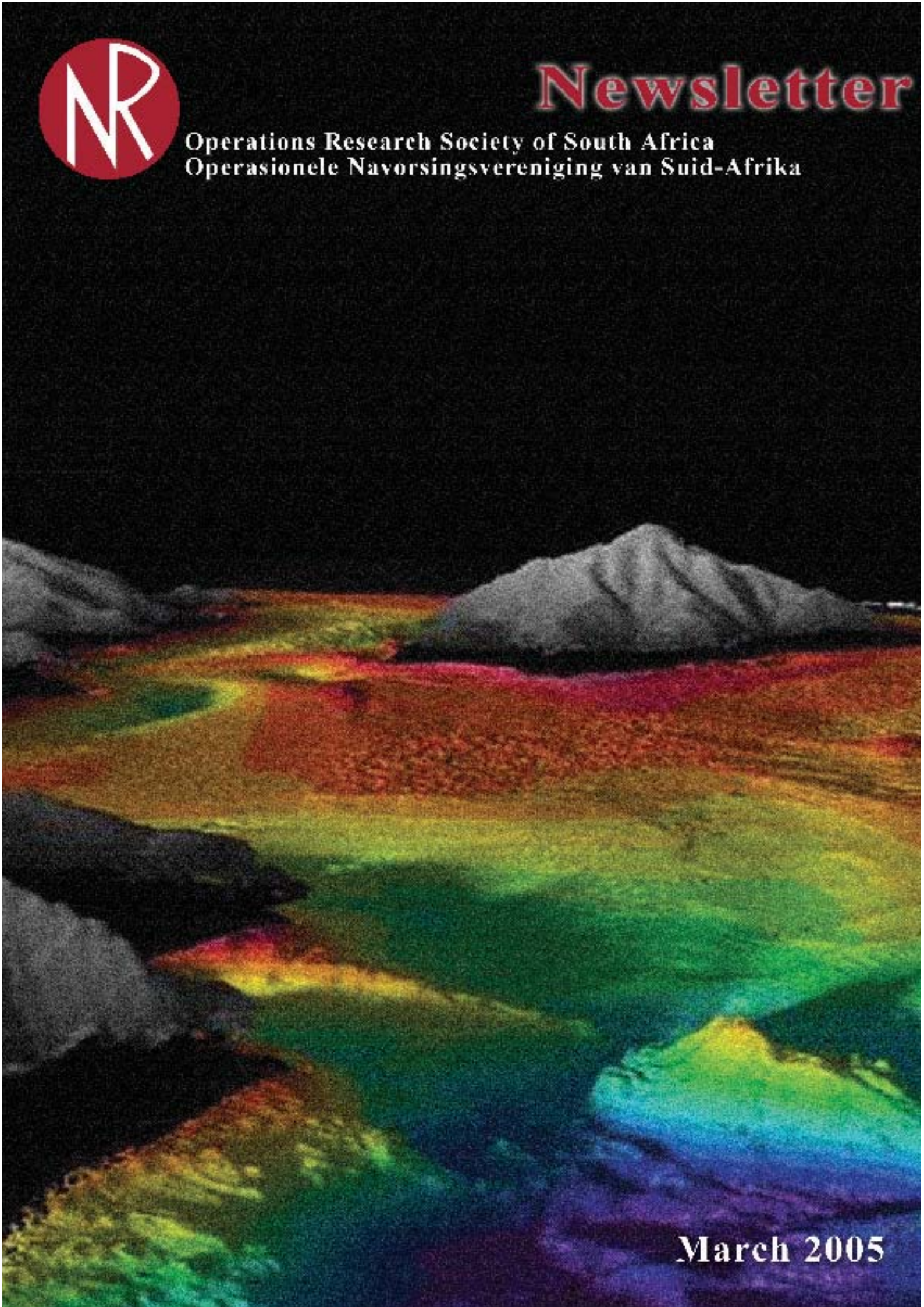
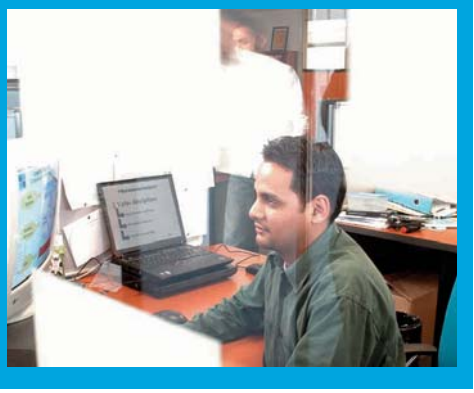
Newsletter

Operations Research Society of South Africa
Operasionele Navorsingsvereniging van Suid-Afrika



March 2005

POWERED BY SOLUTIONS



The PIC Update is a free monthly e-newsletter read by over 30,000 credit, risk, ICT and marketing professionals.

Sign-up today at www.PICSolutions.com or send an email to Subscribe@PICSolutions.com.

Optimising the Credit Life Cycle

PIC SOLUTIONS

PIC Solutions provides customer management solutions to blue-chip organisations. We are experts in the fields of credit, risk & marketing and have an established track record of success, powered by solutions.

Info@PICSolutions.com www.PICSolutions.com

FROM THE PRESIDENT'S DESK

By Wim Gevers (wg@sun.ac.za)
ORSSA President

Wim Gevers

The New Year is well under way, and I hope that you are all making progress in executing your New Year's resolutions! However, many of us probably never made any fixed resolutions, or we have been so busy that we have long forgotten about them…

In this edition I want to dwell briefly on an issue that is receiving increasing attention of late, namely that of sustainable economic development. We probably all agree that sustainability is very important, and then these thoughts evaporate like New Year's resolutions. As I am writing this we hear that the Kyoto protocol that tries to limit the emission of hot-house gasses has come into effect as of 16 February 2005. It was some 30 years ago that research in Hawaii discerned a trend of increasing carbon dioxide levels in the atmosphere, gasses that are blamed for the global warming effects. Their emission is primarily the result of the burning of fossil fuels, and the biggest culprits in the world are the highly developed economies. The USA is one of a number of countries who have not signed the Kyoto protocol, ostensibly because the limiting of harmful emissions is expected to have a severe damper on economic growth. It creates the impression that short term economic benefits and personal wealth are more important than the sustainability of development of our planet – the quality of life that future generations will be able to experience.

Agreed, the Kyoto protocol places more restrictive requirements on developed economies than those of developing economies like China and South Africa and that is a major source of discontent. And one has to deal with some scientists who apparently believe that the relationship between global warming and emissions has not been established – just like there are a handful of scientists who believe that HIV does not cause AIDS…

Admittedly, in sustainable development we are dealing with a very complex problem, part of which is trying to find a form of compensation for the developing economies due to the past liberties by the developed economies. This is, of course, not a strange problem for South Africans – is BEE not a similar exercise in an attempt to right previous wrongs?

In a previous column I alluded to the fact that BEE seems to create numerous possibilities for Operations Researchers to tackle challenging problems to the benefit of our country as a whole. Similarly, there seem to be numerous opportunities for our discipline to make a significant contribution to the resolution of many of the problems of sustainable economic development. It is far too easy to look at local, short-term economic benefits rather than at the overall, global picture. This invariably leads to local, sub-optimal solutions in a global context.

Locally it is also significant that the development of the Pebble Bed Nuclear Reactor has again received a hiccup in its development in that even more comprehensive environmental studies are required – and in the mean time we are burning coal to generate electricity. But more concerning should be the possibility and impact of future power cuts. Gauteng has recently experienced a number of major power outages – with severe consequences to all affected, from private households through retailers to manufacturers.

The Western Cape is experiencing one of its worst droughts, and water restrictions could have been reduced had the Berg River dam been constructed earlier – but it appears as if political processes stalled its development until recently. Are similar processes going to inhibit the development of electricity generating capacity?

We have to face the facts that not taking a decision or postponing a critical decision is a cognitive choice that decision makers make. Perhaps as Operations Researchers we should be a little more explicit in highlighting the consequences of postponing decisions to the decision makers that we support. At any given moment of time we have to make decisions based on the best available information at that time. Postponing the decision implies that current opportunities go by, with possible dire consequences much later.

Perhaps it is significant that this year's IFORS conference is to be held in Hawaii! Those of use fortunate enough to go there can ponder the consequences of losing that paradise through unsustainable development – but then it will probably not happen in our lifetime… It is good that the organizers for this year's combined ORSSA/SAIIE annual conference are taking as theme Sustainability in OR/IE. Let us all think about how we, even in the smallest sense, can make a contribution towards making our environment a better place to live in! ♦

QUERIES AND CONTRIBUTIONS

Address all queries or contributions to the editor:

The Newsletter Editor
ORSSA
PO Box 3184
MATIELAND, 7602

E-mail: orssa_newsletter@dip.sun.ac.za
Tel: (082) 320 0313
Fax: (021) 808 3778

Contributions and other forms of communication with the editor can also be conducted from the website at: **www.orssa.org.za**.

DISCLAIMER

Features

Philip Fourie

Sustainability (revisited)

At the end of the note on sustainability which appeared in the September 2004 issue, I gave the following working definition: "Sustainable development is action leading to a constant increase in the human development index which can be sustained for a century or more". I have received the following comments (my own paraphrase):

1. The definition is totally anthropocentric as it stands, and should be extended to include the ecosystems which underlie all human activity.

2. The timescale is completely arbitrary; it should be possible to derive it from the natural timescales of both human society and the underlying ecosystems.

Both the comments are valid, and should be taken into account in developing a better and more complete definition. Any other comments from readers are eagerly awaited.

The size of the human population itself is of course also an element in the big picture of sustainability. Recently I was re-reading a book which appeared in 1974, in which the author refers to the population as being "more than 3 billion". Now of course it is approximately 6,3 billion. Were the population growth exponential with an annual increase of 2,3% - which fortunately it is not – it would be more than 12 billion by 2035, well within the lifetimes of many of you now reading these words. Think of South Africa with a population of 90 million people….Forecasts of the world population I have seen are slightly lower, in the region of 9-10 billion. The City of Cape Town does have an annual population growth of more than 3%, mainly due to immigration adding to the normal increase.

Philip Fourie
pdfourie@sun.ac.za

FROM THE EDITOR

Cobus Potgieter

This year has started a little too fast for me. So, on my behalf, I want to whish you all the best of luck for the New Year, especially those filling new positions at work or in ORSSA and also for those trying something new. I know that a little change can do you good.

It is amazing how quickly they can extract information and learn from an incident such as the Tsunami disaster that happened on boxing day last year. They are already busy with some analyses to try and prepare mankind to cope better with similar happenings in future. Even doing research in the deepest parts of the ocean is possible today due to technology and some Operations Research techniques.

In the main article by Nicky Pantland and Jan van Vuuren we see how the foot of a continental slope can be computed using three dimensional visual schematics. These techniques can be used to aid South Africa in claiming rights on more of the ocean around her borders.

In the December issue of the newsletter Theo Stewart explained why ORSSA is a member of EURO. This issue includes the letter from the president of EURO, Alexis Tsoukiàs, and is addressed to all members of societies affiliated with EURO.

We might also be lucky enough to have Alexis as our keynote speaker at the joint annual conference of SAIIE / ORSSA later this year. I want to thank Marthi for all her effort in organising this and I hope to see all of you at this splendid event.

Until next time,
Cobus

MEMBER PROFILE: HENNIE KRUGER

By Cobus Potgieter (pottie@dip.sun.ac.za)

Hennie Kruger

Hennie Kruger is op 18 Desember 1955 in Bothaville in die Vrystaat gebore. Hy het aan Hoërskool Bothaville matrikuleer waarna hy 2 jaar lid was van die weermag. Hennie het in 1978 sy BSc graad aan die Potchefstroom se Universiteit vir Christelike Hoër Onderwys voltooi.

Van 1982 tot 1998 het Hennie deeltyds sy studies behartig. Hy het vier grade aan die Universiteit van die Oranje Vrystaat behaal, wat ‘n BSc Hons en BComm Hons asook MComm en MSc insluit. In 1994 is ‘n PhD in Rekenaarwetenskap en Inligtingstelsels aan hom by die PU vir CHO toegeken.

Terwyl Hennie deeltyds studeer het, het hy ook in ‘n breë veld ondervinding opgedoen. Hy het sy loopbaan in 1979 as Programmeerder by die Depatement van Waterwese begin en het daarna by die UOVS sy programmering voortgesit. In die daaropvolgende ses jaar daar is hy ook as Projekleier aangewys.

Hennie is in 1989 by Anglo American Corporation as Senior Rekenaarouditeur aangestel waar hy betrek is by projekte en later gevra is om dit te bestuur en uit te voer. Hier is sy belangstelling in Operasionele Navorsing vir die eerste keer geprikkel en dit is gedurende hierdie typerk dat hy betrokke geraak het by ONSA.

Hennie is tans as mede-Professor aan die PU vir CHO aangestel, deesdae bekend as die Noordwes-Universiteit, waar hy doseer in Rekenaarwektenskap. In die vyf jaar wat hy daar was het hy steeds kontak behou met die industrie deur betrokke te raak by projekte wanneer hy ookal die geleentheid kon kry.

Hennie word gekenmerk as ‘n lojale lid van ONSA en ‘n gereelde bywoner van die jaarlikse konferensie. Kyk maar uit vir Hennie by SAIIE/ORSSA 2005, u sal hom daar sien!

Wanneer en hoekom het u betrokke geraak by Operasionele Navorsing?

Ek het in die vroeë negentigs, terwyl ek in die privaatsektor gewerk het, ‘n artikel in ‘n koerant gelees oor die Operasionele Navorsingsvereniging van Suid-Afrika en toevallig die week daarna ‘n artikel gesien oor die toekenning van bronne aan verskillende take. Ek was ook op daardie tydstip besig om na sekere oplossings in my destydse werksomgewing te soek en het (gelukkig) a.g.v. die twee artikels raakgesien dat ON waarskynlik die antwoord op ons spesifieke probleem sou wees. Miskien is dit omdat die meeste van my werkservaring tot nou toe nie in ‘n akademiese omgewing was nie, dat ek (ongelukkig) eers omtrent 14 jaar gelede betrokke geraak het by die toepassing en meer intensiewe studie van Operasionele Navorsing en ON-tegnieke.

By watter Operasionele Navorsingsprojekte was u al betrokke?

Terwyl ek by Anglo American Corporation gewerk het was die mees interessantste projek waarby ek betrokke was een waar die aantal ouditeure vir spesifieke streke bepaal moes word, afhangende van die risiko van oudit areas in die streke. Ons het gebruik gemaak van die Analitiese Hierargiese Proses om risikofaktore en hulle invloed en belangrikheid te evalueer en die resultate is toe in ‘n verliesfunksie, wat geminimeer is, gebruik om die uiteindelike toekennings te maak. Ander interessante projekte was byvoorbeeld die gebruik van lineêre respons oppervlaktes om brontoedelings, aan verskillende rekenaarstelsels, te doen op grond van hul risiko, belangrikheid en sukses.

Gedurende 1998 en 1999 met die groot gedruis om rekenaarstelsels versoenbaar met die jaar 2000 te maak, het ons ook van ON tegnieke gebruik gemaak om risiko faktore en oudit areas te identifiseer en te prioritiseer. Gedurende die tyd het ek ook by Anglo se bedrywighede in Mali, Argentinië, Brasilië en die VSA gewerk.

Sedert ek by die akademie aangesluit het, het ek saam met Prof Giel Hattingh betrokke geraak by wiskundige programmerings-tegnieke wat gebruik word by model seleksie en bepaling van uitskieters in datastelle. Die werk ten opsigte van meer praktiese toepassings het ook nie agterwee gebly nie en ek was byvoorbeeld betrokke in die industrie by ‘n projek om die prestasie van sekere besigheidseenhede oor ‘n tydperk te meet.

Tans is ek besig (in samewerking met ‘n vennoot in die industrie) om ‘n geskikte model te probeer ontwikkel om die vlak van bewustheid van inligtingsekuriteit (information security awareness) vir ‘n gegewe area te bepaal. Ek het verlede jaar tydens my Sabbatsverlof tyd spandeer in Perth, Australië om die moontlikhede van so ‘n model te ondersoek. ‘n Prototipe van die model is reeds in Australië en in Wes-Afrika getoets.

U is tans dosent aan die Noord-Wes Universiteit. Hoe sien u die rol van ‘n ON-opvoeder?

Omdat ek maar nog relatief kort in die akademiese wêreld is, dink ek nie ek kan die vraag met vreeslike gesag beantwoord nie, maar ek dink tog dat ons ons studente ten minste meer bewus moet maak van die ryk verskeidenheid van tegnieke, benaderings, metodes en modelle wat beskikbaar is en dat daar so ‘n groot aantal probleemareas is wat hiermee aangespreek kan word.

U is al 14 jaar lid van ONSA. Watter voordele bestaan daar vir akademiese en nie-akademinese lede van ONSA?

Ek is maar 5 jaar lank lid van ONSA as deel van die akademiese opset. Sonder om hard te dink sou ek baie voordele kon opnoem. Een van die belangrikes is sekerlik die geleentheid wat mens het om ander mense, wat in die dieselfde veld werk, te kan ontmoet. Dit alleen het natuurlik weer ander addisionele voordele. Hierdie geleenthede om te kan netwerk word moontlik gemaak deur die jaarlikse ONSA konferensie, die nuusbrief, ORiON ens. – elkeen van hulle op sigself weer

'n voordeel wat verkry word deur lid te wees. Lidmaatskap dra dus grootliks daartoe by dat mens nie in isolasie of in afsondering jou werk hoef te beoefen nie.

Wat sal u boodskap wees aan jong, voornemende ON-praktisyns?

ON is 'n dinamiese veld wat gedurigdeur vernuwing ondergaan en dit het toepassings in omtrent enige veld of industrie. Daar is veral geleenthede om hedendaagse probleme, wat spesifiek is mbt ons situasie hier in Suid-Afrika, mbv ON aan te pak. Ek dink hierdie is so breedweg gesien van die dinge wat aan jong voornemende ON-praktisyns verduidelik behoort te word sodat (veral jonger) studente dit nie bloot net moet sien as 'n klomp (wiskundige) tegnieke en formules wat allerhande kwantitatiewe resultate kan lewer nie. ♦

APORS Conference 2005

Optimising Resources for Outstanding Results

January 16-18, 2006

Contact: Elise del Rosario
elise@jgdelrosario.com

Website: www.managementsciences.org.my

EURO Summer Institute "OR in Health"

Southampton, UK
July 24 - August 5, 2005

A EURO Summer Institute for new researchers - people with less than 10 years' experience in OR - will be held at the University of Southampton, UK. Each national OR Society is entitled to send at least one participant (and possibly up to three) to the ESI. All the costs of the ESI are met by EURO, except travelling expenses.

Call for papers deadline: 30 April, 2005

Contact: Sally Brailsford , Conference Organizer,
☏ +44 (0) 23 8059 3567
✉ tripathy@iimahd.ernet.in

Website: www.management.soton.ac.uk/esi

ICORD-V

Jamshedpur India

19th - 21st December, 2005

The ICORD conference series was initiated with a conviction that Operational Research (OR) can make significant contributions to the process of development in general and in developing countries in particular.

Contact: Prof. Arabinda Tripathy,
tripathy@iimahd.ernet.in

Website: www.icord-v.net

CURRICULUM VITAE

One of the benefits of being a student member of ORSSA is that students may request that abbreviated versions of their CV be published in the newsletter when they want to enter the job market. Please contact the newsletter editor if you want your CV published.

Grant Neville Crosse

I graduated from Stellenbosch University last year and I am eagerly looking for a Operations Research position or a place in a logistics department.

Contact numbers: 082 904 8270
011 314 1066 (H)

E-mail: grant@caxal.co.za

Education:

2000 Matriculated at St John's College, Houghton

2004 Stellenbosch University: BSc Operations Research

Computer Skills:

Microsoft Excel, Microsoft Access, Visual Basic, Statistica, R, SIMUL8, MATLAB, LaTeX, and others

Work Experience:

Vacation contract with Tibbett and Britten, experiencing Research and Development, being an on-site warehouse assistant and vehicle tracking and planning

Referees:

Noel Fitzgibbon
Financial director for Tibbett & Britten South Africa
Tel : +27 11 375-0119

Prof Jan H van Vuuren
Associate Professor of Applied Mathematics, US
Tel : +27 21 808-4213

The copy of **Community Operational Re-Search: OR and Systems Thinking for Community Development** (reviewed in the December 2004 issue, p. 15) can still be won by a fully paid-up ORSSA member that answers the following question correctly:

How is the classic case study by Russell Ackoff titled?

Please e-mail your answer and contact details to the editor at *pottie@dip.sun.ac.za*. The winner will be announced in the next issue.

The book **Decisions by Objectives** by Prof Ernest Forman is still available for reviewing. It deals with practical management decision making and the AHP. If you are interested, please contact the editor.

A 3D APPROACH TOWARDS THE COMPUTATION OF THE FOOT OF A CONTINENTAL SLOPE

By

Nicky Pantland (np@imt.co.za)

Institute of Maritime Technology
Simonstown

Jan van Vuuren (vuuren@sun.ac.za)

Department of Applied Mathematics
Stellenbosch University

Introduction

In order to address the growing list of contentious issues relating to the uses and rights of a sovereign state with respect to its seas, the *United Nations Convention on the Law of the Sea* (UNCLOS) was drawn up and opened for signature on the 10th December 1982. South Africa signed and ratified UNCLOS in 1998, and as a ratified state, has a period of ten years to lay a once-off claim for extended maritime estate beyond its two hundred nautical mile *Exclusive Economic Zone* mark. This deadline was later extended to May 2009. Article 76, paragraph 4a, of UNCLOS outlines a criterion for determining the *Foot of the Continental Slope* (FoS) upon which this claim rests, namely: "In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in the gradient at its base."

South Africa stands to gain an estimated 400 000 km^2 in seaward estate during its claim process. This figure is considerably less than was first estimated and is deliberately conservative, not including areas of low and medium probability of claim acceptance, such as the Agulhas Plateau and certain Marion / Prince Edward Islands areas.

In November 2002 a Cabinet memorandum approving funding of R23 million, from the Central Energy Fund, was filed. The Central Energy Fund is administered by the Department of Minerals and Energy, and Petroleum Agency South Africa was appointed project coordinator. A Steering Committee and Working Group were established. The Working Group consists of scientists and technicians from Petroleum Agency South Africa, the Council for Geoscience, the Institute for Maritime Technology and the South African Navy Hydrographic Office. The Working Group reports to the Steering Committee, which is made up of a member from each of the organizations comprising the Working Group, in addition to members from the Department of Foreign Affairs and the Department of Minerals and Energy, amongst others.

The authors launched a feasibility study with respect to a 3D and mathematically justifiable method of FoS determination that may contribute to a more defendable and beneficial claim. The idea was that, should application of the method emanating from this study turn out to be feasible and practical, it might be considered for inclusion in the Working Group's portfolio of tools for use in the claim process. However, if it turned out that further work is required before the results of the feasibility study can be of value to the claim process, the results of the study might form the basis of motivation for such work. The feasibility study commenced in April 2003, was completed in December 2004 and was funded independently by the Institute for Maritime Technology – therefore it has no responsibility to the South African claim process, and was not defined as a deliverable for the greater claim process.

Geographical Considerations

Criteria for locating the FoS, other than that contained in the Article 76 definition of the point of maximum change in gradient, include the use of various features and characteristics of continental margins to argue for a particular FoS. Article 76 of UNCLOS refers to the "natural prolongation of the land" and defines the position of the FoS to lie "on the outer limit of the prolongation." There are two ways to perceive natural prolongation of the land: through the eyes of a geomorphologist (*i.e.* considering the continental margin as consisting of three separate sections: the *shelf*, the *slope* and the *rise*, based on profile shape alone) or through the eyes of a geologist (*i.e.* also considering the material of which the seafloor and subsoil consists, in addition to the general appearance of the margin).

In general, a continental margin has both simple and complex sections, invariably with transition zones. This makes it imperative, in calculations of the position of the FoS, to be able to identify the different areas of a margin, in order to prevent mistaking a saddle or terrace as part of a possible FoS (perhaps due to not sampling to adequate depths). The continental rise, bordering the foot of the slope, is a depositional feature caused by the accumulation of sediment from the continent that has been transported down and along the slope and thus should be identified not only by its gradient and surface texture, but by aspects such as sediment thickness and underlying seabed characteristics. These features may be used as "evidence to the contrary" in the Article 76 FoS determination process. The

"evidence to the contrary" approach may be used to argue for a particular FoS position other than that defined by the "maximum change in gradient at its base." This would imply that the FoS may lie in a zone of possible positions, but is not the conventional choice. The Commission's provisional guidelines imply that subsurface information may be used in the identification of the FoS where "the rule of maximum change in gradient would not, for example, equate to the limit of the geological margin." However, in legal terms this places a heavy burden of supplying evidence and will have to be researched well and be entirely convincing before being used in the claim process.

Conventional 2D FoS Determination

Foot line determination within the South African Working Group desktop study is currently performed by means of the software suite *Caris Lots*, which provides a user-friendly interface for determining the FoS, based on a number of criteria, by applying Article 76 of UNCLOS to user and public domain data sets. The software package provides for two methods of locating the FoS, namely by means of gridded data sources (such as the *Earth Topography* (ETOPO) data sets and the *General Bathymetric Chart of the Oceans* (GEBCO) data set) or by means of a "three-dimensional" ship's track. The user examines the seafloor image visually and identifies an area where there is a probable FoS. Once an area has been identified, a two-dimensional cross-section profile is created for that area, consisting of a line that is perpendicular to the continental margin. The start point of the profile should be chosen on the continental shelf and the end point near the start of the abyssal plain.

A FoS point is determined in *Caris Lots* as one proceeds from a seaward direction to a landward direction along the chosen (and possibly filtered) profile. This point is determined by analysing the profile slope, using the *Caris Lots* foot of slope tool. This tool computes the second derivative of the profile line and then marks the point where the maximum second derivative value is found. The profile under examination is then displayed with the foot point marked. Further information displayed includes lines indicating sediment thickness and a geodetic analysis of the profile. The operator then manually adjusts the marked foot point until satisfied with the result. A change to the marked foot point is typically made if the operator feels that the changes in the profile slope or geodetic factors contradict the placement of the marked point.

Once a number of foot points have been computed for a certain area (one foot point per profile or ship's track), the points are manually evaluated by the operator and only those points offering the most advantageous claim area are retained. The final foot points chosen may not be more than 60 nautical miles apart. These points are then joined by means of straight lines to form a foot line. A measure of subjectivity is therefore introduced to *Caris Lots* by the user being able to *choose* a profile line (and the angle this line makes with the coastline). Further bias is introduced by the user's ability to change the position of a marked foot point, and the user's preferred selection of computed foot points to retain for use in formation of the final foot line. The subjectivity is thus a result of the operator choice rather than software limitations.

3D FoS Determination as Alternative

Methods for a more objective 3D computation of the FoS are not abundant. In fact, there have only been two mathematical papers published on the topic to the best knowledge of the authors. The method proposed by Ou & Vanícek [2] in 1996, was the first exploration of the topic and the second method, published by Bennett [1] in 1998, constituted a closer look at the problem, as a direct result of the perceived drawbacks and shortcomings of the work of Ou & Vanícek. Bennett's work is essentially a generalisation and re-formulation of the method proposed by Ou & Vanícek, incorporating smoothing of the data. The authors' hypothesis is that the perceived shortcomings of Ou & Vanícek's method were, to a large extent, a result of the poor data resolution available at the time of the method's development. It is only very recently that the higher resolution one- and two-minute bathymetric data sets have become available, thereby significantly reducing the coarseness of the five-minute data that were used by Ou & Vanícek and Bennett. The authors therefore followed the general approach of Ou & Vanícek in their feasibility study.

Since the change of the gradient of a surface is measured by its curvature, Ou & Vanicek simplified the definition of the foot line of a continental shelf by assuming that it corresponds to the ridge line formed by the maximum curvature of the seafloor. This maximum curvature may be computed using the well-known first and second Gaussian fundamental forms of the seafloor. If the depth of the seafloor is described (approximately) by a smooth function $z = z(x,y)$ in some Cartesian frame, as shown in Figure 1, then the first Gaussian fundamental form of the seafloor is given by

$$El^2+2Flk+Gk^2 = 1, \qquad (1)$$

where $l = \mathrm{d}x/\mathrm{d}s$ and $k = \mathrm{d}y/\mathrm{d}s$ are the directional coefficient derivatives with respect to an arc length parameter s, measured on a shortest curve C along the seafloor between a general point **P** and another point **P'** on the seafloor. Here $E = 1+(\partial z/\partial x)^2$, $F = 1+(\partial z/\partial x)(\partial z/\partial y)$ and $G = 1+(\partial z/\partial y)^2$ describe the shape of the seafloor.

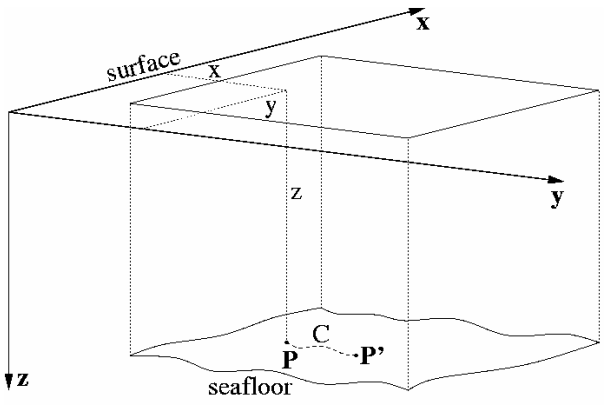


Figure 1: Mathematical description of the seafloor surface

The curvature of the seafloor is given by the second Gaussian fundamental form,

$$\kappa = (Ll^2+2Mlk+Nk^2)/H\,, \qquad (2)$$

where $L = \partial^2 z/\partial x^2$, $M = \partial^2 z/\partial x \partial y$, $N = \partial^2 z/\partial y^2$ and

$$H = \sqrt{1+\left(\frac{\partial z}{\partial x}\right)^2+\left(\frac{\partial z}{\partial y}\right)^2}\,.$$

The surfaces of extremal curvature corresponding to the seafloor may now be found by computing locations of extremal values of (2) subject to the constraint (1). A standard optimisation approach, using Lagrange multipliers, yields the surfaces of extremal curvature,

$$\kappa_{\pm}(x,y) = \frac{(EN-GL-2FM) \pm \sqrt{(EN-GL-2FM)^2-4(EG-F^2)(LN-M^2)}}{2(EG-F^2)}\,.$$

Once the *surface of maximum curvature* (SMC) $\kappa_+(x,y)$ has been computed, the ridge line of maximality that forms on the resulting SMC is assumed to correspond to the FoS. This means that, in order to determine the FoS, this maximal ridge line has to be traced. A semi-automated method to achieve this tracing was conceptualised, involving a modification of the general *floodfill* tool found in most graphics packages. The modified floodfill method starts at an initial point on the SMC specified by the user and then investigates all neighbours of the point on a discretized version of the SMC. Should the curvature values of the neighbours be within a user-specified tolerance range, they are added to the list to be investigated. If, however, the curvature value of a neighbouring point lies outside the tolerance range, the point is marked as a ridge point. When all possible points have been investigated and marked as either a ridge point or a point to be analysed, the algorithm terminates. The resulting set of points marked as ridge points forms the computed foot line.

Data and Results

The *Caris Lots* software suite (mentioned above) serves as a platform for the distribution and use of a number of gridded public-domain bathymetry data sets. Specifically, *Caris Lots* offers three digital bathymetry libraries: the ETOPO five-minute data set, the ETOPO two-minute data set and the GEBCO one-minute data set. In the five-minute data set there are five minutes of latitude or longitude between two consecutive data points in the grid. One minute of latitude or longitude is equivalent to approximately one international nautical mile (1852m). The five-minute data set is therefore a rather coarse data set, with approximately 9,260km between two consecutive grid points. The two-minute data set, similarly, has approximately 3,704km between two consecutive data points and the one-minute data set has 1,852km between two consecutive data points. The cumulative source of the ETOPO data sets is not as reliable as that of the recent GEBCO data sets, and is of a lesser quality. The one and two-minute data sets were therefore used in the feasibility study. All data in the *Caris Lots* digital bathymetry libraries are defined with respect to the WGS84 global datum (hence ellipsoidal data), and was extracted to a planar format using the well-known regular Mercator map projection.

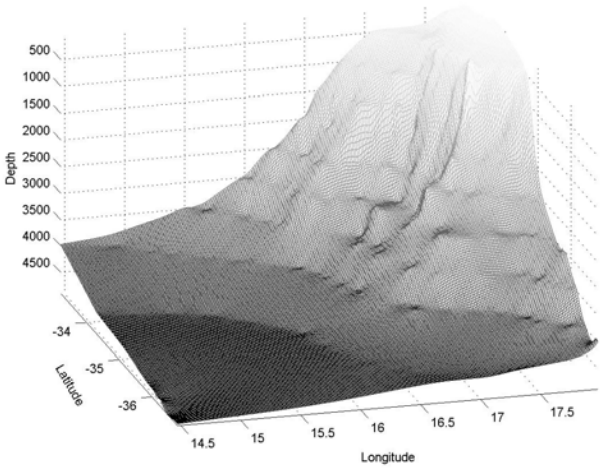


Figure 2: One-minute GEBCO bathymetric data for a portion of the South African south west coast seafloor

Application of the discretized 3D method (using standard central, forward and backward difference formulae to approximate derivatives) to a portion of the South African south west coast one-minute GEBCO data, shown in Figure 2, yielded two possible ridge lines. The SMC obtained is shown in Figure 3 and the results of application of the tracing algorithm to each of these ridges are shown on the contour plot in Figure 4.

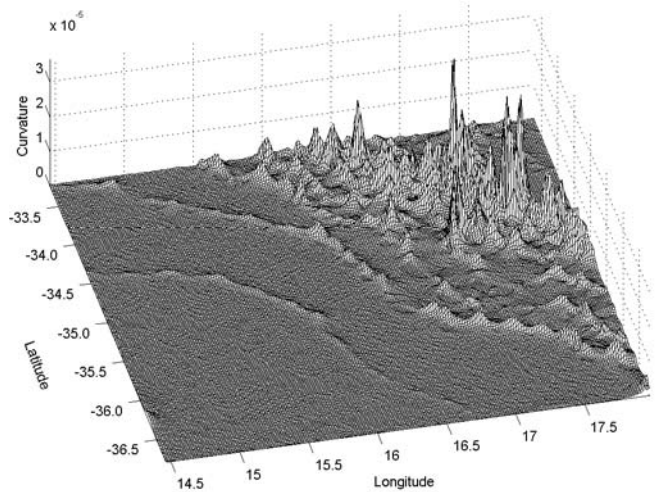


Figure 3: Non-negative truncation of the SMC corresponding to the south west coast seafloor, shown in Figure 2

Inspection of the position of the two computed foot lines in Figure 4, indicates that ridge line 1 most likely corresponds to the foot of the continental rise, and ridge line 2 corresponds to the FoS. It is very beneficial to be able to trace the foot of the continental rise, as the resulting line offers an upper bound on the seaward position that may be considered for the submitted FoS line. Ridge line 1 could therefore be used by either the United Nations Commission on the Law of the Sea, in the validation of a submitted claim and in the bounding of acceptable positions of the FoS for the region, or by the claimant, to verify that the FoS line chosen lies landward of the upper bound represented by the ridge line 1. The south west region represents an important case study, in the sense that it is the only region along the South African coast where *two* distinct and identifiable ridges were established and traced.

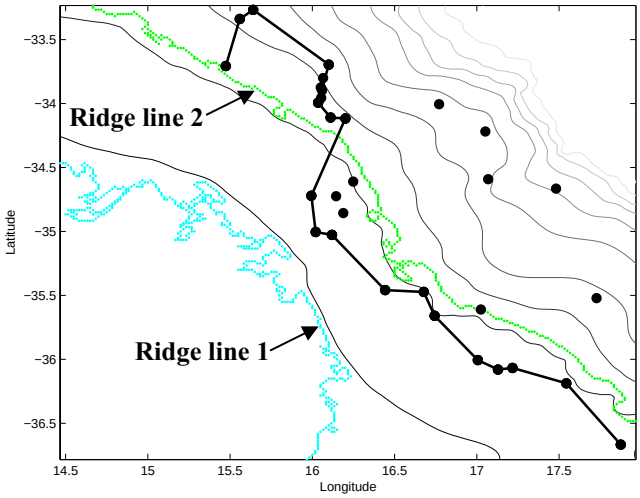


Figure 4: A comparison of the computed foot lines and a possible Caris Lots line for the south west coast. The bold faced line segments represent the Caris Lots foot line, ridge line 1 represents a possible foot of the Continental Rise position and ridge line 2 represents a possible FoS position.

In order to compare the results obtained via the 3D mathematical method described above to the results of the conventional 2D approach, a set of example foot points was extracted from *Caris Lots* for the south west coast data region, shown in Figure 2. These foot points are shown as scattered dots in Figure 4 and are typical of what would be chosen by an experienced *Caris Lots* operator during FoS determination. The resulting foot line from the example foot points is also shown as a piecewise linear curve in Figure 4, along with the two mathematically determined possible foot lines. Ridge line 2 (equated above to the FoS) offers a more advantageous claim line than the *Caris Lots* foot line in one area, but otherwise is situated inshore of the *Caris Lots* line. The area of more advantageous approximation may be as a result of *Caris Lots* including gravity, magnetic and sediment thickness variables in its computation of the FoS. One or more of these variables could be responsible for attracting the *Caris Lots* line further inshore than the computed line, based on the shape of the seafloor only.

Conclusion

The aim of this feasibility study was to ascertain whether application of a more objective 3D and mathematically based method of computation of the FoS (without data smoothing) was possible (as an alternative to the 2D *Caris Lots* approach) and, if so, whether its use would be beneficial to the claim process. Benefit, in this case, is seen as a mathematically defendable maximization of the area proposed for claim.

It was found that the 3D mathematical approach of Ou and Vanícek [2] was suitable for application to the one-minute GEBCO data available for the South African coast, and that data smoothing techniques were not required. Furthermore, the numerical results obtained were encouraging, in the sense that the FoS resulting from the 3D mathematical approach may yield an enlarged claim area, when compared to the FoS resulting from the conventional 2D approach in some instances, as was illustrated above. However, the 2D approach often seems to yield a FoS that is significantly more seaward than the FoS rendered by the 3D mathematical approach, and the question arises whether such a seaward FoS computation might not lead to an exaggerated or opportunistic claim, given the amount of bias involved in the conventional 2D approach. In some cases the discrepancies between FoS locations obtained by the two methods may be used to identify areas where further surveying should be undertaken in order to optimise the claim. Finally, the choice of whether the 3D mathematical method of FoS computation will be incorporated into research required for the South African claim process, rests entirely with the South African Working Group.

References

[1] BENNETT JO, 1998. *Mapping the foot of the continental slope with spline-smoothed data using the second derivative in the gradient direction*, US Department of the Interior, Minerals Management Service, Resource Evaluation Division, OCS Report MMS 97–0018.

[2] OU Z & VANÍCEK P, 1996. *Automatic tracing of the foot of the continental slope*, Marine Geodesy, 19, pp. 181–195. ♦

ACCURATE FORECASTING COULD SAVE ENERGY COMPANIES MILLIONS

Accurate prediction is vital for today's energy and utilities industry as it continues to adjust to an environment of change.

"The industry is beginning to feel the impact of stringent corporate governance legislation, as well as changes to operations and technology," says Peter Venn Strategic Account Manager: Eskom at SAS Institute, leaders in business intelligence.

"In addition, it is finding data management increasingly difficult as internally its systems continue to become more sophisticated. To excel in this environment, more precise and focused forecasting has become a necessary core competence," he says.

The ability to accurately predict the volume of retail and wholesale demand, along with more accurate revenue projections, can bring significant financial rewards. Improving corporate governance through the same functionality can also significantly reduce risk.

A recent benchmarking study by SAS consulting partner Capgemini – internationally recognised as leaders in the energy industry – calculated that even improvements of 0.5 percent in forecasting accuracy could yield millions of dollars in annual savings even for small and mid-sized energy companies.

"Additional intangible value can be achieved by improving revenue projections through reduced needs for re-budgeting," says Venn.

"Payback periods for forecasting improvement initiatives are typically measured in months, and the savings are realised year after year."

However, many energy companies find it difficult or impossible to achieve these savings due to a lack of integration, flexibility, and functionality in their current demand and revenue forecasting systems.

Two global companies, SAS Institute and Capgemini, have addressed this problem with an innovative new demand and revenue forecasting solution.

SAS for Adaptive Forecasting by Capgemini combines the strengths of the latter's world-class expertise in the energy industry with the former's unrivalled data warehousing and predictive analytical software.

The solution enables generators and energy delivery businesses to reduce risks, increase profitability, and provide internal value in the areas of:

- compliance with corporate governance requirements,
- portfolio optimisation and pricing strategies,
- sourcing optimisation and energy procurement strategies,
- compliance with PUC requirements for Integrated Resource Plan,
- energy balancing, and
- customer acquisition and retention.

EURO
The Association of European Operational Research Societies

The President

Paris 9/2/2005

to the member Societies
Their Presidents
The EURO representatives
The EURO Working Groups
Their Coordinators

Dear friends

As I take office as President of EURO I would like, first of all, to thank my predecessor, Laureano Escudero for the excellent work done until today in conducting EURO. I would like to take this opportunity to address you a number of important issues that are in front of us.

1. EURO has now a new visual identity (as you may see also in this letter). Our logos have changed. You can find them and download them from our web site (http://www.euro-online.org). Please feel free to use them in any appropriate occasion, when the European community of OR comes into play. May also ask you to substitute the old EURO logo with the new one in the web sites where this is used?

2. Our ``Branding OR'' campaign is going on. You can get the last news and the documents produced in the special page of our web site. With the occasion of the celebration of the 30 years of EURO a brochure explaining what OR and EURO are has been published. You can download it from our web site. You are also going to receive hard copies to your address also. If you need large amounts of hard copies please get in touch with us. If you plan to translate this document please let us know. We will be glad to support you. Our campaign of course does not end here. Another brochure more practice and profession oriented is going to be published later on in 2005 (based on the brochure produced by INFORMS and the ORS). A web site on ``OR Inside'' dedicated to explain what OR is to the young and the unaware audience is under study. We plan to have this site on line for 2006. Our colleague Horst Hamacher from the University of Kaiserslautern is in charge of this project. Please do not hesitate to contact our office in Brussels (office@euro-online.org) or myself for any feedback, idea or suggestion.

3. As you know, in 2005 EURO celebrates its 30 years (EURO has been established the 29 of January 1975 in Brussels). A first celebration event has been organised in Brussels the 28 of January and a second one is scheduled for the 15 of February in London. Further such events include: the 28 of April in Milano, the 1 of July in Münich, the 5 of July in Istanbul and later in autumn in Paris. I would like to thank the local societies who have offered their collaboration in organising these events. We are receiving very positive feedback from these events. You can know more and download the lectures from our web site.

4. Already in 2004, as President Elect of EURO, I have announced my will to visit all of member societies in order to discuss about the future of EURO. It has been already the case with the Slovak, the Turkish, the German, the Dutch, the Polish, the Spanish, the Finish and the British societies and I really learned a lot about the presence of our discipline around Europe. Further visits have been scheduled with the French, the Swedish, the Byelorussian, the Greek, the South African and the Croatian societies. However, many other remain on my

EURO
The Association of European Operational Research Societies

The President

list unscheduled. If your society is among these please do not hesitate to contact me so that we may arrange such a meeting. They represent a big value for the future of our community.

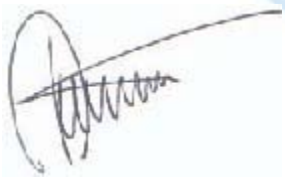
5. As you remember, during our last Council meeting in Rhodes, July 2004, we decided to go ahead in implementing the ``dual membership'' perspective for EURO: allow individuals become members of EURO, provided they are members of a member society of EURO. We will soon come up with a precise proposition as far as the statutes modifications are concerned. Please consider this issue at the highest priority.

6. As you know, since 2003, EURO discerns at each EURO conference the ``Management Science Strategic Innovation Prize''. This award is expected to compensate the most advanced contribution in a specific field of Management Science announced three years in advance. The award is sponsored presently by SAP. Presently there are openings for the 2006 edition (Humanitarian Security, jury chaired by Giorgio Gallo) and for the 2007 edition (Logistics, jury chaired by Luk van Wassenhove). You can see more details in our web site. We now have to establish the subject for the 2009 edition. For this purpose the ideas and the suggestions of the member societies and the EURO working groups is essential. I will be happy to receive your propositions from now until June 2005. At our web first site you can find the form by which you can introduce a subject for the next edition of the MSSIP. Please remember that together with suggesting an area you should suggest a potential chair for the jury. EURO puts a lot of emphasis on this later award. Your contribution is essential.

7. During 2005 we should be able to circulate the new EURO bulletin aimed to appear on a monthly basis and circulate electronically to our mailing list compiled by the registered users of the EURO web site. We also plan to upgrade our web site. As EURO we are trying to do our best to improve the services we offer to our community, our member societies and their members. Please do not hesitate to contact our office in Brussels (office@euro-online.org) or myself (president@euro-online.org) for any information, feedback, suggestion or idea. We will be happy to talk to you.

Please accept my best regards

Alexis Tsoukiàs
President of EURO



Alexis Tsoukiàs, CNRS -- LAMSADE, Université Paris Dauphine
75775 Paris Cedex 16, France, tel : +33 1 44054401, fax : + 33 1 44054091
e-mail : tsoukias@lamsade.dauphine.fr, http://www.lamsade.dauphine.fr/~tsoukias/

19TH SAIIE & 35TH ORSSA ANNUAL CONFERENCE 2005

30 August – 2 September 2005

Presenting a curious mix of contrasts, where business is combined with pleasure, action with relaxation, and finess with frivolity, the Resort enables guests to enjoy a down to earth yet regal atmosphere in understated yet sumptuous surroundings.

SOUTHERN AFRICAN INSTITUTE FOR INDUSTRIAL ENGINEERING

Emerald Casino Resort, Vanderbijlpark, Gauteng, South Africa

PREAMBLE

The fields of Industrial Engineering (IE) and Operations Research (OR) have a lot in common. Amongst other things, both use scientific methods to improve the way in which decisions are made in business and industry, in government and society. This, together with the economies of scale benefits utilised, has lead the Vaal Triangle Chapter of the Operations Research Society of South Africa (ORSSA) and the Southern African Institute for Industrial Engineering (SAIIE) to host a joint conference. The chapter is indebted to Sasol Ltd. who will be the main sponsor for this event.

Conference theme for discussion:
Building towards growth and sustainability in SA

CALL FOR ABSTRACTION

All authors interested in presenting papers of theoretical or applied nature, or case studies are invited to submit abstracts as an e-mail attachment to Petra Lawson at dvdpal@puk.co.za or send a hard copy and a disc containing the document file to Attention: Petra Lawson, P O Box 1174, Vanderbijlpark, 1900. The abstract should be a maximum of 300 words. Use MS-Word, Arial font size 11, 1½ spacing, left justification, and margins left 25mm and right, top and bottom 20mm. The title should be in bold italic font size 14 and the name(s) of the author(s), department(s), institution(s) and e-mail address(es) in regular font size 11. If more than one author, the presenter must be indicated by an asterisk. Full contact details of authors and institutional affiliations and a short CV (not more than 100 words) must be included. Full papers are not required since authors are encouraged to publish in the accredited journals of SAIIE and ORSSA. Presentations will be confined to 20 minutes plus a 5 minutes question time.

IMPORTANT DATES

3 June 2005:	Deadline for submission of abstracts
20 June 2005:	Notification of acceptance of abstracts
1 July 2005:	Deadline for early-bird registration
11 August 2005:	Deadline registration and payment

PROVISIONAL PROGRAMME OUTLINE

Day 1	Afternoon:	Registration
	Evening:	Welcoming function
Day 2	Conference program:	Sessions
	Evening:	Social event
Day 3	Conference program:	Sessions
	Evening:	Gala Dinner
Day 4	Conference program:	Sessions
	Afternoon:	Industry visit

The detailed programme will be announced once it has been finalised

CONFERENCE REGISTRATION

Full conference:		**Early bird**	**Normal fee**
Non-Members	Non-speaker	R2 400.00	R2 900.00
	Speaker	R2 000.00	R2 500.00
Members	Non-speaker	R2 000.00	R2 500.00
	Speaker	R1 600.00	R2 100.00
Full-time students (members only)		R 800.00	R1 600.00

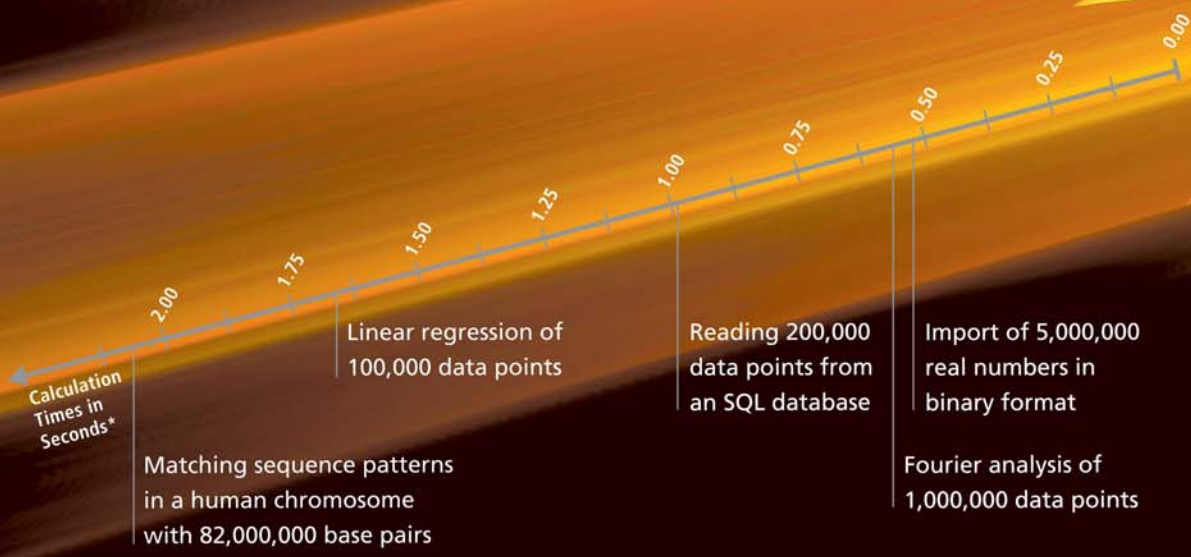
Day attendance (excluding all functions and industry visits):	
Non-members	R1 600.00
Members	R1 200.00
Full-time student (members only)	R 800.00

Accompanying persons:	
Welcoming function	R 170.00
Social event (Day 2)	R 170.00
Gala dinner	R 260.00

A 20% surcharge will be payable on all fees received after the deadline dates.

General & Registration Enquiries:
Ms Petra Lawson
Tel & fax +27 (0)16 910 3442
E-mail dvdpal@puk.ac.za

Analyze data at HIGH SPEED...



...when you use MATHEMATICA® 5.1

JUST RELEASED November 2004

Mathematica 5.1— Adding unmatched performance for handling data to unparalleled speed, scope, and scalability

- Industrial-strength string manipulation
- Built-in universal database connectivity
- Highly optimized binary data I/O
- Additional import-export formats, including XLS & AVI
- Integrated web services support
- 2D and 3D automated network visualization
- High-performance array visualization
- Numerical linear algebra performance enhancements
- Fully integrated piecewise functions
- Integration over implicitly defined regions
- Event handling in numerical differential equations
- New algorithms for symbolic differential equations
- Cluster analysis capabilities added
- Interactive exploration tool for differential equations
- *MathematicaMark*™ benchmarking tool
- *GUIKit* interface and application builder—now built in
- and many more innovations

A Selection of *Mathematica* Features

Numeric computation: full support for arbitrary and machine precision • hundreds of mathematical functions fully implemented for all parameters • fast sparse and dense matrix operations • solvers for equations and differential equations • finite and infinite sums and products • integral transforms • global optimization • linear programming • automatic or manual algorithm selection • precision control

Symbolic computation: expanding • factoring • simplification • solvers for equations, differential equations, difference equations, and inequalities • sums • products • differentiation • integration • limits • power series • integral transforms • algebraic and semi-algebraic domains

Discrete mathematics: combinatorics • graph theory • computational geometry • number theory • Diophantine equations

Statistics and data analysis: descriptive statistics of uni- and multivariate data • generalized linear and nonlinear fitting • multidimensional interpolation • convolution • correlation • regression • ANOVA • confidence intervals • distributions • hypothesis testing • statistical plots

Programming: multiparadigm symbolic programming language • support for procedural, functional, list-based, rule-based, and object-oriented programming • advanced pattern matching • just-in-time compilation • platform-independent implementation

Graphics: over 50 2D and 3D plot types • graphics language • animations • sound generation

Connectivity: .NET, Java, and C/C++ APIs • import and export filters for over 40 data and image formats • XML support • symbolic language XML

Publishing: full technical document system for presentation, print, and the web • interactive typesetting and graphics • sound • outlining • one-step export to TeX, LaTeX, XML, MathML, HTML, and XHTML

Platforms: Windows, Macintosh, Linux, other Unix platforms • web and grid versions available

User interface: WYSIWYG notebook interface • programmable buttons and palettes • presentation environment with slide show • fully interactive help

WOLFRAMRESEARCH

Contact your local distributor:

BLUESTALLION technologies
WWW.BLUESTALLION.CO.ZA

PO Box 742
Saxonwold, 2132
Johannesburg
Tel: (011) 447 9916
Fax: (011) 447 9911
info@bluestallion.co.za

Test *Mathematica* 5.1 on your computer today with our free trial download at www.wolfram.com/m51trial

* Times represent the average of ten computations on a 3.0GHz Pentium IV, 2 GB RAM, Windows XP SP1.

With SAS® software's complete vision for performance management...

Align every aspect of your business. And gain a single, shared view of your targets.

ENTERPRISE INTELLIGENCE

SUPPLIER INTELLIGENCE

ORGANIZATIONAL INTELLIGENCE

CUSTOMER INTELLIGENCE

INTELLIGENCE PLATFORM

New competitive threats. The proliferation of products and channels. Increased regulatory scrutiny. The growing complexity of doing business has intensified your need to obtain a single, consolidated view of performance. And a clear path for executing strategies more effectively. SAS software provides an all-encompassing view of your business. One that goes beyond strategy, planning and finance to encompass all areas of your company including customers, suppliers and operations. It's a breakthrough vision no other software can deliver. Hear why, direct from the experts. To find out more, call **Johannesburg (+27 11) 713 3400 or Cape Town (+27 21) 689 7870 or visit our Web site.**

www.sas.com/align

SAS 9

The Power to Know.

sas