LAUDATIO OF PROF DAVID ROGER JONES OWEN

by

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Professor Roger Owen (Roger for his many friends) was born in Bynea (near Llanelli) in Wales, on May 27th 1942. He is Professor in Civil Engineering at Swansea University, Wales, UK, and an international authority on finite element and discrete element techniques, is the author of six textbooks and over four hundred scientific publications. In addition to being the editor of thirty monographs and conference proceedings, Professor Owen is also the editor of the International Journal for Engineering Computations and is a member of several Editorial Boards. His involvement in academic research has lead to the supervision of seventy Ph.D. students.

Professor Owen's research, in the field of solid and structural mechanics, has centred on the development of solution procedures for non-linear problems encountered in science and engineering. After undertaking his initial degrees at University of Wales Swansea, he completed his Ph.D. at Northwestern University, USA, under the guidance of Prof. T. Mura, in the field of Theoretical and Applied Mechanics. This work, and also his early post-doctoral experience as Walter P. Murphy Research Fellow at Northwestern, involved both the analytical and computational study of fundamental plastic material deformation described by continuously distributed dislocation mechanisms. Professor Owen subsequently returned to University of Wales Swansea to take up an academic post in the Department of Civil Engineering, where under the influence of Prof. O. C. Zienkiewicz, he developed an interest in computational methods. From that time, Prof. Owen has contributed prominently to the development of computational strategies for plastic deformation problems, both for fundamental material studies and for application to engineering structures and components.

Over the last two decades, Prof. Owen's work has focused on the development of discrete element methods for particulate modelling and the simulation of multi-fracturing phenomena in materials, where much of his research has been pioneering. This work has extended developments in the continuum modelling of finitely deforming solids by including damage/fracture based failure and introducing material separation on a local basis to permit simulation of the degradation of a continuum into a multi-fractured particulate state. Based upon this methodology,

contributions have been made to fundamental understanding in several key application areas; including explosive simulations which necessitates coupling of the multi-fracturing solid behaviour with the evolving detonation gas distribution, deep level mining/oil recovery operations, defence problems related to high velocity impact involving penetration of metallic and ceramic materials and structural failure predictions for impact, seismic and blast loading.

With an interest in solving large-scale problems, Prof. Owen has over the last three decades been engaged in the development of parallel processing strategies for the simulation of engineering and scientific problems. Commencing from early work on shared memory machines, his most recent work has involved implementation on distributed memory platforms, where for problems involving multi-fracturing solids or adaptive mesh refinement in which continual changes in mesh topology takes place, the development of dynamic domain partitioning schemes and incremental inter-processor data migration is essential.

More recently, Prof. Owen has become involved in research for describing random media fields in stochastic finite element modeling with a view to modeling both uncertainties in the distribution of material properties and the presence of internal fractures in geomechanical and other solids. A further topic of recent research has been the coupling of particulate systems and multi-fracturing solids with other physical fields, involving liquids or gases, through the introduction of a Lattice Boltzmann description.

Professor Owen plays a leading role in national and international scientific affairs. For example, he is a member of the *Executive Council* of IACM (International Association for Computational Mechanics) which is a world wide organisation established to promote and guide research and applications in the field of numerical modelling. It is pertinent to point out the general Secreatariat of IACM is located in CIMNE at UPC. He is a *Board Member* of the European Council for Computational Mechanics (ECCM) of ECCOMAS (which Secretariat is also located at CIMNE in UPC) and is also *Past Chairman* of the UK Association for Computational Mechanics in Engineering, which is the national association affiliated to IACM. A further measure of Prof. Owen's research esteem is his membership of the Research Assessment Exercise panel for Civil Engineering in the UK in 2001. He has been appointed to similar panels for the corresponding exercise in Mechanical Engineering for the Netherlands (QANU Quality Assurance Netherlands Universities*)* in 2000 and 2008 and DeutscheForschungsGemeinschaft (DFG), Germany in 2006 and 2007 for its Graduate Schools, Centres of Excellence and Institutional Funding initiatives. He was also a member of the International Advisory Board for the Institute for High Performance Computing in Singapore for a five year period. Due to his industrial involvement, Professor Owen

served for over ten years as elected *Council Member* of NAFEMS, which is an international organisation aimed at establishing standards and quality assurance procedures for the safe use of finite element methods. Professor Owen has recently been elected a member of the Civil Engineering Panel for the UK Research Excellence Framework (REF) exercise to be undertaken in 2014.

Prof. Owen's contribution to research has been recognised by the following awards and distinctions:

- Elected Fellow of the Royal Academy of Engineering in 1996.
- Awarded an Honorary D.Sc. by the University of Porto, Portugal in 1998.
- Received the Computational Mechanics Award of the International Association for Computational Mechanics (IACM) in 2002 for "outstanding contributions in the field of computational mechanics".
- Awarded the Warner T. Koiter Medal of the American Society of Mechanical Engineers (ASME) in 2003 for "contributions to the field of theoretical and computational solid mechanics".
- Awarded the Gauss-Newton Medal of IACM in 2004 for "outstanding contributions in the field of computational mechanics".
- Awarded the Gold Medal of the University of Split, Croatia in 2004 for "international achievements in the field of computational mechanics"
- Awarded the Premium Medal of the Spanish Society for Computational Mechanics (SEMNI) in 2005 in "recognition of his outstanding scientific work". SEMNI was created in 1989 by initiative of a group of academics in UPC and its Secretariat office is located at CIMNE in UPC.
- Awarded an Honorary D.Sc. by Ecole Normale Superieure de Cachan, France in 2007.
- In 2009 he as elected Fellow of the Royal Society, this being one of his greatest scientific achievements.
- Honorary Professor, Welsh Institute for Mathematics and Computational Science, 2009
- Founding Fellow, Learned Society of Wales, 2009
- Outstanding Research Activity Award, Swansea University, 2009

- Awarded the Grand Prize of the Japan Society for Computational Engineering and Science (JSCES), 2010.

- Elected Foreign Member of the United States National Academy of Engineering (NAE) in 2011.

Named Lectures

Prof. Owen is a very fine lecturer. As a former student of him and colleague in many joint courses, I can say that his lectures are most enjoyable and highly appreciated by students. He has been invited to deliver the following named lectures:

2002 Prestige Lecture of the Institution of Civil Engineers and the Royal Academy of Engineering,
Institution of Civil Engineers, November 2002.

2003 Warner T. Koiter Lecture of the American Society of Mechanical Engineers,
Washington, D.C., November 2003.

2007 Alan Jennings Memorial Lecture
Queen's University Belfast, April, 2007.

2011 Higginson Lecture, Durham University, November, 2011.

In addition, he has presented a total of over 90 Keynote and Plenary lectures at leading international conferences in the field of computational mechanics.

Entrepreneurship

In 1985, Prof. Owen formed Rockfield Software Ltd. aimed at disseminating his academic research based on computational modeling procedures to the industrial sector. The company, initially employing two engineers, was based in the Innovation Centre at Swansea University. Over subsequent years Rockfield Software has expanded to over 35 personnel, with over two thirds of the staff possessing Ph.D. degrees, making the company a leading employer of high technology graduates in the Swansea area.

The success of the company lead to relocation firstly to Technium I in the SA1 Development in Swansea, followed by a permanent move to the Ethos Building, also in SA1, which it was instrumental in designing and building together with Rowland Jones & Partners.

Rockfield has a wide portfolio of clients and operates in several commercial areas. Principal sectors in which the company is involved include:

- Failure prediction for structures under seismic or blast loading.
- Industrial forming processes for glass, plastics and metals.
- Food technology processes.
- Defence applications involving explosive and impact conditions.
- Deep level mining and other minerals recovery operations.
- Oil recovery operations and resource prediction.

In addition to both UK and overseas SMEs, Rockfield has over the years built strong relationships with many of the world's leading companies including; Unilever, DSTL, Qinetiq, Corus, Proctor & Gamble, Devonport Marine Ltd., Rio Tinto, BP-Amaco, Shell, Exxon Mobil, Total-Fina-Elf, Miningtek, Orica, Anhauser Busch and Los Alamos, Sandia and Lawrence Livermore National Laboratories. The prominent involvement of Rockfield in the mining and minerals recovery sector lead to the formation of Rockfield Technologies Australia, based in Townsville, Queensland to support these activities and the company currently employs eight R&D engineers.

The success of the company has lead, under Prof. Owen's Chairmanship, to the granting of the Queen's Award for Innovation on two separate occasions:

- In **2002** Rockfield received the award for the development of finite element/discrete element simulation techniques for the strengthening of masonry bridges and arches. This technology has been utilized within a consortium that includes Cintec International and Gifford & Partners, to provide a complete service from assessing the need for strengthening, determination through the FE/DE approach of the precise location for insertion of retrofitted reinforcement anchors, to the clean and efficient installation of anchors.
- In **2007** the award was granted for outstanding innovation in the development of the ELFEN computational system for the simulation of multi-fracturing solids. Recognition was given to the versatility and widespread industrial application of the methodology in diverse areas such as blast and impact loading of structures, defence applications, mining and minerals operations and oil recovery processes.

Since founding Rockfield Software in 1985, Prof. Owen was firstly it Managing Director, then becoming Chairman until his retirement from the company in 2010.

Relationship with UPC

Prof. Owen has had a long standing relationship with UPC. As early as in December 1979 he and Prof. Ernie Hinton, organized the first Basic Course on the Finite Element Method. This course was attended by some

70 participants from all parts of Spain. Indeed this course, that was repeated every December for 10 consecutive years up to 1989, can be considered the foundation of the numerical methods community in UPC at the Civil Engineering School of Barcelona. The visits of Roger and Ernie to UPC around December 15th every year soon become a tradition, almost a pre-Christmas event that brought us many good moments of scientific interchange and friendship with our colleagues from Swansea. To the course soon was added a series of very successful international conferences first in the field of Non linear Finite Element Methods (1984) and then in Computational Plasticity, the so-called COMPLAS conference series that has run for 11 editions in UPC since 1986. COMPLAS 12 will again take place in Barcelona, precisely in this Auditorium, on September 2013.

Ernie Hinton with whom Roger had published a number of seminal books on the finite element method, unfortunately died on November 1999. The cooperation with Roger and his team however continued through the COMPLAS conference series and even expanded by creating, jointly with UPC, international conferences in new fields such as the International Conference on Computer Aided Training in Science and Technology, held in Barcelona in 1990 and a series of conferences in the field of Particle Methods. The two first editions of the Particle Conference took place in Barcelona in 2009 and 2011, and the third one will be held in Stuttgart on October 2013.

I would like to emphasize that the COMPLAS conference series have established themselves as an international reference in the field of computational solid mechanics. Over 3000 colleagues and friends have attended one of the editions of this conference that combines a blending of high scientific level with an informal setting and a selected social programme.

I would also like to mention the important role that Prof. Owen has played in supporting the activities of the International Center for Numerical Methods in Engineering (CIMNE). Indeed, CIMNE, which this year celebrates its 25th anniversary, was created in 1987 under the auspices of the many activities on the field of numerical methods at UPC, and in particular at the School of Civil Engineering. It is important to note that in 1987, the cooperation of UPC with Prof. Owen and the University of Swansea had been intensively going already for nine years.

To name the many interactions of UPC with Prof. Owen and his team at Swansea during the last 25 years will be indeed too long. This cooperation was indeed strengthen by the fact that Prof. Zienkiewicz, one of the founders of our scientific community of computational mechanics and former Director of the Civil Engineering Dept. at Swansea, spent 20 years in periodic stays at UPC as UNESCO Professor of Numerical Methods

in Engineering, this being the first UNESCO chair in the world created in 1989 at the initiative of UPC.

Many European research projects, joint courses, workshops, seminars and scientific meetings have taken place in cooperation with Prof. Owen and his team in that period. All of them have indeed helped UPC to establish a reputation in the field of numerical methods in engineering and computational mechanics. Roger, many thanks for that.

I will not be surprised if due to this interchanges Roger has visited UPC and Barcelona over one hundred times.

Let me also mention the important role that Roger has had in supporting the Spanish Association for Numerical Methods in Engineering (SEMNI). This scientific organization, created in 1989, presented to Roger its highest award in recognition of his scientific merits and also for his contribution to the development of the field in Spain. SEMNI will celebrate its 25th anniversary in 2014, and in coincidence with that, it will organize in cooperation with CIMNE and the School of Civil Engineering of UPC, three major events in Barcelona that will take place simultaneously, the World Congress on Computational Mechanics, the European Conference on Solid and Structural Mechanics and the European Conference on Fluid Dynamics. This promises to be a landmark event in the field of computational methods in engineering and applied sciences.

Roger has also been very supportive to the Latin American community of numerical methods in Engineering. He was a founder member of the Mexican Association in that field and as such took part in the inaugurating conference in Guanajuato on January 2002. He has also taken part in scientific events on computational mechanics in Argentina and Brasil and other Latin American countries.

On the personal side I consider Roger as a friendly and well humored person. He is one of these persons that finds difficult to say no to a request from a colleague or a friend. He is extremely hard working and among his hobbies I can say that he is a fine airplane pilot, activity that took some of his time some years back, a supporter of Welsh rugby team and a dedicated expert to international cuisine and good wines. He has also a reputation for his COMPLAS after dinner stories, which deserve to be collected in a separate volume of this conference series.

Finally, I would like to express my gratitude to the Department of Strength of Materials and Structural Analysis of UPC for proposing Roger for this Honorary Doctorate Award to UPC and to the many institutions and individuals who have supported it. Many thanks to all of you for participating in this memorable event and in particular to the many colleagues and friends who have come from other parts of Spain and from

many countries around the world. We are very proud to have distinguished representatives of national and international organizations and academies from Spain, other countries in Europe, US, Japan, Korea and several Latin American countries. Many thanks to all for supporting with your presence this event.

Dear Roger, time has flown too fast since you first landed in UPC on December 1979. The work of many people, yourself included, has not been in vain and the modern UPC of today has little to do with that of 32 years ago. Believe me that at UPC we all acknowledge that your contribution has been very important in the transformation of UPC to become a world reference in the field of computational engineering.

Many thanks for all that and, above all, many thanks for your friendship.

Thank you very much!

Eugenio Oñate
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