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contents

editorial

2007 has been a record year in terms of the number of conferences on topics related to computational mechanics held worldwide. Over 35 different meetings have taken place in the 5 continents covering many traditional and new areas in the broad field of computational methods and their applications in engineering and applied sciences.

Among the many conference events in 2007 we note the 22 Thematic Conferences promoted in Europe by the European Community on Computational Methods in Applied Sciences (ECCOMAS), the regional organization of IACM in Europe; the 3rd Asian-Pacific Congress on Computational Mechanics held last November in Kyoto organized by APACM,the regional organization of IACM in the Asian-Pacific region, and the many conferences run by national organizations affiliated to IACM, such as the US Conference on Computational Mechanics (San Francisco, July 2007) ,and the conference on Numerical Methods in Engineering (Porto, Portugal June 2007) jointly organized by APMTAC and SEMNI, the Portuguese and Spanish associations in IACM.

Conferences play different roles in our community. Traditionally they are a forum for interchange of ideas and presentation of new mathematical models and numerical methods and innovative applications of existing computational procedures. In addition, conferences are opportunities for scientists to meet. This is becoming more important as the digital era favours virtual encounters in the web, while it is quite difficult to meet "in person" colleagues from other places and have "presential" conversations. Indeed many opportunities for research and professional work can arise through personal contacts made at conferences.

Conferences are also more and more used to held meetings of scientific organizations or technical workshops of on-going research projects. Last but not least, conferences are unique opportunities for getting to know the cultural heritage of cities and regions far away from our everyday life.

The merry spirit of delegates at conferences has been captured by many novelists. My favourite book is *Small World* by David Lodge. The story tells how a group of professors and students of literature, mainly from UK, rejoin every spring in a number of conferences over the world. By the way, the concept of *Unesco Chair*, was taken from this book. This refers to a fictitious and very much desired university Chair providing substantial funds for travelling to international conferences. Nowadays over 400 "real" Unesco Chairs exist in the world. It is interesting that the first one was created in 1989 in the field of Numerical Methods in Engineering at the Technical University of Catalonia in Barcelona. This Unesco Chair has been held since its creation by Professor O.C.Zienkiewicz from University of Wales at Swansea (UK).

It is my belief that the many interactions between the Computational Mechanics community through conferences, joint publications, scientific interchanges and visits can be the basis for setting up a Social Network (SN) in the field of Computational Mechanics.

SNs are social structures formed by nodes which behave as *agents* in artificial intelligence networks. The nodes are typically individuals or associations and are linked in the network by one or more classes of interdependence, such as values, vision of the world, friendship, hobbies,etc. Differently from more traditional social models, the attributes of the nodes (the actors in the SN) are less important than their relationships and links with other nodes. Thus, the network is the "protagonist" in a SN and its quality directly affects the success of the activity of the actors, even beyond their specific individual abilities. Recent experiences show that SNs can play a key role in showing how organizations work, how they solve their problems and how individuals achieve their objectives.

Clearly the topic exceeds the extension of these lines. It is however very appealing to make use of the new theories from Information Society Science for capturing, maturing and interchanging knowledge for the benefit of the IACM and its members.

Returning to conferences, I invite you to take part in the 8th World Congress on Computational Mechanics of the IACM which will take place on 30 June - 5 July 2008 in the beautiful city of Venice in Italy. The congress will be held in conjunction with the 5th European Congress on Computational Methods in Applied Sciences and Engineering of ECCOMAS. Over 3000 abstracts have been received and some 160 minisymposia covering most topics in computational mechanics are being organized by distinguished scientists. Make sure you put Venice 2008 in your Agenda!

Last but not least I wish all members of the IACM community a good 2008.

Eugenio Oñate
President of IACM

Multiscale Computations: Boom or Bust

by
Jacob Fish
Multiscale Science and Engineering Center
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The rationale for multiscale computations

Consider a textbook boundary value problem, which consists of equilibrium, kinematical, and constitutive equations together with essential and natural boundary conditions. These equations can be classified into two categories: those that directly follow from physical laws and those that don't. Wikipedia [1] defines "a constitutive equation as a relation between two physical quantities that is specific to a material or substance, and does *not follow directly from physical law*. It is combined with other equations (equilibrium and kinematical equations) that do represent physical laws to solve some physical problem."

In other words, it is convenient to label all that we do not know about the boundary value problem as a constitutive law (originally coined by Walter Noll in 1954), and designate an experimentalist to quantify the constitutive law parameters. While for linear elastic materials this is a trivial exercise, this is not the case for anisotropic history-dependent materials well into their nonlinear regime. In theory, if material response is history-dependent, one would need infinite number of experiments to quantify its response. In practice, however, one defines a hand-full of constitutive law parameters that are believed to "capture" various failure mechanism observed experimentally. This is known as *phenomenological modeling,* which relates several different empirical observations of phenomena to each other, in a way that is consistent with fundamental theory, but is not directly derived from it.

"... approaches that integrate more than one such technique (...molecular simulations, continuum-based models, etc.) will play an important role in this effort."

An alternative is to derive constitutive equations (or directly field quantities) from finer scale(s), at the scale where established laws of physics are better understood. The enormous gains that can be accrued by this approach have been reported in numerous articles [2 - 7]. Multiscale computations have been identified (see page 14 in [8]) as one of the areas critical to future nanotechnology advances. The FY2004 $3.7-billion-dollar National Nanotechnology Bill (page 14 in [7]) states that: "approaches that integrate more than one such technique (…molecular simulations, continuum-based models, etc.) will play an important role in this effort."

One of the main barriers of such a multiscale approach is increased uncertainty/ complexity introduced by finer scales as illustrated in *Fig. 1*. As a guiding principle for assessing the need for finer scales, it is appropriate to recall the statement made by Einstein, who stated that "the model used should be the simplest one possible, but not simpler." The use of multiscale approach has to be carefully weighted on case-by-case basis. For example, in case of metal matrix composites (MMC) with almost periodic arrangement of fibers, introducing finer scales might be advantageous since the bulk material typically does not follow normality rules and developing a phenomenological coarse scale constitutive model might be challenging at best. The behaviour of each phase is well understood and obtaining the overall response of the material from its fine scale constituents can be obtained using homogenization. On the other hand, in brittle ceramics composites (CMC), the microcracks are often randomly distributed and characterization of their interface properties is difficult. In this case, the use of multiscale approach may not be desirable.

The hype and the reality

Multiscale Science and Engineering is relatively new field and as most new technologies it begins with *naive euphoria* (see Fig. 2) when inventor(s) are usually submersed in the ideas themselves and often tend to overpromise, in part to generate funds to continue their work. Hype is a natural handmaiden to overpromise, and most technologies build rapidly to a peak of hype [9].

For instance, early expert systems success led to inflated claims and unrealistic expectations. The field did not grow as rapidly as investors had been led to expect, and this translated into disillusionment. Back in 1981 Feigenbaum et al. [10] reckoned that while artificial intelligence (AI) was already 25-years old, it "was a gangly and arrogant youth, yearning for a maturity that was nowhere evident." Interestingly, today you can purchase the hardcover AI handbook [9] for as much as $0.73 on Amazon. Multiscale computations had their share of overpromise, such as inflated claims of designing drugs atom-by-atom [11] or reliable design of Boeing 787 from first principles [12] just to mention a few.

Following this *naïve euphoria* (*see Fig.2*), there is almost always an overreaction to ideas that are not fully developed, and this inevitably leads to a crash, followed by a period of wallowing in the depths of cynicism. Many new technologies evolve to this point, and then fade away. The ones that survive do so because industry (or perhaps someone else) finds a "good use" (= true user benefit) for this new technology.

Towards the "good use" at Rensselaer

At Rensselaer over the past six years we became increasingly interested in transitioning multiscale technologies to industry and government. The Multiscale Design System (MDS), schematically illustrated in *Fig. 3*, is a product of such a "good use". The MDS has been originally developed for design of high-temperature engine components (CMC airfoil in the Joint Strike Fighter) and lightweight structural components in automotive and aerospace industries.

The system shown in *Fig. 3* consists of the following modules and technologies:

a. ***Mathematical upscaling***: derivation of coarse-scale equations from fine-scale equations using non linear mathematical homogenization theory [13 - 17].

b. ***Computational upscaling***: reducing the complexity of solving a fine-scale problem to a manageable size that can be adapted based on available computational resources and error estimates in the quantities

> *" Multiscale computations had their share of overpromise, such as inflated claims of designing drugs atom-by-atom or reliable design of Boeing 787 from first principles ..."*

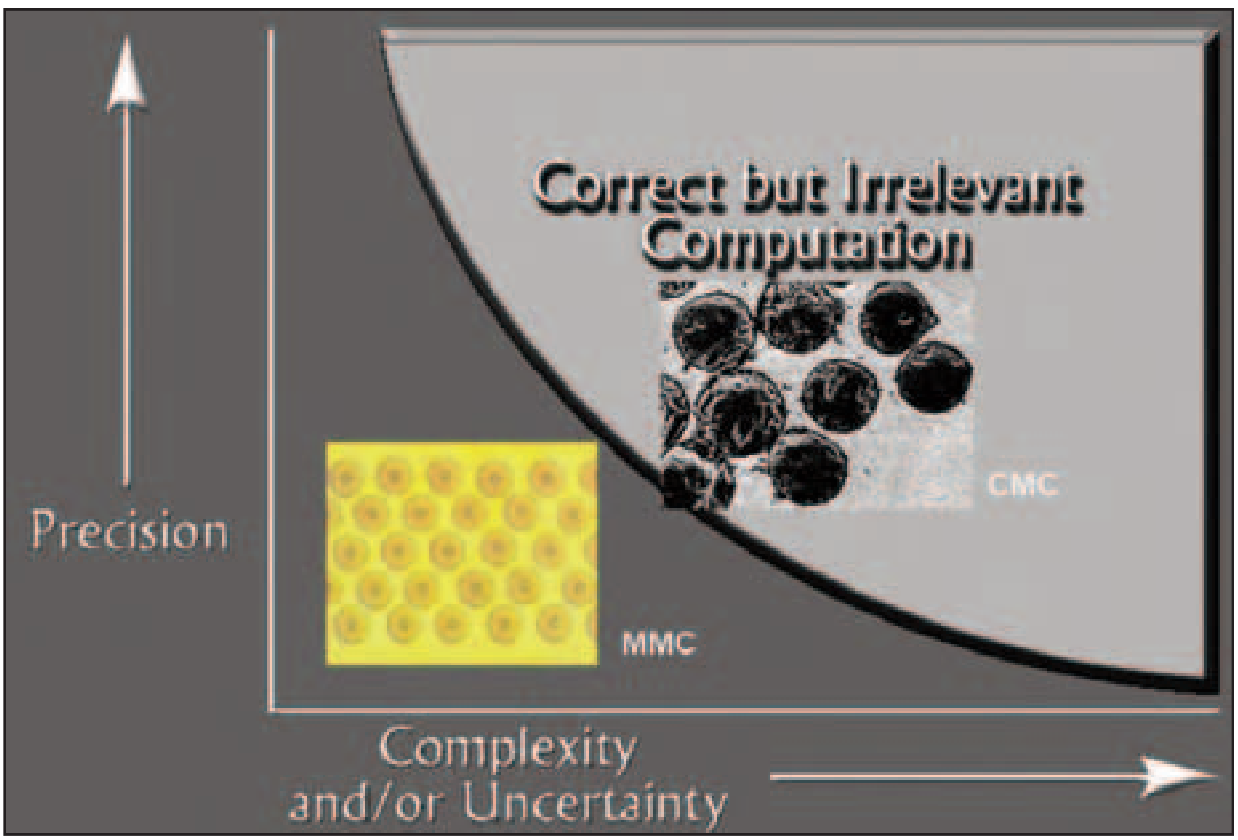

Figure 1:
Reduced precision due to increase in uncertainty and/or complexity

of interest [18]. The model reduction approach adopted in [17] is based on the concept of eigenstrains [19].

c. ***Model calibration:*** solving an inverse problem for constitutive parameters (interfaces, fibers/tows, matrix) by minimizing the error between experimental data at coupon [20] and fine-scale (nanoindentation tests [21]).

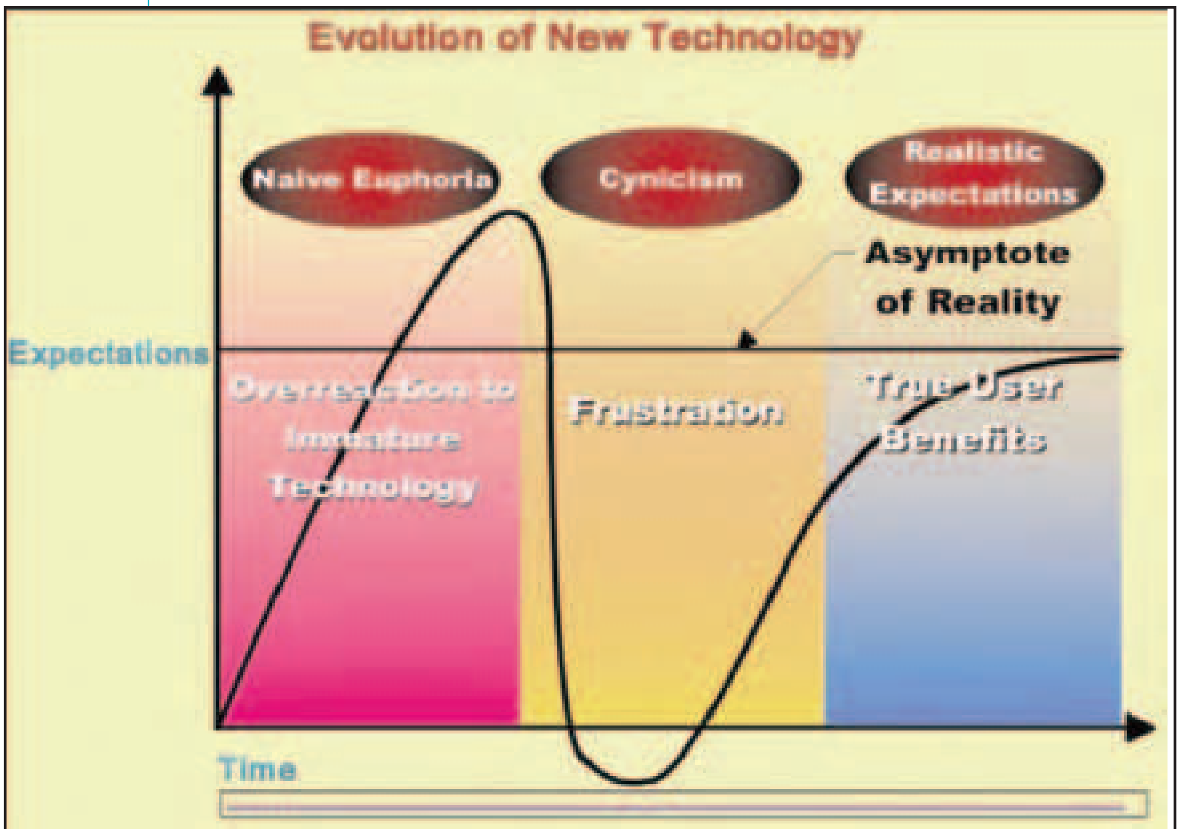

Figure 2:
Evolution of New Technology

Another variant of MDS (*Fig. 3*) for design of components made of nanostructured materials is currently under development at Rensselaer. In this variant, the fine scale model is at the atomistic scale. The coarse scale equations (coupled thermo-mechanical equations of continuum) are systematically derived (upscaled) using the Generalized Mathematical Homogenization [22, 23]. The Proper Orthogonal Decomposition (POD) combined with the space-time multilevel method [24] are employed for systematic model reduction, to capture the critical modes of dislocation motion.

"What would the properties of materials be if we could really arrange the atoms the way we want them?"

Rensselaer is among the first universities to recognize that a systematic multiscale theory combined with intensive technology transfer effort would propel the Institute's initiatives in biotechnology, nanotechnology, energy, and microelectronics. Last year Rensselaer established its Multiscale Science and Engineering Center (MSEC) [25] involving 60 faculty from 10 departments.

Closing remarks

The ultimate question is whether computational mechanics community is ready to take upon the 49-year old challenge [26] posed by Nobel Prize Laureate Richard Feynman, who stated: "What would the properties of materials be if we could really arrange the atoms the way we want them?" More broadly stated, what is the likelihood that in foreseeable future we will able to engineer optimal system behavior by manipulating fine-scale features? The author of this article believes that progress towards fulfilling the promise of multiscale science and engineering hinges not only on its development as a discipline, concerned with understanding and integration of mathematical, computational, and domain expertise sciences, but more so with its ability to meet broader societal needs beyond those of interest to academic community. After all, as compelling as the finite element theory is, the future of the field may have been in douby, if it has not been embraced by practitioners. ●

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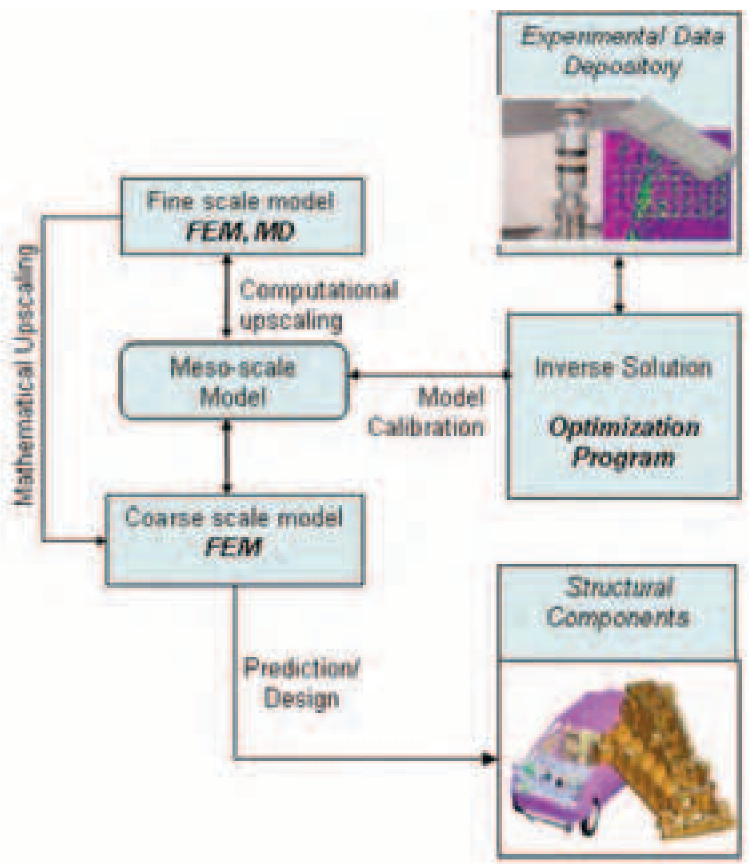
Figure 3: A prototype of MDS developed at Rensselaer



Computational Mechanics:

Bridging the Gap between Science and Technology

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Computational Mechanics is nowadays an indispensable scientific tool for developing new technologies and optimizing existing ones. In the Computational Mechanics field, the interaction between new scientific developments and technological applications is not only very fast but also very natural: industry continuously demands the capabilities for analyzing technological problems of increasing complexity and therefore the advances in computational methods are almost immediately applied for modeling technological applications.

Since technological decisions, with high influence on the ecological impact of industrial facilities, on labor conditions and on revenues, are reached based on the results provided by computational models, it is evident that these models have to be highly reliable. Therefore, it is of utmost importance that sound modeling techniques are used, that highly educated engineers develop the models and that the model outputs are subjected to experimental validation using either industrial or lab determinations.

In the development of computational models we can recognize four different steps:

- The identification of the physical phenomenon that is going to be analyzed and the isolation of its most relevant features.
- The formulation of the mathematical model, usually in the form of a PDE system with its proper domain definition, boundary and initial conditions, etc. Here we have to make important decisions on which aspects of the technological process physics are relevant and, therefore, need to be considered in the model, and which aspects are not; in this level we introduce hypotheses about the material response, friction, loads, etc. It is important that when an engineer analyzes the results provided by the mathematical model she/he checks the adequacy of those hypotheses.
- The formulation of a numerical model. In most cases the PDE system developed in the previous step cannot be solved in closed form; hence, it is necessary to get approximate solutions using numerical methods. In this paper we will focus on the finite element method.
- The verification of the numerical results where we check that they are a *"good enough"* solution for the mathematical model and the validation of the complete procedure where we check that the numerical results represent *"closely enough"* the physical phenomena under study.

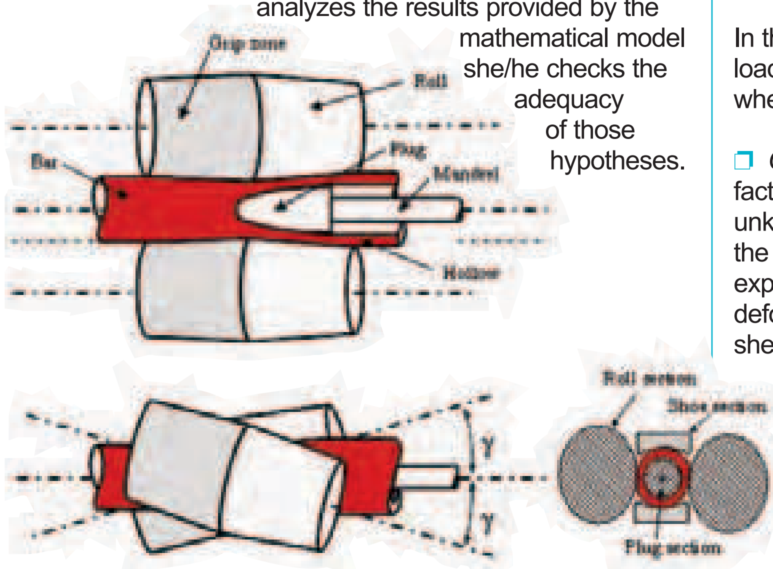


Figure 1:
The Mannesmann piercing process

The examples that we use to illustrate this paper are taken from actual applications that we developed for the steel industry.

From the physical phenomena to the mathematical model

Here the keyword is *abstraction*: the analyst should have enough insight into the physical phenomena that she/he has to model so as to include in the model all the relevant features but only the relevant ones. The educated physical intuition of the analyst together with a clear definition of the expected outputs is fundamental for the definition of an adequate mathematical model.

Due to geometrical or material nonlinearities most of the models that describe physical phenomena of technological relevance are nonlinear.

In the analysis of a solid under mechanical and thermal loads some of the nonlinearities that we may encounter when formulating the mathematical model are [1]:

- *Geometrical nonlinearities:* they are introduced by the fact that the equilibrium equations have to be satisfied in the unknown deformed configuration of the solid rather than in the known unloaded configuration. When the analyst expects that for her/his purposes the difference between the deformed and unloaded configurations can be neglected she/he may disregard this source of nonlinearity obtaining an important simplification in the mathematical model. An intermediate step would be to consider the equi librium in the deformed configuration but to assume that the strains are very small (infinitesimal strains assumption). This also produces an important simplification in the mathematical model. Of course, all the simplifications introduced in the mathematical model have to be checked for their properness when examining the numerical results

❒ *Contact-type boundary conditions:* these are unilateral constraints in which the contact loads are distributed over an area that is a priori unknown to the analyst.
❒ *Material nonlinearities:* elasto-plastic material models (e.g. metals), creep behavior of metals in high-temperature environments, nonlinear elastic materials (e.g. polymers), fracturing materials (e.g. concrete), phase changes in solid state, etc.

In the analysis of a fluid flow under mechanical and thermal loads some of the nonlinearities that we may encounter when formulating the mathematical model are:
❒ *Non-constant viscosity / compressibility:* rheological materials and turbulent flows modeled using turbulence models.
❒ *Convective acceleration terms:* for flows with Re>0 when the mathematical model is developed using an Eulerian formulation, which is the standard case.

In the analysis of a heat transfer process some of the nonlinearities that we may encounter when formulating the mathematical model are:
❒ *Temperature dependent thermal properties:* e.g. phase changes.
❒ *Radiation boundary conditions.*

The numerical model

When using the finite element method for developing the numerical model, the first step is the selection of an adequate element formulation to be used in the discretization of the mathematical problem under consideration.

The finite element formulation has to fulfill the standard reliability criteria [2-4]:
❒ Fulfillment of Irons' Patch Test.
❒ The element formulation must not contain spurious zero energy modes, must be stable and must not lock [5].
❒ The element predictions must be robust and quite insensitive to element distortions. For 2D four-node elements, used in solid mechanic applications, MacNeal [6] showed that a complete insensitivity to element distortions is incompatible with the fulfillment of the Patch Test; hence, in this case we have to give up some insensitivity to element distortions since we cannot wave Irons' test.

In particular, for solid mechanic models:
❒ When we expect a plastic strain localization to be developed we have to use elements that can predict this behavior without unrealistic diffusion of the plastic deformation zone [7]
❒ In those cases in which we expect a brittle-type of failure localization, it is necessary to use elements enriched with a localization mode. In our papers [8-9] we developed a mesh-independent formulation for modeling these problems which does not require the use of a non-physical softening stress - strain relation.

Also, it is worth noticing, that there are a number of practical decisions that the analyst who builds the numerical model has to make regarding iteration techniques, iteration tolerances, time-integration methods, direct or iterative solvers that may require special preconditioners [10], parallelization techniques, etc.

The numerical model inputs

Once the numerical model has been conceptually established it is necessary to input its data.

For elaborating the geometrical data, the development of finite element models from CAD files is a field in continuous expansion [11].

Regarding the material data, once we decide on the constitutive model to use, we need to resort to an inverse analysis methodology to determine the required material constants from experimental results. In previous publications we have analyzed some actual applications in the steel industry where we used inverse analysis procedures for determining material parameters from high temperature torsion tests and heat transfer coefficients from the indication of thermocouples installed in the mold of a continuous casting facility [12-15].

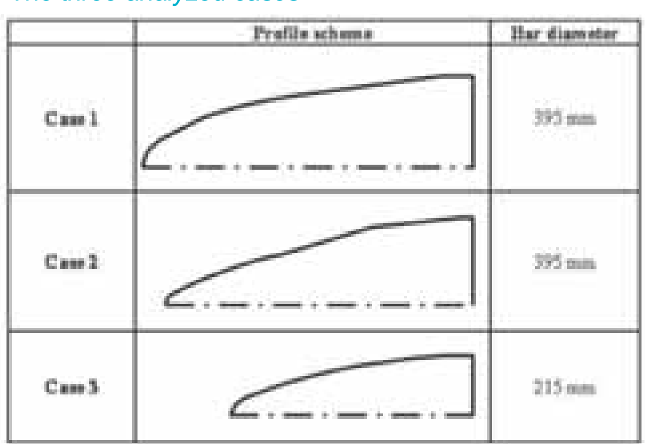
The verification of the numerical models and of its software implementations

In the verification process we have to prove that we are solving the equations right, and therefore this is a mathematical step [16]. In this step we have to show that our numerical scheme is convergent and stable.

Our basic tools in this step are: Irons' Patch Test (impossible to wave it!!), examination of the element eigenvalues under different geometric configurations, mesh refinement studies under different geometric configurations, stability and locking analyses for different values of the material parameters within the range of interest for the application, etc. It is important to notice that the verification process is not only related to a numerical procedure but also to its actual implementation in software (either commercial software or an in-house one) [16].

The next step is the training of analysts in the use of the simulation code. If a code is intended for the use of other analysts apart from the code developer, it is necessary to provide: adequate documentation where the range of applicability and limitations of the code should be clearly specified; user manuals and a set of benchmark problems to be used for testing the code installation and the analysts' understanding of the users manual.

Figure 2:
The three analyzed cases



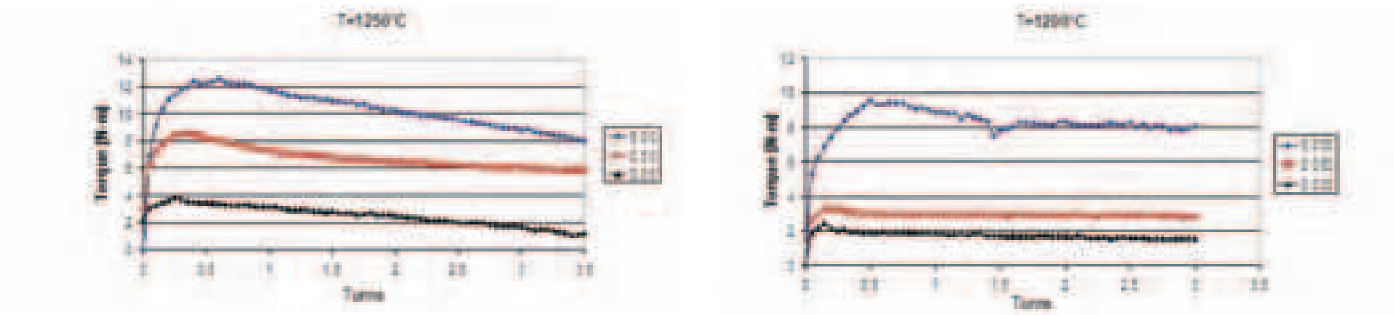


Figure 3:
Torque – turn curves for temperatures of 1200°C and 1250°C; with rotational speeds corresponding to 5; 0.5 and 0.05 turns/sec.

Figure 4:
Plug profile # 1. Comparison between the numerical results and experimental determinations.

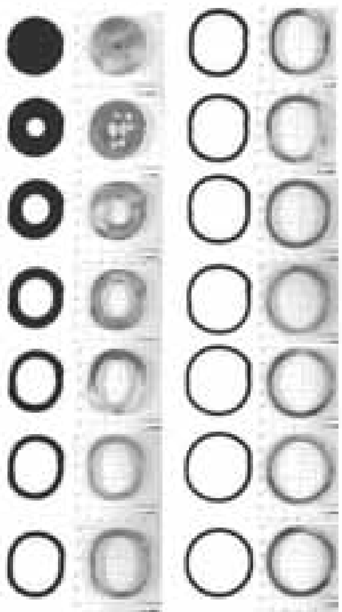


Figure 5:
Section through the rolls. The color map indicates the equivalent plastic strain and the dots the mapped data.

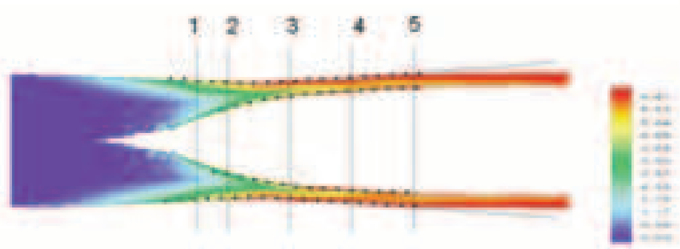
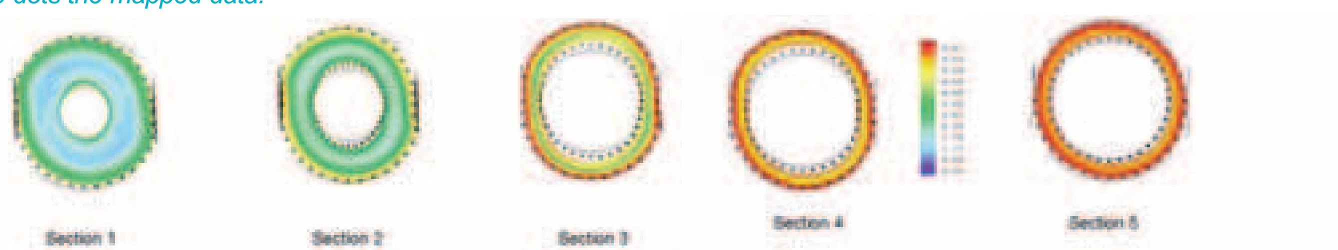


Figure 6:
Transversal sections (indicated in the previous figure). The color map indicates the equivalent plastic strain and the dots the mapped data.



The training of the analysts is particularly important in the case of commercial codes where it is necessary to confront the wrong concept that there is software that does not require from the users any insight into its mechanical and numerical bases.

The validation of the computational model

In the validation process we have to prove that we are solving the right equations, and therefore it is an engineering step [16]. We do validate neither a formulation nor software: we validate the usage of verified software when used by a designed analyst in the simulation of a given process. We have to validate the complete procedure.

We can validate the computational model of a technological process by comparing the numerical results it provides with:

- ❒ Results obtained in the technical literature. This validation procedure serves only as a first approach, because usually the data that can be found in the literature is not complete enough to be used for a final model validation.
- ❒ Experimental results obtained in a laboratory. Of course, this is not a straightforward step because it has to be first proven that the laboratory set-up is an acceptable physical model of the technological process that we want to investigate. Hence, this is an involved two steps process: first we need to validate the physical model and afterwards use it to validate the numerical model.
- ❒ Results measured in the actual industrial process. This procedure provides the most reliable validation; however it is very expensive (an industrial facility has to be used during several hours as a lab) and difficult to control.

As illustrative examples of the last procedure, in the next sub-sections we are going to comment on the validation of computational models that we developed for a world class industry that manufactures seamless steel pipes.

Finite element model of the Mannesmann process

The Mannesmann process is used to produce hollow bars starting from circular cylindrical casted bars. To simulate this process, described in *Fig. 1*, we used a rigid/viscoplastic material model [17] implemented in our code METFOR using the pseudo-concentrations technique [18-19]. Details on the implementation and verification of the numerical technique are discussed in Refs. [20-24]. In Ref. [15]

presented the model validation, that was performed by comparing the numerical results with industrial determinations.

The cases described in *Fig. 2* were analyzed in the validation process: the three cases correspond to the piercing of bars made with the same steel; the torque-turn curves of this steel were experimentally determined and a couple of them are shown in *Fig. 3*. By post-processing these experimental results we got the material parameters corresponding to an exponential-power law [12]. Isothermal analyses were performed considering a temperature of 1200°C.

A very sensitive parameter for comparing the numerical and industrial results is the pitch of the helix where the points initially on a straight line along the bar surface get located on the final hollow. This torsion helix is an important factor affecting the total redundant deformations that are introduced in the material by the piercing process. For cases 1 and 2, in *Table I* we compare the numerical and industrial results. In both cases the piercing process was interrupted with the blank inside the machine

Plug	Elements	dof	FEM Pitch	Exp. Pitch
1	96,576	314,097	1158mm	1054mm
2	100,950	327,444	714mm	695mm

Table I:
Comparison between numerical and experimental results

In *Fig. 4* we compare, for the plug profile # 1, the first fourteen transversal cross sections determined with the model and the corresponding cross sections obtained during the industrial experiment.

In the third case the piercing process was also interrupted with the blank inside the machine. The outer surface of the semi-processed bar was mapped using the *"shapemeter"* described in Ref. [25]; the inner surface shape was replicated using a resin cast and the shape of the replica was also mapped as described in the cited reference. In *Figs. 5 & 6* we present, for this case, the comparison between the finite elements determined and experimentally mapped surfaces.

Model stability

In the development of the model several assumptions were made regarding the values of the friction coefficients and the length of the Mannesmann fracture cone [15]; hence, we have to investigate the stability of the results when those assumed physical parameters change. In Table II we summarize the numerical results.

Plug	μ_{rolls}	μ_{shoes}	μ_{plug}	L_{Mann}	FEM-pitch	$\frac{FEM\ pitch}{Exp\ pitch}$
1	0.2	0.2	0.25	150 mm	1054 mm	0.88
1	0.5	0.2	0.25	150 mm	1252 mm	1.05
1	0.2	0.2	0.25	300 mm	1158 mm	0.97
2	0.2	0.2	0.25	150 mm	695 mm	0.88
2	0.5	0.2	0.25	150 mm	599 mm	1.14
2	0.2	0.2	0.25	300 mm	714 mm	0.90

Table II:
Stability analysis for the Mannesmann process model

The limited variation in the model results when the input parameters are changed is a good indication of the model stability.

Finite element model of buckle arrestors for deepwater linepipes

Deepwater pipelines are normally subjected to external pressure and bending and they are designed to prevent buckling and collapse failures. But a pipeline that is locally damaged may collapse and, if the hydrostatic pressure is high enough, the collapse may propagate along the

Figure 7:
FEM vs. experimental results for a flattening cross-over

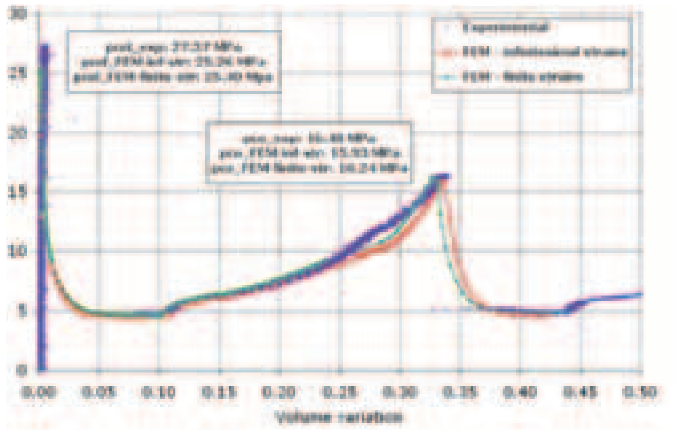


Figure 8:
Experimentally observed and FEM predicted shapes of collapsed pipes after a flattening cross-over

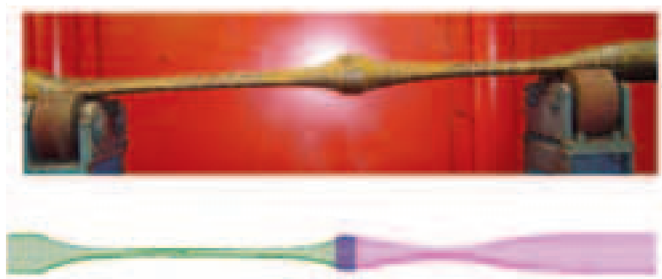


Figure 9:
FEM vs. experimental results for a flipping cross-over

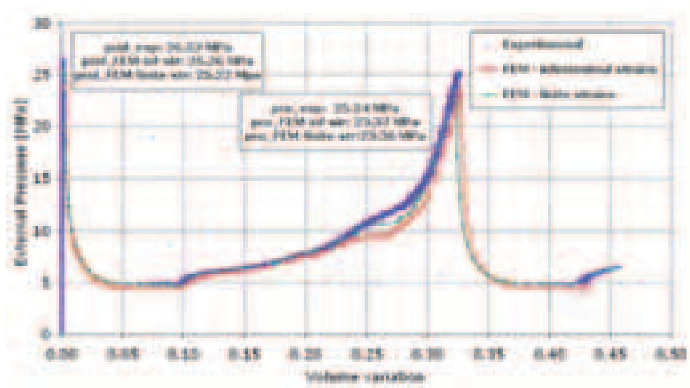


Figure 10:
Experimentally observed and FEM predicted shapes of collapsed pipes after a flipping cross-over

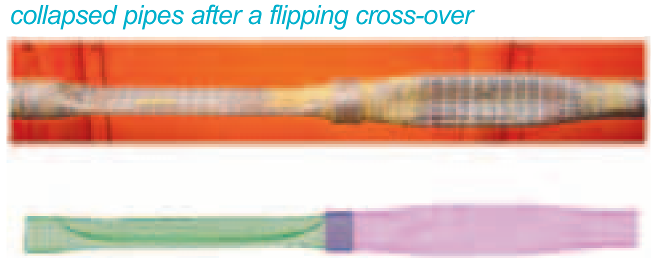


Figure 11:
Strain gages for verifying an OCTG connection model

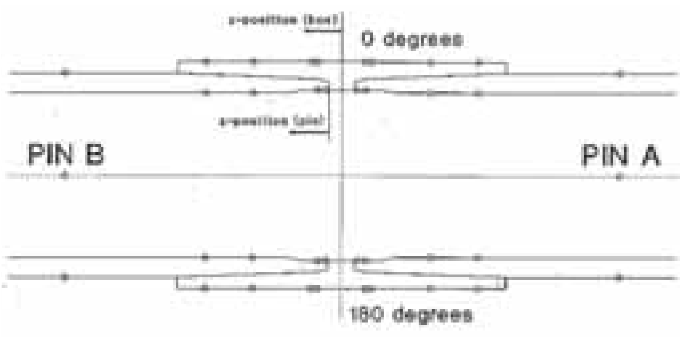


Figure 12:
Dope pressure measured during make-up

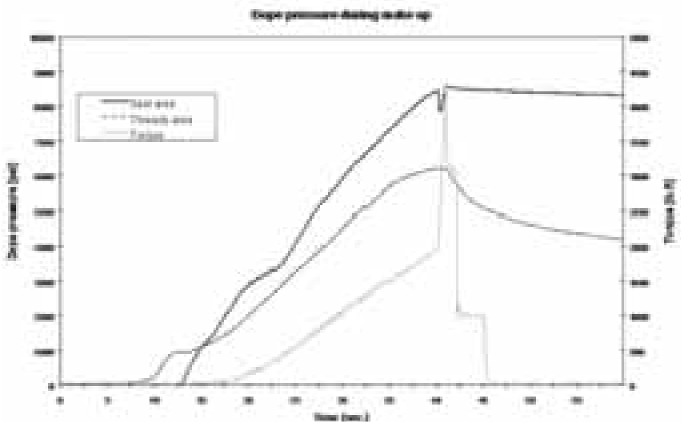


Figure 13:
Strains comparison without considering dope pressure in an over-doped connection.

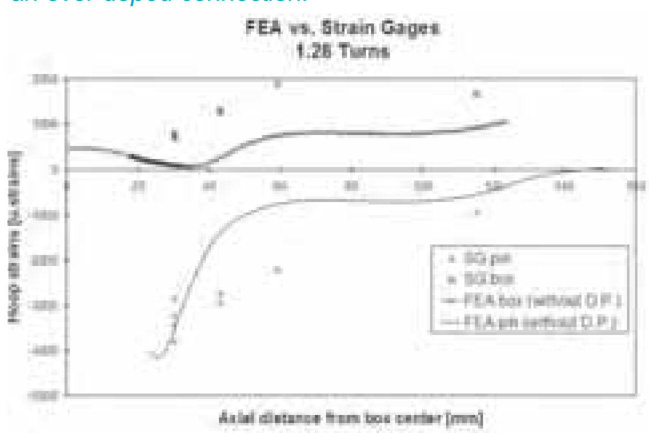
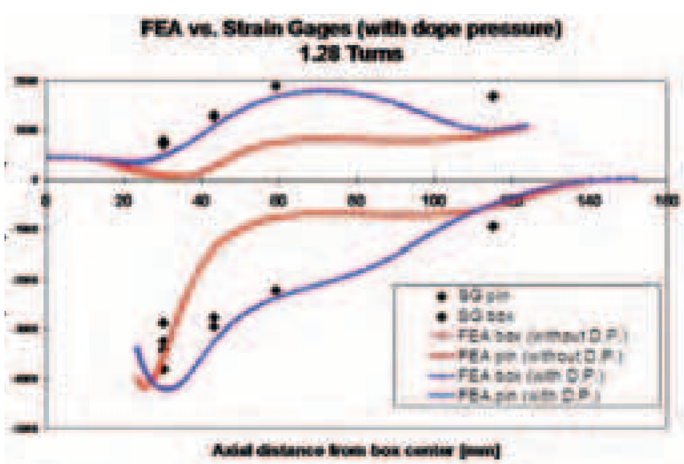


Figure 14:
Finite element analysis considering dope pressure.



pipeline. The collapse propagation pressure is the lowest pressure value that can sustain the collapse propagation [26]. Since the external collapse propagation pressure is quite low in comparison with the external collapse pressure, it is necessary to install buckle arrestors, at intervals along the pipeline, with the purpose of limiting the extent of damage to the pipeline by arresting the collapse propagation.

Buckle arrestors are devices that locally increase the bending stiffness of the pipe in the circumferential direction and therefore they provide an obstacle in the path of the propagating buckle; there are many different types of arrestors, but all of them typically take the form of thick-walled rings. The external pressure necessary for propagating the collapse pressure through the buckle arrestors is the collapse cross-over pressure.

In our paper [27] we focused on the analysis of the collapse and post-collapse behavior of pipelines reinforced with buckle arrestors: we developed finite element models to analyze the collapse, collapse propagation and cross-over pressures of reinforced pipes and we presented an experimental validation of the models. In particular we considered the case of welded integral arrestors.

Two different integral buckle arrestor cross-over mechanisms were identified in the literature: flattening and flipping. The occurrence of either cross-over mechanism is determined by the geometry of the pipes and of the arrestors [28].

In *Figs. 7-10* we present comparisons between numerical and experimental results for various [pipe –arrestor] configurations.

Finite strain or infinitesimal strain formulations?
In the post-buckling regime finite elastic-plastic strains are developed only at localized zones and therefore the analyst may doubt between using geometrically nonlinear finite strains (more expensive) or geometrically nonlinear infinitesimal strains (less expensive) models. Hence, in *Figs. 7 & 9* we compared the results provided by both models with the experimental results and we arrived to the conclusion that using the less expensive model is an adequate choice.

Finite element models of a threaded connection for OCTG: learning from validation

Oil country tubular goods are the pipes that go inside the oil wells for oil production (tubings and casings); their threaded connections have to be extremely reliable and provide adequate strength; also in many cases (proprietary connections) they must be gas-tight.

Nowadays finite element models are extensively used for the design of these threaded connections. Therefore the validation of these models is a very important issue [13, 29 and 30].

In *Fig. 11* we present the strain gages that we installed in an OCTG connection (pins and box). An actual connection was made-up with extra dope and the dope pressure values shown in *Fig. 12* were measured during the make-up. In *Fig. 13* we compare the strains determined via a standard finite element analysis with the strains measured in the full-scale test; it can be seen that the agreement between numerical and experimental values is not as good as in the cases reported in our previous publications. Then we re-run the analysis adding among the loads the dope pressure distribution determined in the full-scale test; in *Fig. 14* we compare the experimental results with the numerical results obtained with and without the inclusion of the dope pressure; it is obvious that the inclusion of the dope pressure improves the matching between the experimental and numerical results.

Engineering design considerations
As a result of the above discussed validation results, it was obvious that the over-doping condition should be always avoided and therefore the connection design was modified to include "dope pockets" that could allocate a possible amount of extra-dope without a pressure increase [31].

Conclusions

Finite element models are a powerful tool in industry for analyzing technological process. Since the reliability of the models is of utmost importance, the analyst should be able to make fundamental decisions regarding the mathematical model (modeling hypotheses), the numerical model (e.g. how many elements? and which elements?), numerical model inputs (e.g. material parameters).

After getting the results one should be able to verify the adequacy of the modeling hypotheses and of the discretization scheme. An experimental validation process is necessary to have reliable results that can be used in technological decisions.

The usage of black-boxes by analysts lacking the necessary background is a road map for disaster. ●

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The Golden Gate Bridge

From the Beginning till Today

by
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University of Stuttgart
Germany

Short version of a Presentation at the 9th US National Congress on Computational Mechanics San Francisco 22 July 2007

Figure 1: *Ekkehard Ramm and Robert L. Taylor, August 2006*

Figure 2: *First design by Strauss in 1921*

Most likely Sir Francis Drake had already in 1579 a first glimpse of what is called today the Golden Gate. Drake's Beach in Point Reyes National Seashore farther up north marks the position where he landed. The official datum is 1769 when a Spanish expedition under the commander Caspar de Portola discovered the bay. In 1776 the first settlement is called "Yerba Buena" (good herb). The Yankees came 70 years later. In 1847 the village with its 450 inhabitants was renamed "San Francisco". The leisurely development changed abruptly in 1848 when James Marshall found gold at the foot of the Sierra in a mill of the Swiss immigrant John Sutter. The "gold rush" started; only one year later the population increased to 35000.

In 1872 the railway owner Charles Crocker proposed a railway bridge across the Golden Gate, an idea which was immediately rejected as being far too bold. The rapid development of the city continued. In 1906 San Francisco being a metropolitan with 400000 inhabitants was for the most part destroyed by the earthquake and the subsequent fire. People moved farther north to the Marin County increasing drastically the ferry traffic.

J. B. Strauss and the Development of the Golden Gate Bridge

The civil engineer and journalist James Wilkins proposed in the 1916 San Francisco Bulletin a suspension bridge across the Golden Gate. The article found a lively interest from the people. The San Francisco City Engineer O'Shaughnessy interviewed renowned engineers. Nearly all answers were negative; the project would be too risky and with 100 million dollars far too expensive. Only the engineer Joseph Baermann Strauss *(Fig 3)* from Chicago reacted positively and answered "I think I can do it and for far less money".

Strauss, of German descent, born in Cincinnati, a difficult person of small stature, was described as a man with an enormous ego and ambition but also with a great sense for a mission. In 1918 at the age of 48 – he had been involved in the design of 399 Bridges already – he sensed the unique opportunity to design the longest bridge in the world. In 1921 Strauss presented his first design: a combination of a truss-like cantilever beam and a suspension bridge *(Fig 2)*. The design regarded as grotesque and ugly was rejected, so was a further bridge design by Strauss. The final concept, namely a pure suspension bridge, was proposed by others, among them the famous suspension bridge expert Leon Moisseiff, a fact which was never acknowledged by Strauss.

During this planning phase in the 1920ies a lot of problems and objections had to be overcome, among them the survey of the soil conditions, the financing by issuing bonds (time of depression!), convincing the navy (Oakland was a military harbour!) and the population (fear of another earthquake!). In 1928 the courts decided that the bridge could be built. Shortly thereafter a competition for the position of the chief engineer took place. It is probably not by mere chance that Strauss with his whole personal commitment for the bridge project was appointed as chief engineer. He was smart enough to propose two of his competitors as consultants, Amman and Moisseiff. In November 1930 the residents of San Francisco and the northern counties approved a bond issue of $ 35 million by a margin of 3 to 1. Already in 1922, long before the final decisions were made, Strauss hired Charles A. Ellis (1876-1949) as Principal Assistant Engineer, a scholar teaching at the Universities of Michigan and Illinois. Ellis, a modest person not inclined to seek fame, was the head figure in working out all details of the bridge; he cooperated with Moisseiff to master the calculations and designs. Apparently Strauss did not understand the complexity of the engineering work and accused Ellis for wasting time and money. He dismissed Ellis in 1931 and replaced him by Clifford Paine who was listed as Principal Assistant Engineer of the Golden Gate Bridge in all reports and official announcements. Ellis was shocked but eventually found a teaching job at Purdue University. His achievements were for a long time not officially acknowledged. Not until recently he received the necessary recognition for his enormous role in the engineering of the bridge.

Final Design and Construction

The "blue prints" were submitted in the middle of 1931 *(Fig. 4)*. The "real" (not self anchored) suspension bridge has a total length of 1966 m and a span of 1281 m. The two main cables anchored at both sides in huge anchor houses have a diameter of 92.4 cm and consist of 61 strands with 451 wires each. The pier of the north tower is founded in solid volcanic rocks (basalt, diabase) whereas the south pier which is located in shallow waters of the bay is founded on relatively soft chert, a compressed clay mineral (serpentine). The height of the towers is 228 m. It is reported that an analysis with 33 unknown is performed for half of one tower (symmetry!) using the displacement method followed by a Williot diagram to capture additional moments. The U-shaped truss stiffening girder *(Fig. 5)* is designed according to the "classical" construction principle (main girders, floor beams, stringers). It is remarkable that 30 % of the entire dead load comes from the concrete roadway and the maximum live load amounts only to 19 % of the dead load. The seismic load assuming 7.5 % of the dead load as horizontal static equivalent load was by far underestimated.

For the first time the outer appearance of the bridge was influenced by an architect, namely Irving Morrow and his wife Gertrude. Though to date they had no experience in the design of bridges, they had a considerable influence, e. g. the tapering at the top of the towers, the structural masking of the horizontal struts as well as the art-deco design of railing and light posts are based on their recommendations.

Beginning of 1933 the construction of the bridge commenced, accompanied by a ground breaking ceremony some

Figure 3:
Joseph Baermann Strauss (1870 - 1938)

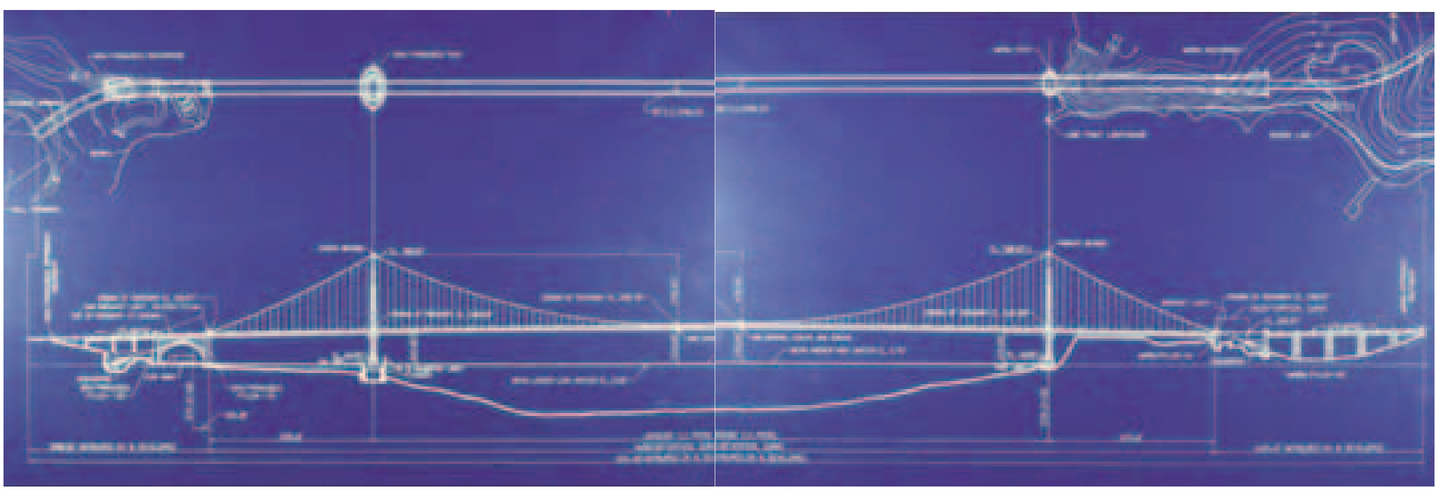


Figure 4:
Blue prints:
San Francisco (left)
with soft soil,
Marin County (right)
with solid soil conditions

Figure 5:
Cross section of main girder

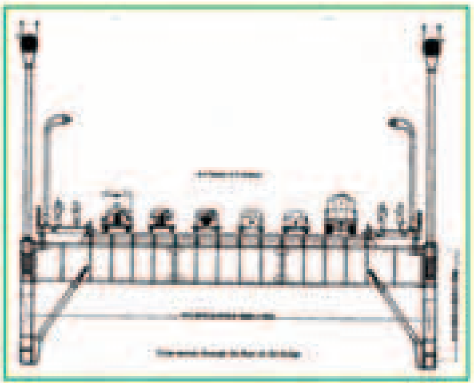


Figure 6:
Section through south pier

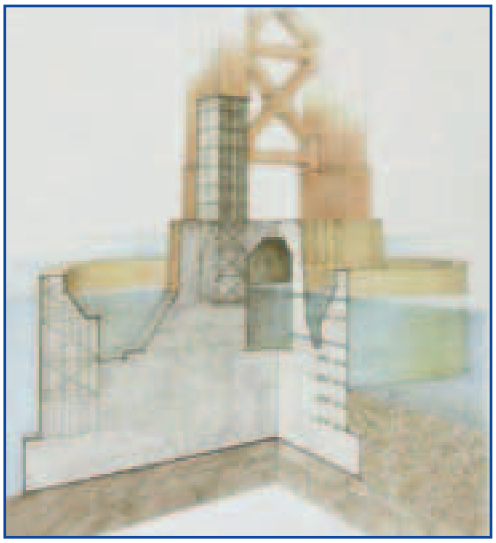


Figure 7:
Erection of towers

weeks later. First the anchor houses in the North and South were built. For the first time concrete was transported in mixer trucks from a batching plant. The foundations of the pier for the north tower followed a traditional concept using a sheet pile coffer dam. The south pier construction 350 m offshore in 20 m deep water, was probably the most challenging task during the erection of the bridge. The pile trestle bridge was destroyed two times by a ship collision and a heavy storm. The original construction method of the pier utilizing a caisson failed so that a conventional concept using a fender wall and under water concreting had to be selected *(Fig. 6)*. Both piers got a 16 cm thick steel plate on top as basis for the tower construction.

All steel elements are prefabricated at Bethlehem Steel Company in Pennsylvania and shipped via the Panama Canal to the site. The erection of the towers was handled very efficiently, so that already in June 1935 both towers were completed *(Fig. 7)*. During this period however the steel workers got sick due to lead poisoning, caused by the lead based protective coating. Huge cable saddles machined out of cast iron blocks each weighing 160 t were mounted on top of the towers. Probably the most interesting construction phase for the residents was the spinning process of the cables. The famous Roebling Company from New York was commissioned; they used the technique introduced already in 1829 by the Frenchman Vicat. After the first basic cable was shipped over the gate the so-called catwalk could be erected and stiffened underneath by a cable storm system. A spinning wheel, a cable tramway, runs between the anchorage points and “spins” the single 5 mm thick wires to strands which eventually are adjusted to form the entire cable. After just six months the cable spinning was finished so that the suspender ropes could be added every 15 m which carry the main truss girder. These are again pre-assembled in Pennsylvania and attached to the suspenders *(Fig. 9)*.

Until summer 1936 no fatal accident had occurred on site although the statistics said that 1 casualty per 1 million dollars construction costs were reported at that time. This can definitely be attributed to the fact that Strauss was a

Figure 8:
Erection of main girder with safety net

safety fanatic. Alcoholic beverages were prohibited on site; workers received snow goggles to protect against the dazzling brightness. But most importantly the safety net *(Fig.8)*, for the first time introduced in bridge construction, has saved many lives. The "Fell of the Bridge Club", also called "Half Way to Hell Club", was founded to which finally 19 persons belonged.

It should be mentioned that the San Francisco-Oakland-Bay Bridge was built at the same time; it was finished in November 1936. It had 22 casualties at the end. On the Golden Gate Bridge one worker was killed when a derrick failed; in January 1937 a terrible accident happened when a scaffolding segment failed and cut across the safety net pulling 10 workers into the depth.

The architect Morrow had tested several coatings with different colors like grey, silver and gold. Finally he decided to take "International Orange" which gave the bridge its unique appearance. In November 1936 the last gap of the main girder was closed; the final stage commenced by adding the concrete roadway.

On 27 May 1937 the bridge was opened to the public. Strauss recalled the statement of San Francisco City engineer O'Shaughnessy made in 1917: "Everybody says it can't be done and even if it could be done it would cost over 100 million dollars". Now in 1937 he said: "It took two decades and two hundred million words to convince people the bridge was feasible but only four years and 35 million dollars to build it". After completion of the bridge Strauss retired. In less than a year he died of thrombosis in Los Angeles at the age of 68.

70 years of Golden Gate Bridge

In May 2007 the 70th anniversary of the bridge was celebrated. In all the years big challenges were faced which needed continuous attention; some of them are briefly mentioned in the sequel.

Wind

The bridge has undergone several big storms however no extreme dynamic excitation occurred. However, the experts became concerned when the Tacoma Narrows Bridge with its shallow cross section collapsed during a heavy but expected storm on 7 November 1940. Also the Golden Gate Bridge had a U-shaped truss girder with low torsion stiffness. As a consequence of the Tacoma Bridge disaster the Golden Gate Bridge was experimentally monitored. In winter 1951 the biggest storm was measured with a velocity of 110 km/h, however no serious damage occurred. Nevertheless in 1954 a lower bracing was added proposed by the former Principal Assistant Engineer C. Paine and the office of Amman & Andrew. Although no serious dynamic excitations were monitored since then the question of wind loading is permanently discussed because of a general increase of wind speed (climate change!) and a potential change in the design of the railing (suicide barrier!).

Environmental Effects: Fog

The proverbial air-conditioning in the San Francisco bay with a continuous interplay of fog and sunshine is a permanent challenge for the bridge engineers. Not only that a continuous painting process is going on using sophisticated coating recipes also the exceptionally corrosion asks for steady repair measures. Already in the 1960ies a main inspection indicated that suspenders and joints were in a critical state; they were afterwards piece by piece replaced. Extensive repair measures have been done also for the approach viaducts, mainly in the context of the retrofitting procedures in the last years.

Loads

In 1982 the heavy reinforced concrete roadway was worn out and had to be replaced by a light orthotropic steel deck with asphalt covering. Worth mentioning is the reduction of the dead load by 17 % corresponding to about the maximum assumed live load.

The 50th anniversary of the Golden Gate Bridge was celebrated in 1987 by a pedestrians' day. It is said that the bridge was exposed to the biggest load ever. Even if the construction was not reaching its "limits" the main span considerably flattened *(fig. 10)*.

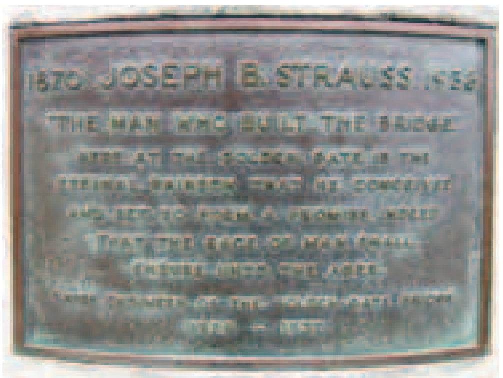
Figure 9:
Manufacturing of truss girder

Figure 10:
Pedestrian´s day at 50th anniversary 1987

Increasing Traffic

Over the years the traffic has increased in such a way that the ferry service is also very much in demand. The construction of a second bridge is rejected, mainly because of aesthetic reasons. For the purpose of a second deck with two railroads a feasibility study had been commissioned in 1988. The result of the investigations was that the bridge is able to carry two tracks (recall reduction of dead load by 17 %) however it is considered as too expensive for the time being.

Figure 11:
Plaque at Strauss Monument



Earthquake

Not only had the Loma Prieta earthquake in 1989 made the engineers aware of the sensitivity of the bridge. Since this time numerous experimental and numerical studies have been carried out. A magnitude of 8.3 on the Richter scale is assumed leading to a bundle of retrofitting measures which started in August 1997 (Fig. 12). Since it turned out that the approaches in the North and the South (including the truss arch across Fort Point) were the most critical parts, the retrofitting started there ; this part has been almost completed in 2007. Entire towers foundations and structural elements hat to be replaced or reinforced; base isolators and dampers installed, extra bracings and liners added, bolts used instead of rivets; just to mention only a few measures. The retrofitting of the main bridge is on the agenda for the coming years.

Résumé

The Bridge has its own legend. Chief Engineer J.B. Strauss tried to set himself a monument and its simple meaning of the word he was successful (Fig. 11). It is said on the plaque **"The man who built the bridge"**. Technically speaking this is certainly not true. Many engineers and workers have contributed with great devotion and responsibility to the success of this magnificent structure. But Strauss´s visions and ability to assert himself were the important driving forces for the construction of the bridge.

Being for a long time the bridge with the largest span of 1280 m, the Golden Gate Bridge is now No. 8 in the world, the largest one being the Akashi-Kaikyo Bridge with 1991 m span. The bridge has its happy stories, but has also a very sad side being attracted by suicides. Suicide barriers are disputed and have already been designed. The mentioned retrofitting project on the south side has been named 2007 Outstanding Civil Engineering Achievement (OCEA) by ASCE.

The Golden Gate Bridge is an engineering masterpiece. No other bridge is appreciated or even loved equally by residents and visitors as much as the Golden Gate Bridge.

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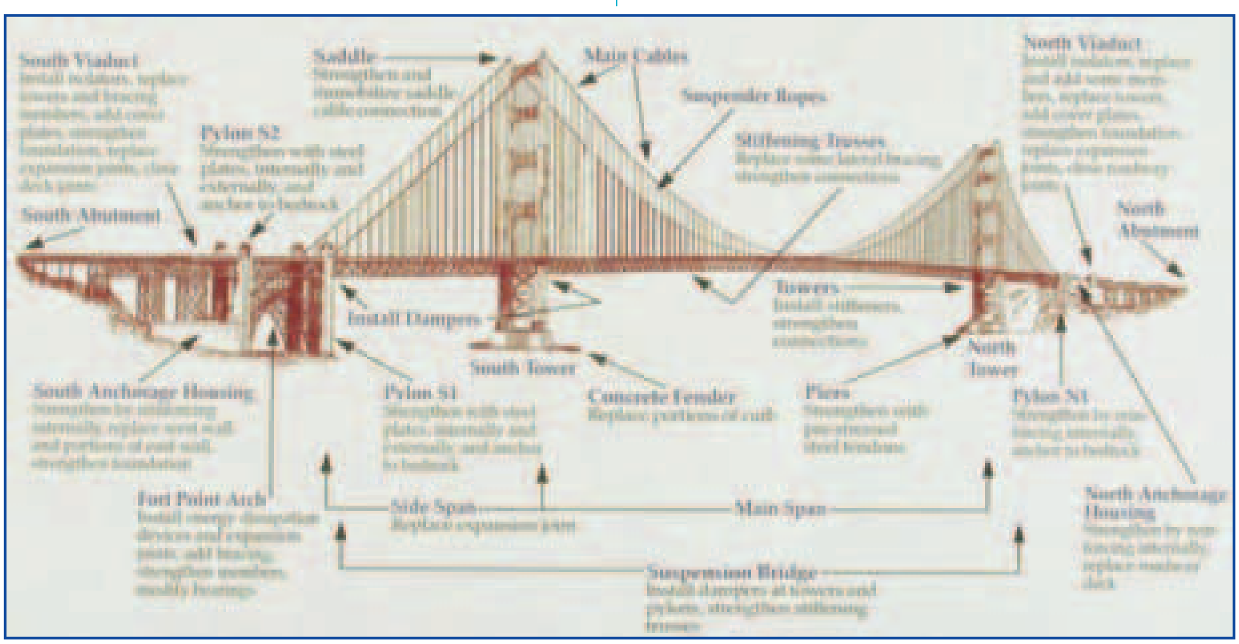
Some of the figures are taken from these books.

Figure 12:
Retrofitting measures



Fluid Mechanics and Optics:

the Effect of Turbulence in the Observation of the Universe

by
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***Joan Baiges**(1)*
***Daniel Pérez-Sánchez**(1)*
*and **Manuel Collados**(2)*

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(2) Astrophysical Institute of the Canary Islands (IAC)

In spite of its impact in some applications, the problem of estimating the optical properties in a turbulent flow is not particularly popular in the computational fluid dynamics (CFD) community. An example where this problem is of paramount importance is in the determination of the location where large telescope facilities have to be built. The purpose of this note is precisely to explain the problem and to comment on the impact that CFD may have in this technical decision.

The location for the construction of a telescope depends on several factors, some of them of logistic nature (such as the ease of construction or the scientific and political environment) and others, obviously, directly relevant to the quality of the astronomical observation. Among the latter, periods of good visibility (without clouds), weather conditions or the proximity to the Equator (leading to the so called sky quality) have an obvious impact. However, at least as important as those are the optical properties of the environment where the telescope enclosure is placed, primarily determined by the aerodynamic behavior of this enclosure.

One of the well known sites for telescope locations is the Roque de los Muchachos mountain in the La Palma island, in the Canary archipelago. *Figure 1 (left)* shows a picture of the summit with the different telescopes located there, as well as a computer model (*figure 1 right)* we have used for a simulation described below.

The effect of the air dynamics around the telescope building on the visibility is due to the wave nature of light. Light rays, as the visible portion of the electromagnetic spectrum, travel at the light speed and with a wavelength between 400 and 800 nanometers in the vacuum. However, when they enter a transparent medium, such as the earth atmosphere, they decrease their speed, therefore changing their wavelength (the frequency is kept). The ratio between the speed of light in the vacuum and in a medium is the so called refractive index of this medium, usually denoted by *n*.

For a single beam of light, if this beam is not orthogonal to the medium interface, refraction occurs. In a medium in which the refractive index changes from point to point, the direction of the beam of light suffers continuous changes. However, the problem arises when different light rays forming a wave front enter a medium with variable refractive index. The variability of this index causes the different rays to refract in a different way, thus leading to wave front distortion and a deterioration of the quality of the visibility. This is so both from beam lights coming from the frontiers of the known Universe or from Sun rays.

Figure 1:
***Left**: Picture of the Roque de los Muchachos.*
***Right:** Computer model.*

The problem thus is the variability of the refractive index in the atmosphere rather than the refractive index itself. Here is where turbulence comes into the picture. Turbulence fluctuations, particularly in temperature, induce fluctuations in the refractive index that lead to visibility deterioration.

A first and classical approach to determine the feasibility of a certain site as a telescope location has been to quantify turbulence in the region, usually by experimental means. Classical turbulence parameters, such as the integral length, turbulence intensity or turbulence energy spectra have proved to be useful to assess the quality of a site to build a telescope. However, arguments derived from this information are merely qualitative, giving for granted that the higher the turbulence effects, the lower the visibility quality.

That CFD may play a role in this problem is obvious from what has been explained. The idea would simply be to replace experimental data by results of numerical simulations. In fact, the qualitative link between turbulence and optical quality led the International Center for Numerical Methods in Engineering (CIMNE) to participate in several projects related to the aerodynamic analysis of telescope buildings in collaboration with the Astrophysical Institute of the Canary Islands (IAC). In particular, CIMNE has been involved in the aerodynamic analysis of the GRANTECAN telescope [1] or in the ELT project from the European Commission [2], as well as in the analysis of the ATST project of a solar telescope. In this last case we have considered the possibility to go further, and to *quantify* the effect of turbulence in the visibility quality rather than simply computing the turbulence parameters.

In the astrophysical community, optical quality is measured, among other parameters, by the so called Fried parameter $\boldsymbol{r_0}$ and the Greenwood frequency $\boldsymbol{f_G}$ (see [1,2,3] for background in the optical concepts to be used). Roughly speaking, the former corresponds to the radius of a circle where the mean distortion expected of a light wave front is 1 radian, whereas the latter gives an idea of the temporal frequency at which refraction varies. Both are essential in adaptive optics in astronomy. They are used to design segmented telescopes (the size of the segments being determined by the Fried parameter) and their actuators in typical active control systems of these devices.

The question is whether $\boldsymbol{r_0}$ and $\boldsymbol{f_G}$ can be computed or not. If one assumes that the air flow is fully turbulent, the answer is positive. For length scales in the inertial range of the Kolmogorov energy cascade, it turns out that these parameters can be expressed in terms of the structure function of the refractive index and, under an isotropy assumption, by the square of the so called constant of structure, $\boldsymbol{C_n^2}$. This is, therefore, the scalar field that needs to be computed which, according to the previous discussion, must be related to the turbulence fluctuations. This dependence can be finally expressed as a relationship between $\boldsymbol{C_n^2}$ and the *mean pressure* and the constant of structure of the temperature, which, in turn, depends on the gradients of the *mean temperature and mean velocities*. The conclusion is thus clear: If we are able to compute mean flow quantities (pressure, temperature and velocity) in a fully developed turbulent flow, we will be able to estimate the constant of structure of the refractive index and, from integration along the optical path of the light beam, the Fried parameter and the Greenwood frequency. These parameters need to be computed for all directions of observation of interest.

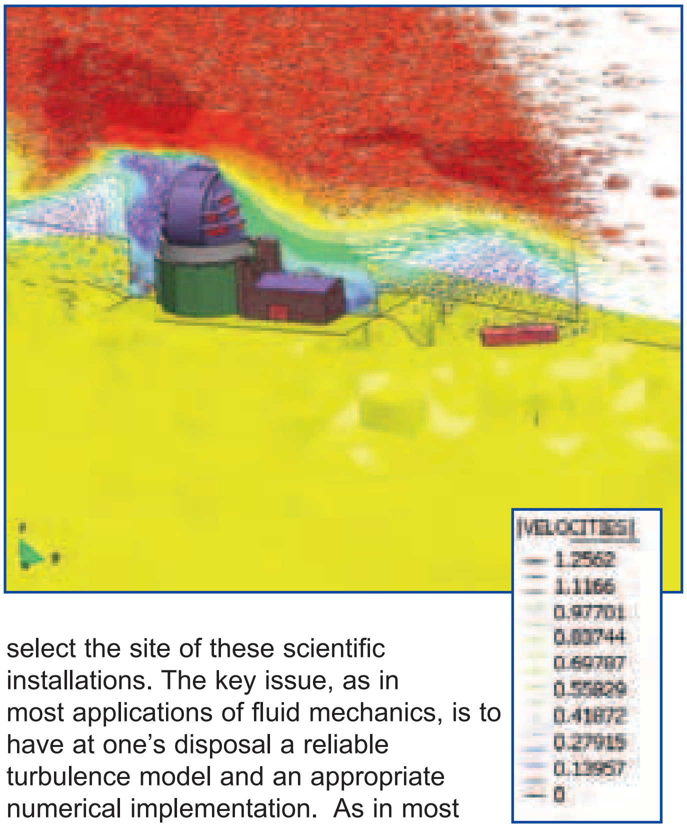
Once the model to compute the optical parameters is established (and accepted) the success depends on the CFD simulation to obtain mean flow quantities. However, now they are needed not only to establish a mere qualitative indication of the optical quality, but to compute a quantitative measure of this quality. The first and essential point to consider is that all the expressions to be used are derived under the assumption that the flow lies within the inertial range. The classical statistical temporal and spatial correlations between velocity components, pressure and temperature need to apply. This excludes from the very beginning the use of RANS (Reynolds averaged Navier-Srokes) models and restricts the alternatives to, at least, LES (large eddy simulation) formulations.

As an example of application of the strategy presented, we have applied it to the ATST telescope mentioned earlier. As basic numerical formulation we have used a stabilized finite element method for the spatial discretization together with a second order time integration scheme [6]. The Smagorinsky model has been used as LES formulation, even though richer dynamics and still genuine turbulent behavior are obtained if the stabilization alone is let to act as turbulence model [7,8].

Figure 2 shows a snapshot of a section of the velocity field (left) and the pressure contours on the surface of the telescope building and the terrain (right) computed in a certain flow configuration. The flow boundary conditions (temperature, velocity direction and velocity magnitude in the far field) are chosen among the climate data considered representative.

Once the flow variables are computed, the square of the constant of structure of the refractive index can be obtained and time averaged. Contours in a section corresponding to the flow simulation of *Figure 2* are displayed in *Figure 3*. From these results one may now compute the Fried parameter and the Greenwood frequency by integration of functions that depend on $\boldsymbol{C_n^2}$ along different optical paths corresponding to the directions of observation of interest. In this particular example, $\boldsymbol{r_0}$ happens to be in the range of 2 to 4 centimeters and $\boldsymbol{f_G}$ in the range of 20 to 50 Hertz.

We believe this example may serve to understand the potential of CFD in the field of the optical environmental quality, which in the case of telescopes is crucial to



select the site of these scientific installations. The key issue, as in most applications of fluid mechanics, is to have at one's disposal a reliable turbulence model and an appropriate numerical implementation. As in most cases, large eddy simulation seems to be the only viable approach to tackle the problem.

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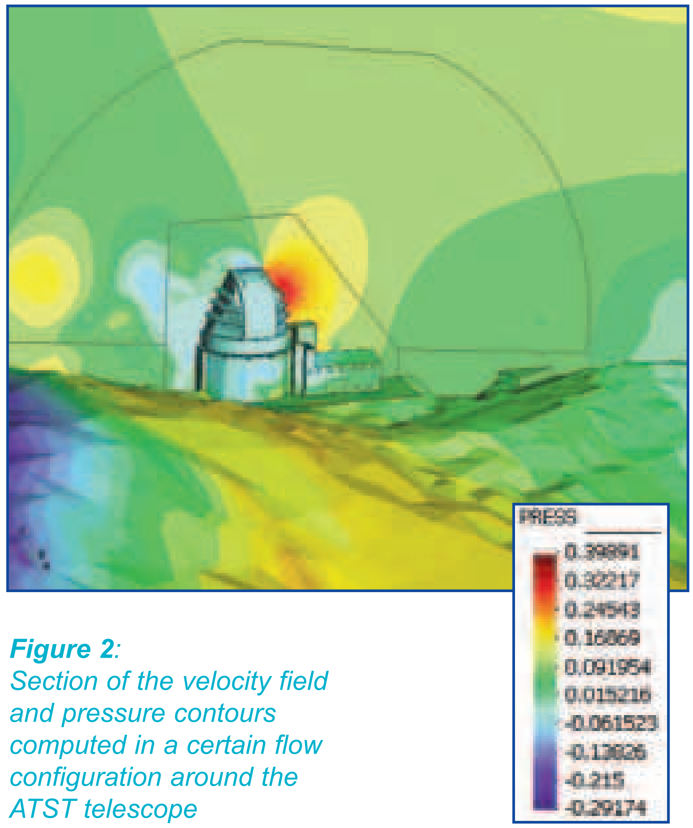

***Figure 2**:*
Section of the velocity field and pressure contours computed in a certain flow configuration around the ATST telescope

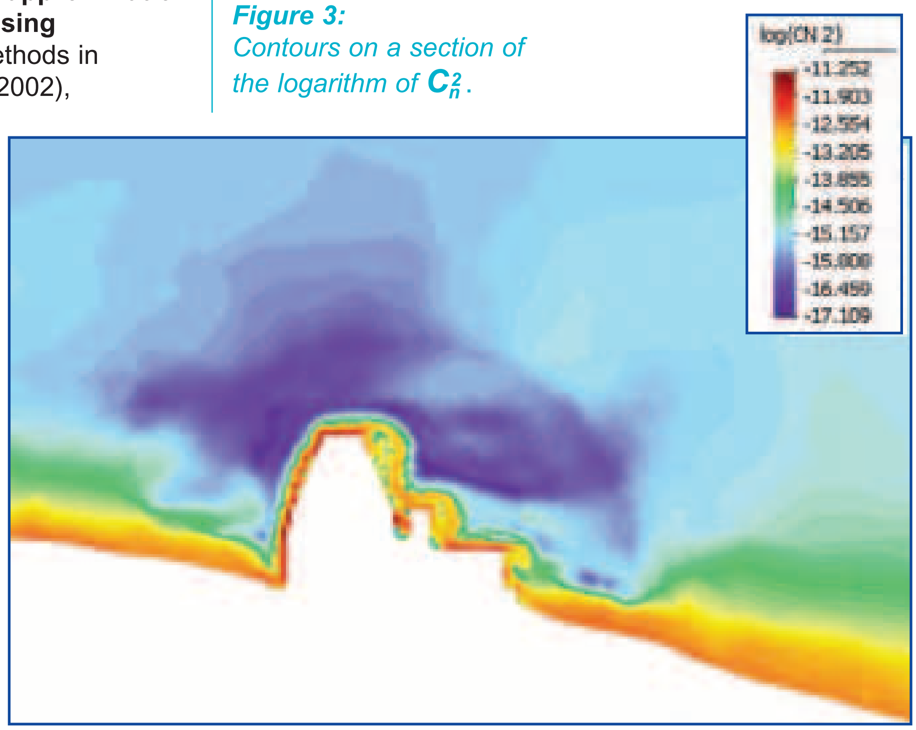

Figure 3:
Contours on a section of the logarithm of C_n^2.

Seismic Design of Structures: a Challenge for Computational Mechanics

by
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Although the fastest computers can execute millions of operations per second, they are always too slow. It may be a paradox, but the bigger and better computers become, the larger the problems scientists and engineers want to solve.
Arthur Jaffe, 1984

" The main task in a performance-based seismic design procedure is the definition of the performance objectives."

SEISMIC DESIGN CODES

The requirements and provisions of seismic design codes have been based on experience and observations and they have been periodically revised after disastrous earthquakes. Seismic design codes usually rely on a single design earthquake for assessing the structural performance against earthquake hazards. As a consequence, these codes have many inherent assumptions built in the design procedure regarding the seismic behaviour of structures and the characteristics of earthquake loading. Severe damages caused by recent earthquakes triggered a number of questions by the engineering community regarding the reliability of the current seismic design codes. Given that the primary goal of contemporary seismic design is the protection of human life together with an economic design, it is evident that additional performance targets and earthquake intensities should be considered in order to assess the structural performance for many hazard levels. In the last decade the concept of performance-based structural design (PBD) under seismic loading conditions was introduced. In PBD, more accurate analysis procedures are implemented based on the nonlinear structural response.

Most of the current seismic design codes belong to the category of prescriptive or limit state design procedures where if a number of conditions, expressed primarily in terms of forces and secondarily in terms of displacements, are satisfied the structure is considered safe and no collapse is assumed to occur. A typical limit state based design can be viewed as one (i.e. ultimate strength) or two (i.e. serviceability and ultimate strength) limit state approach. All contemporary seismic design proce dures are based on the concept that a structure will avoid collapse if it is designed to absorb and dissipate the induced kinetic energy during the seismic excitation.

According to a prescriptive design code the strength of the structure is evaluated at one limit state, between life-safety and near collapse, using a response spectrum-based loading corresponding to one earthquake hazard level. In addition, the serviceability limit state is usually checked in order to ensure that the structure will not deflect or vibrate excessively. On the other hand, PBD is a different approach which includes, apart from the site selection and the consideration of the design stages, the performance of the structure after construction in order to ensure reliable and predictable seismic performance over its life.

The main task in a performance-based seismic design procedure is the definition of the performance objectives. A performance objective is defined as a given degree of system performance response for a specific hazard level. According to the Enhanced Objectives of FEMA-350 [1] the following three structural performance levels are usually considered:

i) *Operational level*: the overall damage is characterized as very light. No permanent drift is encountered, while the structure essentially retains original strength and stiffness.
ii) *Life Safety level*: the overall damage is characterized as moderate. Permanent drift is encountered but

partial or total structural collapse is avoided. Gravity-load bearing elements continue to function and the overall risk of life-threatening injury as a result of structural damage is expected to be low. It could be possible to repair the structure, however, for economic reasons this may not be practical.

iii) *Collapse Prevention level*: the overall damage is characterized as severe. Substantial damage has occurred to the structure, including significant degradation in the stiffness and strength of the lateral-force resisting system. Large permanent lateral deformation of the structure and degradation in the vertical load bearing capacity is encountered. However, all significant components of the gravity load resisting system continue to carry their gravity load demands. The structure may not be technically repairable and is not safe for reoccupancy, since aftershock activity could induce collapse.

The definition of the earthquake hazard, according to FEMA-350, includes parameters such as direct ground fault rupture, ground shaking, liquefaction, lateral spreading and land sliding. Ground shaking is the only earthquake hazard that structural design codes directly address. Ground shaking hazard is defined by means of a hazard curve, which indicates the probability that a measure of seismic intensity (e.g peak ground acceleration or 1st mode spectral acceleration) will be exceeded over a certain period of time. The three levels of recommended seismic hazard are defined as follows:

i) *Occasional Earthquake Hazard level*: with probability of exceedance 50% in 50 years and interval of recurrence 72 years.

ii) *Rare Earthquake Hazard level*: with probability of exceedance 10% in 50 years and interval of recurrence 475 years.

iii) *Maximum Considered Event Earthquake Hazard level*: with probability of exceedance 2% in 50 years and interval of recurrence 2475 years.

The combination of one performance level with an earthquake hazard level results to a performance objective. *Figure 1* depicts the performance objectives for three classes of facilities (i) For Low Importance Facilities three performance objectives are defined: L1, L2 and L3. (ii) For Standard Importance Facilities two performance objectives are defined: T1 and T2. (iii) For High Importance Facilities one performance objective is defined: H1.

When a non-linear dynamic analysis procedure is implemented in the framework of a PBD, a number of seismic records have to be applied for each hazard level. The time histories of the seismic records can be either natural records or artificial accelerograms.

COMPUTATIONAL EFFORT

Seismic design of structures is an extremely computational intensive task since, in order to assess the structural performance for different hazard levels, the prediction of the nonlinear dynamic response is required which can be influenced by a number of inherently uncertain parameters. Such parameters include, among others, the material properties, the workmanship, the hysteretic behaviour of structural members and joints, the support conditions. The intensity and the earthquake ground motion characteristics are also random. Furthermore, uncertainty is also involved in the design procedure that would be adopted as well as in the numerical simulation of the structure. In order to account for as many as possible of the above uncertainties a reliability-based, in conjunction with a performance-oriented, approach should be considered. If, in addition to system uncertainties, structural optimization is also implemented, by substituting the traditional "trial and error" procedure with an automated optimization design procedure for obtaining not only a feasible but also the best possible design, then the computational cost increases dramatically.

"The definition of the earthquake hazard ....includes parameters such as direct ground fault rupture, ground shaking, liquefaction, lateral spreading and land sliding."

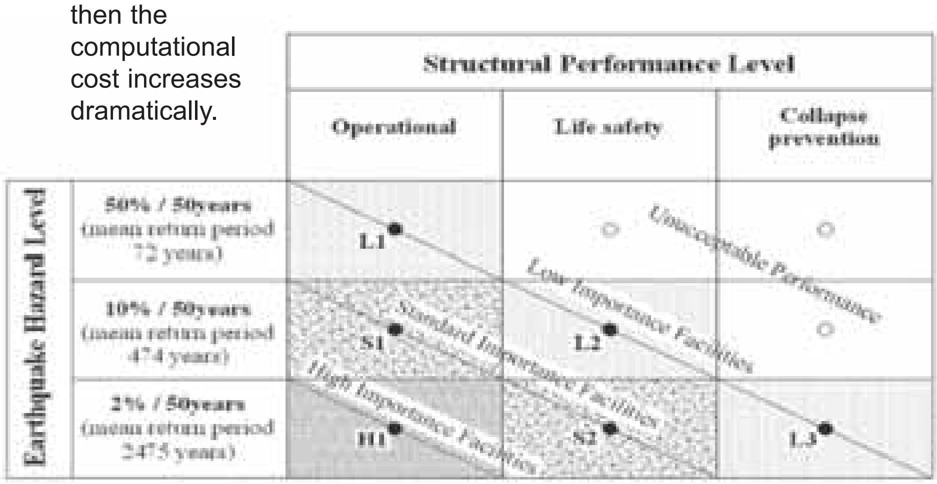

Figure1. *Design performance objectives for three types of facilities*

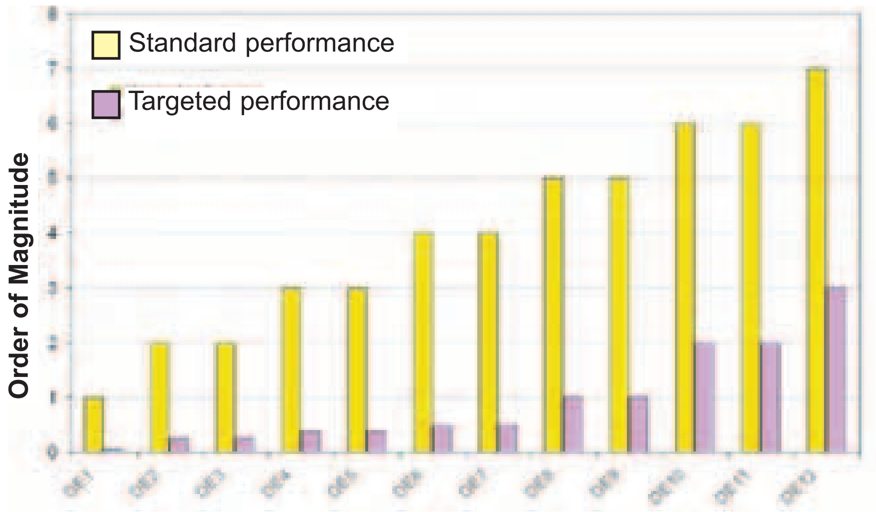

Figure 2: Computational effort-Deterministic Problems

Glossary of acronyms:
DE1 Static Analysis – Linear Response
DE2 Static Analysis – Non-linear Response
DE3 Dynamic Analysis – Linear Response
DE4 Dynamic Analysis – Non-linear Response
DE5 Static Design Optimization – Linear Response
DE6 Static Design Optimization – Non-linear Response
DE7 Dynamic Design Optimization – Linear Response
DE8 Dynamic Design Optimization – Non-linear Response
DE9 Static Multi-objective Design Optimization – Linear Response
DE10 Static Multi-objective Design Optimization – Non-linear Response
DE11 Dynamic Multi-objective Design Optimization – Linear Response
DE12 Dynamic Multi-objective Design Optimization – Non-linear Response

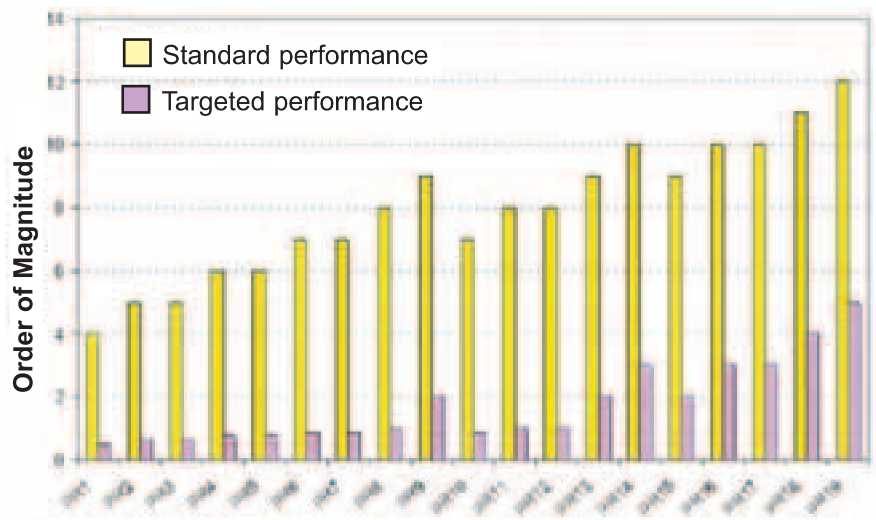

Figure 3: Computational effort-Probabilistic Problems

Glossary of acronyms:
PR1 Reliability Static Analysis – Linear Response
PR2 Reliability Static Analysis – Non-linear Response
PR3 Reliability Dynamic Analysis – Linear Response
PR4 Reliability Dynamic Analysis – Non-linear Response
PR5 Reliability-Based Static Design Optimization – Linear Response
PR6 Reliability-Based Static Design Optimization – Non-linear Response
PR7 Reliability-Based Dynamic Design Optimization – Linear Response
PR8 Reliability-Based Dynamic Design Optimization – Non-linear Response
PR9 Reliability-Based Earthquake Design Optimization – Non-linear Response
PR10 Robust Static Design Optimization – Linear Response
PR11 Robust Static Design Optimization – Non-linear Response
PR12 Robust Dynamic Design Optimization – Linear Response
PR13 Robust Dynamic Design Optimization – Non-linear Response
PR14 Robust Earthquake Design Optimization – Non-linear Response
PR15 Reliability-Robust Static Design Optimization – Linear Response
PR16 Reliability-Robust Static Design Optimization – Non-linear Response
PR17 Reliability-Robust Dynamic Design Optimization – Linear Response
PR18 Reliability-Robust Dynamic Design Optimization – Non-linear Response
PR19 Reliability-Robust Earthquake Design Optimization – Non-linear Response

The Computational Mechanics Problems may be categorized, in general, according to the following characteristics:

1. Depending on the system response: Linear or Non-linear
2. Depending on the loading conditions: Static or Dynamic
3. Depending on the type of the design parameters: Deterministic or Probabilistic
4. Depending on the design procedure: Prescriptive or Performance-Based.

Computational effort of deterministic problems

Figure 2 depicts a qualitative assessment of the computational effort required for solving different types of deterministic problems starting from the static analysis with linear response to the most demanding dynamic multi-objective design optimization with nonlinear system response. It can be seen that, assuming the basic problem requires 10 seconds computing time to be solved, the corresponding most demanding deterministic problem would require 120 days of computing time. A targeted reduction of the computing time for treating realistic problems should be a reduction of at least 4 orders of magnitude, requiring 20 minutes for the DE12 problem to be solved, as indicated in *Figure 2*.

Computational effort of probabilistic problems

Figure 3 depicts a similar qualitative assessment for solving probabilistic problems starting with the reliability analysis with linear response to the most complicated one, but very essential for a safe and economic design, reliability combined with robust earthquake design optimization with nonlinear system response. The computational effort becomes excessive, increased by orders of magnitude, with regard to the required effort for the corresponding deterministic problems. In these cases, the need for reducing the computing times becomes much more pronounced. The only way to attempt the solution of these type of problems is to achieve six to seven orders of magnitude reduction in the required computational effort. Thus the time of 32,000 years which is required to solve PR19 with a standard numerical approach compared to 10 seconds for the corresponding DE1 problem, will be reduced to 1 day.

Reducing the computational cost

The reduction of the computational cost can be achieved with a synergy of the following actions during the design procedure:

i) Using accurate and cost-efficient surrogate models for the numerical simulation of the physical problem.
ii) Implementing efficient solution algorithms for handling the resulting finite element equations in sequential as well as in parallel or distributed computing environments.
iii) Applying reliable and efficient optimization algorithms for improving the design procedure.
iv) Adequately treating the system uncertainties including a proper selection of the seismic loading.
v) Implementing artificial intelligent methodologies that combine accuracy and robustness.

STRUCTURAL OPTIMIZATION: A tool for evaluating the seismic design procedures

Structural optimization can be employed as a fiducial procedure for assessing the designs obtained not only through prescriptive or performance-based seismic design procedures, but also through various alternative recommendations of the design codes. Depending on the formulation of the optimization problem the designs can be assessed with respect to both initial construction or lifecycle costs, as well as with respect to structural performance in one or many levels of earthquake intensity.

The mathematical formulation of the most generic reliability-, combined with, robust-design optimization problem under seismic loading is stated as follows:

$$\min_{\mathbf{s}\in F} \quad [C_{IN}(\mathbf{s}, \mu_x), \sigma(\mathbf{s}, \mu_x)]^T$$

$$\text{subject to} \quad g_{SERV}(\mathbf{s}, \mu_x) \leq 0 \quad \text{(serviceability checks)}$$

$$g_{PBD}(\mathbf{s}, \mu_x) \leq 0 \quad \text{(ultimate limit state checks)}$$

$$P(g_{PBD}(\mathbf{s}, \mu_x) > 0) \leq P_a \quad \text{(probabilistic checks)}$$

$$\mathbf{s} \in R^n$$

$$x \sim N(\mu_x, \sigma^2_x)$$

The vectors $\mathbf{s}$, $\mathbf{x}$ and μ_x represent the design, the random variable and the mean value vectors, respectively. F is the feasible region, where both the serviceability g_{SERV} and the ultimate limit state g_{PBD} constraint functions are satisfied, P_a is the allowable probability of violation of the ultimate limit state constraints, while C_{IN} corresponds to the objective function representing the initial construction cost and σ is the standard deviation of the response.

NUMERICAL RESULTS

Due to space limitations the numerical results will be restricted to the computational efficiency achieved by the implementation of soft computing methodologies, such as Neural Networks (NN) predictions of the structural response, for addressing optimum design problems considering uncertainties. The interested reader is refereed to Refs. [2,3] for enhanced methodologies for handling the resulting finite element equations by implementing domain decomposition methods in parallel computing environment and advanced optimization algorithms incorporating multi-database cascade evolutionary algorithms.

Example 1: Six-storey space frame

A Reliability-Based Design Optimization under static loading is performed for the 3D steel frame shown in *Figure 4* with a required probability of failure $p_f \leq 10^{-3}$. The random variables correspond to the material properties (E, σ_y), the cross-section dimensions of the designs variables and the loading. The results of *Table 1* show the performance of DE5 and PR6 design procedures.

"It can be seen that the NN-based methodology achieves a reduction of the required computing time of up to four orders of magnitude compared to the conventional ones."

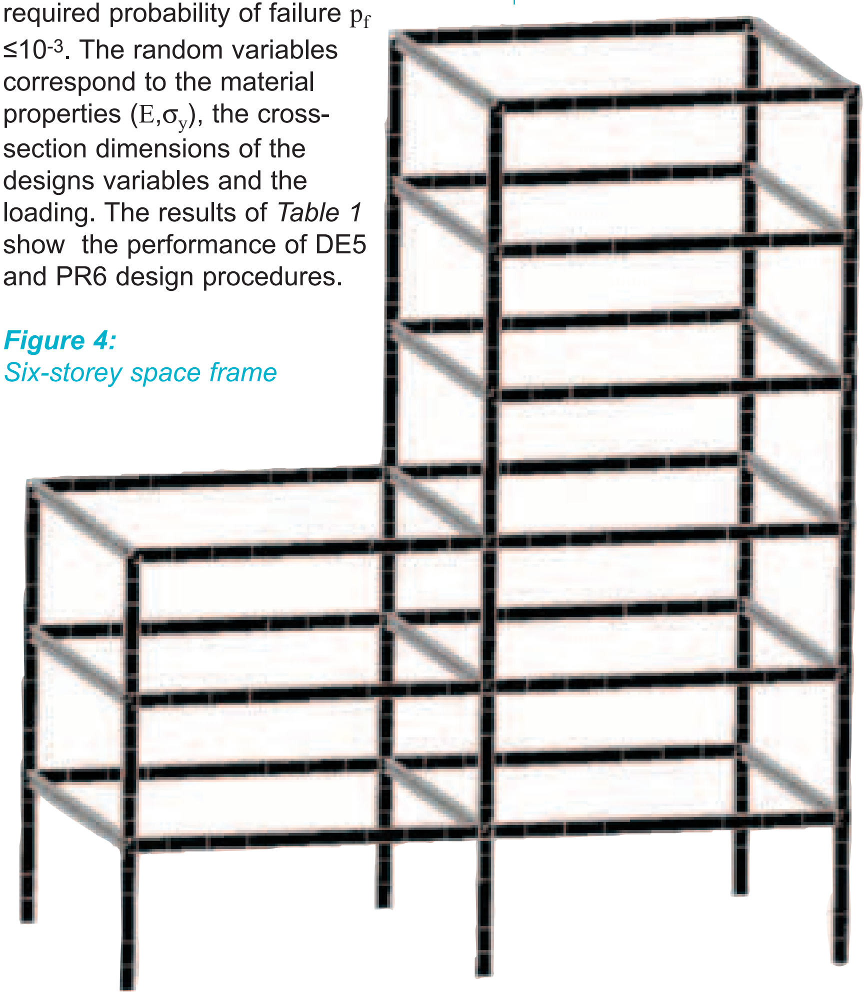

Figure 4: *Six-storey space frame*

Table 1:
Six-storey space frame: Performance of the methods

Formulation	Monte Carlo Simulations	p_f *	Optimum Weight (kN)	Computing Time (hours)
DE5	-	1.71E-1	727	0.05
PR6	10,000	1.01E-3	875	162.20
PR6-NN1	10,000	1.01E-3	875	52.50
PR6-NN2	100,000	9.70E-4	881	5.00

*For 100,000 simulations using the NN2 scheme

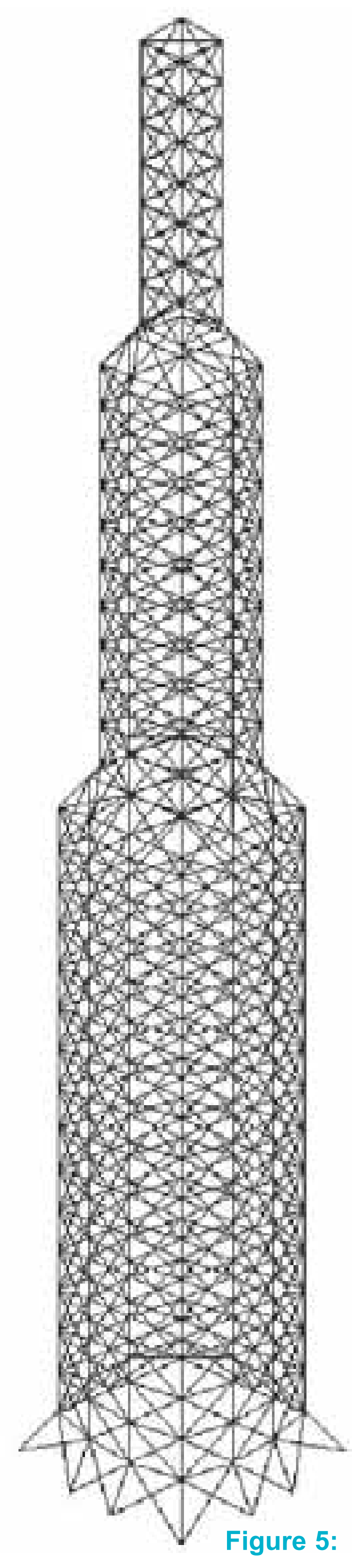

Figure 5:
3D tower

For the application of the PR6-NN1 methodology, the number of NN input nodes is equal to the number of design variables, while the number of output nodes is one, corresponding to the feasibility of the design. For the application of the PR6-NN2 methodology the number of NN input nodes is equal to the number of random variables, whereas one output node predicts the critical load factor. The Monte Carlo (MC) simulations in the case of NN2 scheme can be extremely large without affecting its computational efficiency due to the trivial computing time required by the NN to perform one Monte Carlo simulation. The difference on the computational time needed by the NN1 methodology, compared to NN2, is due to the fact that in the first methodology the computational time for the generation of the training set depends on the number of MC simulations [4].

Example 2:
3D tower

For the 3D truss tower shown in Figures 5, four different design formulations have been considered, abbreviated according to the corresponding glossary: (i) PR12, (ii) PR15(2%) with allowable probability of constraint violation equal to 2%, (iii) PR15(0,1%) with allowable probability equal to 0.1% and (iv) PR15(0.01%) with allowable probability equal to 0.01%. Twelve groups of design variables are considered.

The computing cost for the different design objectives is depicted in Table 2 with and without the NN implementation. It has to be noted that the computing costs for the conventional implementations of PR15(0.1%) and PR15(0.01%) are estimations due to the excessive computing time required by these two design cases. It can be seen that the NN-based methodology achieves a reduction of the required computing time of up to four orders of magnitude compared to the conventional ones.

Test example 3:
Seven-storey building

For the design problem under seismic loading of the 3D steel building, shown in Figure 6, two design cases are considered: (i) Deterministic sizing optimization (DE6) and (ii) Reliability-based sizing optimization (PR9). The

Table 2:
3D tower: Computational effort of different design approaches

Formulation	Monte Carlo Simulations	Computing Time (hours)	
		Conventional	NN
PR12	10,000	5.33E+01	5.87E-01
PR15(2%)	10,000	5.42E+01	5.96E-01
PR15(0.1%)	100,000	5.59E+02*	6.15E-01
PR15(0.01%)	500,000	2.79E+03*	6.14E-01

*Estimated

reliability analysis problem encountered in PR9 formulations is dealt with three methodologies: (i) Monte Carlo with Latin Hypercube Sampling (MC-LHS), (ii) Monte Carlo with Neural Networks (MC-NN) and (iii) First Order Reliability Method with Neural Networks (FORM-NN) [5].

The comparison of the deterministic and probabilistic optimum designs, with respect to the computational cost, is shown in Table 3. For the conventional Monte Carlo method with 100,000 samples generated with the LHS method, 5 years of computation will be required. The computational effort is reduced by two orders of magnitude when NN approximations are implemented. This improvement can be further enhanced when the required number of samples by the conventional Monte Carlo becomes larger as the allowable violation probabilities become smaller. The allowable probabilities of violation for the PR9 formulation are equal to 0.1%, 0.05% and 0.001% for the 50/50, 10/50 and 2/50 hazard levels, respectively. ●

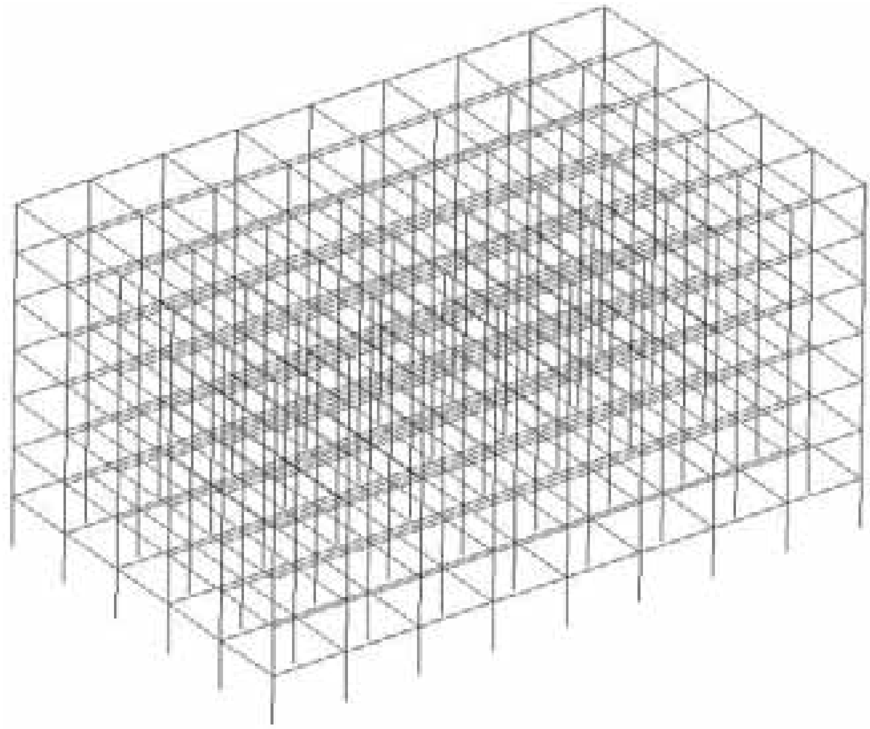

Figure 6:
Seven-storey building

Table 3:
Seven-storey building: Final designs achieved and computational effort

Formulation	Volume (m^3)	P_{viol} (50/50)	P_{viol} (10/50)	P_{viol} (2/50)	Computing Time (years)
DE6	38.32	6.45E-05 (%)	2.51E+01 (%)	4.28E+01 (%)	9.13E-04
PR9 (MCS-LHS)	47.71	<10E-07 (%)	3.76E-03 (%)	5.05E-04 (%)	5.00E+00*
PR9 (MCS-NN)	47.71	<10E-07 (%)	3.76E-03 (%)	5.05E-04 (%)	2.57E-01
PR9 (FORM-NN)	47.71	<10E-07 (%)	3.76E-03 (%)	5.05E-04 (%)	3.70E-02

* *Estimated for 100.000 simulations*

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The Girkmann Problem

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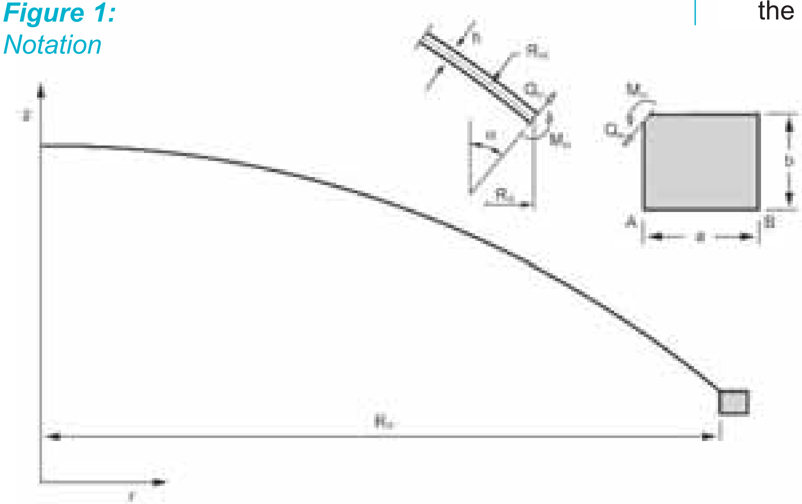
There is a growing interest in procedures for ensuring the reliability of predictions based on computed information. For predictions to be reliable, the mathematical model must account for those aspects of the physical reality being modeled that have significant influence on the data of interest and the numerical solution of the mathematical model must be shown to be sufficiently accurate for the purposes of analysis. General guidelines pertaining to the use of mathematical models in solid mechanics were issued by the American Society of Mechanical Engineers in 2006 [1] and adopted by the American National Standards Institute. We are interested in the question of how verification procedures are applied in specific situations in professional practice.

The model problem described herein was first discussed by Girkmann [2], subsequently by Timoshenko and Woinowski-Krieger [3]. Solutions by classical methods are presented in both references. Numerical solution of this problem is presented in [4]. We propose this problem as a benchmark for evaluating verification procedures that an experienced user of a finite element analysis software product would apply in professional practice to verify that the computed information is sufficiently accurate. We invite readers to analyze this problem and send their solutions and comments to the corresponding author to be received on or before 1 June 2008. We will summarize the results and the comments received, without attribution, from the point of view of how the requirements for verification were met.

Problem description

Geometry: The notation is shown in *Fig. 1*.
The z axis is the axis of rotational symmetry. A spherical shell of thickness h=0.06 m, crown radius $\mathbf{R_c}$ = 15.00 m is connected to a stiffening ring at the meridional angle $\alpha = 2\pi/9$ (40°). The dimensions of the ring are: $\mathbf{a}$ = 0.60 m, $\mathbf{b}$ = 0.50 m. The radius of the mid-surface of the spherical shell is $\mathbf{R_m} = \mathbf{R_c}/\sin\alpha$.

Figure 1:
Notation



Material: Reinforced concrete, assumed to be homogeneous, isotropic and linearly elastic with Young's modulus E=20.59 GPa and Poisson's ratio $\nu = 0$.

Loading:

a. Gravity loading. The equivalent (homogenized) unit weight of the material comprised of the shell and the cladding is 32.69 kN/m³. In the classical solutions the distributed load T_z = -1.9614 kN/m² was assumed to act on the mid-surface of the shell in the negative z-direction and the ring was assumed to be weightless. In the numerical solution volume forces may be applied to the shell and the stiffening ring.
b. Uniform normal pressure p acting at the base AB of the stiffening ring. The resultant of p equals the weight of the structure.

Problem statement

The domain, loading and support conditions are axisymmetric. We realize that in engineering applications axisymmetric models are rarely used. It will be acceptable to solve the problem on a sector of the stiffened shell, using symmetry conditions.

a. Find the stress resultants Q_α (shearing force, kN/m units) and M_α (bending moment, Nm/m units) acting at the junction between the spherical shell and the stiffening ring *(see Fig. 1)*.
b. Determine the location (meridional angle) and the magnitude of the maximum bending moment in the shell.
c. Verify that the results are accurate to within 5 percent.
d. State what software, what mesh and what type of elements were used. Describe how the accuracy of the data was verified. ●

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Professor Wing Kam Liu *awarded the* 2007 USACM John von Neumann Medal

Professor Wing Kam Liu, the Walter P. Murphy Professor of Mechanical Engineering at Northwestern University, was awarded the 2007 USACM John von Neumann Medal at the 9th US National Congress on Computational Mechanics in San Francisco, California on July 25, 2007. The von Neumann Medal is the highest award bestowed by the USACM to recognize individuals who have made outstanding, sustained contributions in the field of computational mechanics generally over periods representing substantial portions of their professional careers. The award criterion certainly describes Wing's impact on the field of computational mechanics.

Wing Kam Liu's potential was evident as an undergraduate student and began to flourish from the beginning of his graduate studies. As Professor Tom Hughes notes:

> *"Soon after I joined Caltech as an Assistant Professor in August 1976, Wing Kam Liu arrived as a PhD student in Civil Engineering. He came to my office and told me he had worked with Ted Belytschko and Al Schultz at the University of Illinois at Chicago as an undergraduate research assistant and he liked doing research. I mentioned that the first year of graduate school at Caltech was very intense due to a heavy course load, but he was not dissuaded at all and told me he would get bored if he was not engaged in research. That being the case I told him he had come to the right place. I wrote a finite element code for teaching on sheets of paper (this is the way we did it in those days) and he keypunched and debugged it. This gave us a platform to work with. We started to do research on a number of topics including implicit-explicit finite elements (for which we received the Melville Medal from ASME in 1979), energy conserving transient algorithms (with the late Tom Caughey), the first fully nonlinear shell formulations (the Hughes-Liu shell of LS-DYNA fame), incompressible fluid flow with finite elements, and fluid-structure interaction. Wing was a bundle of energy and it seemed every morning there were new results on my desk for review. In the afternoon, we would discuss what to do next. He kept up this incredible pace during his four years at Caltech."*

Prof. Liu was one of the pioneers in the field of reproducing kernel particle methods and meshless methods. Professor Liu's recent research activities include concurrent and hierarchical bridging scale methods for computational mechanics, nano mechanics and materials, multi-scale analysis, and computational biology. He is the Director of the NSF Summer Institute on Nano Mechanics and Materials.

Wing's significant and prodigious research program equally is matched by his sustained service to the community. Beginning as the Program Chairman for the 1st US National Congress on Computational Mechanics in 1991, he has been instrumental in the success of both National and World Congresses. He has served on the Executive Committee of USACM since 1994, serving as the USACM President from 2000-2002. He was the co-Chairman of the 6th World Congress on Computational Mechanics in Beijing China in 2004 and as the General Chairman of the 7th World Congress held in Los Angeles, California in 2006. He has been a member of the IACM General Council since 1994 and presently is a member of the IACM Executive Council. Wing also has a long and active service record with the American Society of Mechanical Engineers. He has served as Chairman of the Applied Mechanics Division of ASME in 2006 and has been a strong advocate for computational mechanics researchers as a member of numerous ASME awards committees. He serves on numerous editorial boards of international journals and is the editor of *Computational Mechanics*.

Amongst his many awards and honors are the ASME Melville Medal (with Tom Hughes in 1979), Pi Tau Sigma Gold Medal (1995), Gustus L. Larson Memorial Award (2001), He was awarded the USACM Computational Structural Mechanics Award in 2001 and the Computational Mechanics award from IACM (2002) and the Japan Society of Mechanical Engineers in 2004.

In November 2007, Wing received the ASME Robert Henry Thurston Lecture Award, which is a Society Award that "provides an outstanding leader in pure or applied science or engineering with the honor of presenting to the Society a lecture that encourages stimulating thinking on a subject of broad technical interest to engineers." The seminar, "Multiresolution Mechanics: Linking Material Properties/Component Performance to Evolving Microstructure" was both stimulating and of broad technical interest. It is evident that Wing's energy and inquisitive mind continue to be unbounded, which is perhaps best expressed by Tom Hughes, *"I am happy to say, if anything, Wing Kam Liu is even more dynamic and productive today than he was 30 years ago."* ●

For all inclusions under Israel Association for Computational Methods in Mechanics (IACMM)

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The Israel Association for Computational Methods in Mechanics (IACMM) has held three IACMM Symposia since our last report (see IACM Expressions No. 20). In this issue we report on the first two of them.

The 21st IACMM Symposium was held in October 2006 at the Ben-Gurion University of the Negev. The local organizer was Zohar Yosibash. The Symposium Opening Lecture was given by Prof. Ernst Rank, Vice President of the Technical University of Munich, who talked about *"Cell-Based High-Order Elements with a Coupling to Geometric Models."* The very interesting lecture described recent work of Rank and co-workers on the use of *p*-elements whose geometry is not boundary fitted. *Fig. 1* is a photo taken at a special dinner in honor of Prof. Rank, attended by four members of the IACMM Council.

Following Prof. Rank's Invited Lecture, six more talks were given, three of them by graduate students. The Symposium ended with a Tutorial lecture given by Isaac Harari on *"Dynamic Finite Element Analysis."* This talk prompted a lively and interesting discussion on some practical issues related to modal analysis and time integration.

IACMM publishes its own newsletter (the Israeli analogue of IACM Expressions). The IACMM newsletter appears in Hebrew twice a year, in conjunction with the IACMM Symposia. The newsletter issue associated with the 21st Symposium included an article by Moti Santo and Ilan Gilad from Rotem Industries and Ben-Gurion University, on the numerical simulation and optimization of sapphire crystal growth processes, using the gradient solidification method. *Fig. 3* shows the temperature field in the crucible (right) and furnace (left) as obtained from this analysis.

The 22nd IACMM Symposium was held in March 2007 at the Technion. The local organizers were Pinhas Bar-Yoseph and Dan Givoli. The Opening Lecture was given by Prof. Ekkehard Ramm from the University of Stuttgart, one of the international leaders of Computational Mechanics (CM) today. Prof. Ramm's delightful lecture was entitled *"Shell Structures – Modeling, Efficiency and Sensitivity."* *Fig. 5* shows Prof. Ramm during his talk. *Fig. 2* was taken during an evening visit of Prof. Ramm with the IACMM Council in the old and beautiful "German Colony" district in Haifa.

The 22nd Symposium also included two sessions of talks, one on Multiscale Problems and Computational Methods, and the other on Computational Fluid Dynamics. From the former session we mention the talk given by Dr. Joan Adler from the Physics Department at the Technion on "*Atomistic Simulation and*

Figure 1: *A special dinner in honor of Prof. Ernst Rank, Invited Speaker of the 21st IACMM Symposium. From left to right: Zohar Yosibash, Ernst Rank, Dan Givoli, Pinhas Bar-Yoseph and Isaac Harari.*

Visualization with examples from Nanomechanics.” *Fig. 4*, taken from Dr. Adler’s talk, shows the result of a simulation of damage in diamond, which is used as an insulator in electronic devices.

Also as part of the 22nd IACMM Symposium, the second part of the Tutorial on *“Dynamic Finite Element Analysis”* (with an emphasis on time-integration schemes) was presented by Isaac Harari (the former President of IACMM), and a Review lecture entitled “*What’s Hot in CM?”*, was presented by Dan Givoli (the current President of IACMM). *Fig. 6* was taken during the latter. This was the first in what is hoped to be a long sequence of lectures given annually, in which the speaker surveys recent themes and ideas in CM that have received special exposure in conferences and journal publications during the passing year.

A major forthcoming CM event in Israel is the **18th International Conference on Domain Decomposition Methods (DD-18).** It will be held at the campus of the Hebrew University in Jerusalem during 12-17 January, 2008. ●

Figure 2:
Prof. Ekkehard Ramm, his son and the IACMM Council. From left to right: Zohar Yosibash, Emanuel Ore, Michael Engelman, Pinhas Bar-Yoseph, Ekkehard Ramm, Christoph Ramm (Ekkehard’s son), Dan Givoli and Isaac Harari.

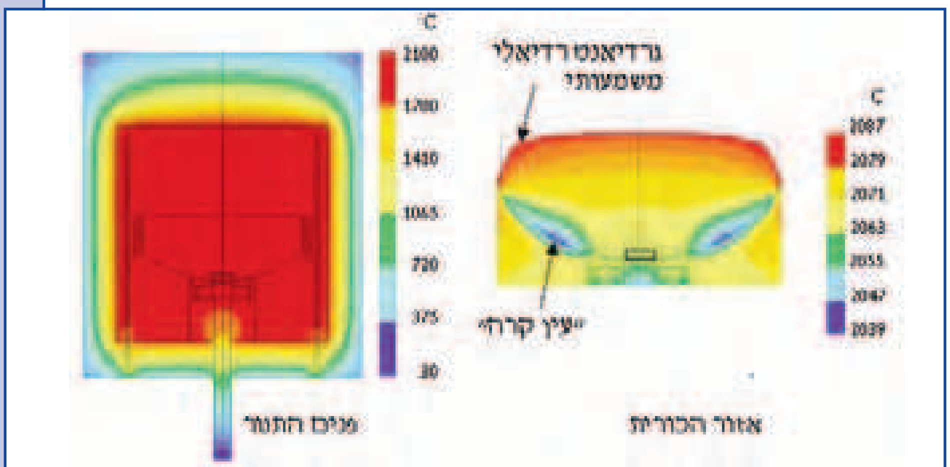

Figure 3: *(above)*
Results of numerical simulation of sapphire crystal growth process, using the gradient solidification method: temperature field in the crucible (right) and furnace (left). Taken from an article of Moti Santo and Ilan Gilad in the IACMM newsletter, issue No. 17.

Figure 4: *(below)*
Results of an atomistic simulation of damage in diamond. Taken from a talk given by Dr. Joan Adler at the 22nd IACMM Symposium.

Figure 5:
Prof. Ekkehard Ramm gives an Opening Lecture at the 22nd IACMM Symposium.

Figure 6:
Dan Givoli gives a Review lecture entitled “What’s Hot in CM?” during the 22nd IACMM Symposium.

APMTAC

CMNE 2007

Congress on Numerical Methods in Engineering

XXVIII CILAMCE

Iberian Latin American Congress on Computational Methods in Engineering

CMNE CILAMCE 2007

For allinclusions under The Portuguese Society of Theoretical, Applied and Computational Mechanics

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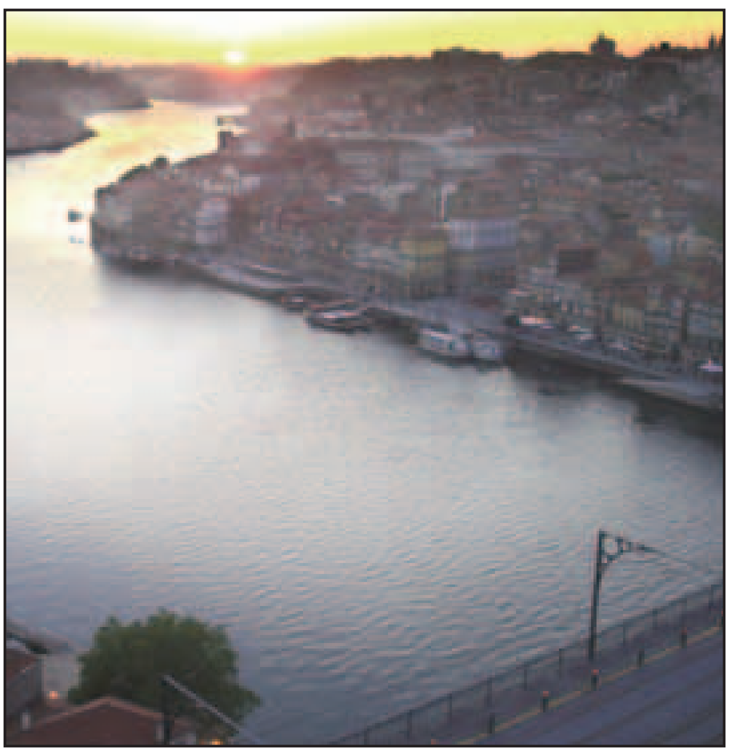
Culminating a long period of intense collaboration, APMTAC – The Portuguese Association of Theoretical, Applied and Computational Mechanics and SEMNI – The Spanish Society of Numerical Methods in Engineering, decided to merge into a joint venture their congresses previously organized independently in each country. The first congress of this new series took place in Madrid (2002), followed by those of Lisbon (2004) and Granada (2005). Here the decision was taken to permanently adopt the designation of Congress on Numerical Methods in Engineering.

Figure 1:
Veiw of the City of Porto



The last congress in this series, CMNE 2007, was held in Porto Portugal, on 13-15 June 2007 and had the particular feature of being jointly organized with the XXVIII CILAMCE - Iberian Latin American Congress on Computational Methods in Engineering, a prestigious annual venture of ABMEC – The Brazilian Association for Computational Methods in Engineering.

The congregation in Porto of these two congresses in 2007 aimed to reinforce the scientific relations and future coo-peration between the scientific com-munities in both sides of the Atlantic.

The congress proceedings included more than 600 papers covering a wide variety of subjects raging from the traditional areas, related to solid and fluid mechanics, to the topics that have gained, more recently, special attention from many researchers working in the field of Computational Mechanics like:

- Biomechanics,
- Multiscale Modelling,
- Moving Interfaces,
- Advanced Discretization Methods,

etc.

Apart from the General topic sessions the congress had more than 40 Mini Symposia organised by researchers from the three countries:
Portugal, Spain and Brazil.

There were 9 Plenary Lectures given by both distinguished international scholars and young researchers with an important work in the field:

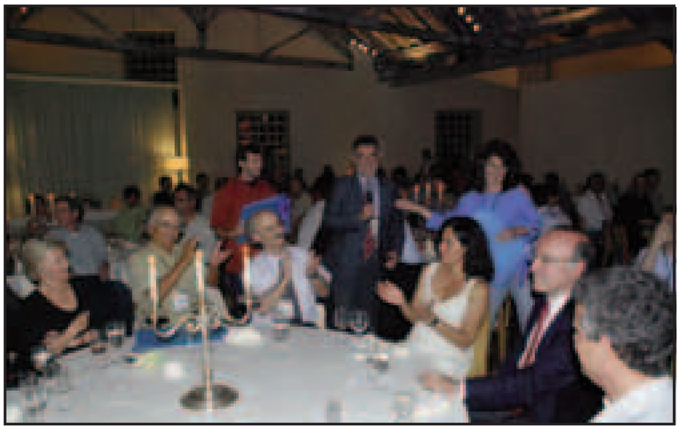


Figure 2 and 3 (above left and right):
Awards presentation during the banquet

- *Ted Belytschko*
  (Recent Developments in Computational Mechanics),
- *D.R.J. Owen*
  (Modelling of Fracturing Solids and Particulate Media in The Presence of Coupled Fields),
- *Bernhard A. Schrefler*
  (Computational Problems in Fusion Technology),
- *Stefano Rebay*
  (High-Order Discontinuous Galerkin Solution of Low and High Reynolds Number Compressible Flows),
- *Amable Liñán*
  (Ignition, Lift-Off and Blow-Off of Diffusion Flames),
- *Lucia Catabriga*
  (Krylov Space Solvers and Related Data Structures in Finite Element Analysis),
- *Norberto Mangiavacchi*
  (Numerical Simulation of Hydropower Reservoir Flows and Transports for Environmental Analysis),
- *João Azevedo*
  (Modelling of the Behaviour of Masonry Structures)
- *Pedro Camanho*
  (Simulation of Damage and Fracture of Polymer-Based Laminated Composites).

The congress has strengthened the ties between the Portuguese, Spanish and Brazilian communities working in this scientific field and provided a sound and agreeable atmosphere between all the participants that was patent in the Congress banquet which took place in the port wine cellars in the banks of river Douro. ●

Figure 4 and 5 (above and below):
Chatting at the banquet

Figure 6 (below):
Night view of Porto, after the banquet

Association of Computational Mechanics Taiwan (ACMT)

- a New Affiliate of IACM -

For all inclusions under ACMT please contact:

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The Association of Computational Mechanics Taiwan (ACMT) was established during the Annual Forum on Advanced Engineering Computation in Taipei, Taiwan on December 21, 2006. The objective of ACMT is to stimulate and promote education, research and practice in computational mechanics, to foster the interchange of ideas among various fields or societies related to computational mechanics, and to provide forums, seminars and meetings for the dissemination of knowledge on computational mechanics. ACMT has established the following forum website to facilitate its operation along these lines: http://groups.google.com/group/acmtaiwan.

The following is a brief introduction of the key members of ACMT:

- Chairman: **Y. B. Yang**, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan 10617; E-mail: ybyang@ntu.edu.tw.
- Vice Chairmen:
  Chung-Yue Wang, Department of Civil Engineering, National Central University, Chungli, Taiwan 32011; E-mail: cywang@cc.ncu.edu.tw.
  L. J. Leu, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan 10617; E-mail: ljleu@ntu.edu.tw.
- Executive Director:
  David C. S. Chen, Department of Civil Engineering, National Taiwan University, Taipei, Taiwan 10617; E-mail: dchen@ntu.edu.tw.

Figure 1: *Chairman: Y.B. Yang*

Other active members of ACMT include:

- **J. T. Chen**, Department of Harbor and River Engineering, National Taiwan Ocean University, Keelung, Taiwan 20224;
- and **J. S. Chen**, Chair, Department of Civil and Environmental Engineering, UCLA, Los Angeles, CA 90095-1593.

Figure 2: *Executive Director: David Chen*

Since its inauguration, ACMT's key members have actively participated in international events related to computational mechanics. Among them are the 9th US National Congress on Computational Mechanics (**USNCCM 9**) held in July 2007 in San Francisco, U.S.A., and the International Symposium on Computational Mechanics held in July 2007 in Beijing, China. A special mini-symposium on Recent Advances in Interaction and Multiscale Mechanics will be hosted by key members of ACMT in the upcoming Asian-Pacific Association for Computational Mechanics 2007 (**APCOM 2007**) to be held in December 2007 in Kyoto, Japan.

ACMT actively supports the incoming quarterly journal: *Interaction and Multiscale Mechanics: an International Journal*, for which J. S. Chen and Y. B. Yang are the editors and David C. S. Chen the associate editor. The first issue of the journal is scheduled to appear in March 2008. A number of international renowned scholars in the field of Computational Mechanics have been invited to join the editorial board. The aim of the journal is to provide a platform for publication of research results in which interaction and multiscale mechanics play a vital role. This journal publishes articles with contributions in all aspects of interaction and/or multiscale problems. The problems of interaction mechanics include the interaction of two different subjects/systems, whether they are connected or not, with or without relative motion.The problems of multiscale mechanics include structural, mechanical or material systems with varying length or time scales. In addition, the journal is expected to publish Refereed Reports from important conferences related to computational mechanics. Details of the journal are available in the following website: http://technopress.kaist.ac.kr/imm/imm01.jsp.

Annual gathering of ACMT members through the annual event of Forum on Advanced Engineering Computation on every December is expected. In addition, ACMT will continually support the journal: *Interaction and Multiscale Mechanics: an International Journal* and strive to make it a premier one. ACMT will also co-sponsor the 11th East Asia-Pacific Conference on Structural Engineering and Construction (**EASEC-11**). It is anticipated that numerous research results related to computational structural mechanics will be presented in this meeting.

10 Years of

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http://www.abmec.org

The genesis of the **Brazilian Association on Computational Methods in Engineering (ABMEC)**, on 1997, followed a long story of the computational mechanics community in search for finding its space and identity. Some of the landmarks can be considered the simultaneously presented course on Matrix Analysis at ITA in São José dos Campos and at COPPE-UFRJ in Rio de Janeiro given by **Prof. Fernando Venâncio Filho**, one of the pioneers of computational mechanics in Brazil, passing on to stress analysis applications for Aeronautical and Civil Construction industries, and the development of the first general purpose Brazilian finite element code in the late sixties.

Since then the computational mechanics started to be an area with a growing number of researchers and practitioners. By initiative of **Prof. A. J. Ferrante**, the first of a series of now 30 conferences (by including the two precursors conferences specifics on Civil Engineering held in 1977 and 1978), the Iberian Latin American Congress on Computational Methods in Engineering (the CILAMCE series) started to be held in 1977, completing 30 years of uninterrupted existence.

In 15^{th} of September, 1997, the first meeting of ABMEC happened at LNCC (The National Laboratory for Scientific Computation) in Rio de Janeiro, during the Workshop on Computational Methods for Oceanic and Atmospheric Flows, leading to the formalization of the Association. The first name was "Associação Brasileira de Mecânica Computacional" (Brazilian Association on Computational Mechanics).

The association has recently been under reorganization and revitalization, promoting plurality and interdisciplinary having also its name changed in 2004 to **"Associação Brasileira de Métodos Computacionais em Engenharia"** (Brazilian Association on Computational Methods in Engineering). During its existence, ABMEC has also tried to strengthen ties with sister associations in Argentina, Italy, Portugal, Spain and United States by promoting joint conferences and initiatives, being also affiliated to IACM since its foundation.

This year, for instance, ABMEC organized jointly with the Portuguese (APMTAC) and the Spanish (SEMNI) Associations the CMNE/CILAMCE 2007 http://numiform.inegi.up.pt/CMNE/ which congregates over 500 members, with over 600 full paper contributions, of the Iberian Latin American community in Porto, Portugal, from 13 to 15 of June, 2007. The Brazilian presence was massive with around 200 delegates. The receptivity of the local organizers, the level of the presentations and the friendly atmosphere of the conference were the main highlight.

Figure 1:
Prof. Cesar de Sá and part of the Portuguese Organizing Committee

Finally, as part of the celebration of the 10^{th} anniversary of ABMEC, a workshop in honor of the 60th birthdays of Professors **Abimael F. D. Loula** and **Augusto C.N.** and to celebrate the 30^{th} years of **CILAMCE** and 10^{th} years of **ABMEC** will be held at LNCC on September 14-15, 2007. ●

by
Dr. Estevam B. de Las Casas
first President of ABMEC
*and **Paulo R. M. Lyra***
current President of ABMEC

abmec

Associação Brasileira de Métodos Computacionais em Engenharia

Highlights of 1 ENEBI

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In the town of Itaipava, close to Rio de Janeiro, the first Brazilian Meeting of Biomechanical Engineering (I ENEBI) was held between **May 23 and 25**. Around 120 participants from the areas of Engineering and Life Sciences gathered to present their current research work and to discuss the future of the area in Brazil. The participants were mostly from Brazil, with guests from Portugal, Spain, Cuba, United States, Venezuela and Argentina.

A special prize was given to **Rafael Cobucci** for the best student presentation by the International Society of Biomechanics. The Meeting was organized by the Bioengineering Committee of the Brazilian Association For Mechanical Sciences and Engineering, with the support of the Brazilian Association for Numerical Methods in Engineering. The second meeting will be held in Floranópolis, in 2009. (*by Dr. Estevam B. de Las Casas*).

Prof. J.T. Oden in Brazil for the *2nd LNCC Meeting on Computational Modelling*

Prof. J.T. Oden delivered an opening lecture at the 2nd LNCC Meeting on Computational Modelling, held in Petrópolis, RJ, Brazil, **8-11 August 2006**. His journey to Brazil also included a visit to COPPE/UFRJ (The Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering Science of the Federal University of Rio de Janeiro) at Rio de Janeiro, RJ. An earlier visit of Prof. Oden to Brazil dates back to the summer of 1974 when he taught a series of Lectures on the Numerical Analysis of the Finite Element Method, at COPPE/UFRJ.

Celebrating the 32nd Anniversary of Prof. Oden´s visit to Brazil and in grateful appreciation for that seminal milestone and invaluable contribution to the development of Computational Mechanics in our country, ABMEC, LNCC and COPPE/UFRJ handed award plates to Prof. Oden and the members of that class gathered once again in a very enthusiastically attended opening ceremony for the Meeting.

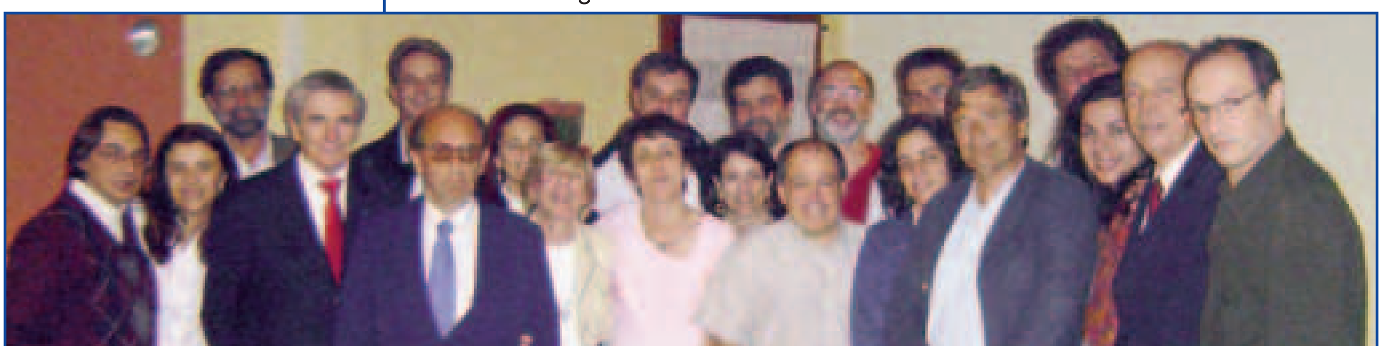

Figure 2: *Prof. Oden dinner party reception hosted by Regina Almeida and Renato Silva.*

Prof. Abimael Loula, Director of LNCC, Prof. Fernando Rochinha, Academic Director of COPPE/UFRJ and Prof. José Alves, Vice-President of ABMEC, handed the plates to Prof. Oden and the Class of 1974, namely professors Abimael F.D. Loula (LNCC), Augusto C.N. Galeão (LNCC), Cid S. Gesteira (UFBA, retired), Nelson F.F. Ebecken (COPPE/UFRJ) and Raul A. Feijóo (LNCC). Following the ceremony a reception cocktail took place when very good memories were recalled and shared among all the attendants.

by Dr. José L. -D. Alves, vice-president of ABMEC

Workshop on Computational Modeling

and Birthday Honors

Workshop on Computational Modeling in honor of the **60th birthdays** of **Professors Abi-mael F. D. Loula** and **Augusto C.N. Galeão** and to celebrate **30th years of CILAMCE** and the **10th anniversary of ABMEC**.

Figure 3:
Profs. Augusto C.N. Gale□o and Abimael F. D. Loula 60th birthday party.

The Laboratório Nacional de Computação Científica - LNCC/MCT (National Laboratory for Scientific Computing), and the Brazilian Association of Computational Mechanics (ABMEC) organized jointly a two-day workshop in honor of the 60th birthdays of Professors Abimael F. D. Loula and Augusto C.N. Galeão and to celebrate 30th years of CILAMCE and the 10th anniver-sary of ABMEC. Profs Loula and Galeão have made many significant contributions towards the development of the Computational Mechanics in Brazil and supervised numerous students. The CILAMCE conference has also played a major role in the dissemination of the most recent computational applications and computational developments throughout the Iberian Latin American community. The whole meeting was extremely enjoyable and took place on **September 14-15, 2007**, in Petrópolis, Rio de Janeiro, Brazil, and was part of the celebration of the 10th anniversary of ABMEC, which has been having a growing role on the organization of different groups with common interests in the development and applications of computational methods in science and technology.

For further information details and for a photographic memories have a look at LNCC www.lncc.br. *(Remark: in a forthcoming issue of IACM Expressios there will be an extended reference to such a great event)* ●

Forthcoming Events

CILAMCE2008

The XXIX Iberian Latin American Congress on Computational Methods in Engineering

The 29th edition will be held in Maceió, Alagoas, Brasil, 04 to **07 of November 2008.** It is being organized by the Federal University of Alagoas (UFAL). The organizing committee consists on: Eduardo Setton. S. da Silveira and Aline R. Barboza, as Co-Chairmen, Adeildo S. Ramos Jr., Eduardo N. Lages, Viviane C. L. Ramos and William W. M. Lira, as members.

The XXIX CILAMCE will be held in November 04-07, 2008, at the Convention and Exposition Center, in the beautiful city of Maceió, capital of the State of Alagoas (AL), Brazil. Maceió is famous for its beaches, seafood and folk expressions, being a very attractive tourist city in the northeast region with a lively nightlife.
Deadline for abstract submission: March 15th, 2008.

Figure 4:
Beach of the "Carro Quebrado" (Broken Car).

The CILAMCE 2008 will be organized in a set of mini-symposia covering a vast range of multid-isciplinary subjects on computational methods in engineering and applied sciences. The scientific program of the Congress consists of invited plenary lectures and invited mini-symposia keynote lectures by respected experts, contributed papers and poster presentations by under-graduated students.
The conference will cover a vast range of classical and new themes on computational modeling and simulation, from theoretical to application.

For further information: www.acquacon.com.br/cilamce2008
or send an e-mail to cilamce2008@acquacon.com.br. ●

USNCCM IX

The **ninth US National Congress on Computational Mechanics** was held in San Francisco, California **July 22-26 2007**. The Congress Chairman were *Panos Papadopoulos, Tarek Zohdi and Robert Taylor* of the University of California, Berkeley. They and their conference team are to be congratulated for hosting the most successful US National Congress to date.

Figure 1: *Profs. Tarek Zohdi and Panos Papadopoulos, USNCCM IX Chairmen*

More than 1300 people from over 40 countries attended the Congress. The Congress theme: "Interdisciplinary Computation" was reflected in the more than 110 symposia held during the four days, four short courses and six plenary lectures spanning all aspects of computation.

Two special symposia and dinners were held to celebrate the 70th birthday of Professor J. Tinsley Oden and the 65th birthday of Professor Kaspar Willam. Symposium organizers and guests were treated to a rare, clear sky dinner cruise of the San Francisco Bay and the privilege of hearing Ekkehard Ramm present an entertaining and informative history of the Golden Gate Bridge. Financial support from the National Science Foundation helped the Congress support nearly 25% of the student attendees to the Congress, with additional corporate support from Simulia, Elsevier, SIAM, Springer and John Wiley & Sons. ●

USNCCM Student Presentation Competition

Continuing the tradition started at the US National Congress in 2005, a student presentation competition was held during the USNCCM IX. The competition consisted of presentations of original student work, in the six specialty committee areas of USACM, judging of the presentations by members of the specialty committees, and awards given by USACM to the outstanding presentations. The competition was very keen this year, with more than 80 applications received. The students who participated in the Competition were:
Nitin Agarwal, Mahboub Baccouch, Ali Bahtui, Jie Bai, Geraud Blatman, Kemelli Campanharo Estacio, Karthick Chandraseker, Sheng-Wei Chi, Shardool Chirputkar, Paul Constantine, Tamer Elsayed, David Fuentes, Wei Hu, Hyun Jin Kim, Mohan Kulkarni, Sony Joseph, Jean-Vincent Le Lan, Song Li, Scott Lipton, Wayne McGee, Antti Niemi, Mohan Nuggehally, Jeronymo Peixoto Athayde Pereira, David Powell, Anand Srivastava, Alireza Tabarraei, Sarah Vigmostad, Philip Wallstedt, and Lena Wiechert.

The winners of the competition for the 6 specialty areas are:

Computational Biotechnology	*Sarah Vigmostad*
Verification and Validation	*Paul Constantine*
Meshfree Methods	*Jeronymo Peixoto Athayde Pereira*
Nanotechnology	*Mohan Nuggehally*
Integration of Computational Mechanics with Manufacturing	*Jean-Vincent Le Lan* *Scott Lipton*
Materials Modeling	*Tamer Elsayed* *Mohan Kulkarni* *David Powell* ●

USACM Awards - 2007

During the Banquet of the 9th US National Congress on Computational Mechanics, awards were presented to ten people to recognize their outstanding contributions to the field of computational mechanics.

USACM Fellows

The USACM Fellow Award recognizes individuals with a distinguished record of research, accomplishment and publication in areas of computational mechanics and demonstrated support of the USACM through membership and participation in the Association, its meetings and activities.

Ken Chong
Roger Ghanem
J. Woody Ju
Leopoldo Franca
Somnath Ghosh

Computational Structural Mechanics Award

Michael Ortiz
For his contributions to nonlinear solid mechanics and materials science, particularly linking continuum mechanics with atomistic and subscale behavior

Computational Fluid Dynamcis Award

George Em Karniadakis
For his pioneering work in computational fluid dynamics, particularly spectral hp finite elements, discontinuous Galerkin methods and microfluidics

Computational and Applied Sciences Award

Stanley Osher
For his pioneering work in high resolution schemes for hyperbolic conservation laws and Hamilton-Jacobi equations, and level set methods for moving fronts

Gallagher Young Investigator Award

The Gallagher Young Investigator award recognizes outstanding accomplishments, particularly outstanding published papers, by researchers of 40 years or younger. The Gallagher Young Investigator award and medal are supported by John Wiley & Sons in recognition of Richard H. Gallagher, the founding editor of the *International Journal of Numerical Methods in Engineering*.

Narayan Aluru
For his contributions to computational methods of MEMS, Bio-MEMS, nanoelectromechanical systems and microfluidics

John von Neumann Medal

The John von Neumann Medal is the highest award given by USACM. It honors individuals who have made outstanding, sustained contributions in the field of computational mechanics generally over periods representing substantial portions of their professional careers.

Wing Kam Liu
For contributions to nonlinear finite element methods, meshfree particle methods and multiresolution bridging scale methods, and their applications to materials design, nano mechanics and materials.

See the article in this issue of *iacm expressions* for more about the career and accomplishments of Prof. Liu. ●

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http://www.gacm.de

Organized for Young People by Young People

Success of 2nd GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry at TU München exceeded all expectations

The *2nd GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry* took place from **October 10-12** on the Garching Campus of TUM (Technische Universität München). It provided a platform for presentation and discussion of recent results in research and development for young scientists from both the academic and the industrial sector.

Following the original idea of the first meeting of the series in Bochum in 2005, the conference as a whole, as well as the individual mini-symposia, have been organized and chaired exclusively by young scientists. The conference chairmen were Dr. Volker Gravemeier (from the "Lehrstuhl für Numerische Mechanik", Prof. W.A. Wall, in Munich) and Dr. Matthias Hörmann (from the company CAD-FEM, with its headquarters also located near Munich). The organizing team has managed to bring together more than 200 participants from Germany and other countries, thus exceeding all expectations and representing a broad thematic spectrum, ranging from bio-physics, aeronautical, automobile and civil engineering to computational methods in medicine. Thus, also young scientists from disciplines that have not – yet – been strongly represented in the GACM community have been motivated to attend.

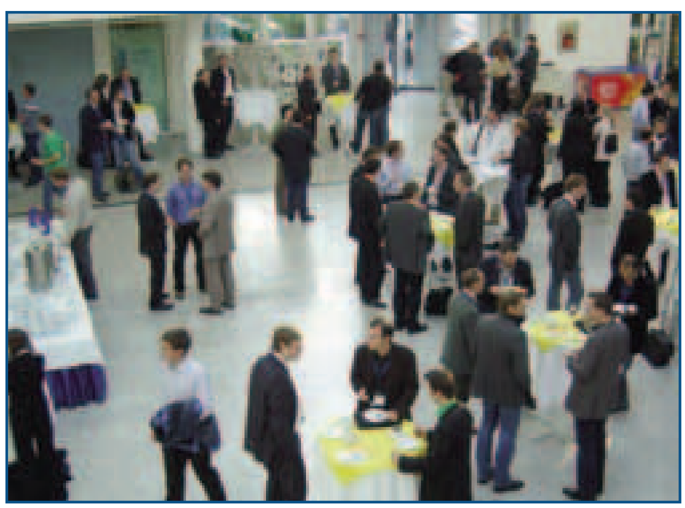
The scientific program comprised 151 contributed papers and 3 plenary lectures. With Peter Wriggers (University of Hannover, Vice President of GACM and designated president of GAMM), Christoph Gümbel (Porsche AG) and Alfio Quarteroni (EPFL, Lausanne and Politecnico di Milano) three internationally renowned representatives of academia and industry were able to inspire conference attendees with their plenary lectures.

Exhibitions by industrial sponsors from the area of computational mechanics accompanied the scientific program and also served as a forum for the search for high quality employees in this area. More information on the colloquium, as well as a photo gallery may be found on the conference web page **http://www.lnm.mw.tum.de/gacm07.** ●

V. Gravemeier, M. Bischoff

Figure 1: *Plenary speaker Christoph Gümbel (Porsche AG) together with the conference chairmen Matthias Hörmann and Volker Gravemeier (from left to right)*

Figure 2: *Coffee break in the atrium of the Department of Mechanical Engineering at TUM*



- Electing Excellence -

The decisions in the second – and tentatively last – round of the German "excellence initiative" are taken. On the basis of an expertise by a panel of 27 national and international referees, a commission consisting of the German Science Council ("Wissenschaftsrat") German Research Foundation ("Deutsche Forschungs-gemeneinschaft", DFG) has encouraged 35 Universities to hand in full applications. Like in the first round, three different funding instruments are installed: graduate schools, clusters of excellence and so-called "future concepts".

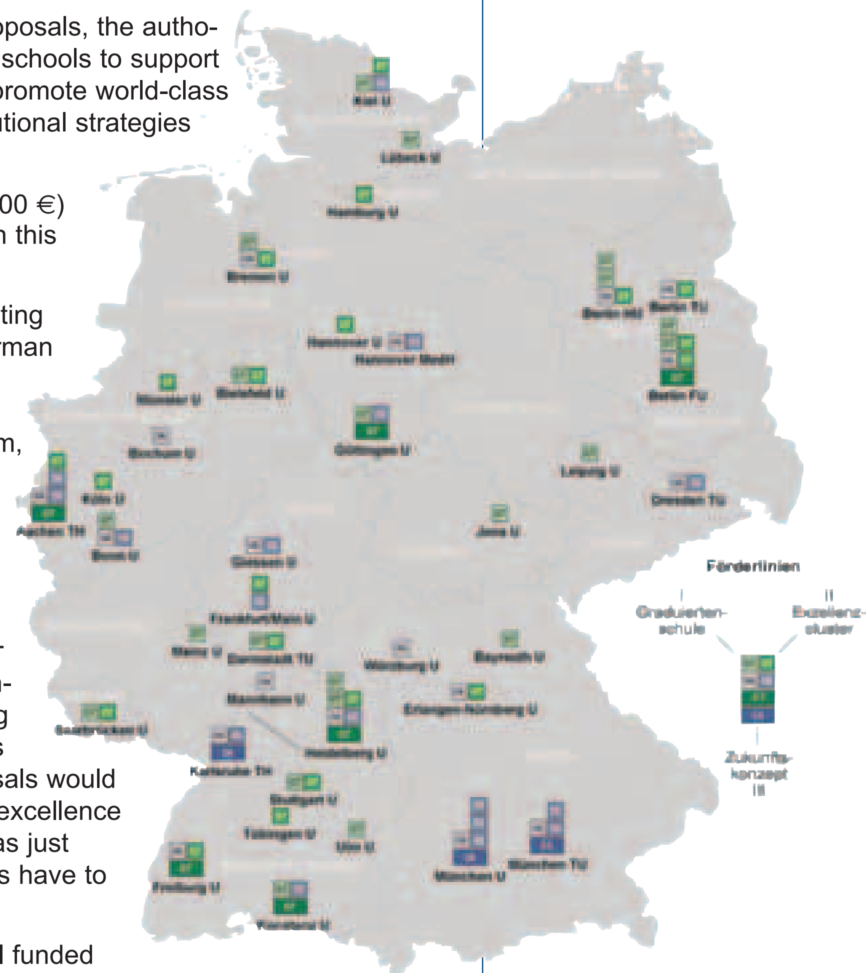
On October 19th, after reviewing a total of 92 proposals, the authorizing committee decided funding of 21 graduate schools to support young researchers, 20 clusters of excellence to promote world-class research and 6 "future concepts", meaning institutional strategies to promote top-level university research.

A budget of about one Billion Euros (1,000,000,000 €) for five years has been allotted for the program in this second round.

The excellence initiative aims toward both promoting top-level research and improve the quality of German universities and research institutions, thereby making a significant contribution to strengthening science and research in Germany in the long term, improving its international competitiveness and raising the profile of the top performers in academia and research.

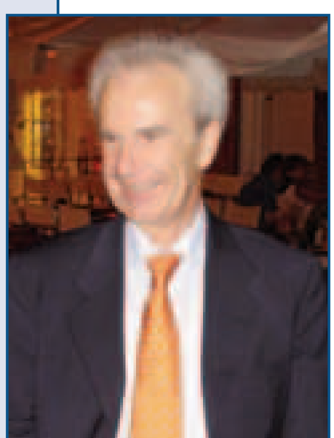
The political and scientific community expects a tremendous impact from this funding, notwithstanding the fact that the response in the popular mass media tends to overly emphasize the ostensible nomination of "elites", thus risking the wrong impression that universities and individual groups which have not been successful with their proposals would represent second class institutions. After all, the excellence initiative is not over now but on the contrary it has just started: The projects described in the applications have to be implemented now.

The chart shows the geographic distribution of all funded projects, including those from the first round in 2006 (blue boxes). ●



Honorary Doctorate for Bernhard Schrefler

Figure 3:
Bernhard Schrefler



Professor Bernhard Schrefler has been granted a doctor honoris causa by the Faculty of Civil Engineering and Geodetic Sciences of the Leibniz Universität Hannover for his work on theory and numerics of multi-physics problems and their application in the area of civil and environmental engineering. Schrefler, born 1942 in Meran and Professor for Structural Mechanics at the University of Padua since 1980, has contributed significantly to the field of computational mechanics. He developed coupled formulations for geotechnical problems as well as thermo-electro-mechanical models for the construction of the fusion reactor. He also worked on reservoirs and environmental problems related to the city of Venice. ●

P. Wriggers, M. Bischoff

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Authorities of AMCA

During the regular assembly of AMCA, the new Executive Council has been elected for the Argentine Association for Computational Mechanics (AMCA), for the period 2007-2009.

It is formed by: Victorio Sonzogni (President), Norberto Nigro (Secretary), Victor Fachinotti (Treasurer), and as members of the executive council: Enzo Dari, Sergio Elaskar, Guillermo Etse, Carlos García Garino, Luis Godoy, Axel Larreteguy, Angel Menéndez, Marta Rosales and Marcelo Venere. ●

Call for papers

ENIEF 2008

XVII Congress on Numerical Methods and their Applications
10-13 November 2008 - San Luis, Argentina

The annual congress of the Argentine Association of Computational Mechanics (AMCA) will take place from November 10^{th} to November 13^{th} 2008, in the city of San Luis, in the west of Argentina.

The congress is organized jointly by the National University of San Luis, and the International Center for Computational Methods in Engineering (CIMEC-INTEC) belonging to National University of Litoral (UNL) and the National Council for Scientific and Technological Research (CONICET), of Argentina.

Information about the congress may be found at:
http://enief2008.unsl.edu.ar ●

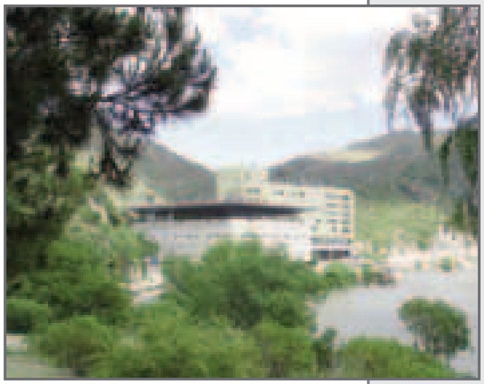

***Figure 1**: San Luis, Argentina*

Symposium to Honor
CARLOS A. PRATO

Carlos A. Prato has been one of the most influential researchers in structural mechanics and the application of finite elements in this field in Argentina since the early 1970s. A graduate of the National University of Cordoba and Massachusetts Institute of Technology, Prato joined the National University of Cordoba in 1970. With a strong background in both applied mechanics and computational mechanics, Prato promoted research on the boundaries of the two fields at a time when the transition from applied to computational mechanics had not yet started in the country.

***Figure 2**: Carlos A. Prato (at the center of the photograph) with some of the participants of the symposium*

The role of Prato as researcher, teacher and engineer was acknowledged last October by a community of researchers who worked with him at various stages during his career. This technical as well as friendly celebration took place on the occasion of Prato's 63^{rd} birthday, in the form of a three-day symposium attended by some 100 participants, which was part of the ENIEF 2007 conference. Under the official title: "A symposium to honor Dr. Carlos A. Prato", the event took place in Cordoba, Argentina, from October 3 to 6, and was coordinated by Prof. Luis A. Godoy. Forty five technical papers were presented during the sessions. The participants traveled from many provinces in Argentina (Buenos Aires, Mendoza, Tucuman, Neuquen, Santa Fe, Cordoba), United States (Georgia, Washington, Puerto Rico, Virginia, Indiana) and Colombia. ●

***Figure 3**: Carlos A. Prato with other participants during a coffee break.*

ENIEF 2007

XVI Congress on Numerical Methods and their Applications

2 - 5 October 2007, Cordoba, Argentina

The XVI Congress on Numerical Methods and their Applications, ENIEF 2007 was held from October 2nd to 5th, 2007 in Cordoba city, Argentina. In this opportunity the ENIEF 2007 took place simultaneously with the First Congress on Applied, Computational and Industrial Mathematics, MACI 2007. Both congresses were organized by the National University of Cordoba (UNC) and they received the support of the Argentine Association of Computational Mechanics (AMCA) and the Argentine Section of the Society for Industrial and Applied Mathematics (AR-SIAM).

The congresses were attended by more than 350 delegates, mainly from Argentina and Brazil, but also from Puerto Rico, Chile, Mexico, Paraguay, Colombia, Uruguay, Venezuela, Spain, United States and Germany. Special lectures have been given by: José M. Martínez (UNICAMP, Brazil), José M. Longo (DLR, Germany), Wolfgang Rodi (Institute for Hydromechanics University of Karlsruhe, Germany), Max Gunzburger (Florida State University, USA), John Burns (Interdisciplinary Center for Applied Mathematics, Virginia Tech, USA), Miguel Cerrolaza (Universidad Central de Venezuela, Venezuela), Juan Sanmartín (Universidad Politécnica de Madrid, Spain) and Eugene Cliff (Interdisciplinary Center for Applied Mathematics and Department of Aerospace and Ocean Engineering, Virginia Tech, USA).

Full length papers were submitted to a review process prior to publication. From them, 250 paper have been accepted and included in the XXVI Volume of the AMCA Series "Mecánica Computacional". The editors of this volume were Sergio Elaskar, Elvio Pilotta and German Torres. The papers of "Mecánica Computacional" are available at the web site: http://www.cimec.org.ar/ojs/inex.php/mc/issue/archive

The event lasted four days at the Faculty of the Exacts, Physics and Natural Sciences building of the National University of Cordoba. The technical program included eight plenary lectures, eight short curses, and twenty one sessions in seven rooms in parallel. The sessions "Symposium to Honor Carlos A. Prato" and "Aerospace Technology" were specially organized in honor to Prof. Carlos Prato and Prof. José Tamagno respectively. On Thursday the Congress banquet took place at the Amerian Hotel. The ordinary annual assembly of AMCA was held on Wednesday.

A student paper competition was also carried out and an special poster session was devoted to undergraduate students papers. The three best papers received special prizes consisting in money, books and short fellowships.

In the same week of ENIEF 2007, the "V Latin-American Meeting of the Abaqus Users" was also held during the first and second days of October. This meeting took again place at the building of Faculty of the Exacts, Physics and Natural Sciences.

The congresses received supports from CONICET, SECyT and Secretary of Water Resources of Argentina, SIAM, SIMULIA, National Technological University, Thomson, ROFEX, Austral University, National University of Litoral and Argentinean Mathematics Union (UMA).●

ERRATA

In IACM Expression 21, June 2007, an error was committed at page 33, in connection with the AMCA-Awards 2006.

The first prize for student papers, was obtained by Marcelo Valdez, from the Universidad Nacional de Córdoba.

We apologise for the error.

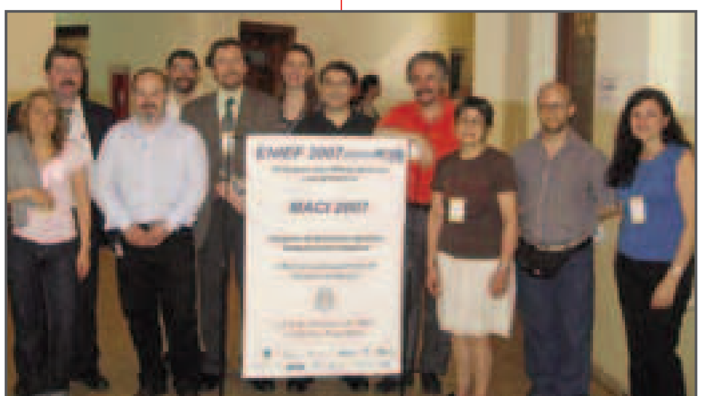

***Figure 4**:*
From the left to the right: C. Turner, R. Spies (President of AR-SIAM), S. Elaskar (President of Congress), V. Sonzogni (President of AMCA), J. Weber, W. Schulz, D. Tarzia, E. Zapico, M. Maciel, G. Torres and D. Rubio.

***Figure 5**:*
Participants at ENIEF 2007

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GIENS 2007

8TH EDITION OF CSMA MEETING

FRANCE

8th edition of CSMA meeting was organised at the holiday village of Giens (near Toulon) last may. This conference gathers young scientists (mainly PHD students) many of them in their 2nd PHD year and experienced researchers in the field most of them stay the whole week: this is why this is the major event of the community, which permits fruitful and relax exchanges between the seniors and young researchers.

The presentations were of high quality and nearly all in the French language which permited fast and deep discussions. A general conference was also given every day.

This year the general conferences were given by:
Prof M Bonnet (Ecole Polytechnique: fast non iterative methods for defects identifications),
Dr S Orain (ST Micro electronics: Mechanical challenges in MEMS),
Prof E Massoni (CEMEF Ecole des mines: thermo mechanical challenges for material processing),
Prof Chinesta (ENSAM Paris: on the boarders of simulation: when models size become incredible),
Prof.A Preumont (UL Bruxelles: vibration and control for ultra high precision mechanics).

The nice tradition of high scientific levels combined with the relaxed French Riviera life style has been met once more.

Figure 1:
Arrival committee: G Kermouche (assistant professor at ENISE) in the centre.

The congress gathered 320 participants from all French laboratories associated with computational mechanics and also about 15 participants from foreign countries like Canada, Belgium, Germany, UK Spain, and Tunisia. About 10% of the participants came from industry.

The presentation were organised in 5 themes: material and structure behaviour modelling, solution methods and techniques, optimisation and control, coupling interaction and dynamics, applications.

For the first time, 5 mini symposiums were organised on topics bringing to the event people usually out of the community. The symposiums were on biomechanics, contact and tribology, small scale numerical approaches, multiphysic high temperature coupling for fabrication processes, identifications and field measurements. This organisation led to a substantial increase of the success of the meeting, and intensive and very interesting exchanges.

The CSMA prices for years 2005 and 2006 were distributed during the conference dinner. The winners were for the scientific prize ***J Réthore***, ***N Legrain***, and for the "industrial" prize, ***F Massa***, ***A Bastier***.

For more information visit the web site: **http://giens2007.enise.fr/** (you may practice your French!!!).. ●

Figure 2:
Mechanics of MEMS: Dr S Orain (ST Micro electronics)

Figure 3:
The two organisers of the biomechanics minisymposium: Professors P Chabrand and S Drapier

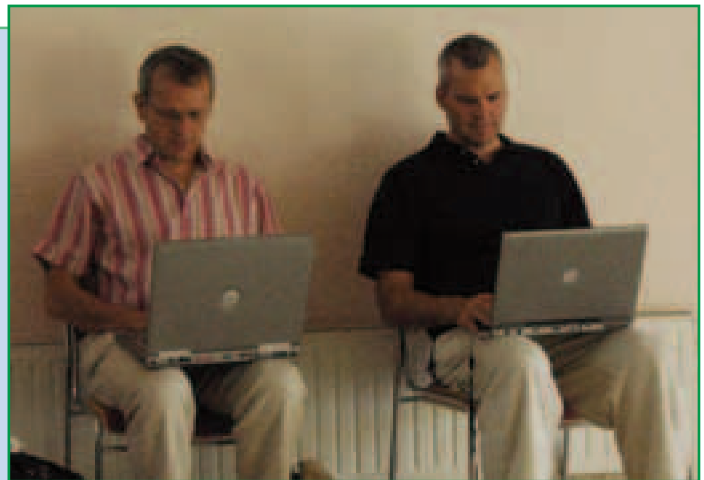

Figure 4:
CSMA price ceremony: Dr J Rethoré and Prof. O Allix (former CSMA president)

Figure 5:
Prof. JM Bergheau (LTDS Enise) Conference Chairman Prof. A Combescure (LaMCoS) scientific Chairman, new CSMA president

CHILEAN SOCIETY FOR COMPUTATIONAL MECHANICS

For all inclusions under
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In 2007, the annual meeting of the Chilean Society for Computational Mechanics (CSCM) was hosted by the University of Chile at Santiago de Chile. It was the **sixth Workshop on Computational Mechanics** (**JCM 2007**, acronym in Spanish) organized by the CSMC and it was chaired by Prof. Ramón Frederick, Head of the Mechanical Engineering Department. The Workshop was opened by Prof. Patricio Aceituno, Vice-dean of the Faculty of Physical Sciences and Mathematics.

The CSCM is particularly grateful to Prof. José Miguel Atienza from the Polytechnical University of Madrid (UPM) who has presented as Plenary Lecture a remarkable talk on the numerical simulation and experimental validation of residual stresses in steel cables.

A summary of 26 works were presented from different areas of computational mechanics and sciences and 13 full written papers were reported in the journal of the CSCM "*Cuadernos de Mecánica Computacional, Vol. 5*".

The CSCM also thanks to the authors and the audience: academics, students, researchers and professionals from the industry for their interest on the JMC 2007; and cordially invites to participate in the next version of the Workshop (JMC 2008) to be held in **Santiago of Chile** at the Pontifical Catholic University of Santiago of Chile during **September 5th 2008**.

Contact Prof. Diego Celentano for further information on this next meeting or visit the the web page of the CSCM.

dcelentano@ing.puc.cl
www.scmc.cl.

Figure 1:
Participants of the VI Workshop on Computational Mechanics (JMC2007) together with Prof. José Miguel Atienza (Invited Professor)

Central European Association for Computational Mechanics

For all inclusions under CEACM please contact:

Jurica Sorić
University of Zagreb
jurica.soric@fsb.hr

The idea for the **Central European Association of Computational Mechanics (CEACM)** emerged in 1990s through the initiative of prominent individuals such as M. Okrouhlik and I. Babuš ka. After some discussions with scientists in the field of Computational Mechanics it Central European countries, H.A. Mang initiated the foundation of CEACM, which was established at the University of Leipzig in 1992. In the beginning, members of CEACM were scientists from Austria, Czechoslovakia (after 1993 Czech Republic & Slovakia), Hungary, and Poland, were joined by individuals from Slovenia and Croatia in 1993. The first board members, elected unanimously, were H.A. Mang as Chairman of CEACM, L. Demkowicz as Vice-Chairman, F.G. Rammerstorfer as Cashier and G. Meschke as a Secretary of CEACM.

From the creation, CEACM established itself as a leading entity in the field of Computational Mechanics in the respective countries and has been directly involved in the activities of IACM and ECCOMAS. Today, CEACM represents the interests of the mentioned Central European countries within IACM, and via CEACM, the members can join IACM. A considerable number of scientific activities have been sponsored by this association, one of the most important being the permanent education through seminars and lectures, the first of which were held in Budapest. The publication activities of CEACM started with the first "CEACM Newsletter" which appeared in January 1994 and, due to the efforts of M. Kleiber and H.A. Mang, the official scientific publication of CEACM, the *"Central European Journal of Computer Assisted Mechanics and Engineering Sciences (CAMES)"* was established in the same year.

Figure 1:
Press Conference at WCCM V, Vienna, Austria, July 2002

In the meantime, CEACM has become a recognized factor in the Computational Mechanics Community and a number of scientific activities would not have been run with the same success without establishing this scientific association. Today, CEACM gathers members of the 7 Central European countries. Currently, the board members are: J. Sorić(Croatia) as President, J. Korelc (Slovenia) as Vice-President and I. Smojver (Croatia) as Secretary. National Representatives in the board are F.G. Rammerstorfer (Austria), P. Polach (Czech Republic), Z. Gaspar (Hungary), T. Lodygowski (Poland) and J. Murin (Slovakia). Previous presidents were H.A. Mang (Austria), M. Kleiber (Poland) and V. Kompiš (Slovakia).

Some activities of National Branches

Nearly all Professors working in the field of Computational Mechanics at Austrian Universities are personal members of CEACM. Many of them have substantially contributed - as members of scientific and organizing committees, as chairpersons, as invited lecturers, and by sending young researchers to Conferences - organized under the auspices of CEACM, or having been closely related to CEACM. The Austrian members of CEACM have organized a large number of scientific events, such as several ECCOMAS Thematic Conferences and EUROMECH Colloquiums. In addition, the ECCOMAS Multidisciplinary Jubilee Symposium – New Computational Challenges in Materials, Structures, and Fluids (EMJS08) is planned to take place in February, 2008 at Vienna University of Technology. A number of direct research cooperation activities and exchanges between Austrian researchers and those of other CEACM countries have intensified the scientific contacts within this scientific association. Thus, Austrian

establishments such as the Institute of Mechanics, Montanuniversität Leoben; Institute of Lightweight Design and Structural Biomechanics, Vienna University of Technology, and the Institute for Mechanics of Materials and Structures of Vienna University of Technology have excellent relations with Institute of Fundamental Technological Research, Polish Academy of Science; Institute of Physics of Materials, Academy of Sciences of the Czech Republic; Department of Aeronautical Engineering, Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb and the Department of Mechanics, Czech Technical University, Prague. The Czech Republic CEACM members participate in the Computational Mechanics development by contributing to the national and international projects, grant projects supported especially by the GAČR (Grant Agency of the Czech Republic). In addition, they participate in teaching subjects in the field of theoretical, applied and computational mechanics and mechatronics as well as in solving the tasks of technical practice at technical universities in the Czech Republic (e.g. CTU in Prague, VUT in Brno, VŠB-TU of Ostrava, etc.), in the institutes of the Academy of Science of the Czech Republic and other research institutes. The following most important activities have been performed under the auspices of the Czech members of CEACM:
organization of the IX International Conference on the Theory of Machines and Mechanisms in Association with the II CEACM Conference on Computational Mechanics, Liberec, 2004; dissemination of information concerning scientific conferences, especially those organized or co-organized by IACM and ECCOMAS.

The scientific activities of the Slovak branch of CEACM cover a wide area of theoretical and applied mechanics such as developing methods leading to efficient solution of multi-body contact problems and modeling of composite materials reinforced with particles and short fibers using Trefftz methods with polynomial and radial functions. Besides, recent research includes meshless BEM formulations with many applications in static and dynamic thermomechanical problems as well as development of new LINK/BEAM composite (FGM's) finite elements for multiphysical analysis (eg. electric-thermal structural). This scientific research is perfomed at the Academy of the Armed Forces in Liptovský Mikuláš, Slovak Academy of Science in Bratislava and Slovak University of Technology in Bratislava. The most important events organized by Slovakian CEACM members are the 9th International Conference on Numerical Methods in Continuum Mechanics (NMCM), 2003, Žilina; the 10th Conference on NMCM and IVth Workshop on Trefftz Methods, 2005, Žilina;

Figure 2:
Opening ceremony of the IX International Conference on the Theory of Machines and Mechanisms in Association with the II CEACM Conference on Computational Mechanics, Liberec (Czech Republic)

Figure 3:
Conference excursion to Rajecké Teplice (Slovakia)

Composites with Micro- and Nano-Structure (CMNS) – Computational Modeling and Experiments, 2007, Liptovský Mikuláš and two ICES Symposiums on Meshless Methods (2005 and 2006) in Stara Lesna.

Slovenian CEACM members operate within the framework of the Slovenian Society of Mechanics which is the main society in the field of mechanics in Slovenia. It links researchers from all major fields of mechanics – theoretical, numerical and applied. Members are professors, students and researches from technical and mathematical departments from all universities in Slovenia, research institutes, and industry. The members of the Slovenian branch of CEACM took part in organizing traditional annual conference called "Kuhljevi dnevi" (Kuhelj's days) in memory of Prof. A. Kuhelj (1902-1980). In the last three years these events took place in Početrtek; Lipica and Snovik.

The Croatian CEACM branch brings together researchers with common interest in Computational Mechanics. The Croatian branch operates within the activities of the Croatian Society of Mechanics and CEACM members are very active in the promotion of numerical methods. Their greatest contribution is strengthening of the role of Computational Mechanics in their own country as well as in Central Europe and world-wide. Some of them have very fruitful collaboration with the members of other European computational mechanics associations.

A number of scientific events organized in Croatia were supported by CEACM. Among others, the 5th International Congress of Croatian Society of Mechanics was held under auspices of CEACM in year 2006. The CEACM, together with the German Association for Computational Mechanics (GACM), supported the Special Workshop Advanced Numerical Analysis of Shell-like Structures (ANASS 2007) which was held in September this year. The aim of all scientific gatherings is to bring together prominent researchers and junior scientists who will exchange new ideas and recent developments in the field of Computational Mechanics which may have a great impact on the technological progress in their countries.

Ivica Smojver & Jurica Sorić

***Figure 4**:*
Conference excursion to Plitvice Lakes (Croatia)

***Acknowledgment** -*
The contribution of the following individuals is highly appreciated:
Prof. V. Kompiš , Prof. J.Korelc, Prof. H.A. Mang, Prof. J. Murín, Dr. P. Polach and Prof. F.G. Rammerstorfer (particularly on the history of CEACM)

***Figure 5**:*
ANASS 2007 participants, Zagreb, Croatia, September 2007

The Japan Society for Computational Engineering and Science

For all inclusion please contact

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The Japan Society for Computational Engineering and Science (JSCES) hosted the twelfth Conference on Computational Engineering and Science, which was held on **May 22-24, 2007**, at the National Olympics Memorial Youth Center (Yoyogi Shibuya-ku, Tokyo). More than 380 delegates attended the conference and about 280 papers were presented. The conference had 30 parallel sessions in total, each of which is organized by prominent researchers in each field of computational engineering and science. The conference lasted three days with full lectures, many of which were given by Japanese researchers as well as graduate students and young practitioners.

The plenary lecturer for this year was Prof. David J. Benson (University of California, San Diego) as who gave a talk, entitled "Contact Methods for Multi-Material Eulerian and ALE Finite Element Analysis" *(Figure 1)*. Also, we had a panel discussion, "Do computational mechanics and CAE lose touch with each other?" and organized a special session that collected papers on specific activities by ten CAE vendors in Japan. All the events in this conference were quite successful, which we welcomed lots of enthusiastic participants as well as high-standard presentations.

***Figure 1**: Plenary lecture by Prof. David J. Benson*

The significance of JSCES's annual meeting has been determined as an established setting for the exchange of ideas in the field of computational engineering and science, and for the enlightenment of state of the art in this field. The effort will continue to have another conference in Sendai, May 2008.

The JSCES also held the **Second Korea-Japan (KJ) Joint Workshop on Computational Engineering** with the Computational Structural Engineering Institute of Korea (COSEIK) from **August 31 to September 2** at Seoul National University, Seoul, Korea. The opening remarks by Prof. Sung Woo Lee (Kookmin University, Korea), the President of the COSEIK and by Prof. N. Takeuchi (Hosei University, Japan), the Vise-President of the JSCES, were followed by twenty-four talks in two parallel sessions interchangeably given by Korean and Japanese young scientists *(Figure 2)*.

At present, the JSCES has about 900 members, all of who are registered as international members of the IACM.
The JSCES periodically publishes both quarterly magazines **(http://www.jsces.org/Issue/Journal/journal.html)** and internet journals **(http://www.jstage.jst.go.jp/browse/jsces)**
Also, the JSCES organizes special lecture classes and compiles reference books and textbooks for various topics in computational mechanics. Moreover, the JSCES awards various kinds of JSCES prizes to senior and young researchers and practitioners; this year's recipients are Y. Yoshida, N. Tosaka, H. Ohtsubo, T. Watanabe (The JSCES Award), H. Noguchi (Kawai Medal), T. Sasaki (The JSCES Merit Award), K. Terada, M. Kurumatani, S. Yamada (Outstanding Paper Award), M. Asai and T. Teramoto (Young Researcher Award). Finally, as an IACM affiliated society in Japan, the JSCES has continuously supported and will continue to support the IACM activities, such as WCCM's, APCOM's and other regional and national congresses (APCOM'07-EPMESC-XI, organized by the JSCES with other local organizers, was in fact successful and is reported elsewhere in this issue). Please visit our web site **(http://www.jsces.org/)** for the details of our activities. ●

***Figure 2:** Group shot of participants the 2nd Korea-Japan (KJ) Joint Workshop on Computational Engineering*

A Eulogy For My Friend and Colleague

Richard E. Ewing

The Computational Mechanics community has suffered a great loss with the untimely passing of Professor Richard E. Ewing. As a long time friend and professional colleague of Dick Ewing and a member of the faculty at the same institution, I am honored to be asked to provide a few comments on this great human being and computational scientist.

To me Dick always appeared bigger than life, a true giant from Texas with gigantic ambitions for the success of Computational Mechanics, and for making great contributions to the organizations with which he was associated.

Dick, a Native Texan, was a distinguished graduate of the Department of Mathematics of The University of Texas at Austin. I first heard about Dick from my advisor Tinsley Oden, who served as a member in Dick's Ph.D. committee. I still vividly remember Dick's first lecture that I attended during the International Conference on Finite Elements in Fluids in early 1984. I later heard about his group in Wyoming and his great successes there and wrote to him when I was nearing graduation in 1985. He immediately offered me a visiting Professor position, which I ultimately declined in favor of a tenure track position at Texas A&M University.

Dick's contributions to the University of Wyoming are legendary. Ken Chong of the National Science Foundation, who overlapped with Dick at the University of Wyoming while he was Professor and Chair of Solid Mechanics recently recalled: *"Dick did excellent work in seismic exploration problems and built an Institute as well as a strong consortium consisting of 16 oil companies and others. Everyone there was touched by his energy, scholarship and leadership. Dick was a true scholar, educator and a gentleman."*

A few years later, I met Dick during the Second Workshop on Reliability of Finite Elements which was organized by Tinsley Oden in Lakeway outside Austin in the Fall of 1989. Dick talked to me in some length about the possibility of joining Texas A&M University and about the excitement that he and his wife Rita felt about coming back to Texas. Their dream became a reality when Dick became Dean of Sciences at Texas A&M in 1992.

In relatively short time, Dick led the transformation of the Mathematics Department from a classical one with a small concentration of faculty in Computational and Applied Mathematics to a modern, dynamic department with great hires in Numerical Analysis and Applied Mathematics. In 1994, Dick was able to recruit Jim Bramble and this led to the building of a Numerical Mathematics group which today includes Joe Pasciak, Yalchin Efendiev, Bojan Popov, Jean-Luc Guermond, Wolfang Bangerth and several others and also his trusted friend and colleague Raytcho Lazarov, who came down with Dick from Wyoming in 1992 and was also instrumental in helping Dick with his many endeavors.

Dick also founded the Institute of Scientific Computing (ISC) upon his arrival at Texas A&M in 1992. The Institute has hosted a great number of distinguished visitors and has had great impact on the university computing infrastructures. Dick always considered the ISC at Texas A&M is a continuation of his previous endeavors at the University of Wyoming - the Institute for Enhanced Oil Recovery from the early eighties and ISC at the University of Wyoming from the mid eighties.

At a social function at Jim Bramble's house, I believe it was in the Fall of 1999 following a Finite Element Rodeo at UT, I asked Dick about his plans for the future and if he would continue to serve as a Dean of Sciences at Texas A&M. He said that he was talking with the University about bigger things. Soon thereafter I learned about his appointment as Vice President for Research. Dick subsequently made his presence felt throughout the University by promoting outstanding new interdisciplinary research and inter University projects such as NASA/URETI, jointly with Rice University, which brought important new resources, including several new faculty lines in the College of Engineering and resulted to two new faculty hires in my own department of Aerospace Engineering.

Dick was always in the middle of the action, making many important contributions including the development of Eulerian-Lagrangian localized adjoint method (ELLAM), mixed finite element methods, modified method of characteristics, superconvergence, parallel computing for applications in miscible and immiscible displacement problems in petroleum engineering and hydrology. He was always close to the best people in the field like Jim Douglas, Jim Bramble, Tinsley Oden, Mary Wheeler, Ivo Babuska, Lars Wahlbin, to name a few, who were his friends and had great appreciation for his work and contributions.

Above I recounted only my own rather limited personal experiences about Dick. It would certainly take many pages and considerable research if one wanted to make a fair and full account of Dick's contributions to the field of Computational Mathematics and to Computational Mechanics, to the broader scientific community and also to Texas A&M University that he dearly loved. I would like instead to borrow a few words that were written by his good friend and colleague from the early days Tom Russell of the National Science Foundation on December 22th, 2007 a couple of weeks after Dick's passing.

"Ewing was an extraordinary connector of people, institutions and countries. He was instrumental in establishing a Texas A&M campus in Qatar, traveled to China 37 times to build U.S.-Chinese scientific relations and was elected to the European Academy of Sciences. His expansion of research at A&M was envied by universities nationwide. His remarkable ability to recruit talented people to work together was due to his unquestioned integrity and commitment to doing the right things for the right reasons. His prodigious output of high-quality research in scientific computation advanced fields of major importance, including energy and environmental applications. He was a devoted colleague and mentor to countless researchers and young scientists."

I felt privileged to be Dick's colleague at Texas A&M and always counted on him to be there for me. I am therefore deeply saddened by his untimely passing and by the void that he leaves behind at the Texas A&M and in our scientific community.

Fanis Strouboulis

Announcement of the John Argyris Award

for the best paper by a young researcher in the field of Computational Mechanics

Fourth competition for the John Argyris Award for the best paper by a young researcher in the field of Computational Mechanics. This Award has been initiated to honor Professor John Argyris and sponsored by Elsevier, holds a prize of 2000 euros which will be conferred on the winner by the President of the IACM at the VIII World Congress on Computational Mechanics (WCCM VIII) in June.

Applicants: submit a paper accepted for publication not earlier than 31 March 2006 in the journal Computer Methods in Applied Mechanics and Engineering. The papers are to be submitted electronically, by 31 March 2008, to:

Professor Eugenio Oñate ,The John Argyris Award, IACM Secretariat, CIMNE, Barcelona, Spain
e-mail: iacm@cimne.upc.edu

Best Ph.D. Thesis in Europe 2006

The table below lists the best Ph.D Thesis in Europe in 2006 as selected in each community by the different national organisations affiliated to ECCOMAS. The winners of the ECCOMAS Ph.D Thesis Awards are highlighted.

Society / Country	Title	Author	E-mail Author	Supervisor	E-mail Supervisor
BNCM Belgium	*Analysis of Differential Diffusion Phenomena in High Enthalpy Flows, with Application to Thermal Protection Material Testing in ICP Facilities*	**P. Rini**	pietro.rini@gmail.com	**P. Boulanger**	phboul@ulb.ac.be
CEACM Central Europe	*Modeling of Macrosegregation in Direct Chill Casting*	**M. Založnik**	miha.zaloznik@mines.inpl-nancy.fr	**J.Sarler**	jurica.soric@fsb.hr
Finnish Mathematical Society	*State Space Output Regulation Theory for Infinite-dimensional Linear Systems and Bounded Uniformly Continuous Exogenous Signals*	**I. Eero**	Eero.Immonen@tut.fi	**M. Gyllenberg**	mats.gyllenberg@helsinki.fi
CSMA France	*Extension of the X_FEM Approach to Large Strain for the Simulation of Fracture in Hyperelastic Materials*	**G. Legrain**	gregory.legrain@ec-nantes.fr	**O. Allix**	Olivier.Allix@lmt.ens-cachan.fr
GAMNI France	*Large Eddy Simulation in a Stabilized Finite Element Framework: A Variational Multiscale Approach*	**V. Levasseur**	levasseur_v@yahoo.fr	**D. Chapelle**	Dominique.Chapelle@inria.fr
GACM Germany	*Mechanical Integrators for Constrained Dynamical Systems in Flexible Multibody Dynamics*	**S. Leyendecker**	sigrid@aero.caltech.edu	**P. Wriggers**	wriggers@ibnm.uni-hannover.de
GAMM Germany	*Parallel Scalable Iterative Substructuring: Robust Exact and Inexact FETI-DP Methods with Applications to Elasticity*	**O. Rheinbach**	oliver.rheinbach@uni-due.de	**P. Wriggers**	wriggers@ibnm.uni-hannover.de
GRACM Greece	*Adjoint Formulations for the Analysis of Turbomachinery Cascades and Optimal Grid Adaptation using a Posteriori Error Analysis*	**D.I. Papadimitriou**		**A. G. Boudouvis**	boudouvi@chemeng.ntua.gr
Iris Society for Scientific & Eng. Computation	*Factors Affecting the Dynamic Interaction of Bridges and Vehicle Loads*	**Yingyan Li**	yingyan.li@gmail.com	**M. Gilchrist**	Michael.Gilchrist@ucd.ie
IACMM Israel	*Seismic Behavior and Control of irregular Structures: Energy Approach*	**O. Lavan**	olavan@buffalo.edu	**I. Harari**	harari@eng.tau.ac.il
AIMETA Italy	*A Computational Model of the Human Cornea: A Predictive Approach to Refractive Surgery*	**F. Manganiello**	manganiello@stru.polimi.it	**F. Auricchio**	auricchi@unipv.it
SIMAI Italy	*Regularization methods for the Solution of Inverse Problems in Solar Plasma Physics*	**M. Prato**	marco.prato@unimo.it	**A. Speranza**	alessandro.speranza@i2t3.unifi.it
Netherlands Mechanics Committee	*Fluid-Structure Interaction Simulations*	**A. van Zuijlen**	A.H.vanZuijlen@tudelft.nl	**D.H. van Campen**	D.H.v.Campen@tue.nl
Netherlands Mechanics Committee	*Optimum Forming Strattegies with a 3D Reconfigurable Die*	**S. Boers**	s.h.a.boers@tue.nl	**D.H. van Campen**	D.H.v.Campen@tue.nl
PACM Poland	*Numerical Analysis of Heat Transfer Process within Selected Electrical Transformers*	**J. Smolka**	jacek.smolka@polsl.pl	**T. Burczynski**	Tadeusz.Burczynski@polsl.pl
ONIV Russia	*Evaporation and Destruction of a Meteoric Body in the Atmosphere*	**N. Gennadevna**	barry_natalia@mail.ru	**B.N.Chetverushkin**	chetver@imamod.msk.su
SEMA Spain	*Development of Post-Process Techniques for Hydrodynamic Flows, Modelling of Sediment Transport Problems & Numerical Simulation using Finite Volume Techniques*	**A. M.Ferreiro Ferreiro**		**C.Vázquez Cendón**	carlosv@udc.es
SEMNI Spain (Ph.D Thesis Award Winner)	*Stabilized Pressure Segregation Methods and their Application to Fluid-Structure Interaction Problems*	**S. Badia**	sibadia@sandia.gov	**R. Codin**	codina@cimne.upc.es
NoACM Sweden (Ph.D Thesis Award Winner)	*Finite Element Procedures for the Numerical Simulation of Crack Propagation and Bilateral Contact*	**P. C. J.Heintz**	per.heintz@bredband.net	**A. Eriksson**	anderi@kth.se
ACME UK	*Stochastic Finite Element Modelling of Elementary Random Media*	**Chenfeng Li**		**A.Chan**	andrewhcchan@aol.com

iacm news

CSMA Presidential Change

Wishing **Professor Alain Combescure** of Insa de Lyon well with his appointment as the new President of CSMA, France.

CEACM Presidential Change

Having done a fantastic job, Vladimir Kompis has handed over the presidency of the Central European Association for Computational Mechanics to **Professor Juric Soric**.

Association of Computational Mechanics Taiwan

We are pleased to welcome the "Association of Computational Mechanics Taiwan" into the IACM. The following are the key persons of the association: Chairman - **Y. B. Yang**, Vice Chairman - **Chung-Yue Wang**, Executive Director - **David Chen.**

A Royal Award to Prof Pieter Wesseling

Prof. Pieter Wesseling has received the Royal Award “Ridder in de Orde van de Nederlandse Leeuw.

ASME Applied Mechanics Division give honours

Tom Hughes has received the ASME Applied Mechanics Division (AMD) highest honour, the Timoshenko Medal. During the same event, **Tom Hughes** and **Ted Belytschko** were also honored by renaming the ASME AMD Young Investigator Award to **ASME AMD Thomas J. R. Hughes Young Investigator Award**, and ASME AMD Award to **ASME Ted Belytschko AMD Award**. Congratulations to both of them.

Eugenio Oñate

Prof. Eugenio Oñate honoured in Swansea and Porto

Last July, **Prof. Eugenio Oñate** was presented with the title of Honourary Fellow of the University of Swansea in Wales. He also received the SEMNI Award in the CIMNE Conference held in Porto last June.
(see page 30 of this bulletin).

Two Awards for Wing Kam Liu

We are pleased to announce that **Wing Kam Liu** has just won the **Robert Henry Thurston Lecture Award** (http://imechanica.org/node/2305).
Wing Kam Liu, the Walter P. Murphy Professor of Mechanical Engineering at Northwestern University, was awarded the 2007 **USACM John von Neumann Medal** at the 9th US National Congress on Computational Mechanics in San Franciso, California on July 25, 2007. The von Neumann Medal is the highest award bestowed by the USACM to recognize individuals who have made outstanding, sustained contributions in the field of computational mechanics generally over periods representing substantial portions of their professional careers.

Sergio Idelsohn

Sergio Idelsohn receives ELSEVIER-SCOPUS Award

Prof. Sergio Idelsohn received the ELSEVIER-SCOPUS 2007 Award to the eight Argentinean researchers most cited in the last ten years in the References of all the World Scientific Journals.

Bernhard Schrefler

Bernhard Schrefler granted Doctor Honoris Causa

Professor Bernhard Schrefler has been granted a doctor honoris causa by the Faculty of Civil Engineering and Geodetic Sciences of the Leibniz Universität Hannover for his work on theory and numerics of multi-physics problems and their application in the area of civil and environmental engineering

IUTAM awards two major prises in Mechanics

The International Union of Theoretical and Applied Mechanics (IUTAM) has awarded the **G.K. Batchelor Prize in Fluid Mechanics** to **Prof. Howard Stone** of Harvard University and the **Rodney Hill Prize on Solid Mechanics** to **Prof. Michael Ortiz** of the Californian Institute of Technology. Congratulations from the IUTAM, the IACM and the international community.




Joint

WCCM VIII

VIII World Congress on Computational Mechanics

and

ECCOMAS V

V European Congress on Computational Methods in Applied Science & Engineering

June 30 to July 4 2008

The organization of the joint VIII World Conference on Computational Mechanics (WCCM VIII) and V European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS V), to be held in Venice, from June 30 to July 4 2008, is progressing according to the schedule. The Conference is organized by the University of Padua and the Politecnico of Milan under the auspices of the International Association of Computational Mechanics (IACM), the European Community on Computational Methods in Applied Sciences (ECCOMAS), the Italian Association of Theoretical and Applied Mechanics (AIMETA) and the Italian Society of Applied and Industrial Mathematics (SIMAI).

Almost 200 proposals for Minisymposia, by leading scientists from all over the world, have been received and about 150 have been accepted after review. The complete list is available at the Conference website:
http://www.iacm-eccomascongress2008.org/frontal/Invited2.asp

In accordance with the tradition of previous issues of IACM and ECCOMAS Congresses, the Minisymposia are intended to cover the latest developments in all aspects of computational mechanics with topics at the current front of research in computational mechanics and applied mathematics. Several Calls for Abstracts have already been launched worldwide. All contributions intended to broaden the fields of application of the discipline or to include new computation oriented areas in engineering and sciences are welcome, even though not directly included in one of the Minisymposia.

The Executive Council of IACM and the Managing Board of ECCOMAS have elected distinguished speakers for 10 Plenary and 16 Semi-Plenary Lectures intended to provide an interdisciplinary forum for information and discussion on some of the most advanced subjects. The list of the Lectures and information on the speakers are also available at the Conference website.

Abstract submission and Registration to the Conference are open.
Important dates to remember are:

December 15th, 2007:	Deadline for presenting a one page abstract
January 31st, 2008:	Acceptance of the contributions and instructions for writing the final one page abstract
February 28th, 2008:	Deadline for submitting the final abstract and early payment

The Conference Secretariat at "IACM-ECCOMAS08" **iacm@cimne.upc.edu** is pleased to receive all possible inquiries about registration and abstract submission.

The conference will be held at the Lido di Venezia Congress Center, located in the Complex formed by the Palazzo del Cinema and the former Venice Casino. The Palazzo del Cinema and the nearby Casino represent a

conference centre offering over 3,000 visitor places and spacious exhibition areas. The lido di Venezia is an island which limits the lagoon of Venice towards the Adriatic sea. There exist frequent links from the airport and other parts of the city including a ferryboat from the Tronchetto car terminal. Venice is easily accessible by road, by train or by air, arriving either at Marco Polo international airport or Nicelli airport on the island itself.

In the immediate vicinity of the congress center there are 1,600 hotel rooms available, offering a range of 2-star to luxury accommodation. Further there are many hotels in Venice itself. Prospective participants should have in mind that Venice is one of the most attractive tourist destinations in the world and that it is necessary to plan their trip well in advance. Block reservations of a large number of hotel rooms, both on the Lido Island and in the main town have been secured by the organization in the interest of the participants. However, these reservations will be released by March 31st. It is highly recommended that booking is finalized before this date. The complete list of the hotels is available on the Conference website.

The venue represents the perfect place for those who want to meet colleagues and at the same time mix cultural tourism and a vacation by the sea. Venice is considered among the most beautiful and best preserved historical cities in the world, unique in the fact that it is the only city in the world built on water. The city has earned the name of La Serenissima, the most serene, as throughout the city's remarkably stable history Venice favoured neutrality and peace when possible. Today the city's peaceful atmosphere is due to the complete absence of cars; boats provide the only means of transport along a system of over 150 canals. For those who prefer to explore the city on foot, more than 430 bridges connect the canals and streets together. There are numerous museums and over 200 churches to explore. San Giorgio Maggiore, Giudecca are separate islands, as are Torcello, Murano (where glass is produced), and Burano (where lace is historically made). There are over 100 other islands in the lagoon.

http://www.iacm-eccomascongress2008.org/frontal/Invited2.asp

conference diary planner

7 - 11 January 2008	**WSCS 2008 - Winter School on Computational Science** *Venue:* The University of Texas *Contact:* http:/www.math.utep.edu/wscs_2008
12 - 17 January 2008	**DD-18 - 18th International Conference on Domain Decomposition Methods** *Venue:* Jerusalem, Israel *Contact*: www.iacmm.org.il
31 March - 4 April 2008	**iX Congreso Internacional de Métodos Numéricos en Ingenieria y Ciencias Aplicadas** *Venue:* Isla Margarita, Venezuela *Contact:* www.cimenics.org.ve
14 - 16 May 2008	**SUSI 2008 - Structures Under Shock and Impact** *Venue:* Algarve, Portugal *Contact:* http://www.wessex.ac.uk/conferences/2008
1 - 6 June 2008	**EngOpt 2008 - International Conference on Engineering Optimisation** *Venue:* Rio de Janiero, Brazil *Contact:* www.engopt.org
3 - 6 June 2008	**ECMS 2008 - European Conference on Modeling and Simulation** *Venue:* Nicosia, Cyprus *Contact:* http://www.scs-europe.net/conf/ecms2008
18 - 20 June 2008	**ACI/CANMET Conference on High Performance Concrete Structures and Materials** *Venue:* Manaus, Brasil *Contact:* venus.ceride.gov.ar
24 - 27 June 2008	**VECPAR 2008 - High Performance Computing for Computational Science** *Venue:* Toulouse, France *Contact:* http://vecpar.fe.up.pt/2008
30 June - 5 July 2008	**8th World Conference on Computational Mechanics and Engineering** **5th ECCOMAS Congress on Computatioal Methods in Applied Sciences** *Venue:* Venezia, Italy *Contact:* www.iacm.info / www.eccomas.org
2 - 5 September 2008	**ECT 2008 - 6th Int. Conference on Engineering Computational Technology** *Venue:* Athens, Greece *Contact:* http://www.civil-comp.com/conf/ect2008.htm
2 - 5 September 2008	**CST 2008 - 9th Int. Conference on Computational Structures Technology** *Venue:* Athens, Greece *Contact:* http://www.civil-comp.com/conf/cst2008.htm
5- 6 September 2008	**JMC 2008 - 7th Worksho on Computational Mechanics** *Venue:* Sanitago, Chile *Conact*: www.scmc.cl
1 - 6 October 2008	**12th IACMG Conference** *Venue:* Goa, India *Contact:* www.12iacmag.com
4 - 7 November 2008	**CILAMCE 2008 - 29th Iberian Latin American Congress on C.M. in Engineering** *Venue:* Maceió, Brasil *Contact:* www.acquacon.com.br/cilamce2008
10 - 13 November 2008	**ENIEF 2008 - XVII Congress on Numerical Methods and their Applications** *Venue:* San Luis, Argentina *Contact*: http://enief2008.unsl.edu.ar
7 - 10 January 2009	**AfrCCM'09 - 1st African Conference on Computational Mechanics** *Venue:* Sun City, South Africa *Contact:* http://www.afrccm.com/
15 - 17 June 2009	**III ECCOMAS Int. Conference on Computational Methods in Marine Engineering** *Venue:* Trodheim, Norway *Contact:* http://congress.cimne.upc.es/marine09
17 - 19 June 2009	**5th MIT Conference on Computational Fluid and Solid Mechanics** *Venue:* Cambridge, ,MA, USA *Contact:* http://www.fifthmitconference.org
2 - 4 September 2009	**COMPLAS 2009 - X International Conference on Computational Plasticity** *Venue:* Barcelona, Spain *Contact:* http://congress.cimne.upc.es/complas09