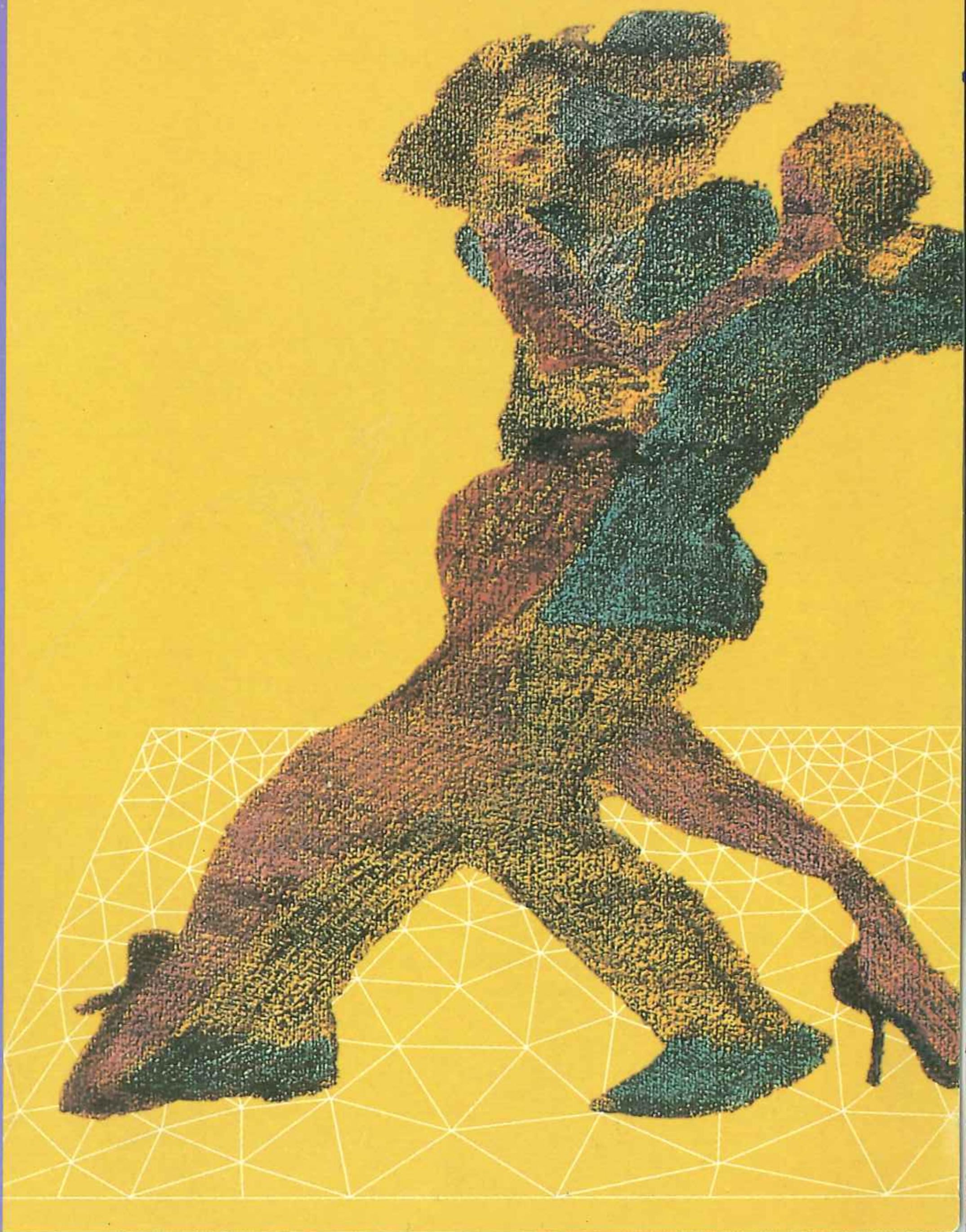
iacm

expressions

Fourth iacm World Congress on Computational Mechanics

Buenos Aires, Argentina
29 June - 2 July, 1998



Bulletin for The International Association for Computational Mechanics

Nº 2
Fall / Winter 1996

IACM Executive Council

President: **A. Samuelsson** Sweden
Past Presidents: **J.T. Oden** U.S.A., **O.C. Zienkiewicz** U.K.
Vice President (Americas): **T.J.R. Hughes** U.S.A.
Vice President (Asia-Australia): **Y.K. Cheung** Hong Kong
Secretary / Treasurer: **E.Oñate** Spain
H.A. Mang Austria, **W. Zhong** P.R. China, **J. Periaux** France,
S. Idelsohn Argentina, **G. Yagawa** Japan
Corresponding Members: **E.R. Arantes e Oliveira** Portugal,
S.N. Atluri U.S.A., **M. Kleiber** Poland, **R. Ohayon** France,
E. Stein Germany, **S. Valliappan** Australia, **W. Wunderlich** Germany
Honorary Members: **J.H. Argyris** Germany, **R. Dautray** France,
R. Gallagher U.S.A., **T. Kawai** Japan, **H. Liebowitz** U.S.A.

IACM General Council

S.N. Atluri U.S.A.
I. Babuska U.S.A.
F. Basombrio Argentina
K.J. Bathe U.S.A.
J.L. Batoz France
O.M. Belotserkovsky U.S.S.R.
T Belytschko U.S.A.
P.G. Bergan Norway
D. Beskos Greece
M. Borri Italy
M. Casteleiro Spain
M. Cecchi Italy
M. Cerrolaza Venezuela
Y.K. Cheung Hong Kong
C.K. Choi Korea
M. Chrisfield U.K.
M. Crochet Belgium
T.A. Cruse U.S.A.
D.R. de Borst The Netherlands
F.B. Damjanic Slovenia
L. Demkowicz Poland
J. Donea Italy
E. Dvorkin Argentina
R. Ewing U.S.A.
R. Feijoo Brazil
C. Felippa U.S.A.
M. Geradin Belgium
D. Givoli Israel
R. Glowinski France
I. Herrera Mexico
T.J.R. Hughes U.S.A.
S. Idelsohn Argentina
C. Johnson Sweden
S. Kaliszky Hungary
W. Kanok-Nukulchai Thailand
M. Kawahara Japan
T. Kawai Japan
M. Kleiber Poland
B Kroplin Germany
V.N. Kukudzanov U.S.S.R.
P. Ladeveze France
K. Li P.R. China
J.L. Lions France
W.K. Liu U.S.A.
G. Maier Italy
H.A. Mang Austria
J.L. Meek Australia
F. Michavila Spain
M. Mikkola Finland
K. Morgan UK
G. Nayak India
A.K. Noor U.S.A.
J.T. Oden U.S.A.
R. Ohayon France
E.R. Arantes e Oliveira Portugal
E. Oñate Spain
J. Orkisz Poland
R. Owen U.K.
P. D. Panagiotopoulos Greece
J. Periaux France
C.V. Ramakrishnan India
E. Ramm Germany
B.D. Reddy S. Africa
J.N. Reddy U.S.A.
A. Samuelsson Sweden
B. Schrefler Italy
M. Shephard U.S.A.
E. Stein Germany
G. Steven Australia
B.A. Szabo U.S.A.
B. Tabarrok Canada
R.I. Tanner Australia
R.L. Taylor U.S.A.
T. Tezduyar U.S.A.
P. Tong Hong Kong
S. Valliappan Australia
J. Whiteman U.K.
N.E. Wiberg Sweden
W. Wunderlich Germany
G. Yagawa Japan
Z. Yamada Japan
W. Zhong P.R. China
O.C. Zienkiewicz U.K.

Honorary Members: **E. Alarcon** Spain, **J.H. Argyris** Germany, **J.L. Armand** France, **J. Besseling** The Netherlands, **R. Dautray** France, **C.S. Desai** U.S.A., **S.J. Fenves** U.S.A., **R.H. Gallagher** U.S.A., **P. Larsen** Norway, **H. Leibowitz** U.S.A., **A.R. Mitchell** U.K., **T.H.H. Pian** U.S.A., **K.S. Pister** U.S.A., **L.-X. Qian** P.R. China, **G. Strang** U.S.A., **C.W. Towbridge** U.K., **E.L. Wilson** U.S.A., **Y. Yamada** Japan, **Y. Yamamoto** Japan

IACM Standing Committee for Congresses

S. Idelsohn: *Chairman Local Organising Committee, WCCM iv,*
M. Kleiber, H. Mang, J.T. Oden, E. Oñate, A Samuelsson, O.C. Zienkiewicz

IACM Affiliated Organisations

Listed in order of affiliation

U.S.A.	**U.S. Association for Computational Mechanics (USACM)**
Argentina	**Asociacion Argentina de Mecanica Computacional (AMCA)**
PR China	**The Chinese Association of Computational Mechanics**
Italy	**Gruppo Italiano di Meccanica Computazionale (GIMC)**
Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden	**The Nordic Association for Computational Mechanics (NoACM)**
Japan	**The Japan Society for Computational Engineering and Science (JSCES)**
Spain	**Sociedad Española de Métodos Numéricos en Ingeniería (SEMNI)**
Germany	**German Association of Computational Mechanics (GACM)**
France	**Computational Structural Mechanics Association (CSMA)**
U.K.	**Association for Computer Methods in Engineering (ACME)**
Greece	**The Greek Association of Computational Mechanics (GRACM)**
Austria, Croatia, Hungary, Poland, Slovakia, Slovenia, The Czech Republic	**The Central-European Association for Computational Mechanics (CEACM)**
Poland	**Polish Association for Computational Mechanics**
Bulgaria	**The Bulgarian Association of Computational Mechanics (BACM)**
Israel	**The Israel Association of Computational Methods in Mechanics**
Portugal	**The Portuguese Society of Theoretical, Applied and Computational Mechanics**
Australia	**Australian Association of Computational Mechanics**
S. Africa	**South African Association for Theoretical and Applied Mechanics (SAAM)**
Turkey	**Turkish National Committee on Computational Mechanics**

IACM Membership

Fee

The annual fee for direct individual membership of IACM is 25 US dollars. For affiliated organisations the membership fee is reduced to 10 dollars for the first fifty members, 7 dollars for the next one hundred and fifty members and 10 dollars for any member exceeding two hundred. The Bulletin and a discount on IACM supported activities (congress, seminars, etc.) are some of the benefits of the membership. For further details contact IACM Secretariat.

IACM Expressions

Published by
The International Association for Computational Mechanics (IACM)

Editorial Address
IACM Secretariat, Edificio C1, Campus Norte UPC, Gran Capitán s/n, 08034 Barcelona, Spain. Tel: (34) 3 - 401 7441, Fax: (34) 3 - 401 6517, Email: iacm@etseccpb.upc.es

Editorial Board

E. Dvorkin	South America
M. Kawahara	Asia-Australia
E. Oñate	Europe
J. N. Reddy	North America

Advertising
For details please contact Diane Duffett at the IACM Secretariat.

IACM members are invited to send their contributions to the editors.

Views expressed in the contributed articles are not necessarily those of the IACM.

Front Cover
Fourth IACM World Congress on Computational Mechanics - Page 20.

contents

editorial

Thanks, to all of you ..

We are pleased at IACM to release the second issue of our renewed bulletin IACM Expressions. The content of the first issue has apparently fulfiled all expectations, as shown by the kind letters sent by many IACM members. We are grateful to all of them for their support.

We sincerely hope that the bulletin grows both in quality and quantity, in parallel with the increasing number of activities of IACM worldwide. Indeed, the bulletin should be a just reflection of the momentum and prestige of our association.

The potential content of this magazine seems to be enormous as the number of applications of computational mechanics grows boundless. We look forward to receiving contributions from scientists and engineers in the form of state of the art (equationless!) descriptions of old and new trends in the wide field of computational mechanics. Please also feel free to send comments to published articles and indeed any news related to events in the field worldwide.

Finally, the editors want to thank the effort and collaboration of all of those who have contributed to the 1996 issues, and wish you all the best for the New Year 1997.

Eugenio Oñate
IACM Secretary & Treasurer

My Reminiscence on Early Developments of the Finite Element Method in Japan

Editorial letter from
Tadahiko Kawai
The Science University of Tokyo

In 1956, at Lehigh University, I heard that Mr Turner and his colleague of the Boeing Airplane Company had first presented their historical paper on the direct stiffness method of structural analysis in the journal of Aeronautical Science. But it took me about 10 years to recognize the importance of this matrix method of structural analysis.

During this period Professor Kyuichiro Washizu was based at the Aeroelastic and Structure Research Laboratory of the Massachusetts Institute of Technology. In March 1955 he proposed a generalization of the principle of minimum potential energy. At exactly the same time, a young Chinese professor H.C. Hu independently published a paper on the same principle . Today this is called the Hu-Washizu Principle.

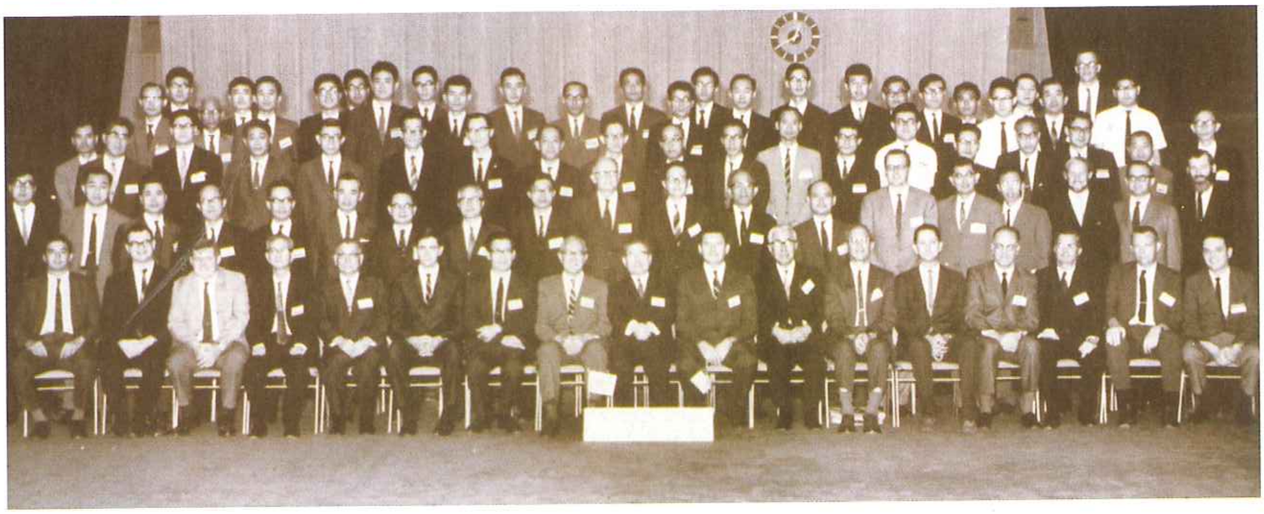
" ..it took me about 10 years to recognize the importance of this matrix method of structural analysis "

Up until the death of Prof. Washizu in 1981, Prof. T.H.H. Pian of MIT and Prof. Washizu were excellent research collaborators dealing with the variational basis of finite element methods. Indeed, Prof. Pian's work was very influenced by Prof. Washizu and in return Prof. Washizu was stimulated into writing a book based on the work of Prof. Pian and his own work at MIT. This celebrated book titled 'Variational Methods in Elasticity and Plasticity' was published in 1965. Today this book still plays an important role in steering the development of the finite element method.

Our group's first participation in the 'brotherhood of computational mechanics' was in 1968 at the 2nd Wright Patterson Air force Base Conference. Here papers were presented by Prof. H. Ohtsubo and myself (buckling of a perforated plate), Prof. Y. Yamada (incremental inelastic analysis), and Dr T. Fujino and K. Ohsaka of Mitsubishi Heavy Industries (heat conduction and thermal stress problems). At this conference two more papers were presented by young japanese engineers. They were Prof. F. Kikuchi of the University of Tokyo (a new variational functional for the FEM of the plate and shell problems) and Mr W. Mizumachi of Toshiba Co. (neutron diffusion problems). During this period of FEM development in Japan, the works of Professors G. Yagawa (University of Tokyo), Y. Yoshida (Tokyo Institute of Technology) and M. Kawahara (Chuo University) should not be excluded.

Based on an agreement between the U.S. National Science Foundation and the Japan Society for the Promotion of Science, the first U.S. - Japan seminar on the Matrix Method of Structural Analysis was organized in 1969 by professors R.H. Gallagher and Y. Yamada

Memorial Picture of the first U.S. - Japan Seminar on the Matrix Method of Structural Analysis



which was held in Tokyo. This seminar was a great success mainly due to two points: firstly that top scholars and engineers from both countries could get together and present their latest works in this area and, secondly, the tremendous impact which this gave to various engineering fields in Japan. It was at this seminar that I was extremely fortunate to meet many American scholars including Messes. Turner, Martin, Denke, Archer, Clough, Melosh, Pian, Fulton, Oden, Ping Tong, and Marcal. *Photo 1* shows the memorial picture of all U.S. and Japanese participants. It can be seen that almost all U.S. pioneers in FEM development at this time got together at this seminar. The Japanese participants were leading and young university professors and engineers representing major industrial companies.

We were very impressed by papers presented by three 30 year old U.S. participants: Professors J.T. Oden, Pedro Marcal and Ping Tong. *Photo 2* shows a snap of Mr M.J. Turner and Professor K. Washizu at the banquet. *Photo 3* shows a just married handsome couple, Professor and Mrs J.T. Oden with Professor and Mrs Yoshikatsu Tsuboi, a well known Japanese professor of shell structures.

The 2nd U.S. - Japan Seminar was held in July 1971 at Berkeley, California and chaired by Prof. Ray W. Clough. The 3rd Seminar was held in August 1978 at Cornell University, Ithaca N.Y. and was chaired by Prof. John Abel. Together with Prof. M. Kawahara, I organised the 4th international symposium on finite element methods in flow problems in Tokyo in August 1982. The participants exceeded 400 with over one fourth from outside Japan. It was during this symposium that the first informal discussion was held among leading participants on the possibility of founding the IACM.

Through these activities I have made contact with many eminent scholars, some of which were invited to the Institute of Industrial Science, University of Tokyo, including Professors R.H. Gallagher, F. de Veubeke, O.C. Zienkiewicz and T.H.H. Pian.

My international exchange activities in Asia started when the first international conference on computational mechanics was held in Shanghai in 1982 where Prof. Y.K. Cheung played an important role in the organisation. Here I met Prof. E.R. Arantes e Oliveira, rector of the Lisbon Technical University at the time. Our discussion turned to some shared work in contributing to projecting science and building up the scientific structures of the Far East. We called our project "EPMESC - Education, Practice and Promotion of Computational Methods in Engineering using Small Computers". To carry it out we invited

Mr M.J. Turner and Prof. K. Washizu

the support of colleagues from other countries who partook of our ideas: Luo of Canton, Cheung of Hong Kong, Lee of Singapore, Valliappan of Australia and Pian of the United States. We proposed to hold the first EPMESC Conference in Macao which was accepted and took place in August 1985.

This conference series has become one of the most important international conferences on computational mechanics in the Asia-Pacific region. The 1st, 3rd and 5th took place in Macao, the 2nd in Guangzhou, the 4th in Dalian and EPMESC VI will again be held in Guangzhou in 1997.

My memories are never exhausted because they are full of so many precious experiences in my life. However, my reminiscing here may be sufficient to supplement some Asian contributions to Alf's Brotherhood in Computational Mechanics. •

"My memories are never exhausted because they are full of so many precious experiences in my life."

Prof. & Mrs J.T. Oden and Prof. & Mrs Yoshikatsu Tsuboi

On Difficulty Levels in Non Linear Finite Element Analysis of Solids

by
T. Belytschko
Departments of Civil and Mechanical Engineering, Northwestern University

Nonlinear finite element analysis has blossomed into widespread use in industry for a large variety of simulations of prototype tests and manufacturing processes. Examples of the former include crashworthiness analysis of automobiles and other vehicles, drop tests of various consumer products and performance tests of new design concepts in products as diverse as washing machines, power saws, and printers. Process simulations include sheet-metal forming, extrusion and many other processes. I have recently even heard a report about the simulation of the birthing process for humans to aid doctors in the decision on whether to select a Caesarean section.

There is a widespread perception that nonlinear finite element methods have reached a state of robust maturity and that commercial software can deal effectively with almost any of these nonlinear problems. Although this is true for certain sets of problems, it cannot be said for all nonlinear problems, and many characteristics of industrial and defence community simulations involve phenomena which are still very difficult to treat. Yet many users have little understanding of what characteristics makes a problem difficult and of the degree of maturity and robustness of nonlinear finite element methods for various classes of problems. Therefore, I have attempted a first stab at a classification of nonlinear problems according to their ingredients with respect to levels of difficulty. This will hopefully will aid users in the assessment of the feasibility of contemplated simulations and provide a basis for more complete classifications.

"... nonlinear finite element methods have reached a state of robust maturity ... for certain sets of problems"

This classification subdivides problems according to various characteristics which lead to difficulties in solution. The ingredients which I consider important in assessing the difficulty of a nonlinear problem are:

1. the presence of instabilities and their type;
2. the required resolution;
3. the continuity of the solution in space and time;
4. the magnitude of deformations.

Stability. In the early days of nonlinear finite element analysis, problems were characterized as to whether they had geometrical or material nonlinearities. Geometrical nonlinearities are those which arise from large strains and displacements, material nonlinearities are those which arise from deviations of the stress-strain law from linearity. Today, problems with both geometric and material nonlinearities are in many cases quite straight forward, so it provides little in the way of classifying levels of difficulty.

A similar classification can be made for instabilities which provides an important distinction in the difficulty of problems: geometric instabilities and material instabilities. Geometric instabilities are those associated with changes in geometry. Material instabilities are those associated with loss of stability in the response of the material, i.e. the constitutive equation.

Geometric instabilities can be classified in two types:

1. limit point instabilities, such as the snap-through of an arch;
2. bifurcation instabilities, such the buckling of a beam or a cylindrical shell.

Bifurcation instabilities are often very sensitive to the presence and character of imperfections. A well known example of that is the sensitivity of cylindrical shell buckling to imperfections.

Material instabilities are instabilities which arise from the loss of positive definiteness of the incremental stress-strain law, often known as the acoustic tensor. In the following, we will call problems which are geometrically stable G-stable and those which exhibit geometrical instabilities G-unstable problems, respectively; similarly, problems which manifest material instabilities will be called M-unstable and those which do not M-stable.

Material instabilities arise from two sources:

1. loss of monotonicity in the stress-strain curve which is associated with a negative slope in the stress-strain curve and often known as strain softening;
2. non-associative plasticity.

Well known manifestations of material instabilities are shear bands. Both types of material instabilities appear to be associated with a high degree of imperfection sensitivity: the location of the onset of the material instability may depend upon imperfections, and the nature of the response also. Furthermore M-unstable problems usually exhibit what is known as localization: the deformation is concentrated in a very narrow domain, such as a shear band or a crack. It should be noted that a computation can be assured to be M-stable by restricting the materials to those which satisfy Drucker's postulate.

Resolution Requirements. Another factor in the difficulty of a problem is the resolution required for an adequate solution. If a problem requires the resolution of a comparatively short wave length relative to the problem size, then we will call this high mode response. Examples of problems requiring high resolution are the solution of shear band problems, problems involving short wave length buckles, and problems involving very short time loads. Even in the linear arena, high resolution problems pose a significant challenge, as examplified by the difficulties of solving the acoustic problems associated with submarine signature and in non-destructive evaluation of defects by ultrasonics. In the nonlinear arena, problems requiring high resolution are even more difficult.

Magnitude of Deformation. The difficulty of a nonlinear problem also depends on the magnitude of the deformation. We will characterize the magnitude of the deformation by the norm of the Green-Lagrange strain tensor E and subdivide problems into three categories: small strains (of the order of 0.01), moderate strains (of the order of 0.1) and large strains (of the order of 1). The smallest category of deformation is essentially geometrically linear. Although it would be tempting to classify all other large deformation problems in a single category, experience suggests that there is a threshold below which the deformation causes only moderate additional difficulties. My selection of 1.0, or 100% strain, for this threshold is of course somewhat arbitrary, but it is in this neighbourhood that large deformations often start to cause major problems.

There are two major reasons why large deformation problems are more difficult:

1. meshes become progressively more distorted as the deformation increases, and distorted meshes are less accurate and introduce other difficulties;
2. the difficulties in material characterization also increase in the very large strain range.

The first only applies of course to Lagrangian meshes, but most commercial nonlinear finite element software today still uses almost exclusively Lagrangian meshes, and even in the few program that have ALE and Eulerian meshes for solids, the algorithms tend not to be as robust. For example, contact-impact conditions and history dependent constitutive equations are much more difficult with Eulerian meshes.

Continuity. The fourth criterion we will use is the continuity of the solution. Continuity of the response in both space and time improves the performance of numerical algorithms immensely, while discontinuities cause difficulties, particularly in implicit dynamic and static solutions. Discontinuities in time can arise through phenomena such as impact and contact. Discontinuities in space can arise from phenomena such as cracking and phase changes. If the response of a problem is smooth in time, we will call it C^0 in time t. If there is no cracking or change in the topology of the problem, we will call the deformation C^0. In C^0 response, the deformation is continuous and piecewise continuously differentiable. This condition implies that a unique function which is one to one and onto specifies the deformation. When there is cracking or crack propagation, the deformation is C^{-1}, i.e. the displacement is piecewise continuous but involves discontinuities. Problems with cracking are obviously more difficult, particularly problems involving the development of numerous cracks such as in fragmentation.

"... contact-impact conditions and history dependent constitutive equations are much more difficult with Eulerian meshes."

TABLE 1
Classification and Levels of Difficulty of Nonlinear Problems

Time t	Space x	G-stable	M-stable	$\|E\|$	Resolution	Difficulty level
C^0	C^0	yes	yes	moderate	low	1
C^0	C^0	yes	yes	moderate	low	1
C^0	C^0	yes	yes	large	low	2
C^0	C^0	no	yes	moderate	low	2
C^{-1}	C^0	no	yes	large	low	3
C^{-1}	C^0	no	no	any	either	3
C^{-1}	C^{-1}	no	no	any	either	4

Performance of current FE software:
Level 1: highly robust
Level 2: moderately robust, some difficulties expected
Level 3: sometimes solvable with great care
Level 4: computer games

My estimates of the orders of difficulty of some selected categories based on this classification are summarized in the Table (I have not tried to include all). As can be seen, in my opinion, problems involving continuous, stable response with material and geometric nonlinearities are reasonably well in hand for moderate deformations; in most cases, when large errors arise, they can be attributed to inadequate characterization of the material, lack of resolution or poor modelling.

" ...to provide at least some guidance to users as to how good the roads are ... "

Problems with geometric instabilities, particularly those with imperfection sensitivity, are more difficult, and generally require more sophistication on the part of the user. The analyst must also be prepared to take a more general view of the information provided by a finite element solution, since the solution with a single arbitrary imperfection may not give a good picture of the real performance of a structure.

Problems involving material instabilities are usually very difficult to solve. Because of the localization usually associated with material instabilities, most meshes which I have seen in use currently are quite inadequate. There is insufficient understanding of what the material behaviour is after the onset of instability, since it is perhaps impossible to measure unstable material behaviour. Still, it is sometimes possible to get general indications of performance in the presence of material instabilities which are of engineering value.

Problems involving C^{-1} response in space, i.e. cracking and material instabilities, are among the most difficult problems. Difficulties are presented by the fact that we do not have mature algorithms which can track cracking. Furthermore, the mechanics associated with the initiation and growth of cracks in complicated situations is still not well in hand. While fracture mechanics can predict ,for certain materials, when a crack of a given size will grow, and also how it will grow, to simulate fracture of engineering products in simulations, we need theories and appropriate data to model the evolution of damage and the transition of damage to fracture. Such data and theories are still not available today.

There are many other factors that enter into the difficulty of problems. The most important of these is material characterization. Many materials in common use are not well characterized even for small and moderate strains prior to any damage. The characterization of damage of materials, although voluminously treated from a theoretical viewpoint, is in most cases without any data. Furthermore, the response of many materials exhibit idiosyncrasies we do not understand and are not quantified. Even the response of metals in the small strain range using robust, classical plasticity theories exhibits extreme sensitivity to many factors in cyclic loadings. In the C^{-1} regime of response, we have not yet even begun to make careful studies, and although there are techniques such as erosion or element-kill options in many programs, the user should not get the impression that such methods can deal with cracking.

There are other factors such as requirements for multiphysics models, treatment of frictional interfaces, etc. The list is almost endless. But it would be worthwhile to get a handle on the maturity of the treatment of major aspects of nonlinear finite element analysis and to provide at least some guidance to users as to how good the roads are in nonlinear finite element land. I would welcome any comments or suggestions for modifications or additions. •

Are Squearths *Really* all Nuphs?

All educated people now realise that pprills, squearths and glops have all been proved to be simply forms of nuph. It is also well established that squearths are both glops and nuphs. However, there is a complication. Recent work has established that there are glops which are neither squearths, gdynxs nor pprills. Further, there are squearths which are neither gdynxs nor yet pprills.

Admittedly some pprills are glops as are all squearths and even some gdynxs as well. Now that we know more about gdynxs, that some are squearths, some glops and some, unfortunately, both pprills and squearths, there are certain urgent questions that can be answered definitively.

1. Can the universe contain such an unfortunate creature that, to be truthful, it must admit that it is a pprill, a nuph, a squearth, a glop and also a gdynx?
2. Consider those gdynxs which are not nuphs, can they possibly be glops?
3. If a pprill is a squearth, it is also a glop and can it possibly be a gdynx?

See answer on page 15

An Insight into SAAM

C.G. du Tiot
Treasurer - South African Association for Theoretical and Applied Mechanics
Potchefstroom - July 1996

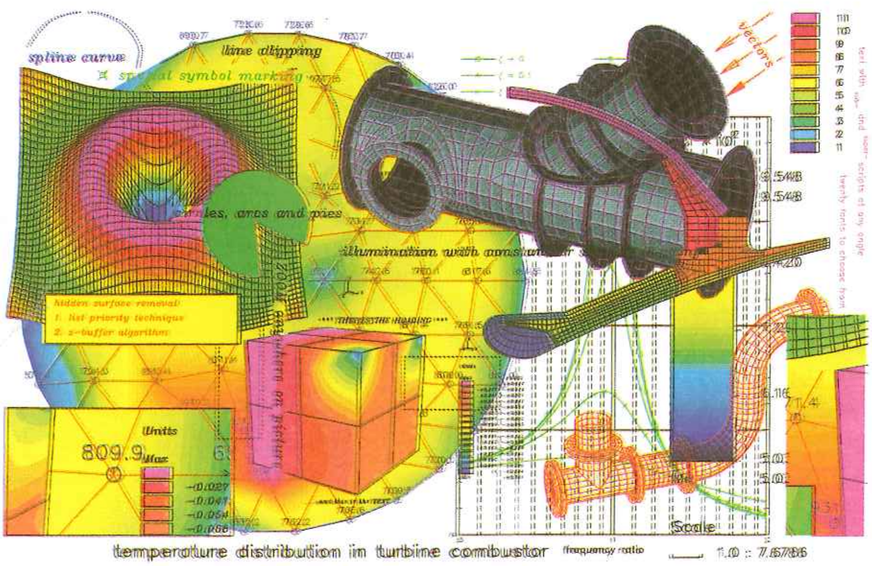
" geomechanics ... biomechanics ... optimisation ... cfd / automated design"

Despite the lack of a society or an association, activity in the field of theoretical, experimental and computational mechanics has been well established in South Africa. This was because the professional engineering societies promoted research in mechanics in their own professional orientation. However, in line with international trends, a mechanics activity emerged which transcended professional orientations. Evidence of this was regular Finite Element Methods in South Africa (FEMSA) and Computational Fluid Dynamics (CFD) symposia. The professional engineering societies were, however, not the appropriate vehicle through which to seek affiliation to international bodies such as the International Association for Computational Mechanics (IACM) and the International Union for Theoretical and Applied Mechanics (IUTAM). In 1992 it was, therefore, decided to form the South African Association for Theoretical and Applied Mechanics (SAAM) and the Association was formally launched in June 1993.

In the future, meetings such as the FEMSA and CFD symposia will therefore be run under the auspices of SAAM. It was, however, also decided to hold a national mechanics conference every two to four years. This then culminated in the First South African Conference on Applied Mechanics (SACAM'96) which took place from July 1-5, 1996 in Midrand near Johannesburg. The conference incorporated the 4th National CFD Symposium, the 14th FEMSA Symposium, the 5th SA Aerospace Engineering Conference and the Annual Seminar of the Strain Society with the aim of providing inter-disciplinary discussions and increasing academic, industrial and international participation. The keynote speaker was the well known Prof. Robert Taylor, whilst Proffs. Keith Kedward, Roger Owen and Joseph Schetz were amongst the invited speakers. A highlight of the conference was the talk by the astronaut Marsha Ivins on the space shuttle. Several research centres, such as CERECAM, SORG and UCM, are institutional members of SAAM.

The FRD/UCT Centre for Research in Computational and Applied Mechanics (CERECAM) in the Faculty of Engineering at the University of Cape Town was established in 1984 and is an interdisciplinary unit which draws participation from the departments of Mathematics and Applied Mathematics, Civil Engineering and Mechanical Engineering. The applications of CERECAM's programmes range from geomechanics and rock fracturing processes to bio-mechanics, where the modelling of joints and the study of the mechanical behaviour of bone is emphasised, to the study of deformation in metals processing during manufacturing. For example, the changing stress waves in rock, resulting from mining activities such as the removal of rock and controlled explosions, are modelled. Also the points of maximum stress on an artificial knee at all stages of movement has been observed and applied to the design of artificial knee joints. CERECAM provides a service to industry through contract research and consultation, and is involved in solving problems of importance to national industrial development, both at a research and application level while contributing to international conceptual development.

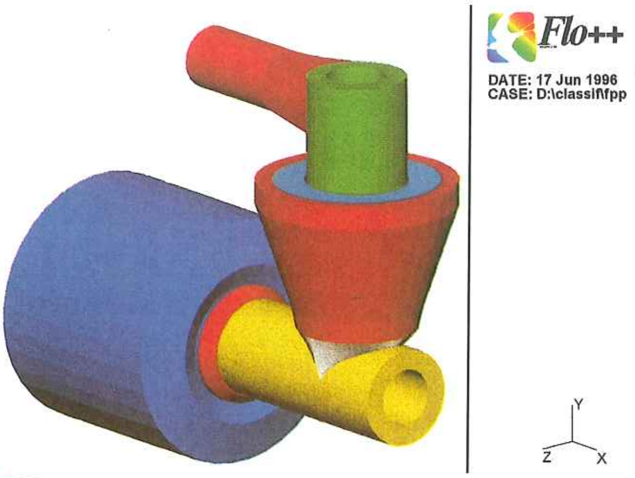
Collage of thermal analyses results



The Structural and Multidisciplinary Optimisation Research Group (SORG) in the Department of Mechanical Engineering at the University of Pretoria is an established group specialising in rational mechanical design based on mathematical optimisation techniques. The group was formed in 1990 with the purpose of providing leadership in design optimisation research and to develop manpower in computer-aided design. It was realised that many industrial design problems were approached in an ad hoc fashion, often involving many trials and failures, without finally knowing whether a "best" or most competitive design had been achieved. Mathematical Optimisation offers a structured approach which, not only yields an optimal design with certainty, but also allows for the integration of various disciplines into a general design methodology. Optimisation also created the opportunity to engage in collaborative and interdisciplinary research. To date structural mechanics, rigid body dynamics, heat transfer and numerical mathematics have been the principle disciplines involved.

A large body of current research focuses on the development and application of Response Surface Methodology, an area of research which utilises global function approximations to avoid the effect of "noise" and the necessity for computing derivatives of design functions. The methodology therefore facilitates the use of existing analysis software in a multidisciplinary design environment. Basic research focuses on efficient approximation procedures which minimise the number of function evaluations (system analyses) required to obtain the optimal design.

An early development by SORG is the SAM-algorithm (feasible descent cone Spherical Approximation Method). In this approach successive two-point collated quadratic approximations of general inequality constrained optimisation problems are solved by the application of a new geometric feasible descent method employing the concept of descent cones. The new method has been applied to the sizing of nonlinear truss and cable structures as well as to a limited number of shape optimisation problems. Two computer programs, currently used by industry, have been the vehicles of research in the area of automated structural design. The first, TOWEROPT, is a structural sizing program for nonlinear cable-stayed truss structures. The programme incorporates SAM as the core algorithm. A second program, RIG, is based on TOWEROPT and has been written for derrick design in which the multiple objective of minimum displacement and minimum pretensioning forces is used to find optimal cable prestrains. Optimality of the structure is considered over various deployed cases.



CAD model of Matimba mill and classifier (CFD analysis)

The Unit for Computational Mechanics (UCM) in the Department of Mechanical Engineering at the Potchefstroom University for Christian Higher Education was established in 1990 with the aim to promote and coordinate research in the field of computational mechanics. The mission of the UCM is to make a contribution to the promotion of expertise in the field of computational mechanics in South Africa through research and training and to establish a centre of excellence in computational mechanics. The achievements of the UCM are particularly notable in the field of computational fluid dynamics. Research to date has mainly concentrated on applications of interest to power stations such as the effect of ambient conditions on the flow field around and the performance of air-cooled heat exchangers, the multiphase flow in mill classifiers and coal combustion, as well as the flow and erosion patterns in boilers. Two-phase flow as encountered in sedimentation tanks is also under investigation. These investigations have lead to the development of the first local commercial CFD code, FLO++, based on the finite volume method. Research, originally on the analysis of compressed air systems for mines also lead to the development of the flow network code FLOWNET. The capabilities of the code have since been greatly extended and it is currently, amongst others, also used to analyse the ventilation systems in aircraft cabins and the one-dimensional analysis of gas-turbine engines. The possibility is currently being investigated of extending the capabilities of the code to include the analysis of the ventilation of coal mines.

SAAM believes that we are looking forward to an interesting future filled with challenges. The association trusts that it will play an important role in bringing together those involved in theoretical and applied mechanics and to forge international ties. •

"SAAM is looking forward to an interesting future ... it will play an important role in theoretical and applied mechanics"

A brief word with Sergio Idelsohn

Sergio Idelsohn
President of the Argentinian Association of Computational Mechanics (AMCA)
Visiting Professor at the International Centre for Numerical Methods in Engineering (CIMNE) Barcelona, Spain

Your work is divided between Argentina and Spain, spending 6 months in each country. What are the advantages of this?

There are several advantages and also some disadvantages. The most important advantage is the facility to meet people and to participate in projects where advanced computational mechanics is used. You must understand that Argentina is very far from the main centre of research and the top universities in the world. The possibility to interact with these centres or participate on large projects is very difficult. I also don't have the administrative distractions I have in Argentina and this allows me to dedicate all my time to research activities. Probably the biggest drawback is not being able to participate in all the meetings and decisions regarding research activities in my absence, but I think I have achieved a good balance.

Could you please expand on your current research activities?

For many years I worked on structural problems and my Doctorate thesis was on finite elements in shell problems. I did a lot of work in structural dynamics, in particular Newton methods and reduction methods. But for the last 10 years I have worked on fluid mechanics problems. Compressible and near incompressible flow with equal order approximations, preconditioning and stalilization techniques are some of the subjects I am working with. At the moment I am enthusiastic about two things: one is the finite point method, which is a method that does not need meshes to solve the problem and the other is the ship wave problem.

You describe Argentina as a 'contradiction'. What do you mean by this?

The contradiction of all 3rd world countries, which Argentina is by no means an exception, is that we are underdeveloped because we lack sufficient hospitals, schools, communications and the universities are limited, but we have a few areas where we are highly specialised and developed. The contradiction is the lack of balance. Chemical examples are India and China, completely underdeveloped but they both have the atomic bomb. In Argentina we have a very advanced nuclear technology but we only have two nuclear plants. We also have world renown cardiac physicians, but lack good hospitals. Within computational mechanics I would say we have attained a very good level, working closely with top experts in the world. The Argentinian Association of Computational Mechanics (AMCA) boasts over 100 members and holds 2 regular conferences: MECOM and ENIEF. We have 14 volumes of "Computational Mechanics", an accumulation of all works performed over the last 10 years. We have several well organised groups led by F. Basombrio, C. Prato, L. Godoy, G.E. Dvorkin, G. Sanchez Sarmiento and G. Marshall to mention only some. Our ideas are also published in the most prestigious international journals.

What do you think are the areas that Computational Mechanics is most applied to in Latin America?

In general, the industries in Latin America are just subsidiaries of the main factories which, on the whole, are in North America and Europe. Very little development is performed in Latin America and thus very little Computational Mechanics is used. There are some exceptions in the aeronautical industry, nuclear plants and also in metallurgical industries where, due to national strategies, they perform their own research and development. This is probably one of the main reasons that many of our researchers leave for more advanced countries.

I believe you are in a very fortunate position of being able to combine your pet subject at work with your hobby?

Oh yes, you mean my love of nautical activities especially sailing and windsurfing and my research into ship's waves. In Argentina I live near the Parana River which, unlike most European rivers, is 3 kilometres wide and dotted with islands. In Barcelona, of course, I live close to the sea. I now see the yacht's waves in a completely different way. I am constantly analysing it's magnitude, it's damping and it's velocity. Together with the International Centre for Numerical Methods in Engineering, we have the possibility to participate in the evaluation of the drag resistance and shape optimisation of the Spanish 'America's Cup' yacht which is a real experience for me.

How will hosting the next IACM Conference in 1998 in Argentina influence Computational Mechanics in Argentina and Latin America?

To host the next World Congress of Computational Mechanics was not only a success for all the Latin American Countries, but for all Spanish speaking countries. Certainly it will be a good opportunity to show the world what we are doing and to bring together most of the renowned specialists in the field. •

Impressons from U.S. Federal Agency Presentations

Dan Givoli
Rensselaer Polytecnic Institute
On leave from:
Israel Institute of Technology
Affiliated to the
Israel Association for Computer Methods in Mechanics - IACMM

I am spending this year on sabbatical in the U.S. Recently I attended two review sessions conducted by two different federal funding agencies. Such sessions often take place as part of large conferences, and their purpose is to convey to the research community the issues, themes and points of focus that currently interest the agency, and for which the probability of funding allocation in the near future is high. These presentations have a significant effect on the research directions that American researchers (and indirectly researchers in other countries) take, since research in the U.S. depends heavily on federal funding.

I think that this funding system is in general very positive and stimulating, and so the criticism expressed below should not be interpreted as an objection to the system itself. Also, this criticism is based only on two specific presentations, and I am aware that it may be unsafe to draw general conclusions from them. But, being a visiting Professor in the U.S., I have the advantage of seeing things as an "outside observer" and maybe notice a few details that are ignored or taken for granted by some of my fellow American researchers.

" emphasis was on fast solution ... while accuracy ... was not of special concern "

The two federal agency presentations that I attended were meant for an audience who is involved in research in various areas of scientific computing. In both cases, the lecturer presented a set of transparencies with lists of research topics that are currently gaining a lot of attention by the agency, and commented on them. In both the transparency text and the accompanying comments, the worlds "speed", "computing power", "cost", "performance", and also "visualization", "postprocessing" and "multimedia" were repeated many times, while words such as "accuracy", "resolution", "reliability", "benchmarks", "error control" and "adaptivity", were mentioned only rarely, if at all. In fact, I got the impression that the emphasis was on the fast solution of complex problems and on effective ways to handle the input and output data, while the accuracy of the numerical results was not of special concern.

I am certainly not trying to reduce the significance of the issues such as increasing computing speed and effective postprocessing. These are very important research goals indeed. But I think too little emphasis is put on the accuracy and reliability of the numerical results.

This last statement should be made more precise. To this end, consider a possible definition for the "effectiveness" E of a given numerical model, as a function of its speed S and accuracy A. Here S and A are scalar constant measures. A simple formula that one might think of at first try is,

$$E = A \cdot S$$

However, a moment of reflection shows that this is an extremely bad formula, since according to it, one can get very high values of E by employing a terrible method, which yields non-meaningful results, but which is extremely fast. A much better formula is,

$$E = (W_1 A^{-1} + W_2 S^{-1})^{-1}$$

where W_1 and W_2 are given constant weights. Here, even if the speed S is very large, E will still be small if the accuracy A is low. A yet better formula takes into account the complexity of the problems under consideration. Suppose we want to apply our numerical methods to a

Rensselaer
Department of Computer Science

sequence of N test (benchmark) problems, with various levels of complexity, and let us assign a "complexity measure" C_n to each problem, $n = 1, \ldots, N$. Then the previous formula becomes,

$$E = \sum_{n=1}^{N} C_n \left(W_1 A^{-1} + W_2 S^{-1} \right)^{-1}$$

Now, returning to the statement made above, I think that the values assigned to the weights W_1 and W_2 by the funding agencies whose presentations I attended, are not appropriate. The value chosen for W_1 is too small.

I was surprised to see this trend, and particularly so in light of the special awareness that the issue of computational reliability and adaptivity enjoys in recent years. This is well reflected in international research journals and conference proceedings. In addition, the article by I. Babuska and J.T. Oden in *IACM Bulletin* [1] and the ones following it [2-4] carry a very important educational message to the scientific computation community. Why do some of the U.S. funding agencies seem to ignore all this? •

References:

[1] I. Babushka and J.T. Oden, 'Benchmark Computation: What is the Purpose and Meaning?', *IACM Bulletin*, 7 (4), 1992.

[2] T. Belytschko, 'A Response to Babuska-Oden Recommendations on Benchmarks', *IACM Bulletin*, 8, (4), pp.63-64, 1993.

[3] B.A. Szabó,'On Benchmarks for Finite Element Programs', *IACM Bulletin*, 8, (4), pp. 64-65, 1993.

[4] I. Babuska and J.T. Oden, 'Benchmark Computation: Further Comments', *IACM Bulletin*, 10, (1), 1995.

"The scientific theory I like best is that the rings of Saturn are composed entirely of lost airline luggage."

Mike Russell

iacm news

South Africa

Prof. John Martin, previously Dean of Engineering at the University of Cape Town, was recently appointed as Deputy vice Chancellor of the University of Cape Town.

The General Meeting of SAAM was held during the First South African Conference on Applied Mechanics (SACAM '96). There Prof. Daya Reddy of the University of Cape Town was elected president for the next term.

Internet Bibliography

Finite Element books and conference proceedings will be published worldwide on the internet from 1997. Please refer to our book report for further information and www address.

Creation of the ECCM

The European Council of Computational Mechanics grouping all IACM affiliated organizations in Europe has been recently created. The main ECCM objective is to promote and coordinate IACM activities in Europe. The ECCM council is chaired by Prof E. Stein.

Awards

Profs. O.C. Zienkiewicz and J. Periaux have received the Chevalier dans l'Ordre des Palmes Académiques award from the French Ministry. The awards were given at a gala dinner in Paris on 12 September during the second Congress of the European Community on Computational Methods in Applied Sciences (ECCOMAS), an organization closely linked to IACM.

The Spanish Association of Numerical Methods in Engineering (SEMNI) has recently created two awards. The first SEMNI award to a senior scientist was presented to Prof. O.C. Zienkiewicz during the SEMNI meeting on 3-6 June 1996. The Juan Carlos Simo award to a young scientist was also created to honour the memory of our prestigious colleague.

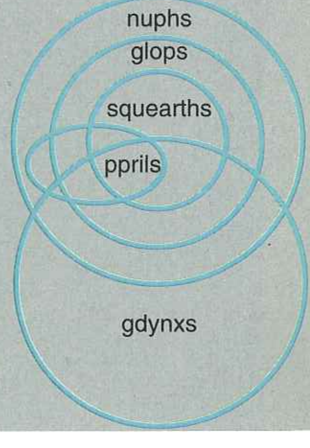
The 1996 Robert J. Melosh Medal Competition for the best student paper on Finite Element Analysis was awarded to David Winkler of the University of Connecticut.

Answers - Are Squearths Really All Nuphs?

Question on page 8.

1. It can, alas! it can.
2. No. If they are not nuphs there is no way they can be glops.
3. Yes, it must be a glop and it may be a gdynx.

   The classification problem is best understood from this diagram.



An IACM Special Interest Conference

Announcement and Call for Papers

10th International Conference on Finite Elements in Fluids

Tucson, Arizona, January 5-8, 1998

As the Finite Elements in Fluids Conference enters its 25 years of existence, gathering together researchers from all over the world who are engaged in computer modelling of all aspects of flow phenomena, this is the time to look back and try to assess the progress made so far and use it to look at the future. The strong conviction that one of the most efficient ways to exchange information and create strong working relations is by establishing personal contact among researchers engaged in all aspects of computer simulations of problems involving fluid flow motivated the first of these conferences and continues to be the driving force behind this one.

Topics: All topics related to the numerical simulation of flow phenomena are considered, these include but are not restricted to: Adaptive Meshing, Aeroacoustics, Aerodynamics, Algorithm Development, Atmospheric Dynamics, Bio Fluid Dynamics, Combustion, Crystal Growth, Electromagnetics, Error Estimation, Flow Control, Flow in Porous Media, Fluid Structure Interaction, Free Surface Flows, Gas Dynamics, Geomechanics, Heat and Mass Transfer, High performance Computing, Lubrication, Magneto hydrodynamics, Mathematics of Finite Elements, Mesh Generation, Multi phase Flow, Non Newtonian Fluids, Ocean Engineering, Optimization, Reacting Flows, Seepage, Shallow Water Circulation, Transonic Flows, Turbulence, Wave propagation.

Organising Committee
R.H. Gallagher - U.S.A. (Chairman), M. Hafez - U.S.A. (Co-Vice-Chairman), J.C. Heinrich - U.S.A. (Co-Vice-Chairman), T.J.R. Hughes - U.S.A., M. Kawahara - Japan, M. Morandi Cecchi - Italy, K. Morgan - U.K., J.T. Oden - U.S.A., E. Oñate - Spain, J. Periaux - France, O.C. Zienkiewicz - U.K.

Call for Papers: Prospective authors are invited to submit 500 word abstracts of their papers by February 15, 1997, and submitted to: Engineering Professional Development, Harvill Building - Room 235, Box 9, The University of Arizona, P.O. Box 210076, Tuscon, AZ 85721-0076 USA.
Tel +1 520-621-3054, Fax +1 520-621 1443
E-mail: baltes@bigdog.engr.arizona.edu

Notifications of acceptance will be sent by July 7, 1997, when full instructions for preparation of the papers will be given. The final papers will be due on or before October 1, 1997.

Fees: The registration fees are $375.00 US for participants and $200 US for students if registration is received on or before October 1, 1997. For registrations received after that date, the fees are $425.00 US and $250.00 US respectively. •

Robert J. Melosh Medal Competition

The Robert J. Melosh Medal Competition for the best student paper on finite element analysis was inaugurated by the Department of Civil and Environmental Engineering at Duke University in 1989 to honour Prof. Melosh for his pioneering work on the finite element method and for his dedication to research, teaching, and service during his tenure at Duke University.

Papers are invited in all areas of finite element analysis and the deadline for receipt of papers is January 17, 1997. Six finalists are selected annually by a panel of distinguished judges, and these papers are presented orally at Duke University. The winner receives a Robert J. Melosh Medal and a $500 honourarium.

For further information please contact: The Robert J. Melosh Medal Competition, Department of Civil and Environmental Engineering, School of Engineering, Box 90287, Duke University, Durham, North Carolina, 22708-0287, USA. •

book report

Finite Element Books Bibliograph on Internet

Finite element books bibliography is under preparation for WWW (Netscape 2.0, colour, screen). This bibliography is committed to offering a fast access to information about Finite element books and Conference proceedings published worldwide from 1967. For each entry a full bibliography as well as an abstract is given and when complete this will contain information on 300 - 400 books.

All this information will be free-of-charge and aimed at students, researchers as well as practicing engineers looking for relevant books and conference proceedings dealing with finite element methods.

WWW - http:/ohio.ikp.liu.se/fe/index.html

Internet for Scientists and Engineers (Online Tools and Resources)

Brian J. Thomas (Ed.)
495pages, May 1996, UK£ 19.50,
Oxford University Press..

This, the second edition, contains updated information on the World Wide Web plus 75 additional pages of new science and engineering Internet resources. It has been written to guide the novice Internet user and to give the new and experienced user alike a comprehensive guide to new resources in science and technology. Learn how to get online, about the software and hardware required and essential tools you will need. Learn the basics of e-mail, telnet, ftp, and the World Wide Web. Begin navigating the net and discover the abundance of information and resources available to users.

Structural Analysis of Historical Constructions.

Possibilities of Numerical and Experimental Techniques

P. Roca, J.L. Gonzalez, A. Mari and E. Oñate (Eds.) 300 pages, April 1996, US$ 80.00, CIMNE Barcelona.

This book contains contributions from leading world experts in the field of structural analysis and repair of historical constructions.
Some of the authors and their contributions include: G. Macchi (general methodology); R. Meil & A.R. Sanchez (the Mexico City Cathedral); T.G. Hughes (masonry arch bridges); G. Croci (the Angkor's temples in Cambodia); R. Brufau (The Golfas of the Pedrera); D. Novak & J. Zak (Charles Bridge in Prague); F. Mola & R Vitaliani (The St. Mark's Basilica in Venice); P. Roca (Gaudi's 'Cripta de la Colonia Güell') and E. Oñate (St. Marks Chapel)

book report

Structural and Multidisciplinary Optimization

N. Olhoff and G. Rozvany (Eds.)
960 pages, 1995, US$ 195.00,
Pergamon, Oxford.

The First World Congress of Structural and Multidisciplinary Optimization was held in Goslar, Germany from 28 May to 2 June 1995. Its aim was to bring together, at a single international meeting, researchers and practitioners in the field of structural optimization. This aim was met and these proceedings contain contributed papers presented here. They demonstrate strong activity, recent advances and increasing importance of the field of optimum design. The book facilitates overview and easy access to these papers by categorising them under 26 topics of modern optimization and by providing author and keyword indices.

Finite Element Methods of Thin Shell Problems

Michael Bernadou (Ed.)
376 pages, January 1996, UK£ 55.00,
John Wiley & Sons Ltd.

This concise book provides a complete mathematical analysis of general thin shell equations and gives a representative set of numerical analysis results on thin shell problems by emphasising their approximation and implementation. The main results of mathematical and numerical analysis, related to the approximation of the solutions of thin shell problems by various finite element methods are presented. The different classical models of thin shells are considered. Beyond this theoretical analysis, the implementation and the use of these various FE methods to solve engineering problems such as arch dams, turbine blades, shell junctions, buckling loads and shape optimization are carefully described.

Technology Management and Corporate Strategies - a Tricontinental Perspective

J. Allouche & G. Pogorel (Eds.) 368 pages, 1995, Elsevier North-Holland.

State-of-the-art statements in technology-related issues of business policy are presented in this volume. All aspects of technology policy which managers have to cope with are covered, including R&D management, corporate strategy, procedures conducive to innovation, matching technology trends and so on. This book will provide useful indications for scholars and professionals, students and R&D managers, strategists and planners, and all general managers who have to deal with technological decisions and issues.

An IACM Special Interest Conference

COMPLAS

Fifth International Conference on Computational Plasticity

Barcelona, Spain, 17 - 20 March 1997

The first conferences in this series were held in Barcelona in April 1987, September 1989, April 1992 and April 1995. The present conference pursues the same objective of bringing together leading researchers and practitioners in the field of computational plasticity. This will provide a forum for discussion of the current state of solution procedures for plasticity problems and their integration in computer aided analysis and design.

The conference will address both the theoretical bases for the solution of plasticity problems and the numerical algorithms necessary for efficient and robust computer implementation.

A series of technical sessions are planned, each initiated by an invited lecture and distinguished contributor to a particular aspect of the subject. These presentations will be complemented by a number of contributed papers.

Papers relating to the conference theme will fall within the following subject groups:

(a) Constitutive model and fundamentals, development and verification of constitutive models involving plasticity, viscoplasticity, dynamic plasticity, damage mechanics, etc.
(b) Computer implementation of constitutive models, parallel processing, software reliability and benchmarking, nonlinear equation solving techniques, etc.
(c) Application to practical engineering problems.

The conference will be hosted by the Universitat Politecnica de Catalunya in the cosmopolitan city of Barcelona, Spain and within easy reach of many holiday resorts including the Costa Brava. Barcelona itself is a fascinating city with it's unique blend of historical tradition, exciting architecture and nightlife. A special social programme for delegates will be arranged including a reception and banquet at local places of interest.

Registration fees, including social events, with early registration applicable if received before 15 January 1997 are quoted in £ sterling:
Delegates (early) £340, (late) £380, and Students (early) £150, (late) £170.

All conference and accommodation enquiries should be addressed to:
COMPLAS V,
International Centre for Numerical Methods in Engineering (CIMNE), Modulo C1,
Campus Norte UPC,
Gran Capitán s/n,
08034,Barcelona, Spain.
Tel: (34) 3-205 70 16
Fax: (34) 3-401 65 17
E-mail: cimne@etseccpb.upc.es •

conference notices

2nd NUMETe - International Conference on the Application of Numerical Methods in Engineering

The primary role of this conference is to promote the use of numerical modelling tools in a broad range of engineering disciplines. The objective is to bring together researchers of diverse disciplines, thus initiating cross fertilisation of ideas and forging links between industry, universities and research centres.

It will be held at the UPM Centre of Extension and Continuing Education on **23 - 25 June 1997** and hosted by the Faculty of Engineering, University Pertanian, **Selangor, Malaysia**.

The conference will be divided into a wide range of topics which include, but are not limited to: various Applications, Mathematics of Numerical Techniques, Pre & Post processing Techniques and Education (Teaching Numerical Methods).

A trade exhibition by research organisations, industries and learned institutions will be organised to be held in conjunction with the conference.

For further information: Mrs. Lailawti
Tel: 603 - 948 6101 ext. 2010
Fax: 603 - 948 8939
E-mail: shahnor@eng.upm.edu.my •

5th ACME '97 - Conference for the U.K. Association for Computational Mechanics in Engineering

The 5th ACME - UK conference is organised by, and will be held in, the Department of Aeronautics, Imperial College, **London, U.K** on **7 - 8 April 1997**. The previous four conferences were held in Swansea (1993), Manchester (1994), Oxford (1995) and Glasgow (1996).

The purpose of this conference is to have an annual review in the UK of the computational mechanics activities in any area of mechanics - solid, fluid, gas, bio, geo, etc with a particular emphasis on the interdisciplinary aspects, i.e. where the traditional concepts from one area are adopted in a different area of mechanics.

Special low conference fees have been arranged to encourage the participation of younger researchers.

For more information:
Prof. Mike Crisfield
Department of Aeronautics
Imperial College
Prince Consort Road
London, SW7 2BY.
Tel: (44) 171 - 594 5077 / 5079
Fax: (44) 171 - 594 5078
E-mail: m.crisfield@ic.ac.uk •

ICES'97 International Conference on Computational Engineering Science

ICES'97 will be held in **San Jose, Costa Rica** from **4 - 7 May, 1997**. This conference aims to be a platform of discussion between academic institutions, industrial research laboratories and government institutions.

ICES "97
San Jose, Costa Rica

Topics will include: Variational methods and fundamental theory; Finite Element Methods, High-speed computing methods; Solid and structural mechanics; Computational fluid dynamics; Heat transfer and thermal phenomena and Electromagnetics, to name but a few. More than 20 researchers of international standing have already accepted invitations to deliver keynote lectures and several special synposia are being planned. In addition, a special reception will be hosted by the President and First Lady of the Republic of Costa Rica.

For further information:
C/o Prof. S.N. Atluri
Computational Modelling Centre
Georgia Institute of Technology
A. French Building, Room 225
Atlanta, Georgia 30332-0356, U.S.A.
Tel: (1) 404-894 2768, Fax: (1) 404-894 2299
E-mail: stacy.morgan@cad.gatech.edu
Continuous updates of ICES'97 can be found on the following Internet homepage:
http://www.gen.u-tokyo.ac.jp/ices97/ •

debrief

The Greek Association of Computational Mechanics

The 2nd National Congress of Computational Mechanics was held on 26 - 28 June 1996 at the Technical University of Crete, Chania, Greece under the co-chairmanship of Professor D.E. Beskos of the University of Patras and D.A. Sotiropoulos of the Technical University of Crete. The congress was under the auspices of the Greek Association of Computational Mechanics (GRACM), a member of IACM. 140 Engineers and Scientists participated from Europe, U.S.A. and Canada including 8 distinguished invited speakers (Profs. J Dominguez - University of Seville, E. Hinton - University of Wales at Swansea, M. Kleiber - Polish Academy of Sciences, A.K. Mal - University of California at Los Angeles, L. Morino - University of Rome, S. Nair - Illinois Institute of Technology, E. Oñate - International Centre of Numerical Methods in Engineering at Barcelona, R. Piva - University of Rome. The papers presented were published as articles of 300 authors and co-authors in 2 volumes of the Conference Proceedings, edited by D.A. Sotiropoulos and D.E. Beskos. The topics cover a wide range of research areas of computational mechanics including: Acoustics, Analysis and Design of Structures, Applied Numerical Methods, Computational Methods and Applications, Finite Element Applications, Fluid Mechanics, Fracture Mechanics, Materials, Numerical Methods, Optimization, Solid Mechanics, Stability Analysis and Structural Dynamics. •

Trefftz Method - recent development & perspectives

The First International Workshop on the Trefftz Method was held on **30 May - 1 June 1996** in **Cracow, Poland**. It was organised by the Institute of Mechanics and Machine Design, Cracow University of Technology (CUT) on the occasion of the 70th anniversary of the Trefftz Method. In 1926, in Zurich, E. Trefftz first proposed a new method for solving boundary value problems, which in the last 20 years has been developed considerably.

The aim of the workshop was to discuss the present state and perspectives of the method. The organizers invited researchers who in recent years contributed to the development of this approach and the presentations included: different versions of the method, various fields of its application, derivation of Trefftz systems of functions, different formulations of Trefftz-type finite elements, nonlinear problems, sensitivity analysis and formulations relative to the Trefftz approach.

The post conference proceedings containing the full texts of lectures will appear in a special issue of *Computer Assisted Mechanics and Engineering Sciences*. The next 'Second Trefftz Workshop" has been scheduled for September 1999 in Portugal and will be organised by Prof. J. Teizeira de Freitas. For further information please contact A.P. Zielinski at: E-mail: APT@mech.pk.edu.pl •

3rd Congress on Numerical methods in Engineering in Spain

Prof. O.C. Zienkiewicz receiving the SEMNI award from Prof. E. Oñate

The tri-annual conference of the Spanish Association of Numerical Methods in Spain (SEMNI) was held on 3 - 6 June 1996 in Zaragoza, Spain. The conference was organised by the Technical University of Zaragoza under the chairmanship of Prof. M. Doblaré and with the support of the Technical University of Madrid and the Centre for Experimental and Numerical Studies in Civil Engineering (CEDEX). Previous conferences were held in La Coruña (1993) and La Palmas (1990).

The meeting at Zaragoza was attended by 190 participants and it included 160 papers covering different fields in solid and fluid mechanics, numerical methods, electro-magnetics, CAD techniques, etc. The invited speakers were S. Atluri, R. de Borst, R. Lohner, R. Owen, J. Peraire, J. Periaux, M. Kleiber, T. Van Der Plaats and O.C. Zienkiewicz. The papers presented were collected in a two volume proceedings reaching 1900 pages.

The conference sessions were complimented by a number of social activities including a reception and conference banquet. During the banquet Prof. O.C. Zienkiewicz was awarded the first SEMNI medal to a senior scientist. Also the mother of the late Juan Carlos Simo was awarded a silver tray commemorating the creation by SEMNI, of the Juan Carlos Simo award for young scientists. The first of these awards will be presented at the next SEMNI meeting to be held in Seville in 1999. This meeting will be organized by the University of Seville under the chairmanship of Prof. J. Dominguez. •

debrief

CMT '96 - Computational Methods and Testing for Engineering Integrity

The 1st International Conference on Computational Methods and Testing for Engineering Integrity, organized by the Wessex Institute of Technology (WIT) and co-sponsored by Dartec Limited, was held at the Shangri-La hotel in **Kuala Lumpur** from **19 - 21 March 1996**.

The importance of this conference was somewhat futuristic in its objective of integrating computational methods, testing and model simulation with real-time processing. The conference included presentations from internationally recognised specialists, and covered a wide range of topics associated with the application of computational methods and testing in order to assess risk and performance behaviour, particularly in the areas of mechanical behaviour of materials, experimental and computational simulation, and in design and concurrent engineering.

During the conference, Prof. C. Brebbia, on behalf on WIT, presented Dr John Radon with the Eminent Scientist Award for his outstanding contribution as a scientist to the subject of mechanical behaviour of materials, and in particular to the area of fatigue and fracture mechanics. •

ECCOMAS 96

The second general congress of the European Community for Computational Methods in Applied Scinece (ECCOMAS) was held in Paris on 9 - 13 September, 1996. The first edition of this congress was held in Brussels in 1992. This congress included the 2nd ECCOMAS Conference on Numerical Methods in Engineering and the 4th ECCOMAS Conference on Computational Fluid Dynamics. The meeting was organised by GAMNI / SMAI and was attended by more than 650 participants mainly from European countries. The invited speakers included J.T. Oden, P.L. Lions, F. Brezzi, G.I. Marchuk, G. Wallace, S. Candel, S. Wagner, B. Launder, C. Johnson, E. Ramm, D. Goldberg, G. Molinari, M. Ortiz and R. De Borst.

During the banquet two XXXX awards were delivered to O.C. Zienkiewicz and J. Periaux (ECCOMAS President). The conference proceedings are available and have been published by J. Wiley. More information can be obtained from O. Pironneau on Fax: (33) 1- 44 27 72 00 or E-mail: eccomas96@ann.jussiem.fr

The next ECCOMAS conference will be held in Barcelona in September 2000 and is titled the European Congress on Computational Methods in Engineering and Applied Science. This event will be organized in jount collaboration with all IACM organizations in Europe. •

Fourth IACM World Congress on Computational Mechanics

Buenos Aires, Argentina.

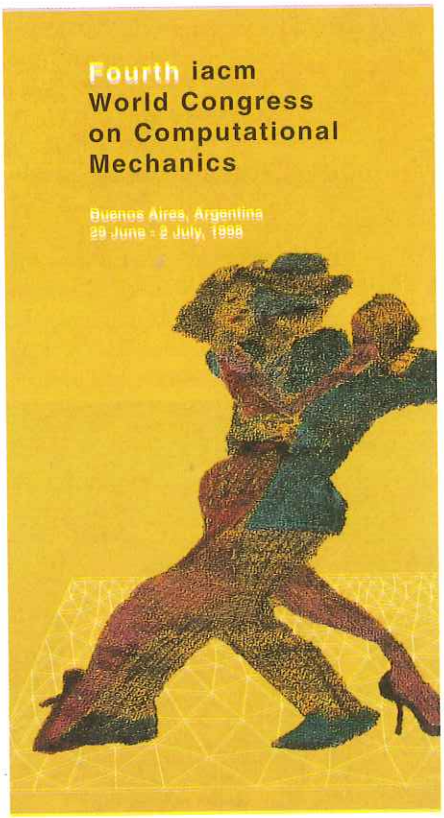
29 June - 2 July 1998

Following the success of the three previous World Congresses on Computational Mechanics held in Austin, Texas (USA 1986), Stuttgart (Germany 1990), and Chiba (Japan 1994), the International Association for Computational Mechanics is pleased to announce the Forth World Congress on Computational Mechanics (WCCM IV) to take place in Buenos Aires, Argentina on 29 June - 2 July 1998.

The conference is to be held at the Sheraton Hotel, Buenos Aires and a full social programme including city tours and a reception banquet is available. At your request, a variety of individual post conference tours can be arranged within Argentina and to neighbouring countries.

This is being organised by La 'Asociación Argentina de Mecánica Computacional' (AMCA) and La 'Sociedad Española de Métodos Numéricos en Ingeniería' (SEMNI) in collaboration with La 'Fundación para el Desarrollo Tecnológico' (FUDETEC), Buenos Aires - Argentina, and The International Centre for Numerical Methods in Engineering, Barcelona - Spain.

For further information and accommodation details please contact:
IACM secretariat,
Edificio C1, Campus Nort UPC,
Gran Cápitan s/n,
08034 Barcelona, Spain.
Tel: (34) 3 - 401 60 36;
Fax: (34) 3 - 401 6517;
Email: iacm@etseccpb.upc.es •



IACM Fourth World Congress on Computational Mechanics

conference diary planner

3 - 6 December 1996	**IV International Conference on Control, Automation, Robotics and Vision.** *Venue:* Western Stamford, Singapore. *Contact:* Dr. Chan Sai Piu. Tel: (65) 799 5471
2 - 4 January 1997	**PACAM V - Pan American Congress of Applied Mechanics** *Venue:* San Juan, Puerto Rico. *Contact:* Prof. L.E. Suarex & Prof. M. Rysz. Fax: (809) 265 3816
17 - 20 March 1997	**COMPLAS - Fifth International Conference on Computational Plasticity.** ***An IACM Special Interest Conference*** Preceded by 5th Short Course on Computational Plasticity, 13 - 14 March 1996. *Venue:* Barcelona, Spain *Contact:* Prof. D.R.J. Owen. Department of Civil Engineering, University College of Swansea. Tel: (44) 1792 - 20 56 78. Fax: (44) 1792 - 29 56 78
26 - 30 March 1997	**CHT '97 - International Symposium on Advances in Computational Heat Transfer.** *Venue:* Cesme, Turkey *Contact:* Prof. G. de Vahl Davis. Tel: (61) 2 - 385 4099. Fax: (61) 2 - 385 4099, Email: g.devahldavis@unsw.edu.au
7-8 April 1997	**5th ACME 1997 - Association for Computational Mechanics in Engineering** *Venue:* Imperial College, Department of Aeronautics, London, U.K. *Contact:* Prof. M. Crisfield. Tel: (44) 171 - 594 5077/5079. Fax: (44) 171 - 594 5078. E-mail: m.crisfield@ic.ac.uk
9 - 11 April 1997	**NAFEMS World Congress '97 - "Design, Stimulation & Optimisation"** *Venue:* University of Stuttgart, Germany. *Contact:* Anne Creechan. Tel: (44) 1355 - 272 639. Fax: (44) 1355- 272 749, Email: tkenny@nafems.org
4 - 9 May 1997	**ICES '97 - International Conference on Computational Engineering Science** *Venue:* San Jose, Costa Rica. *Contact:* Prof. S.N. Atluri. Fax: (1) 404 -894-2299, E-mail: stacy.morgan@cad.gatech.edu
5 - 8 May 1997	**PCCMM'97 - 13th Polish Conference on Computer Methods in Mechanics** *Venue:* Pozan, Poland. *Contact:* Dr T. Lodygowski. Fax: (48) 61 - 766 116. E-mail: lodygowski@put.pozan.pl
1 - 6 June 1997	**CANCAM '97 - 16th Canadian Congress of Applied Mechanics** *Venue:* Laval University, Ste-Foy, Quebec, Canada. *Contact:* Prof. L. Cloutier. Tel: (1) 418 - 656 3271. Fax:(1) 418 - 656 7415.
18-20 June 1997	**Nonlinear Finite Element Analysis and ADINA, 11th Conference** *Venue:* Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A. *Contact:* Prof. K.J. Bathe. MIT. Tel: (1) 617 - 253 6645. Fax: (1) 617 - 253 2275. WWW: http://world.std.com/~feaconf
23-25 June 1997	**2nd NUMETe - 2nd International Conference on the Application of Numerical Methods in Engineering** *Venue:* Centre of Extension and Continuing Education, University of Pertanian, Malaysia. *Contact:* Prof. S. Basri. Tel: (603) 948 6101 ext 2010. E-mail: shahnor@eng.upm.edu.my
6 - 8 August 1998	**The Fourth U.S. National Congress on Computational Mechanics.** *Venue:* Hyatt Regency in Embarcadero Centre, San Francisco, California, USA Contact: M.S. Shephard. Tel:(1) 518 - 276 6795, Fax: (1) 518 - 276 4886, Email: usnccm@scorec.rpi.edu
22 - 27 September 1997	**Annual Conference of the International Association for Mathematical Geology.** *Venue:* Barcelona, Spain. Contact: SEMNI Secretariat, (34) 3 - 401 6057 Fax: (34) 3 - 401 6517, Email: semni@etseccpb.upc.es
2 - 7 November 1997	**IX International Conference of the International Association for Computer Methods and Advances in Geomechanics** *Venue:* Wuhan, China. Contact: Prof. J. Yuan, The Chinese Academy of Science. Tel: (86) 27 - 788 1776
5-8 January 1998	**FLOW '98 - 10th International Conference on Finite Elements in Fluids.** ***An IACM Special Interest Conference*** *Venue:* University of Arizona, Tucson, Arizona, U.S.A. *Contact:* Prof. R. Gallagher. Tel: (1) 315 - 268 6444, Email: dick5762@aol.com
29 June - 2 July 1998	**IACM - Fourth World Congress on Computational Mechanics.** *Venue:* Buenos Aires, Argentina. *Contact:* IACM Secretariat. Tel: (34) 3 401 6036. Fax: (34) 3 - 401 6517, Email: iacm@etseccpb.upc.es

how good are you?

Tony Keck
International Training Corporation
London

So ... how good a lover are you?

This may be a slightly risqué question but there is a point to it.

I am intrigued - what rating have you given yourself? If the score is 90% and over, are you really as good as you think you are? If you scored 50% or less, is there a chance that you may be better than you think?

The trouble is, when you think you are quite good at something, you can become complacent, lazy and lack innovation. On the other hand, when you believe you have something to prove, you try hard to improve performance.

Now is the time to disappoint you. This article is not another one in the series 'how to improve your love life'. It is in fact about your skills in the art of presentation. But I guess I have your attention!

The analogy I used to attract your attention - and your abilities as a presenter - have a certain amount in common.

To be a good presenter, to communicate a message to an audience in a way they understand and identify with, takes creativity, energy, the right words said in the right way, positive body language, knowledge of their needs and time to prepare.

Now do you see the similarity!

In my role as a consultant, I spend a good deal of time coaching people towards improving their presentation skills. Some of those people are very experienced and in gaining that experience have become a little stale, tired and predictable in their approach. Clearly I also work with people who are learning and developing these skills for the first time and for them, the freshness of their approach and their enthusiasm, can more than make up for their lack of experience. They are actually more effective communicators than their more experienced partners.

Like many things in life - if we could combine the best of both aspects - that would provide an excellent example of the art.

"... creativity, energy, the right words... , positive body language, knowledge of needs and time ..."

"I tell you, I don't want to belong to a club that accepts members like me"

So - what does it take to deliver a presentation which is engaging, enlightening, entertaining and memorable for those who are fortunate to experience it.

It will seem a negative approach - but what are the common mistakes which some presenters seem to make:

- preparation is rushed, unsystematic and not focused on a simple purpose;
- as a consequence, the content of the presentation comes across in a random and unstructured way;
- visual material is beginning to lose sight of it's main objective which is to stimulate through visual interest. In these days of computer generated material when templates are so frequently used, it seems to me that a desire for corporate identity has overtaken this basic use of visual aids. You can be too smooth.
- The best presenters allow their own personality and character to show - they have the confidence to be themselves. The human element is important.
- It is true to say that some 50% of your message will be communicated through body language. And yet some presenters do not plan consciously to wear the right cloths, groom themselves appropriately or display open, alert body language.

At the end of the day we must all accept that our knowledge, good as that may be, and our ability to communicate that knowledge is not the same thing.

We must also accept that our credibility is frequently judged on the more subjective level of our presentation skills.

And so ... how good a presenter are you?

"Self-confidence is the first requisite to great undertakings."
Samual Johnson

"Good teaching is 1/4 preparation & 3/4's theatre."
Gail Godwin

iacm

Constitution

1. Name and Objective

1.1 *Name.* This organisation (hereafter referred to as the "Association") shall be known as "International Association for Computational Mechanics".

1.2 *Objective.* The objective of the Association shall be to stimulate and promote education, research and practice in computational mechanics, to foster the interchange of ideas among the various fields contributing to computational mechanics, and to provide forums and meetings for the dissemination of knowledge about computational mechanics.

2. Membership

2.1 *Categories of membership*. Membership in the Association shall consist of the following categories:
a) Individual Members b) Laboratory Members c) Corporate Members

2.2 *Individual Members.* Individual members shall be open to any person engaged in, connected with or interested in computational mechanics and who is a university graduate in engineering, science, mathematics, or possesses equivalent qualifications.

2.3 *Laboratory Membership*. This category is open to non-profit research institutes, technical societies and university laboratories whose activities include work in computational mechanics.

2.4 *Corporate Membership.* This category is open to industrial organisations whose interest include the field of computational mechanics.

2.5 *National and Regional Organisations* can be affiliated to IACM with approval of the Executive Committee and individual, laboratory and corporate members can join via such organisations.

3. General Council, Executive Council

3.1 *The general policy of the IACM* shall be determined by the General Council and its affairs managed by the Executive Council, the members of which are also members of the General Council.

3.2 *The membership* of the General Council will be limited to 70 members. 1/3 of the General Council will be subject to election at four year intervals.

3.3 *The General Meeting* of the Association will take place at four year intervals at the World Congress of IACM.

3.4 *The Executive Council* shall consist of 10 General Council Members and its appointment will take place at 8 year intervals. The Executive Council includes the President, two Vice Presidents and the Secretary elected by the General Council. These officers are subjected to elections by the Executive Council at four year intervals.

3.5 *Three geographical regions* representing respectively Europe-Africa, The Americas and Asia-Australia exist within the association and it is envisaged that these regions be approximately equally represented in the General Council. The President and the two Vice Presidents shall together represent the three regions.

3.6 *Nomination of new members* of the General Council should be made to the Secretary at least 6 month before the General Meeting. Each nomination should be accompanied by 5 signatures of members and a brief biographical sketch. A postal ballot will be made before the General Meeting.

4. World Congress

4.1 World Congress of IACM will be held at four year intervals.

4.2 World Congress will normally be held in rotation in three geographical areas. Proposals for World Congress locations should be made to the Secretariat at least three months before the previous congress.

5. Finances

5.1 *Fiscal Year*. The fiscal year of the Association shall begin on January 1 and end on December 31.

5.2 *Dues.* Each member shall pay annual dues, to be determined by the Executive Council for each membership category to the Association Secretary or to the Secretary/Treasurer of the national chapter and/or association. Dues are payable upon billing. If any member shall be in default in payment of dues for three monthly or longer the Secretary shall notify him or her, in writing, that membership will terminate if payment is not make within one month of the mailing of such notice.

5.3 *Financial Reports.* It shall be the responsibility of the Secretary to keep the financial records of the Association and to present a report on the financial status of the Association to the General Council at the time of the General Meeting.

6. Committees

6.1 *Procedure*. The Executive Council is empowered to establish such committees at it deems appropriate. It will also act on petitions, signed by no less than 5% of the membership, for the establishment of committees.

6.2 *Membership*. Conditions on membership committees shall be set by the General Council. Members on committees shall be subject to approval, by a majority vote, of the council.

7. Bylaws

7.1 The General Council may frame and amend bylaws provided the contents of these bylaws do not conflict with the Constitution and provided that at least two-thirds of the entire General Council have approved them.

7.2 The Executive Council can propose changes to the Constitution. Such changes will be notified to all members of the General Council and accepted unless opposed by 1/2 of its members.

International Association for Computational Mechanics

IACM Secretariat
Edificio C1
Campus Norte UPC
Gran Capitán s/n
08034 Barcelona
Spain
Tel: (34) 3 - 401 7441
Fax: (34) 3 - 401 6517
Email: iacm@etseccpb.upc.es