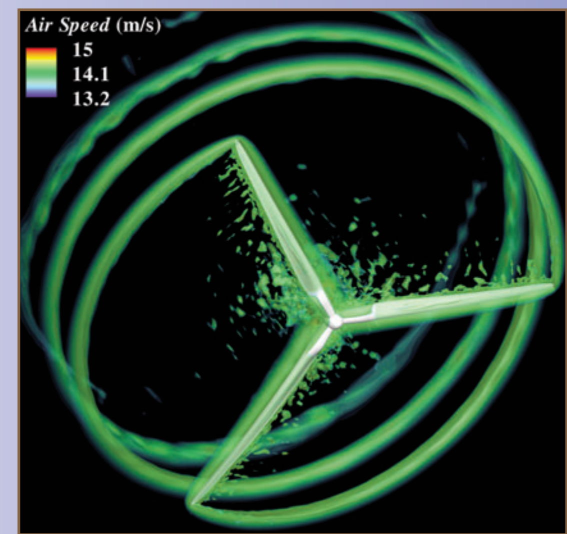


Figure 5:
Simulation of a wind turbine rotor: isosurfaces of air speed at an instant. This figure appears as Fig. 10.28, p. 344, in the book

standard approach, we multiply Eqs. … by the linear-momentum and continuity equations test functions respectively, integrate over …, and add the equations to obtain…" The reader encounters the terms "weak form" and "test functions" for the first time in this book. It is clear from this phrasing and from the very quick way in which the weak form is derived, that the authors assume the reader to be somewhat familiar with these basic concepts.

The weak form for the solid mechanics problem, eq. (1.80), is called here the "variational formulation," and no attempt is made to point to the analogy between the "weak form" of the fluid mechanics problem and the "variational formulation" of the solid mechanics problem. The reader is trusted to be familiar with these concepts, and to understand that the variational form is in fact a weak form. In section 1.2.9 thin-walled structures such as shells and cables are discussed. Again the reader is assumed to know quite a lot about shell theory, and this section mainly serves as a reminder. In any case, it would have been helpful to provide the reader with references to excellent books devoted to fluid mechanics, nonlinear solid mechanics, shell theory, tensor analysis and the finite element method. For the beginner, these subjects should be studied before starting to read the present book.

Chapter 2 includes, beyond a brief coverage of the standard Galerkin FEM, some less standard material, like FE treatment of the advection-diffusion problem, with and without SUPG stabilization, various stabilization techniques for the Navier-Stokes equations, Variational MultiScale (VMS), and Dirichlet conditions enforced weakly. Incidentally, acronyms are used a lot in the book, and their meanings are not always defined clearly. Some of the acronyms are quite long, such as SSTFSI-VMST (p. 123), DSD/SST-SUPS (p. 102), and SENCT-FC-M1 (p. 164). A reader encountering a certain acronym on p. 123 would have a hard time locating where it has been defined. If a second edition of this book is ever to be published, I suggest that the authors include a table of acronyms at the beginning.

The authors concentrate in this book on a certain collection of techniques which they have developed, investigated and implemented themselves. These techniques are based on certain space-time FE formulations, Arbitrary Lagrangian Eulerian (ALE) methods, certain stabilization methods, isogeometric analysis, and certain FSI coupling methods. Together these constitute a powerful tool box which allows solving realistic and very complicated FSI problems. Some other possible approaches and tools receive less attention. These include, for example, time-stepping methods applied to semi-discrete FE formulations (except for some short segments in various chapters), the work of Roger Ohayon's group on FSI for wave problems, the particle FE methods for FSI a là Oñate and Idelsohn, etc. In fact, I think it would be fair to say that the book is not intended to offer a comprehensive review on all existing FSI-related methods. Its strength is in presenting a certain tool box for FSI problems. Moreover, this is not an accidental tool box, but one which has proved itself very clearly and consistently as extremely viable and robust in solving FSI problems of a very high level of complexity.

Chapter 3 provides the essentials of isogeometric analysis, and Chapter 4 covers the basics of ALE and space-time FE methods, with and without the presence of moving boundaries and interfaces. Efficient methods for mesh updating are also discussed. Chapter 5 shows how to employ the methodologies of Chapter 4 to FSI. Chapter 6 introduces advanced FSI and space-time methods, developed mainly by the authors. These include advanced techniques for solving the nonlinear algebraic equations resulting from the discretization, the treatment of time using NURBS, space-time mesh control using NURBS, and a technique for contact between solids, that is relevant, e.g., to parachute problems.

As mentioned above, Chapters 7-10 provide a plethora of examples where the techniques covered by the previous chapters are employed in various applications. Whether the reader is interested in one of these applications or in another application not discussed here, she will definitely find here a clear demonstration to what these sophisticated techniques can achieve today.

In summary, this book is an excellent source to a reader who wants to get serious about solving realistic FSI problems, using a set of techniques that have proved themselves as powerful and robust. ●

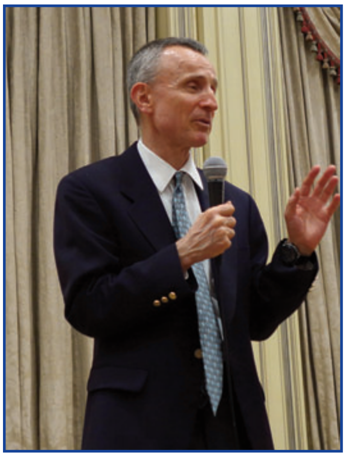
Advances in Computational Fluid–Structure Interaction & Flow Simulation

A Conference Celebrating the 60th Birthday of Tayfun E. Tezduyar

by
K. Takizawa
& Y. Bazilevs

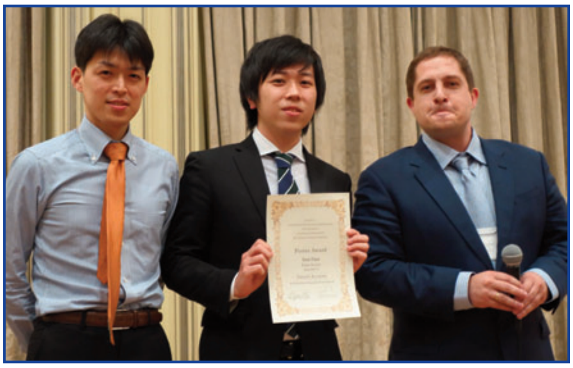
Advances in Computational Fluid–Structure Interaction & Flow Simulation (AFSI 2014)–A Conference Celebrating the 60th Birthday of Tayfun E. Tezduyar was held on March 19 – 21, 2014 in Tokyo, Japan. Kenji Takizawa (Waseda University) and Yuri Bazilevs (UC, San Diego) were the conference co-chairs. The conference technical program took place in the Green Computing Systems Research and Development Center at Waseda University, which is Japan's premier private university. Over 70 people attended the birthday conference, and over 60 talks were delivered as part of the conference technical program (see http://www.tafsm.org/TET60/).

The main objective of AFSI 2014 was to celebrate the exemplary research achievements of Tayfun Tezduyar in computational mechanics, and his impact in the community at large. The main technical focus of the conference was on methods and applications of computational fluid mechanics and fluid–structure interaction, Tayfun Tezduyar's main research areas. Other areas, such as computational mathematics, solid and structural mechanics and materials, and geometry modeling and mesh generation, were also represented at AFSI 2014, and indicative of the breadth of Tayfun Tezduyar's impact in the community. While the conference program featured technical presentations from highly-cited, well-established senior members of the international community, many presentations were also given by young, dynamic, and already visible researchers, a testament to the likelihood that Tayfun Tezduyar's work will live on for many generations to come.



AFSI 2014 also featured a two-day post-conference short course on computational fluid–structure interaction, taught by the conference co-chairs and Tayfun Tezduyar, and a student poster competition held during the conference.
While many excellent research posters were presented at the competition, the following were chosen, with the votes of the conference participants, to be the winning posters: First Place went to Mr. Takashi Kuraishi for a poster titled "Multiscale Thermo-Fluid Analysis of Tires at Road Conditions," Second Place went to Mr. Daiki Matsunaga for a poster titled "Rheological analysis of dens capsule suspension under Stokes flow condition," and Third Place went to Mr. Yuuki Tsutsui for a poster titled "FSI Analysis for JAXA Subscale Parachutes."

The social program of AFSI 2014 consisted of a welcome reception and a conference banquet, both held at the Rihga Royal Hotel Tokyo, located on the edge of Okuma Garden at the Waseda University campus. Partial sponsorship from Waseda Institute for Advanced Study, Advanced Multicore Processor Research Institute, Japan Association for Computational Mechanics, Explosion Research Institute Inc. and Morikita Publishing Co., Ltd. helped raise the quality of the social program. The banquet was especially festive, featuring presentation of the student poster competition awards, a humorous yet impressive account of Tayfun Tezduyar's career by Tom Hughes (UT, Austin), and concluding remarks by the guest of honor that were filled with gratitude and warmth. ●



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5th GACM Colloquium on Computational Mechanics

The fifth GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry was held on the campus of the Hamburg University of Technology from September 30 to October 2, 2013. Three outstanding keynote lectures, 160 innovative presentations and 40 very well-designed posters paved the way to a successful colloquium, which was blessed by the sunniest weather Hamburg is able to offer. The colloquium opened with the keynote lecture entitled "From FEA to IGA: Computational Challenges" given by Prof. Robert L. Taylor (UC Berkeley). Tuesday started with the keynote lecture delivered by Dr. Christian Cabos from Germanischer Lloyd, who presented a summary of the applications of computational mechanics in the structural analysis of ships. The scientific part of that day closed with Dr. Bojana Rosic's plenary talk on the occasion of the newly established GACM Best PhD Award. In the afternoon, the colloquium participants were brought by ferry to the banquet venue, passing the main attractions of Hamburg Port and a couple of the world's largest container vessels. The third keynote lecture on "Fusing differential geometry into computational contact mechanics" was given by Prof. Karl Schweizerhof (Karlsruhe Institute of Technology) on Wednesday. After three days of fruitful scientific exchange, this very successful fifth edition of the GACM Colloquium conference series came to an end. ●

Figure 1:
The participants of the 5th GACM Colloquium on Computational Mechanics held on the campus of the Hamburg University of Technology

GACM Best PhD Award 2012 & GACM Best Poster Awards

At the last general assembly of GACM the member body of GACM voted with one accord for a proposition brought in by the president and the executive council to not install awards for senior researchers but to establish an award for young academics, namely the GACM Best PhD Award. The first such award was confered at the GACM Colloquium 2013 in Hamburg and the awardee is Dr.-Ing. Bojana Rosic for her thesis "Variational Formulations and Functional Approximation Algorithms in Stochastic Plasticity of Materials". The PhD work of Dr. Rosic led to a joint doctoral degree from TU Braunschweig and the University of Kragujevac and has been performed under the academic supervision of Prof. Herrmann Matthies and Prof. Miroslav Zivkovic. As awardee Dr. Rosic was also invited to give a plenary lecture at the GACM Colloquium 2013 and all colloquium partcipants could witness an impressive presentation.

During the GACM Colloquium in Hamburg again a poster competition took place. The jury consisting of the plenary lecturer of the colloquium, the conference chairman and the GACM President had a hard time to choose from a number of outstanding posters. Finally the decision was to confer three awards. The first prize went to Florian Hindenlang from the University of Stuttgart for his excellent poster contribution “Discontinuous Galerkin for High Performance Computational Fluid Dynamics“. The second prize went to Severin Schmitt from the Karlsruhe

ECCOMAS Young Investigators Conference and GACM Colloquium 2015

We would like to invite you to join us for the YIC GACM 2015: July 20-23, 2015 in Aachen, Germany. This Young Investigators Conference (YIC) will be the third conference of its kind organized in partnership with ECCOMAS (European Community of Computational Methods in Applied Sciences). On this particular occasion, we have the opportunity to hold the conference in conjuction with the GACM (German Association of Computational Mechanics) Colloquium. As a new series of scientific events, the YIC focuses on bringing together young researchers to discuss, learn, and collaborate. Senior scientists are also welcome of course to share their ideas and encourage the discussion.

Photo: *Peter Winandy*

Contributions to any topic of scientific interest within computational science and engineering are welcome. The main areas, however, are the following:

- Computational Applied Mathematics,
- Computational Engineering Science,
- Computational Fluid Dynamics,
- Computational Materials Science,
- Computational Solids and Structural Mechanics,
- Scientific Computing.

As a conference designed by young researchers for young researchers, we will offer a variety of highlights such as a Science Slam, Journal Club, and numerous social events, thus nurturing the networking idea behind the conference. In addition, we will host the ECCOMAS PhD Olympiad of 2015.

We are very happy to be able to announce that the event will be held in direct sequence with the AC.CES conference (www.ac-ces.rwth-aachen.de), organized by the graduate school AICES of RWTH Aachen. In contrast to the YIC and the GACM Colloquium, the concept of the AC.CES is based on invited speakers with high international recognition in their particular fields. We will offer an optional combined package, giving participants the opportunity to profit from both conferences. ●

Please visit our website for further details: **www.yic.rwth-aachen.de.**

Figure 2:
GACM Best PhD Awardee 2012 Bojana Rosic with Wolfgang A. Wall (GACM President) and Marek Behr (Head of GACM Award Committee)

Institute of Technology for his excellent poster contribution “Towards a Dislocation based Continuum Theory of Plasticity“ and the third prize to Ajay B. Harish from the Leibniz University Hannover for his excellent poster contribution “Computational Implementation of Finite Thickness Non-Local Cohesive Zone Element for Crack Propagation in Filled Elastomers“. ●

Figure 3:
GACM Best Poster Awardees Severin Schmitt, Florian Hindenlang and Ajay B. Harish with Robert L. Taylor (Plenary Lecturer) and Wolfgang A. Wall

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IGA 2014:

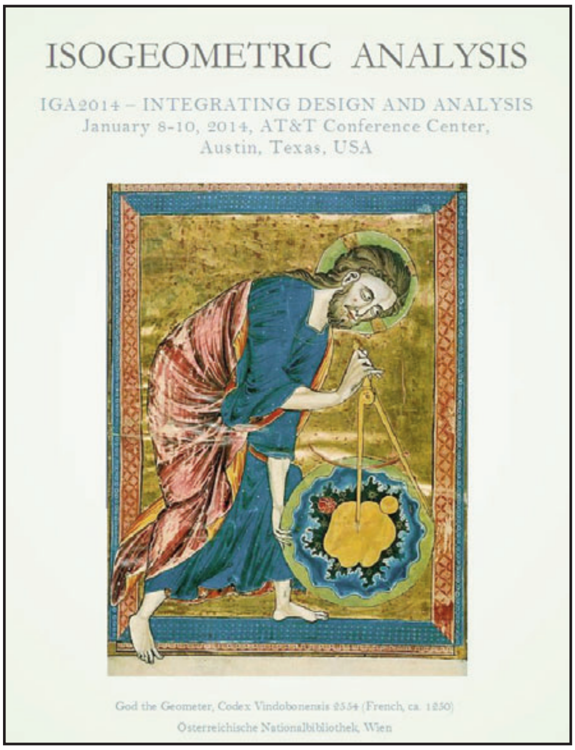
Isogeometric Methods – Integrating Design and Analysis

http://iga2014.usacm.org/

January 8th to 10th, 2014, the second ICES (Institute for Computational Engineering and Sciences) and USACM (United States Association for Computational Mechanics) Thematic Conference on Isogeometric Analysis was held at the outstanding AT&T Conference Center (http://www.meetattexas.com) on the campus of the University of Texas at Austin. The organizers were Yuri Bazilevs, David Benson, Tor Dokken, Tom Hughes, Trond Kvamsdal and Alessandro Reali.

Despite historically horrendous weather at the time in the United States, which severely impacted air travel, the conference was very well attended. There were 108 registrants including 37 doctoral and post-doctoral students. Following the format of the first conference in 2011, there were 72 presentations of one-half hour each, and two simultaneous parallel sessions each day. A student poster competition was held and there were 12 entries. Professors J. Tinsley Oden and Leszek Demkowicz served as judges. The two winners, who received award certificates and cash prizes, were Artem Korobenko of the University of California, San Diego and Guillermo Vilanova Caicoya of the University of A Coruña, Spain. The conference was highlighted by considerable time for the attendees to interact and exchange ideas during extended breaks, an organized luncheon each day, and enjoyable social events, including a welcome reception the night before the conference, a reception during the poster competition the first evening of the conference, a gala banquet the second evening, and a closing dinner the third night.

Figure 1: *Conference Poster*



Isogeometric Analysis has become a focal point of research in the CAGD (Computer Aided Geometric Design) and FEA (Finite Element Analysis) communities. It was clear from the many excellent presentations that much progress has been made since the first conference in 2011 and that the goal of Isogeometric Analysis, to fully integrate geometric design and engineering analysis, and thereby eliminate an enormous bottleneck in product development presently accounting for more than 80% of overall analysis time, is well on its way to being achieved. ●

Thomas J.R. Hughes
Austin, April 1, 2014

Figure 2: *The Austin, Texas skyline, site of IGA 2014*

Multiscale Methods & Validation in Medicine & Biology – Biomechanics & Mechanobiology - II
Berkeley, California

The second USACM Thematic Conference on Multiscale Methods and Validation in Medicine and Biology-Biomechanics and Mechanobiology, was held in Berkeley, California on **February 13-14, 2014**. The organizers were Ellen Kuhl, Krishna Garikipati, Kranthi Kiran Mandadapu, Panos Papadopoulos, Padmini Rangamani and Tarek I. Zohdi. The conference had 42 participants.

The conference focused on the study of the interactions of physical forces with biological systems at all scales, including molecular, cellular, tissue, organ, and species levels. It focused in particular on the linking of disparate spatial and temporal scales using experimentation, image analysis, visualization, and computing to investigate problems in biological and medicine science and technology.

Several discussions were related to state-of-the-art research in computational sciences which investigate phenomena in Biomechanics and Mechanobiology. Particular emphasis was placed on novel techniques in computing, experimentation, visualization, and multidisciplinary research approaches that demonstrate successful synergies; computational reconstruction of experimental findings; and experimental and visualization techniques that support verification and validation of computational models. ●

Figure 3:
Participants chatting during the coffee break

Figure 4:
During one of the conference presentations

USACM Upcoming Events

- **USACM Workshop on Meshfree Methods for Large-Scale Computational Science and Engineering: Theory and Applications of Galerkin and Collcation Methods**
  October 27-28, 2014, Tampa, Florida; http://mmlcse2014.usacm.org/
- **4th International Conference on Material Modeling**
  May 27-29, 2015, Berkeley, California; http://icmm4.usacm.org/
- **13th U.S. National Congress on Computational Mechanics**
  July 26-30, 2015, San Diego, California; http://13.usnccm.org/

Computational Structural Mechanics Association

11th National Conference on Computational Structural Mechanics

Between May 13 and 17, 2013, the Computational Structural Mechanics Association (CSMA) organised its biannual conference. For 20 years, it has been held in the Giens peninsula (on the French Riviera) as a way to both ensure beautiful weather conditions, and feel the pulse of research in the field of computational mechanics

The conference is co-organised by two laboratories of the Ecole Nationale Supérieure des Mines (Paris), under the supervision of E. Massoni (CEMEF): the Centre de Mise en Forme des Matériaux (CEMEF) in Sophia-Antipolis and the Centre des Matériaux (CDM) located in Evry. It is therefore easy to understand that materials and their modelling were at the heart of general preoccupations. Hence the key topics: modelling; behaviour and damaging; reliability and optimization; methods and techniques for resolution; dynamics, interactions and coupling; applications. In addition to these (14 thematic sessions & 125 papers), there were six symposia organised by the researchers in order to throw light onto some major trends: fluid-structure interaction (11 papers), heterogeneous material behaviour and rupture (18 papers), numerical methods for variable separation and model reduction (31 papers), structural analysis in bioengineering (14 papers), coupling discontinuous and continuous models (7 papers), multiphysical problems with thermomechanical and electromagnetic couplings (10 papers).

Added to these technical sessions, the conference included 6 plenary sessions, plus 1 centred on our best young researchers, another dedicated to software demonstration and yet another gathering about fifty poster presentations. Not to mention what is so delightful about Giens: the emphasis on friendliness and social interactions. The conference programme was established with more than 300 proposals selected by a panel chaired by P. Suquet (LMA-Académie des Sciences), attended by an industrialist, B. Mahieux (SNECMA) et E. Massoni (CEMEF) representing the organisation laboratories. The 2013 conference gathered about 400 participants and received support from the following companies: ALINEOS, ALTAIR, EADS-IW, EDF, IRSN, SNECMA, TRANSVALOR.

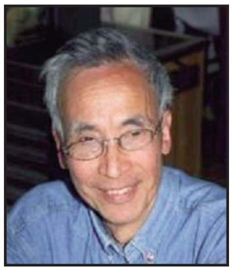
Plenary sessions: J. Buffe (TAS) presented a few *Reflections on the Assessment of the Right Functional Behaviour of Satellites Submitted to Mechanical Environments*; it was the occasion to mention the necessity to prove the functional character of satellite structures (prototype) taking into account the static or vibratory prompting in zero-gravity. S. Andrieux (EDF R&D) presented the [many] *Issues of Modeling and Simulating for the Production of Electricity*. This production comes in various shapes: of course nuclear plants, but also hydraulic, wind, solar, and thermic sources of energy. Thanks to simulation, the balance between energy production and consumption can be made optimal. Speaking perfect French, A. Huerta Cerezuela (LaCàN-Barcelone) made an observation in *Improving Numerical Efficiency with Model Reduction and High-Order Discontinuous Galerkin for Wave Problems*. He noted that numerical simulation has to face two apparently contradictory challenges. On the one hand the necessity to make do with a just-in-time trend, on the other, the need to have results that are as reliable as possible. Those two aims could be reconciled through the notion of computational vademecum.

The presentation made by O. Pironneau (LJLL-Paris) was entitled Intensive Analysis: *What's up in the Field of Engineering Science?* It takes stock of the six-year long activity of the CSCI (Strategic Council for Intensive Analysis) whose aim is to restore France's scientific competitiveness on the international scene in this crucial field for research and industry. Through the presentation of N. Triantafyllidis (LMS-Palaiseau), *Stability of Active Materials: the Role of Microstructure*, what is addressed is the multiphysical problems encountered for many years when dealing with many manufacturers (PSA, FORD, ALCOA…). He concluded with: the mechanics of continuous environments may solve many technological problems and the multiphysical problems should appeal to a growing number of talented researchers. In his presentation entitled *Thermomechanical Imagery and Scale Changes as Tools to Identify Models of Cohesive Zones*, S. Pagano (LMGC-Montpellier) submits original techniques for the identification of thermomechanical properties serviceable on test tubes made of real material.

Mini-Symposia & Thematic Sessions: The amount of presentations (more than 200 of them, many of which of very high quality) reflects us the energy and openness of our laboratories.
Fluid-Structure Interaction Symposium - It was put up by E. Hachem (CEMEF-Sophia), P. Le Tallec (LMS-Palaiseau) et R. Ohayon (LMSSC-Paris) and gathered 11 conferences.
Heterogeneous Material Behaviour and Rupture Symposium - It was organised by S. Forest (CDM-Evry) and Y. Monerie (IRSN-Cadarache, now LMGC-Montpellier) and gathered 18 conferences.
Numerical Methods for Variable Separation and Model Reduction Symposium - It was put up by D. Ryckelynck (CDM-Evry), F. Chinesta (GEM-Nantes) and F. De Vuyst (CMLA-Cachan) and gathered 31 conferences.

Structural Analysis In Bio-engineering Symposium - It was organised by Y. Tillier (CEMEF-Sophia) and P. Chabrand (ISM-Marseille) and gathered 14 conferences.
Discrete and Continuous Models Coupling Symposium - It was put up by H. Ben Dhia (MSSMat-Châtenay-Malabry) and M. Renouf (LMGC-Montpellier) and gathered 7 conferences.
Multiphysics Problems with Thermomecanical and Electro-magnetics coupling Symposium - It was organised by N. Triantafyllidis (LMS-Palaiseau) and O. Hubert (LMT-Cachan) and gathered 10 conferences.

H.D. Bui



Twelve Thematic Sessions: *Thin Structures* (6 conferences), *Numerical Methods and Coupling* (9 conferences), *Behaviour* (20 conferences), *Vibration* (9 conferences), *Contact* (6 conferences), *Optimization* (7 conferences), *Dynamics* (14 conferences), *High Performance Computation* (4 conferences), *Damaging & Structures* (14 conferences), *Probabilistic Mechanics* (7 conferences), *Enriched Elements* (7 conferences), and finally Identification (11 conferences). This session included the presentation which reminds us fondly of H.D. Bui (member of both the Academy of Sciences and the Academy of Technologies) who died on 29 May 2013, aged 76. All the attendees can testify to his skill, availability, kindness and his modesty.

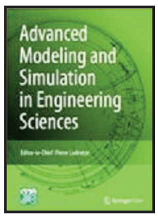
CSMA Prize: The best two PhDs defendes in 2012 were *High-Performance Computing of Sintering Process at Particle Scale* by D. Humberto Pino Munoz (LTDS-Saint-Etienne) and *Efficient Finite Element Approach for Structural-Acoustic Applications Including 3D Modelling of Sound Absorbing Porous Materials* by R. Rumpler (LMSSC-Paris). Those two prize-winners come after V. Yastrebov (CDM-Evry) for *Numerical Mechanics of Contact: Geometry, Detection and Techniques for Resolution* and F. Guinot (LMA-Marseille) for *Regulated Deployment of Spatial Structures: Towards an Unidimensionnal Model of Composite Meter-Ribbon*.

Software Session: About 15 research softwares were presented during a fairly hectic evening: a 200 sq m room contained computers, monitors and most conference-participants. In this atmosphere of excitement, the champions of the field gave demos: CAST3M, FORGE, GMSH, GRANOO, LMGC90, OPENFEM, SALOME-MECA, Z-set. Approaching an industrial level, they come back every year and promote the upgraded and new features to be seen on their respective websites. More specific tools were also presented, such as an adaptation of isogeometry to ABAQUS: ABQ-Nurbs or a first code dedicated to Proper Generalized Decomposition, iPGD.

Poster Session: Introduced during a plenary session by G. Cailletaud (CDM-Evry), this session madeit possible to communicate about one's research in a new way: the 20-minute presentation was replaced by a two-hour question time. This year, the conference organisers fairly decided to give a reward to the best poster: *Simulating the Sintering of Doped Materials and Multimaterials on the Scale of a Grain Piling* by H. Tossoukpe (ENSM-Saint-Etienne).

Social Interaction: It is part and parcel of the conference and hugely contributes to the delight and the warmth noticed a nd enjoyed by every one at the conference: the residence, the opening & closing cocktail receptions, the dinner, the day trip to Porquerolles are the little side orders without which the taste of Giens wouldn't be the same! Which facilitate studious conversations that sometimes last very long over a drink shared by PhD students and professors.

2015 Conference: The organizing committee was a West's team gathering the following laboratories: LGCGM (Rennes), LAMPA (Angers), LASIE (La Rochelle), GEM (Nantes), LIMATB (Lorient) and LBMS (Brest). The 12th conference will also be held in Giens.



New journal: In June 2012, the CSMA launched a new international journal: AMSES , *Advanced Modeling and Simulation in Engineering Sciences*. This open-access peer-reviewed scientific journal, is published by Springer and widely funded by CSMA. It encompass issues of modelisation, simulation, plus interactions with trials, which are essential to modelisation, characterisation and validation – not to mention related subjects..The editor, Prof.P. Ladevèze, was chosen by CSMA's board. He is assisted by an international committee of 7 associated editors in which the CSMA is represented by F. Chinesta.

As a Conclusion: The Giens conference has long been a must-go event which displays the dynamism in digital mechanic research by gathering the younger researchers, scientific leaders and the industry. Although hiding behind academic presentations, industry is the fuel of research, supporting most of the fields tackled in Giens. The conference thus plays the part of the missing link and the communication channel between research and industry. ●

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APCOM / ISCM 2014

5th Asia Pacific Congress on Computational Mechanics (APCOM V) and 4th International Symposium on Computational Mechanics (ISCM VI)

The 5th Asia Pacific Congress on Computational Mechanics (APCOM V) and the 4th International Symposium on Computational Mechanics (ISCM VI) were successfully held together in Singapore during December 11th to 14th 2013. The Congress was co-chaired by Prof. Zishun Liu and G.R. Liu.

The objective of the APCOM/ISCM2013 is to provide an international forum on the stage of Asia-Pacific for exchanging ideas on recent advances in areas related to mechanics, including computational methods, numerical modeling & simulation, as well as their applications in engineering and science. Presentations on a wide range of topics were made not only to facilitate inter-disciplinary exchange of ideas in science, engineering and related disciplines, but also to foster various types of academic collaborations in the Asia Pacific region and internationally. The members of the Local Organizing Committee, International Organizing Committee, and the International Steering Committee have provided advice and guidance in planning and executing this conference. Over 100 Mini-Symposium Organizers made substantial effort in the organization. Over 200 reviewers participated in reviewing the submitted abstracts and papers.

APACM Congress Medal (Valliappan Medal)

The Asian-Pacific Association for Computational Mechanics has recently established an APACM Congress Medal. This award is also named as the Valliappan Medal, in honor of Professor Valliappan for his significant contribution to APACM community. Prof. Valliappan is the founder and the first Secretory General of APACM that was established in 1999 initially with only 3 national associations in Asia Pacific Region: China (represented by W.X. Zhong), Japan (represented by T. Kawai) and Australia (represented by S. Valliappan). APACM has now 14 National Associations.

The Valliappan Award is one of the highest recognitions bestowed on an individual for his/her significant contributions in various fields of computational mechanics.

This award will be given once in three years at the time of the APCOM Congress, in addition to other 3 APACM Awards. The recipient of the award will be chosen by the APACM Awards Committee appointed by the Executive Council. The first Valliappan Award was given to Prof. N. Miyazaki at the 5th Asia Pacific Congress on Computational

The APCOM/ISCM2013 conference program attracted over 600 presentations from more than 40 countries scheduled in about 100 technical sessions. There were 6 Plenary Lectures, 24 Thematic Plenary Lectures, 120 Keynote Lectures and 120 Invited Lectures at the conference. A wide range of topics in relation to computational mechanics, including formulation , computational methods and techniques, modelling techniques and procedures, materials, deformation processing, materials removal processes, processing of new and advanced materials, welding and joining, surface engineering and other related processes. ●

by
GR Liu,
Co-Chairman, APCOM/ISCM 2014

Figure 1:
A speech at APCOM2013 by Prof. Noriyuki Miyazaki, when receiving the Valliappan Medal from Prof. Valliappan

Mechanics (APCOM V) successfully held in Singapore during December 11th to 14th 2013 co-chaired by Prof. Zishun Liu and G.R. Liu.

More detailed information APACM and APACM awards: http://apacm-association.org/.

A speech at APCOM2013 by Prof. Noriyuki Miyazaki, when receiving the Valliappan Medal from Prof. Valliappan. ●

by
GR Liu,
President (2010-2013), APACM

COMPSAFE2014

1st International Conference on Computational Engineering & Science for Safety & Environmental Problems

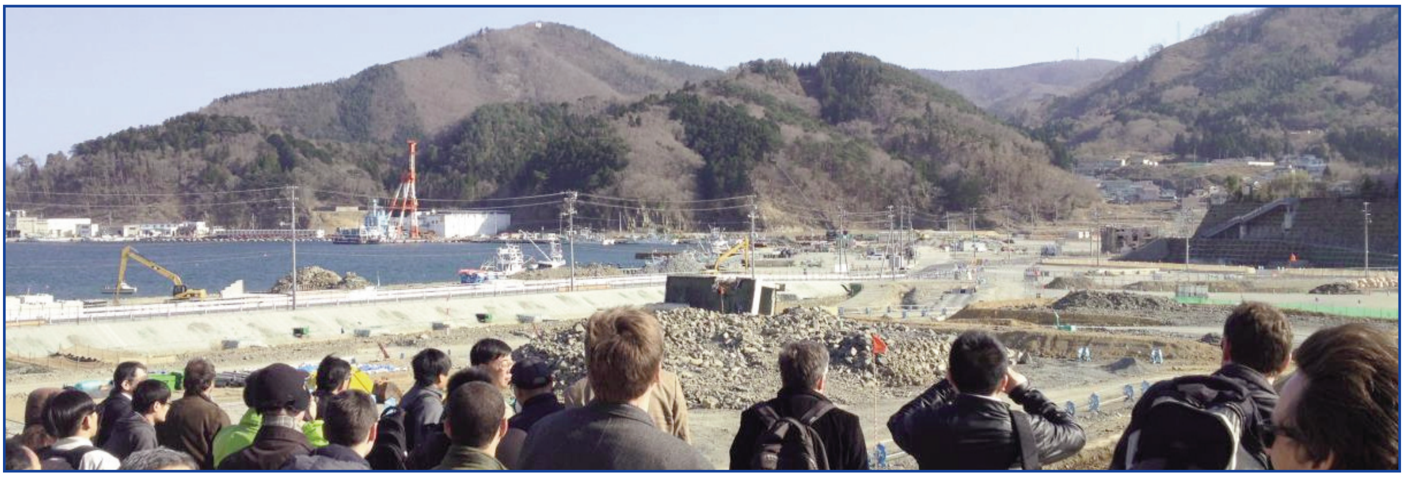
The 1st International Conference on Computational Engineering and Science for Safety and Environmental Problems (COMPSAFE2014) was held in the beautiful city of **Sendai**, Japan during the cherry blossom season of **April 13-16, 2014** as the first thematic conference of the Asian Pacific Association for Computational Mechanics (APACM) as well as a new IACM special interest conference. This is also the first conference ever organized by the Japan Association for Computational Mechanics (JACM) and the Japan Society of Computational Engineering and Science (JSCES). Also, the International Research Institute of Disaster Science (IRIDeS), Tohoku University firmly supported the conference as an on-site organization in many aspects.

The topics of the conference are a variety of methodologies and techniques in computational mechanics, and computational engineering and sciences, and their applications related to (1) safety- / risk-related, disaster-preventing topics including various types of natural hazards such as earthquake, tsunami, typhoon / hurricane / cyclone, flood, explosion of volcano, land slide, (2) accidents and failures of engineering artifacts involving fractures, crashes, explosion and etc., and (3) environmental and social problems such as air / water pollution, radioactive contamination, global environment problems, evacuation and so on.

Figure 1:
Prof. Fumihiko Imamura delivering a plenary lecture on tsunami disaster

The conference started with a pre-conference excursion tour to Onagawa town, one of many tsunami disaster areas of the 2011 Great East-Japan Earthquake, of which introductory lecture was given by Prof. Shunichi Koshimura of IRIDeS. About 120 delegates participated in the tour and witnessed the outcome of the tremendous tsunami along with a slow, but steady restoration of the area *(Figure 2)*. The Opening Ceremony took place at Sendai International Center on 14th April, with opening remarks given by Conference Chairs, Profs. Kazuo Kashiyama and Shinobu Yoshimura, followed by Prof. Genki Yagawa, President of IACM, and Prof. Sung-Kie Youn, President of the APACM. A plenary lecture was delivered by Prof. Fumihiko Imamura on tsunami disaster *(Figure 1)* and 14 semi-plenary lectures were delivered by distinguished researchers on fluid dynamics to earthquake hazards, nuclear power plant accidents to impact and shock problems. About 280 presentations were given within 22 mini-symposia.

Figure 2:
Left and below: Witnessing the restoration at the tsunami damage site in the excursion tour



Kazuo Kashiyama, *Co-chair, Chuo University, kaz@civil.chuo-u.ac.jp*
Shinobu Yoshimura, *Co-chair, The University of Tokyo, yoshi@sys.t.u-tokyo.ac.jp*
Daigoro Isobe, *Secretary General, University of Tsukuba, isobe@kz.tsukuba.ac.jp*
Kenjiro Terada, *Secretary Local, Tohoku University, tei@irides.tohoku.ac.jp*

Figure 4:
Japanese drum performance praying for early restoration of Tohoku region

Among over 300 delegates, about 200 are domestic participants, 60 from Asian countries, 20 from Europe and 10 from the US.

The conference banquet took place at Sendai Shozankan, where beautiful cherry blossom trees and Noh theater welcomed the participants. Prof. Satoshi Tadokoro of IRIDeS delivered a brief, but informative lecture on rescue robots committed to the accident at Fukushima Nuclear Power Plant, followed by a kagami-biraki event, breaking of the lid of a ceremonial sake barrel *(Figure 3)*. The participants also enjoyed a powerful Japanese drum performance by local professional players as a prayer for the restoration of the Tohoku region *(Figure 4)*. As we all know, the banquet was an important social occasion *(Figures 5, 6)*.

The conference closed successfully with a promising expectation towards the second COMPSAFE, which is planned to be held in three years somewhere in Asian-Pacific region. Finally, we would like to thank all the members of the international advisory committee, the local organizing committee, and the local arrangements committee for their help and effort for this conference. ●

Figure 3:
Kagami-biraki event at banquet performed by Profs. Shinobu Yoshimura, Antonio Huerta (CIMNE, Spain), Kazuo Kashiyama and Sung-Kie Youn (KAIST, Korea) (from left to right)

Figure 5:
Above and Below.
Participants enjoying the social event

Figure 6:
Committee members gathered to take a picture after banquet

Message from the new President of JSCES

On behalf of the Japan Society for Computational Engineering and Science (JSCES), I would like to introduce the present status and activities in JSCES as one of the biggest academic societies in the field of computational mechanics in Japan.

The Executive Council of the JSCES was renewed in May 2014 as the regular procedure in every two years: S. Koshizuka (Univ of Tokyo, President), N. Sasaki (Hitachi, Vice-president), K. Terada (Tohoku Univ, Vice-president), M. Fujisaki (Fujitsu), S. Hagihara (Saga Univ), D. Isobe (Tsukuba Univ), T. Kobayashi (Mechanical Design), H. Miyachi (Cybernet), T. Nagashima (Sophia Univ), K. Nakajima (Univ of Tokyo), H. Nakamura (CTC), H. Okada (Science Univ of Tokyo), S. Okazawa (Hiroshima Univ), H. Okuda (Univ of Tokyo), R. Sawada (Toyota), H. Takahara (NEC), N. Takano (Keio Univ), A. Tezuka (AIST), Y. Umezu (JSOL), T. Yamada (Yokohama National Univ), K. Kashiyama (Chuo Univ, Inspector) and K. Yamamura (Nippon Steel & Sumitomo Metal, Inspector).

The JSCES was established in 1995 for researchers and technical experts in the field of computational engineering and science after the 3rd World Congress on Computational Mechanics (WCCM-III) held in Chiba, Japan, in 1994. The JSCES became a general incorporated organization in 2010 to organize and strengthen the management. On 1 May 2014, the JSCES has 980 individual members and 81 corporate members. The individual members come from 60% of universities and research institutes and 40% of industries.

The JSCES has hosted annual conferences every year, each of which constantly collects about 350 papers, published in a CD and presented in more than 30 minisymposia. This year's conference will be reported in the next issue. Also, Transactions of JSCES have been published on the website (https://www.jstage.jst.go.jp/browse/jsces) since 1997, as an academic journal collecting valuable papers in the field of computational engineering and science. Moreover, quarterly journal "Keisankougaku" is delivered to the members for 4 times per year to transfer the topics and news.

Figure 1:
Prof. Seiichi Koshizuka,
The President of JSCES

The JSCES has also carried out many other activities to promote the computational engineering and science. For example, Summer Short Course, Summer Camp and Seminars are regularly provided. The Research Committee of JSCES operates Study Groups for Creative Design and Manufacturing, 1D-CAE, HQC (High Quality Computing), S&V (Simulation & Visualization) and PSE (Problem Solving Environment) to exchange information among the members and cooperation between academia and industries.

This year, the JSCES hosted the 1st International Conference on Computational Engineering and Science for Safety and Environmental Problems (COMPSAFE2014) with JACM (Japan Association for Computational Mechanics) on 13-16 April 2014 in Sendai, where the Great East Japan Earthquake had attacked in 2011. This meeting, which was the APACM Thematic Conference and the first IACM Special Interest Conference held in the Asia-Pacific Region, was brought to a successful conclusion and was reported elsewhere in this issue. In this manner, the JSCES will continuously support the IACM.

by ***Seiichi Koshizuka*** *- Figure 1*

General assembly meeting
Special Lecture & Operating Review of Research Committee

The fifth assembly meeting of JSCES was held at Muza Kawasaki Symphony Hall, Kawasaki, Japan, on May 20th, 2014 *(Figure 2)*. Both the Operating and Financial Review for the previous fiscal year and the Operation and Financial Plan for this fiscal year were reported in this meeting. After the assembly meeting, the JSCES's Research Committee reported Operating Review of Computational Engineering for "Monozukuri". A variety of the activities were presented by the committee, which organizes Study Groups for Creative Design and Manufacturing, 1D-CAE, HQC (High Quality Computing), S&V (Simulation & Visualization) Green-CAE and PSE (Problem Solving Environment). In particular, the effort made by the Study Group for HQC is introduced at the end of this article.

Figure 2:
General Assembly Meeting

Figure 3:
Special Lecture by Dr. Ryutaro Himeno in the JSCES Symposium 2014

Prior to the deliberation in the assembly, a special lecture was presented by Dr. Ryutaro Himeno at Advanced Center for Computing and Communication, RIKEN (http://accc.riken.jp/en/). The topic was entitled as "Road to Exa-scale from KEI: for development of application software". *(Figure 3)* The presentation started with his ten-year carrier for CFD at Nissan Motor Co. (1985-1995) to demonstrate the advances of computer hardware as well as software and was followed by the worldwide trend of high performance computing and its relation to design and analysis in engineering. He emphasized that HPC infrastructures as well as supercomputers must have been developed with a view to its usage in practice and properly nourished together with the development of high performance simulation software.

Award Ceremony for JSCES Prizes

After the meeting, JSCES prizes were offered to senior and young researchers and practitioners. This year's recipients are Prof. Kiyoshi Shingu *(The JSCES Achievement Award)* and Dr. Koichi Ohtomi *(The JSCES Achievement Award)*, Prof. Kenjiro Terada *(Kawai Medal)*, Dr. Hitoshi Nakamura *(Shoji Medal)* and Dr. Toshimitsu Fujisawa *(Technology Prize)*. Paper awards associated with the Transaction of the JSCES (see, https://www.jstage.jst.go.jp/browse/jsces) were also given the following researchers: Profs. Mao Kurumatani, Kenjiro Terada, Junji Kato, Takashi Kyoya & Kazuo Kashiyama *(Outstanding Paper Award)*, Dr. Noriaki Nishikawa *(Outstanding Paper Award)*, Dr. Hitoshi Matsubara *(Young Researcher Paper Award)*, Dr. Nobuhisa Ochi *(Young Researcher Paper Award) (Figure 4)*. The JSCES Grand Prize, the highest award in JSCES, will be given to Prof. Wing-Kam Liu at the 19th JSCES's Annual Conference on Computational Engineering and Science, which will be held on June 11-13, 2014, at International Conference Center Hiroshima, (Hiroshima, Japan). ●

by: : ***Kenjiro Terada***

Figure 4:
Group shot of some JSCES's Board Members and recipients of The JSCES Achievement Award, Kawai Medal, Shoji Medal, Technology Prize, Outstanding Paper Award and Young Researcher Paper Award

HQC Committee in JSCES:

Study Group for High Quality Computing (HQC) in JSCES has been continuing intense research activities for quality management of engineering simulations since 2009. The committee chairperson Dr. Masaki Shiratori, Professor Emeritus Yokohama National University, leads approximately 35 members representing various organizations in industries and academia. The group published two standards for quality management of engineering simulation in 2011. The first one, called HQC001, describes the requirements of quality management based on ISO9001 with reference to NAFEMS QSS001. The second one, called HQC002, provides a model procedure for engineering simulation as shown in *Figure 5*. The procedure is developed based on a policy that introduces V&V (Verification & Validation) concept of modeling and simulation in a process management based on ISO9001. The committee is scheduled to issue application examples and revised editions of the standards in 2014. ●

by: ***Hitoshi Nakamura***

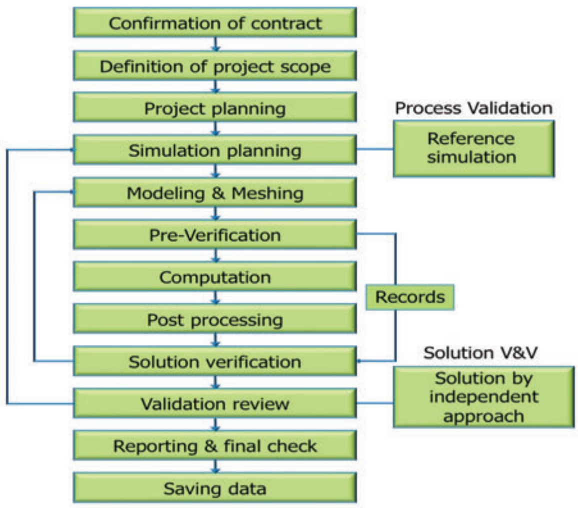


Figure 5:
Model Procedure for Engineering Simulation in JSCES S-HQC002 (proposed by Study Group for HQC)

PANACM 2015

The First Pan-American Congress on Computational Mechanics
27-29 April 2015, Buenos Aires, Argentina
http://congress.cimne.com/PANACM2015

AMCA and CIMNE are pleased to announce the First Pan-American Congress on Computational Mechanics PANACM 2015, in conjunction with the XI Argentine Congress on Computational Mechanics MECOM 2015. A special Interest Conference of the IACM.

Welcome to

PANACM 2015

1st Pan-American Congress on Computational Mechanics
An IACM Special Interest Conference

in conjunction with:
the XI Argentine Congress on Computational Mechanic, MECOM 2015

Buenos Aires
27 - 29 April 2015

About PANACM

The purpose of the PANACM series is to promote achievements in Computational Mechanics in the Americas by encouraging young researchers, stimulating education in universities, disseminating modern trends in the field amongst scientists and engineering and mainly facilitating the interchange of knowledge between the north and the south.

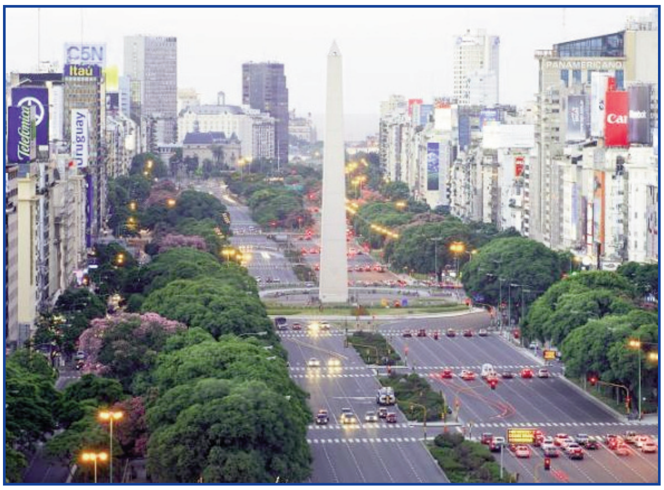


Figure 1:
The always lively Avenida 9 de Julio

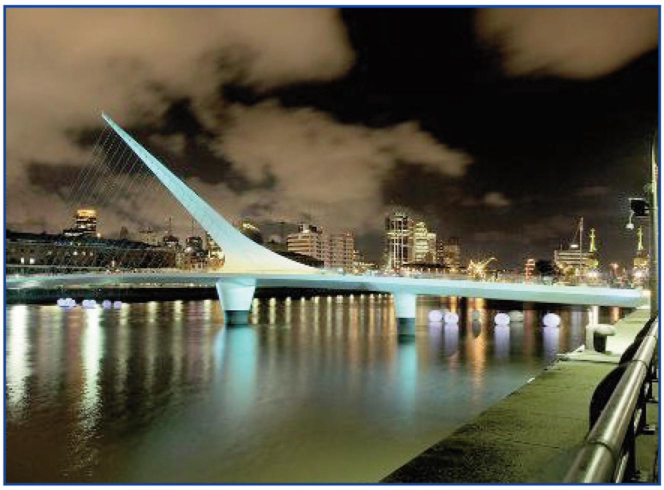


Figure 2:
Puerto Madero, the Buenos Aires neighborhood where PANCAM 2015 will take place

for all inclusions under **AMCA** please contact:
Victorio Sonzogni
sonzogni@intec.unl.edu.ar
http://www.amcaonline.org.ar

PANACM 2015 will feature during 3 days over 500 international presentations in 12 parallel tracks plus 20 Plenary and Semi-Plenary Lectures delivered by the most prominent leaders in the growing field of Computational Mechanics.

About Buenos Aires

Old and new, typical and multifaceted, Buenos Aires vibrates in its streets. Owner of an architecture which combines the past and the vanguard, the capital city of Argentina motivates those who walk along its big boulevards, riverside promenades, parks and squares, stoned streets. Guests may enjoy the tireless night life which guarantees different proposals all along the week; modern and typical bars; neighborhoods which keep their soul; first-level cuisine; sport events; the bohème; the design; commercial circuits and a highly wide cultural offer which makes Buenos Aires to be well-known as the Cultural Capital of Latin America.

This cosmopolitan city, which changes day in day out at Tango rhythms, takes our breath away in each of its corners. Try Argentine food (barbecue) and wine, learn about the history, culture, and language of the country, and most of all meet interesting people in a fun, relaxed, and social environment.

The conference will take place at the Buenos Aires Hilton Hotel, located in the heart of the trendy fashion Buenos Aires known as Puerto Madero, right in the city center. ●

Figure 3:
Buenos Aires architecture combines the past and the vanguard

Figure 4:
Avenida de Mayo motivates those who walk along this boulevard

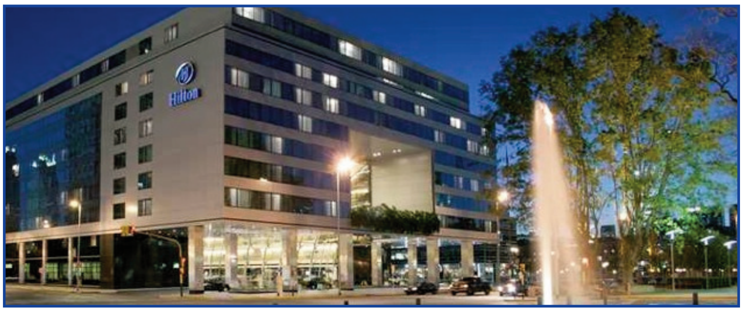
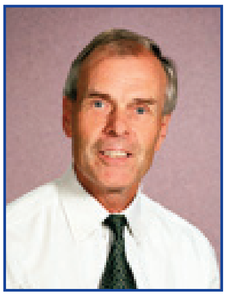
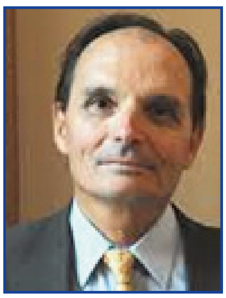


Figure 5:
The Buenos Aires Hilton Hotel, venue of the Conference





Figures 6-13:
Some of the Plenary Lecturers that have confirmed their participation at PANACM 2015:
Top line from left to right:
Klaus Jurguen Bathe, Luis Caffarelli, Charbel Farhat, Tom Hughes, Eugenio Oñate
Bottom line from left to right:
Olivier Pironneau, Ekkehard Ramm, Peter Wriggers



AIMETA
Associazione Italiana di Meccanica Teorica e Applicata

for all inclusions under
GIMC-AIMETA
please contact:
Giorgio Zavarise
giorgio.zavarise
@unisalento.it

The Italian Group of Computational Mechanics (GIMC) has renewed its Managing Board, which is now composed by Giorgio Zavarise (Coordinator), Sonia Marfia (Secretary), Anna Pandolfi and Alessandro Reali.


Giorgio Zavarise


Sonia Marfia


Anna Pandolfi


Alessandro Reali

The Italian Group of Computational Mechanics belongs to **The Italian Association of Theoretical and Applied Mechanics** (AIMETA), that has also renewed its Managing Board. The newly elected board members are Paolo Luchini (President), Walter D'Ambrogio (Vicepresident), Guido Borino (Secretary), Carlo Cinquini (Past-President), Sandra Carillo, Stefano Lenci and Elio Sacco.

Within AIMETA, the **Italian Group of Materials** (GMA) has renewed its Managing Board, which is now composed by Lorenzo Bardella, Roberta Massabo' and Pasquale Vena.

Forthcoming Events

The AIMETA Groups of Computational Mechanics and Group of Materials are pleased to announce the upcoming joint conference **GIMC-GMA** to be held in **Cassino**, on **June 11-13, 2014**.

GIMC - GMA 2014

XX Italian National Conference of Computational Mechanics GIMC

VII Italian Meeting on Advances in mechanics of materials, GMA

The Conference is addresses to the researchers of the area of applied mechanics, and in particular of solid, structure, fluid and material mechanics.

The aim of the conference is to create an opportunity to meet for researchers, that develop and use analytical and numerical advanced methods for solving mechanical problems, in order to promote the interdisciplinary circulation of the most recent developments in computational mechanics and mechanics of materials.

The conference will encourage the discussion among the different researchers. Particular importance will be given to the submission of applications and simulations of innovative processes and products of industrial and engineering interest.

Further information may be found at the website: **www.gimc-gma2014.dicam.unibo.it**

KSCM
KOREA SOCIETY FOR COMPUTATIONAL MECHANICS

for all inclusions under KSMA, please contact:
Moon-Ki Kim - mkkim1212@skku.edu

COEX: WCCM 2016 Congress Venue

The congress will take place at the "COEX", the business and cultural hub located in the heart of "Gangnam", Seoul's business district. It is a popular entertainment destination in Seoul for both domestic and foreign visitors, and welcomes an average of 150,000 people a day. Asia's largest underground mall, including three five-star hotels, two premier office towers, a department store, a subway station, an airport terminal, and more (Web. www.coex.co.kr).

conference diary planner

20 - 25 July 2014	**WCCM XI: World Congress on Computational Mechanics** *Venue:* Barcelona, Spain *Contact:* http://www.wccm-eccm-ecfd2014.org/
1 - 4 Sept 2014	**Innovative Numerical approaches for Material & Structures in Multiscale Problems** *Venue:* Cologne, Germany *Contact:* kerstin.weinberg@uni-siegen.de
2 - 5 Sept 2014	**IV CAIM : Congreso Argentino de Ingeniería Mecánica** *Venue:* Chaco, Argentina *Contact:* http://caim2014.unne.edu.ar/
2 - 5 Sept 2014	**ECT2014: The Ninth International Conference on Engineering Computational Technology** *Venue:* Naples, Italy *Contact:* http://www.civil-comp.com/conf/
7 - 11 Sept 2014	**Uncertainties 2014: 2nd Int. Symposium on Uncertainty Quantification & Stochastic Modeling** *Venue:* Rouen, France *Contact:* eduardo.souza@insa-rouen.fr
8 - 10 Sept 2014	**BEM/MRM 37: 37th Int. Conference on Boundary Elements & other Mesh Reduction Methods** *Venue:* The New Forest, UK *Contact:* http://www.wessex.ac.uk/
8 - 11 Sept 2014	**EngOpt 2014: 4th International Conference on Engineering Optimization** *Venue:* Lisbon, Portugal *Contact:* http://www.dem.ist.utl.pt/engopt2014
23 - 26 Sept 2014	**ENIEF 2014 : XXI Congreso sobre Metodos Numericos y sus Aplicaciones** *Venue:* Bariloche, Argentina *Contact:* http://mecom.cnea.gov.ar/index.php/es/enief-2014
2 - 3 Oct 2014	**JMC2014: Las Jornadas de Mecánica Computacional** *Venue:* Talca, Chile *Contact:* www.scmc.cl or JMC2014@utalca.cl.
19 - 22 Oct 2014	**MM&FGM 2014: 13th Int. Symp. Multiscale multifunctional& Functionally** *Venue:* Sao Pauo, Brazil *Contact:* http://fgm2014.poli.usp.br
23 - 26 Nov 2014	**CILAMCE 2014: XXXV Ibero Latin American Congress on Comp. Methods in Engineering** *Venue:* Fortaleza, Brasil *Contact:* http://www.cilamce2014.com.br/index.html
22 - 24 Dec 2014	**SEC2014: Structural Engineering Convention** *Venue:* Delhi, India *Contact:* civil.iitd.ac.in/sec2014/
16 - 18 March 2015	**FEF 2015: 18th International Conference on Finite Elements in Flow Problems** *Venue:* Taipei, Taiwan *Contact:* http://fef2015.tw/
27 - 29 April 2015	**PANACM-2015: Pan-American Congress on Computational Mechanics** *Venue:* Buenos Aires, Argentina *Contact:* http://congress.cimne.com/PANACM2015
18 - 20 May 2015	**COUPLED PROBLEMS 2015: VI Int. Conf. on Coupled Problems in Science and Engineering** *Venue:* Venice, Italy *Contact:* coupledproblems@cimne.upc.edu
7 - 12 June 2015	**WCSMO-11: World Congress of Structural and Multidisciplinary Optimization** *Venue:* Sydney, Australia *Contact:* wcsmo11@gmail.com
15 - 17 June 2015	**MARINE 2015: VI International Conference on Computational Methods in Marine Engineering** *Venue:* Rome, Italy *Contact:* marine@cimne.upc.edu
26 - 30 July 2015	**USNCCM13: U.S. National Congress on Computational Mechanics** *Venue:* San Diego, CA *Contact:* ruth@usacm.org
1 - 3 Sept 2015	**COMPLAS XIII: International Conference on Computational Plasticity** *Venue:* Barcelona, Spain *Contact:* complas@cimne.upc.edu
8 - 11 Sept 2015	**CMM: 21st International Conference on Computer Methods in Mechanics** *Venue:* Gdańsk, Poland *Contact:* http://www.pcm-cmm-2015.pg.gda.pl/
9 - 11 Sept 2015	**X–DMS 2015: eXtended Discretization MethodS** *Venue:* Ferrara, Italy *Contact:* to be advised
14 - 16 Sept 2015	**ICCB´2015: Sixth International Conference on Computational Bioengineering** *Venue:* Barcelona, Spain *Contact:* iccb2015@cimne.upc.edu
28 - 30 Sept 2015	**PARTICLES 2015: IV International Conference on Particle-based Methods** *Venue:* Barcelona, Spain *Contact:* particle-basedmethods@cimne.upc.edu
19 - 21 Oct 2015	**STRUCTURAL MEMBRANES 2015: VII Int. Conf. on Textile Composites & Inflatable Structures** *Venue:* Barcelona, Spain *Contact:* membranes@cimne.upc.edu
24 - 29 July 2016	**APCOM 2016: 6th Asia Pacific Congress on Computational Mechanics** *Venue:* Seoul, Korea *Contact:* http://apacm-association.org
24 - 29 July 2016	**WCCM XII: World Congress on Computational Mechanics** *Venue:* Seoul, Korea *Contact:* http://kscm-society.org