

# THE INTERNATIONAL CONGRESS ON MODELLING AND SIMULATION: HAMILTON, NEW ZEALAND, DECEMBER 1999

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## 1. An Overview

Every two years, the Modelling and Simulation Society of Australia and New Zealand (MSSANZ, previously the Modelling and Simulation Society of Australia) holds an International Congress on Modelling and Simulation (MODSIM). MSSANZ is an affiliate of the International Association for Mathematics and Computers in Simulation (IMACS). The aims of MSSANZ are to promote, develop, and assist in the study of all areas of modelling and simulation. Members are from a wide range of professional disciplines, including agricultural science, atmospheric science, decision analysis, ecology, economics, engineering, epidemiology, hydrology, information science, medical science, oceanography, statistics, and many others.

Previous conferences have been held in Lucas Heights, New South Wales (1974), Melbourne (1976), Canberra (1978), Brisbane (1980), Armidale (1982), Adelaide (1984), Melbourne (1987), Canberra (1989), Gold Coast (1991), Perth (1993), Newcastle (1995), and Hobart (1997) (see Oxley (1994, 1996) and McAleer *et al.* (1998b) for reviews of MODSIM 93, MODSIM95 and MODSIM97). For the first time, MODSIM was held outside Australia at the University of Waikato in Hamilton, New Zealand, in 1999. The conference organisers were Les Oxley and Frank Scrimgeour. For Les, who has written many conference reviews (see McAleer, McKenzie and Oxley (1988a, 1988b), Oxley (1988a, 1988b, 1990, 1992, 1994, 1996, 1997a, 1997b, 2001a, 2001b, 2001c) and Oxley and Roberts (1987)), MODSIM99 was a chance to demonstrate how an excellent conference should be run by putting his reputation on the line. Following the conference, Les emerged with his reputation enhanced immeasurably.

Around 150 delegates made their various ways to and from Hamilton for the 4-day New Zealand experience, 6–9 December 1999. For many it was their first visit to New Zealand, with the Meeting attracting delegates from 24 countries. The weather was almost perfect, not too hot and only a few minutes of rain. This was important, with lunches ‘planned’ to spillover on to the sun-soaked balcony adjacent to the Waikato Management School. The normal MODSIM areas of interest were well represented, and many ‘old’ friends and familiar faces supported the Meetings.

Conference fees ranged from NZ\$395 for ‘early-bird’ students to NZ\$660 for the last minute non-member. For this, the delegates received a conference ‘opener’ at a local vineyard, four volumes of bound proceedings, conference dinner (with pre-dinner drinks) and ‘entertainment’, sightseeing trip, lunch, morning and afternoon teas (each day), multi-functional conference satchel (plus pen and pad), and a hotel/motel pick-up service! Delegate contact details were provided, as were name tags for delegates as well as their bag! All the angles seemed to have been covered. Although the blue tea shirts were not a new innovation at MODSIM (although the new logo certainly was), the availability of the Proceedings on CD-ROM was definitely a novel development. At NZ\$25 extra, the disk had many takers and its future at MODSIM seems to be established, especially as it allowed many presenters to demonstrate the full-colour versions of their research papers. A special thanks should be extended to the MODSIM99 Administrator, Jenny Cunningham, who was responsible for the compilation, layout and design of the CD-ROM. Jenny seemed to receive a number of compliments from delegates over the 4 days of the Meetings on her organisational skills (and cool-headed approach to potential crises) — all of which were richly deserved.

## 2. Specifics

The Reverend Sonny Melbourne (University Chaplain) performed a Maori ‘Karakia’ (blessing) for the Meetings prior to Deputy Vice-Chancellor Professor Michael Selby’s opening address. His speech is reported in full in the following section, so little more will be said except that everyone in attendance was impressed by its relevance and delivery. Simply superb.

Keynote #1 was Axel Lehmann who agreed to fill-the-gap created by the late withdrawal of the scheduled keynote. Despite one of the longest non-stop trips to the Meetings, Axel seemed fresh and the presentation was very well received. His session was entitled ‘Experiences and Trends in Combining AI and Simulation’. The experiences he alluded to were insightful, and the combinations were novel. There was certainly much to be learned from this address.

Six parallel sessions, morning tea and lunch on the balcony later, Kimio Morimune presented the second keynote lecture on an influential area of econometrics — the unit root test. Kimio is a regular MODSIM participant and it was gratifying to see him as a keynote speaker. As well as a world-class econometrician, Kimio is a gentleman and perfect ambassador for both his institution, Kyoto University, and his country.

Two more equally packed parallel sessions and the indulgence of cream scones and tea left some delegates thinking about a 'breather' — they had to wait as coaches were ready to transport them 15 kilometers to Villagrads Vineyard to experience fine New Zealand's wines and a hot and cold buffet. This was the delegate's first exposure to the unofficial MODSIM99 photographer, Les Oxley, who later posted a range of photographs on a web page. For those interested, follow the links on Les' home page (<http://www.mngt.waikato.ac.nz/depts/econ/staff/les/les.htm>) which also includes a listing of all the papers presented and session information. The photographs which were not posted on the web might be made available upon payment of a suitably high fee!

It seemed that the indulgences of some (if not many?) were in evidence on day 2, which started at 8:30 am with Keynote #3, Joe Baker of Environment ACT. Joe had confided a degree of nervousness about his session to the organizers, but none was evident in a highly polished and informative presentation entitled 'State of the Environment Reporting and Design of Indicators' that discussed the activities of the Australian Capital Territory (ACT) Commissioner of the Environment (Joe), and the potential of State of the Environment (SoE) Reports. ACT is clearly a leader in such Reports and with Joe at the helm it is understandable.

Two sets of parallel sessions scheduled by the organisers led to a later lunch (1:00 pm), followed by a further intense set of sessions in the early afternoon. John Taplin was given the task of capturing his audience at the end of a long day, and immediately prior to the MSSANZ AGM scheduled for 6:00 pm. His session on 'Modelling the Complex Choices made by Car Tourists' was yet another excellent exposition by a world expert in their field. Taking what sounds like a potentially mechanical issue, John drew the audience in and demonstrated the power of modelling and his obvious expertise.

The AGM was followed by a free evening for delegates. After two days of intense presentation and observation, many delegates seemed to relish some freedom to explore the compact high street of Hamilton (Victoria Street), which offered an array of cuisine, although 'Armadillos' and 'Iguana' seemed to attract a well deserved 'cluster' of delegates.

Wednesday continued the tradition of MODSIM by involving a 'day away' from the main venue, in this case the sulphurous charms of the nearby (100 kilometers) Rotorua. This geothermal wonderland of geysers, hot pools and yes, sulphur, provided an ideal getaway from the dairy-country of Hamilton. The aptly named Millennium Hotel hosted the delegates for the day, with scientific sessions in the morning and scenic trips following the buffet-style lunch. Gary Koop, University of Edinburgh, presented the sole keynote speech of the day on Modelling Economic and Environmental Efficiency. Continuing the theme of 'world-class experts' in their field Gary (who was recently ranked in the World's Top-10 of most cited authors in econometrics) presented his paper 'Modelling Economic and Environmental Efficiency', an excellent integration of the best of econometrics, economic modelling and environmental data. The interdisciplinary audience had much to ponder and the after-session questioning of Gary was an excellent tribute to his presentation.

The break for lunch led seamlessly to a well-deserved afternoon of sight-seeing. Faced with a choice of two tours, tour #1 comprised visits to the Whakarewarewa Thermal Reserve (for the novice (non-Kiwi) 'Wh' is pronounced 'F' in New Zealand) and Rainbow Springs Trout Sanctuary. Tour #2 comprised a visit to a geothermal power station and nearby prawn farm (benefiting from the same hot water sources). The guide allocated to the job of explaining the ins and outs of geothermal power got a rather large shock when he found out that many in the tour knew more about geo-thermal power than he did! Notwithstanding, he did his best to bluff his way through the technical details. The 'tour' of the power station involved looking at canals and pipes carrying steaming water, and being told the extraordinary stories of how two workers had died as a result of either falling into a steaming water canal or being on a tractor that suddenly sank into an area of hot mud! The environmental impact of hot water outflows from the power station was vividly illustrated by the new industry it created in the form of a prawn farm. Many returned to the hotel foyer tired, but well satisfied with these world-class attractions — they needed the rest for the dinner and entertainment to follow. Another drinks and nibbles session preceded the awards ceremony and subsequent buffet-style conference dinner, both of which were held 'poolside' at the Millennium Hotel. Many of the delegates thought this was it, but were to be pleasantly surprised by the 'Magically Maori' entertainment group performance.

The touristy-Maori performance commenced with the traditional 'Maori-Challenge'. The Vice-President of MSSANZ had been given the honour of receiving the Challenge. However, the thought of the consequences of insulting the 'offer' by standing on the leaf offered in 'peace' rather than accepting it — death!! — led to a frantic visit to the toilet!! Eventually he was 'discovered' and the ceremony went without further hitch. Apart from the singing and dancing of the traditionally dressed Maori warriors and women, the entertainment involved 'audience participation'. There was no shortage of people wishing to participate in an All Black-like Maori 'Haka'. Some of these impressive exploits were also captured on film and the images are available through Les Oxley's home page (they are worth seeing!). With food and wine aplenty, it seemed that many of the delegates had to be pulled from their seats to the waiting coaches, with many not arriving back in Hamilton until 1:00 am. From all accounts, everyone seemed to have enjoyed the evening!

The dinner also included a number of prize presentations. Student Prize presentations were made in the three MSSANZ categories. Student Prize Committees had been established before the conference, and at least two nominated assessors attended each student presentation. The Prize Winners in the three categories were as follows: Peter Johnson (General Systems, Lincoln U.); Scott Wooldridge (Natural Systems, U. of Newcastle); and Peter Verhoeven (Socio-economic Systems, U. of Western Australia). In addition, the following students received commendation letters for their excellent presentations: Li Zhe (General Systems, Nanyang Technological U.); Teemu Kokkonen (Natural Systems, Helsinki U. of Technology); Adam Liedloff (Natural Systems, CSIRO); Zhengriou Zhu (Socio-economic Systems, U. of Waikato); and Clinton Watkins (Socio-economic

Systems, U. of Western Australia). There were also presentations to the Biennial Medallists in the three MSSANZ categories: David White (ASIT Consulting) for General Systems; Wolfgang Flugel (Institute of Geography, Germany) for Natural Systems; and Kimio Morimune (Kyoto U.) for Socio-economic Systems. MSSANZ Fellowships for outstanding contributions to the Society and to the profession were awarded to the long-serving Secretary of the Society, Fred Ghassemi, MODSIM97 organiser David McDonald, and Abdel El-Shaarawi, for General Systems, Socioeconomic Systems, and Natural Systems, respectively.

The final morning of the final day is sometimes regarded as a 'graveyard' for the keynote speaker and contributed sessions alike. However, a carefully constructed programme and the attraction of John Butcher's keynote on 'Efficient Integrators for Continuous Simulation' led to very little attrition on the final day. The organisers had also advertised a 'final' closing reception at 4:00 pm for those in search of a final 'free' drink. John's keynote showed how technical issues can be presented to a multi-disciplinary audience, and his passion for the subject matter was both obvious and infectious. Again, initial trepidation was to be followed by the well deserved accolades for the final keynote of the Meetings.

Overall, the organisers seemed to have exceeded most people's expectations for a MODSIM Meeting. New innovations, including the CD-ROM version of the proceedings and the www page of photographs, seemed to be successful. The usual stories of who did what, in particular, Shiqing Ling performing the 'Haka' with gay abandon, will live long in the memory, seemed to circulate with the inevitable blurring of fact and fiction, with the latter being far easier to believe. However, the story of the conference taxi-bus driver arriving in his pyjamas to return delegates to Auckland Airport seems to be true, and shows the lengths the New Zealanders went to in order to ensure the success of MODSIM99.

### 3. Conference Opening Address

As reported in McAleer, McKenzie and Oxley (1998, p. 401), it is generally 'neither necessary nor especially interesting to focus on the conference opening', but Michael Selby, Deputy Vice-Chancellor (Research) of the University of Waikato, demonstrated that exceptions exist. It is worth pointing out that Professor Selby's research is in the strength of rock and soils, and especially the application of strength studies to the stability of mountain slopes. He has undertaken field work in Antarctica, the Sahara, southern Africa, the Andes and Himalayas as well as in New Zealand, and has been a member of three international commissions: on landslides; field experiments; and geomechanics. The quality of his address was so high that we have decided to reproduce it in full:

Good morning and welcome to the MODSIM '99 International Congress. It is my pleasure to welcome you to New Zealand, if you have come from overseas, to Hamilton and The University of Waikato.

In these opening comments I would like to discuss with you two matters: the first is the difficulties that the earliest modellers had before the age of

computers, and to reflect on their achievements; the second is to consider the ways in which modelling might develop in the future so that it can provide better information for people who are concerned with policy making.

One of the earliest examples of modelling is provided by the history of Milutin Milankovitch who was appointed to his first position as a university Professor in 1911, at the University of Belgrade. He immediately started to investigate areas of science in which he could make a significant contribution, and spent 3 years developing his scientific plans which were to lead to a study lasting for 30 years, and the solution of one of the major problems in the natural sciences.

Milankovitch decided that he would develop a mathematical theory to explain the climates of the earth. His first objective was to describe the geometry of earth's orbit around the sun and to show how that geometry had evolved over the past ages. He was particularly concerned to understand how variations in the earth's orbit have effected the solar radiation received in the atmosphere. He did this in spite of the views of climatologists of the time, that it was pointless to undertake mathematical theoretical work when there was a perfectly good record of temperature and rainfall from many parts of the world. Milankovitch, however, recognised that, from the work of earlier scientists, that there were three orbital properties which determine how the sun's radiation is distributed over the surface of the earth. The first of these is the eccentricity of the orbit which has a periodicity of 100 000 years, the second is the tilt of the earth's axis of rotation with a period of 41 000 years, and the third is the precession of the equinoxes with a period of 21 000 years.

Milankovitch set out to calculate these three sets of orbital data and eventually carried his calculations back for 650 000 years before the present.

He was able to present some of his earliest work in papers which received almost no notice in the wider scientific community, because he published in obscure journals and in the Serbian language. There are messages here for all young scientists that if they wish to be known they must publish in one of the leading languages and in the top international journals.

Milankovitch finally published, in 1941, the work which was to have enormous importance for understanding earth's changing climates. The significance of his work was recognised by only a very few people initially, but from oxygen isotope analysis of cave sediments, particularly stalactites and stalagmites, and the record left in the skeletal remains of plankton which had fallen to the ocean floor, and then formed an accumulating record which could be sampled with coring tubes, it was realised that the pattern of the oxygen isotope record could be compared with the Milankovitch radiation curves. Immediately then it was evident that there was a climatic record to be read from the sedimentary record and that the sedimentary record itself could provide a long history of climatic variations.

My own experiences of modelling began in the mid-1960s when it was realised that there was a major problem of soil erosion in the Central Volcanic Plateau of New Zealand, which at that time was being developed for farmland

out of scrub. It was found that deep gullies were carving up the newly developed farms and depositing substantial quantities of pumice in the lakes formed behind the dams built to generate hydro-electricity. I had a number of research catchments from which, over a period of 3 years, I collected over half-a-million data units, all derived from paper charts on clockwork recorders. This was essentially done at a time when mechanical calculators were the most common form of calculator available. I was fortunate that by the time I came to complete analysis of my data, the University of Auckland had a main-frame computer. Such was the computing capacity of the time that I needed 24 hours of continuous running time, this was granted to me one Easter on Easter Saturday and Easter Sunday, as long as the work was carried out continuously through the night by a generous colleague. The difficulties of computing were of course greatly increased by the fact that all of the data had to be on punched cards, and my nightmare preceding the time on the computer was in travelling to Auckland with two long drawers filled with cards which could easily be bounced out of sequence.

The results of the research were to contribute to the control of soil erosion and made a minor contribution to New Zealand's part in the International Hydrological Decade. The advantages that we now have through the availability of enormous computing power mean that we can tackle some of the major problems which face the world, at the present time, resulting from the huge increases in human population, and the modification of the natural environment which is a consequence both of the growth in population and the increases in demands for natural resources and manufacturing capabilities.

If we look ahead to what mathematical modelling and simulation can provide for the future, I suggest we need to think beyond the types of programmes which we can see commonly presented at the type of conference which you are attending today. It is a feature of the well-presented, and excellently edited, 4 volumes which you have as your conference proceedings that virtually all of the papers are dealing with single bodies of knowledge and investigation, I have in mind papers on individual watersheds, on particular singular components of the national economy, on particular crops and how they might yield under changed circumstances of soil or climate.

The decision makers of the future have to work in far more complex systems than can be described in single studies. They need, for their purposes, an understanding of the interactions of all of the components of the natural environment with those of the social and economic situations with which they have to deal. The effects, therefore, of climatic change; changes in ocean currents; effects of storm and other extreme natural events; the transport systems, water supply and other infrastructure which are required for manufacturing, processing and production; the effects on the labour force; the demands for housing and all other aspects of production need to be linked to a clear understanding, of the effects of production on the natural environment, and on the demands for increasing wealth and personal time. We are all aware

that computer power, new industry, aggregation of industry and settlement, have led to major problems in traffic flow and in enhancing lifestyles. It is not until we can recognise that all of these factors need to be integrated in a careful study, so that if politicians are to make sound judgements they can do so on the basis of knowledge rather than dogma.

I suggest to you then, that in this age when we have the mathematical powers of our intellects coupled with the powers of computing, we should now start to focus on meeting the needs of the decision-makers of the future. This will not be easy, it will require integrated studies from people working in large teams, from the points of view of many disciplines, to achieve what I have suggested.

In conclusion then, I hope to have reminded you of some of the difficulties on our predecessors, but left you with a challenge for the future in which you, and your successors, over the next, perhaps 20 years, will need to focus your efforts. Thank you for your attention and I wish you well for a very successful and enjoyable conference.

## **4. Academic Program**

### *4.1. Contributed Paper Sessions*

There were in 185 contributed papers, all of which appeared in four beautifully bound volumes of fully refereed and edited Conference Proceedings (with a total of xxx+1136 pages), and six keynote addresses, five of which appeared in Volume 4 of the Proceedings volumes. Despite an initial early deadline for papers of August, papers arriving in late-November were still included in the Conference Proceedings volumes. As for a number of previous MODSIM Conferences, there was a superb conference satchel (with shoulder straps) in which to carry the four volumes.

For the cognoscenti in economics, econometrics and finance, there were 11 papers in economic modelling sessions, 10 papers in econometric modelling and time series sessions, 8 papers in applied economics and tourism economics sessions, 7 papers in financial econometrics and financial modelling sessions, and 6 papers in economic growth and productivity sessions. There were also numerous sessions in groundwater flow and solute transport modelling, surface water runoff models, streamflow response models, evaluation of surface hydrological models, hydrological interaction models, epidemiology, medical research and public health, atmospheric modelling for climate change and air quality management, ecological modelling and decision theory for applied ecology, predictive modelling of ecological systems, social-environment interactions, terrain-based environmental modelling, climate effects on agricultural systems, modelling and simulation of agricultural systems, integrated modelling for resource management, geostatistical developments and applications, distribution networks, traffic control and simulation, system simulation, decision support systems, computing and control, and spatial information systems for resource modelling.

In keeping with multi- and inter-disciplinary nature of the Society, there was a multiplicity of contributed papers across a broad range of topics. There were many contributed papers that caught the eye. On the basis of their titles, some of the more interesting areas beyond economics, econometrics and finance (at least to the non-specialist) were as follows: *Simulation Analysis of the Effects of the Simultaneous Release of Quanta of Acetylcholine on the Endplate Current at the Neuromuscular Junction*; *Modelling the Spread of Dengue in Singapore*; *Quantification of Point and Non-point Inputs to Water Pollution from Urban Areas: Effluent Discharges and Sediment Loadings to Streams*; *Remote Sensing Techniques for Obtaining Effective Land Surface Parameters in the Estimation of Evapotranspiration with SVAT Models*; *Optimal Location of Tsunami Detectors*; *A Poisson Regression Model of Fatal Traffic Accidents Involving Small Passenger Sedans in Japan*; *AIDS Prevalence and Barrier Contraceptive*; *An Application of EM Based Multistate Model in Prostate Carcinoma Data*; *Analyzing Frequencies of Sexual Events Using a Generalized Poisson Regression Approach*; *Modeling Calcium Loss from Bones during Space Flight*; *Evaluating the Climatic Response to Changes in CO<sub>2</sub> and Solar Luminosity*; *Risk Analysis Studies of Banana Fruit Fly, Bactrocera Musae, Recolonising an Area Near Cairns, North Queensland after Area-Wide Insecticidal Treatments had Ceased*; *Separate Collection and Waste Treatment*; *Reconstruction of Hierarchical Fuzzy Driving Logic for Road Transportation Simulator with Measurement Data Reference Simulation Method*; *Fuzzy Graph Model for Sociometry and its Analysis Methodology*; *Software Optimizes Motor-Assist 1-WD Carcycle, Sans Rego/License*; *Derivative Free Training in Seasonal Time Series Using Grid Search*.

#### 4.2. Keynote Presentations

Six Keynote speakers attended (one dropped-out at a very late stage) and comprised Joe Baker, Environment ACT, Australia; John Butcher, University of Auckland; Gary Koop, University of Edinburgh, Scotland; Axel Lehmann, University of Munich, Germany; Kimio Morimune, Kyoto University, Japan; and John Taplin, University of Western Australia.

### 5. Classic Quotes

As with all MODSIM conferences, MODSIM99 produced its share of real classics. As is standard in this section, some names have been omitted to protect the classic quotes themselves (for obvious reasons), or the authors (in the event of litigation).

In sessions on tourism:

‘New Zealand is a very important benchmark for Australia’.

‘Where is New Zealand in the list of top tourist markets?’ (Christine Lim).

‘No one cares’ (McKenzie). ‘Frank [session chair] throw him out!’ (Christine Lim).

An important constraint in tourism: ‘The nobody gets left behind constraint’.

'Move civilised people go up in stages.' (John Taplin, on travel from Perth to Coral Bay, Western Australia).

'There are people who have chaotic holidays'. (John Taplin).

In answer to a question from the floor: 'I'll have a look at that after I return to the Gold Coast' (Christine Lim).

On the use of OHPs:

'I hesitate to put this slide up ... I would never publish it.' (unnamed)

'I have a lot of OHPs, but I left them in my room.'

The prize for the best classic quote at MODSIM99 goes to this absolute gem:

'The occurrence of outliers is like a game of musical chairs. Every now and again the music stops and all hell breaks loose.' (Peter Verhoeven).

In terms of the quantity of quotable quotes, Ron Bewley was probably the winner with:

'The priors get tighter as we go down.' [This speaks for itself!]

'It's not really Bayesian ... it's a sprinkling of Bayesian on top.'

'A drift taking you nowhere fast.'

On new approaches to data (non-)analysis:

'Just keep fudging it until it explains (represents) the data.'

'Fitting curves to two points is pretty wild stuff.'

'No one knows whether you are right or wrong.' (David Giles on fuzzy logic applied to the underground economy).

'Fuzzy statistics', 'fuzzy econometrics — regressions that do not need values of the dependent variable.'

An interchange in an economics session: 'I am a little concerned that you only have 22 observations'. The response was: 'At least, I got some results.'

'This was a surprise to me — probably because I didn't think about it.'

Some people obviously had trouble with their presentations. One presenter worried about whether he had got his message across to the audience naively asked: 'Can you see how I am thinking?'. The response from one participant was: 'I am the wrong person to ask!' A comment heard after a different paper: 'His talk is totally unrelated to his paper.' On the other hand, one presenter was confident enough to state: 'Don't worry about any of my maths.'

Honesty can be the best answer to difficult questions: 'I don't have a story for that yet.' (Clinton Watkins)

On mixing sport and science: 'The rugby approach to the environment ... something to be kicked around.' (Joe Baker)

An economist's view of engineers: 'Engineers. They assume all people are stupid and get it wrong.'

## 6. Epilogue

Approval was given at the Annual General Meeting at MODSIM99 to hold the next Congress to be organized by Fred Ghassemi, scheduled for 10–13 December 2001, at the Australian National University, Canberra, Australia (details from <http://cres.anu.edu.au/~tony/modsim2001.htm>). This conference is certain to follow in the excellent footsteps of MODSIM99.

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