

## Editorial

At the start of the new year it is indeed a pleasure to wish the entire international OR community a wonderful 2009! May this year be better than 2008 and may you all be blessed with good health, joy and many challenges, but also with fulfilment of your endeavours, whatever these may be.

This edition of the newsletter contains a variety of articles, although the majority of these are related to developing countries. The piece from the IFORS executive, Grazia Speranza, is devoted to the state of OR in Africa. Both IFORS and EURO have devoted time and effort over the past number of years to initiatives of getting more OR activities going in Africa. She reports on these and sketches possible ways of taking these initiatives further. Along the same lines, IFORS is calling for proposals to host workshops on OR in developing countries. A fairly comprehensive report on one such IFORS-sponsored initiative, namely the 4th ORPA (Operations Research for Practice in OR) conference that took place in Washington DC, prior to the INFORMS conference, is also contained in this edition. Jim Cochran, who was the organiser of ORPA 4, wrote the report and, although the conference was small, all the delegates got to know one another and were able to share their interesting work.

At the most recent IFORS conference held in South Africa, IFORS again ran the IFORS prize for OR in development. In the September 2008 edition of this newsletter the chair of the adjudication panel, Paul Fatti, reported on how the competition was run, among other things. From all accounts it seemed to have been very successful. The outcome of the competition is that a winner and runner-up were selected from the eight finalists and their names announced during the IFORS conference. Both the winner and runner-up were requested to prepare a short article for the newsletter on their award-winning work. The two articles are presented here, although the article on the winning paper is a shortened version compiled by me as editor of the newsletter. The main author was unable to prepare this due to bad health. It is also important to note that the full papers have automatically been submitted to ITOR (International Transactions in Operations Research) for publication, where the normal review process will be followed.

The most recent IFORS distinguished lecture was presented at the INFORMS conference in Washington DC. Professor Michel Balinski from École Polytechnique and CNRS in France was the IDL and he gave a very interesting talk on "The Majority Judgement: A New Theory for Better Decisions". We appreciate it that he took the time to write a short summary based on his presentation for the newsletter. The OR Society of China held their quadrennial meeting in Nanjing, which was attended by Elise del Rosario, and we have a short report on that. An update on ITOR is presented while a whole range of conference announcements is also reported on.

Finally, I would like to extend an invitation to anyone that wants to contribute to the newsletter in whatever way - please don't hesitate to send me material for publication.

**Hans W Ittmann**  
Newsletter editor  
hittmann@csir.co.za



◀ Awardee Min Yue, a well-respected OR figure in China receiving the award during the ORSC Quadrennial Meeting in Nanjing. To read the article, go to page 7

## INSIDE THIS ISSUE

<i>State of OR in Africa</i>	2
<i>ORSC Holds Quadrennial Meeting in Nanjing</i>	3
<i>IFORS Distinguished Lecture, INFORMS 2008</i>	4
<i>Call for Proposals to Host Workshop on OR in Development</i>	6
<i>IFORS Prize for OR in Development - 1st and 2nd prize winners</i>	7
<i>Announcement - EDDA 2009</i>	11
<i>ORPA 4 – Using Operations Research to address Urban Transportation and Water Resource Management Issues in Africa</i>	12
<i>Call for Papers: Land Workshop</i>	14
<i>An update on ITOR</i>	14
<i>Announcement - ICOREM 2009</i>	14
<i>Special track on "Scheduling in Manufacturing Systems" for INCOM 2009</i>	15
<i>OR-Related Conferences</i>	15

This newsletter may be reproduced in whole or in part. We encourage reprinting in national and local operations research periodicals. Acknowledgement to IFORS would be appreciated.

# State of OR in Africa



*When the editor of the IFORS newsletter, Hans Ittmann, asked me to write an editorial about the state of OR in Africa, I immediately accepted.*

One may wonder why he asked me to write about Africa. Since the beginning of 2008, I am a member of the executive committee of EURO and a vice-president of IFORS, representing EURO. South Africa is the only African member society of IFORS and is at present a member of EURO. Hopefully, in the near future Africa will become an independent regional grouping, like ALIO (Asociacion Latino-Ibero-Americana de Investigacion Operativa), APORS (Association of Asian-Pacific Operational Research Societies), EURO (Association of European Operational Research Societies) and NORAM (Association of North American Operations Research Societies).

The issue of how to develop OR in Africa had been under discussion within EURO and IFORS for a while and the need to coordinate the efforts of EURO and IFORS suggested the creation of a committee specifically devoted to this goal. Adam Ouorou and Theodor Stewart enthusiastically accepted my invitation to join me and be part of this committee. This editorial is broadly based on the information and ideas they provided and I would like to thank them on behalf of IFORS.

In Africa, with the notable exception of South Africa, it is unrealistic to state that OR is an established scientific discipline. Most of the teaching is occasional and limited to linear programming, statistics and game theory. There have been many attempts to promote OR through conferences with greater or less success. Let me first give a short overview of the state of OR in Africa and then sketch some directions IFORS and EURO could follow to promote OR.

**SOUTH AFRICA** - South Africa is the country where OR has really taken off. Its OR society is active with the organisation of activities and regular meetings (<http://www.orssa.org.za/wiki/pmwiki.php>). Last July, the IFORS conference held in Sandton was attended by over 600 participants from all over the world,

an extraordinary event that also had symbolic value for South Africa and for Africa in general.

**WEST AFRICA** - A conference was organised in Ouagadougou (Burkina Faso) with the Faculty of Mons (Belgium) and with EURO support in 2003 (<http://164.15.126.46/africanOR/EnglishFrame.htm>). This resulted in the creation of the West and Central African Operational Research Society (called ROCARO in French). Another conference was held in 2005 in the same city (<http://www.euro-online.org/africanOR/orpa2005En.htm>). In September 2007, a workshop followed by a conference was organised in Benin in the framework of a cooperation agreement with Brazil.

**EAST AFRICA** - An active operations research society seems to exist, since the fourth conference organised by this society was held on July 2008 in Tanzania. (<http://www.fcm.udsm.ac.tz/orsea.pdf>)

**CENTRAL AFRICA** - No information is available about activities related to OR.

**NORTH AFRICA** - Some OR societies have been created in North Africa. The most important one is SOMARO (<http://www.ucam.ac.ma/fssm/somaro>), which organised the CIRO conferences. It was intended to hold this series every three years since its creation in 1996. However, the last conference was held in 2005; the 2008 series did not take place and there is no news about whether or when the next one will be organised. There was also an attempt in Tunisia (<http://www.chez.com/tmss>) but it looks like the society no longer exists after the FRANCORO conference, which was the formation of this society.

This overview shows that OR activities have been taken place in a number of African countries, but these are often difficult to maintain and to capitalise on. It seems to be difficult to create a stable OR group in some African countries, while an active role of local societies, built on a stable OR group, is crucial.

Training is likely to be the most important initiative to start within regions where OR is not yet well established. The training may consist of setting education programmes focused on the practical value of OR. With a five-year project duration, it should be possible to keep graduates in Africa in order to spread the reach of the subject.

To establish successful education programmes focused on OR, we could:

- involve African professors who have the skills and who accept to teach OR subjects;
- involve non-African professors who accept to teach or to co-supervise students with African professors;
- create a network of graduates.

A reasonable start for this project may involve one or two African universities and interesting course content. The same programme and group of teachers may possibly be involved at different universities. Creating a Master's degree in OR is an ambitious goal. The best students may continue with PhDs, supervised in cooperation with universities abroad. Cooperation in PhD training is important, but one should ensure that graduates in return contribute to the development of OR in Africa, for example through training activities in case they will not be employed in Africa.

Conferences, workshops and seminars are important, but these should be viewed as complementary to training, which should form the basis. We should first ensure the stable existence of OR and then reinforce it with conferences and/or workshops.

IFORS looks forward to welcoming Africa soon as an independent regional grouping!

**M. Grazia Speranza, IFORS Vice-President representing EURO, [speranza@eco.unibs.it](mailto:speranza@eco.unibs.it)** ■



# ORSC Holds Quadrennial Meeting in Nanjing

*IFORS President Elise del Rosario was on hand to participate in the Operations Research Society of China (ORSC) National Congress (ORSC2008) held from Oct 18 to Oct 21, 2008 in Nanjing.*

Attended by over 450 participants, the conference has traditionally been convened every four years, supplemented by a biannual academic conference. The Congress featured plenary talks, paper presentations, the ORSC election, competition, and committee meetings.

Plenary talks by Elise del Rosario, Jong-Shi Pang of the University of Illinois, and Xiang-Sun Zhang of the Chinese Academy of Sciences opened the conference. Other plenary speakers included overseas Chinese OR researchers from US, Hong Kong and Taiwan.

In the opening session, Changgen Feng of the China Association of Science and Technology and President of the host university, China Southeast University, Hong Yi, welcomed the participants. This was followed by the presentation of the ORSC award to Minyi Yue for his devotion to OR research in China and his academic contributions. He is considered one of the founders of OR in the country and a well-known professor in the areas of combinatorics, queueing theory, and scheduling. In another session, Young Operations Researcher Awards were conferred to Yanfei Wang, Quanxin Zhu, and Niepu Yan.

The business meeting saw the re-election of current ORSC President Yaxiang Yuan for a term of four years, as well as the installation of the heads of special committees. The newly-elected council is looking at ways of strengthening the society's links to IFORS, APORS and other national OR societies.

ORSC2008 marks the first attendance of an IFORS president in the event. Other guests invited in the past include Masanori Fushimi from ORSJ as well as Charles Larson and Mark Daskin from INFORMS,

Since IFORS99 in Beijing, ORSC events have become more international and attracted more young operations researchers. Majority of its more than 500 members come from universities and research institutes. ORSC plans to play an active part in getting OR applied in industry and be relevant to the rapidly developing economy of China. A step in this direction can be seen in the election into the ORSC council of more representatives from the consulting and financial areas.

The conference was not only academically enriching also afforded a lot of opportunities for social interaction through several banquets and the one-day outing to Yangzhou. The success of ORSC2008 owes much to the efforts put in by the society secretariat and local organizers from Nanjing's SEU.

**Degang Liu, ORSC** ■



◀ *Elise del Rosario while giving the opening plenary talk.*



▲ *The opening ceremonies*



▲ *3 recipients of the Young Operations Researcher Awards*



▲ *The organizing staff and committee for the conference*



# IFORS Distinguished Lecture, INFORMS (2008)



*In 1999 IFORS established a special program, called IFORS Distinguished Lectures (IDL), to recognize distinguished OR scholars and analysts and support member societies and regional groupings.*

**Prof Michel Balinski receives the award from Thomas L. Magnati** ►



Through this program IFORS is sponsoring lectures by distinguished OR scholars and analysts at conferences of members societies and regional groupings. The most recent IFORS distinguished lecturer is Prof Michel Balinski who presented his lecture at the INFORMS meeting held in Washington, DC in October 2008. Prof Balinski is very well known in his field. A short CV of him is presented here plus an extended summary of his presentation at INFORMS. I would like to thank Prof Balinski for the time and effort in preparing this extended summary.

## DIPLOMAS

- B.A., Mathematics, Williams College (1954)
- M.S., Economics, Massachusetts Institute of Technology (1956)
- Ph.D., Mathematics, Princeton University (1959)
- Honorary Master of Arts, Privatim, Yale University (1978)
- Docteur honoris causa, Mathematics, Universität Augsburg (2004)

## PRINCIPAL POSITIONS

- Research Associate and Lecturer, Mathematics, Princeton University, Princeton (1960-63);
- Associate Professor, Economics, Wharton School et University of Pennsylvania, Philadelphie (1963-65);
- Associate Professor (1965-69) then Professor (1969-77), Mathematics, Graduate School and University Center, The City University of New York;
- Chairman, System and Decision Sciences, International Institute for Applied Systems Analysis, Laxenburg, Autriche (1975-77);
- Professor of Organization and Management and of Administrative Sciences, Yale University, New Haven (1978-80);
- Professeur, Institut Auguste Comte, Paris (1980-82);
- Leading Professor of Applied Mathematics and Statistics, and of Economics, State University of New York, Stony Brook (1983-90);
- Directeur de Recherche (de classe exceptionnelle) au CNRS, Laboratoire d'Économétrie de l'École Polytechnique, Paris (1983-99);
- Founder and first Director, Institute for Decision Sciences, State University of New York, Stony Brook (1986-90);

- Directeur du Laboratoire d'Économétrie de l'École Polytechnique (1989-99);
- Directeur de Recherche (de classe exceptionnelle) émérite, CNRS, Laboratoire d'Économétrie de l'École Polytechnique (1999-).

## OTHER

- Phi Beta Kappa (1954);
- Lanchester Prize, Operations Research Society of America (1965);
- IBM World Trade Corporation Fellow (1969-70); Founder and first Editor-in-Chief, Mathematical Programming, (1970-80);
- Lester R. Ford Award, Mathematical Association of America (1975);
- President, Mathematical Programming Society (1986-89);
- Messenger Lecturer, Cornell University (2007);
- George H. Hallett Award, American Political Science Association (2008);
- IFORS Distinguished Lecturer, INFORMS (2008);
- Visiting Professor at University of Michigan, Ecole Polytechnique Fédérale de Lausanne, Université Scientifique et Médicale de Grenoble, INSEAD;
- Consultant to RAND Corporation, Mathematica, Inc., Mobil Oil Research Laboratories, ORTF, Econ, SNECMA, Mayor of the City of New York, SIAAP, ...
- Author of well over a hundred articles in scientific journals, editor of several books.

## BOOKS

- Fair Representation : Meeting the Ideal of One Man, One Vote, Yale University Press, New Haven, 1982 ; 2nd edition, Brookings Institution Press, Washington, D.C., 2001 (with H.P. Young).
- Le suffrage universel inachevé, Éditions Belin, Paris, 2004.
- One-Value, One-Vote : Measuring, Electing and Ranking (tentative title), to appear 2009 (with Rida Laraki). >>



# The Majority Judgement: A New Theory for Better Decisions

By Prof Michel Balinski

## THE IDEA

The *American Heritage Dictionary of the English Language* explains: “**Operations research.** *n.* Mathematical or scientific analysis of a process or operation, used in decision making.” INFORMS concurs: “the application of advanced analytical methods to help make *better* decisions” (emphasis added).

Electing and ranking are certainly processes or operations that make decisions in a vast array of domains. Nations, societies, unions and other large institutions elect presidents, senators, representatives, treasurers, judges, sheriffs, . . . ; juries (of 5 to 12) rank figure skaters, gymnasts, divers, wines, cheeses, . . . ; juries of companies rank employees (“forced ranking”); committees rank nominees for Dantzig and Edelman awards, for von Neumann and Lanchester prizes, for Nobel and other prizes; all kinds of juries rank universities, hospitals, restaurants, hotels, movies, beauty queens, muscle men, professors, students, dogs, pianists, flutists, marching bands, . . . . As Arthur Miller (the dramatist and one-time husband of Marilyn Monroe) once quipped, “We’re ranking everybody every minute of the day.”

It is a curious fact that the theoreticians of voting - the specialists of the theory of social choice - have steadfastly modelled and analyzed the problem in the same way since 1299 (when Ramon Llull suggested a refinement of Condorcet’s rule): every voter, or every judge, rank-orders the competitors and the rule or mechanism amalgamates these into the rank-order of society or the jury. The fact is curious because the model leads to paradoxes, impossibility and incompatibility theorems (notably Arrow’s): i.e., the model leads to an inconsistent theory.

On the other hand, the more pragmatic folk - those faced with judging figure skaters, gymnasts, wines, pianists, . . . , - *all* have invented their own *ad hoc* methods. Instead of rank-ordering competitors, judges assign them points and the points are used to determine the juries’ rank-orders. The difficulty with their methods is that they invariably add or average the points to determine rank-orders, and this opens the door to strategic manipulation and outright cheating (by giving high points to favorites, low points to their opponents), as happened in the 2002 Winter Olympic Games in pairs figure skating.

The *majority judgement* is a method of voting and judging that emerges as the optimal method - by the traditional criteria of the theory of social choice - when the problem is modelled differently. The model follows the lead of the pragmatists: for, although adding points is a bad idea, we noticed - Rida Laraki, my colleague in this venture, and I - that the points they used are invariably well defined, and constitute what we now call *common languages*: their meanings are clear to everyone, though there may be disagreement on how many points a competitor merits. An everyday example is the number of stars given a hotel or given a restaurant: it is a meaningful common language.

Our model postulates a common language of grading (continuous or discrete), our theory imposes the reasonable axioms of traditional social choice. It then characterizes the majority judgement as the unique method that satisfies a number of different desirable properties. In this model Arrow’s theorem says: if there is no common language there can be no consistent decisions (which is only sensible: imagine the presidents of China and the USA trying to reach a decision with no common language!). As in the traditional theory there is no method that is absolutely perfect, but the majority method is uniquely the best that can be done. In particular, there is no method that can completely prevent strategic manipulation or cheating, but the majority judgement best combats it.

## JURIES: FEW JUDGES

The majority judgement itself is easy enough to explain; indeed, its explanation has persuaded some pragmatists to accept it already. The

basic point of view is that voters and judges do not vote: they evaluate candidates in a common language of grades. So, to begin, there must be a common language. It is best to explain the ideas in the context of examples. Consider, first, wines.

The *Union Internationale des Œnologues’s* language of grades is: *Excellent, Very Good, Good, Passable, Inadequate, Mediocre, Bad*.<sup>1</sup> The *majority-grade* of a wine is the middlemost (or median) of its grades if there is an odd number of judges; the lower-middlemost if there is an even number of judges (the choice of lower-middlemost is *deduced* from a principle of consensus). Suppose three wines are given the grades in the table on the left below (only the grades count, not who gave them, so the grades are listed from best to worst).

Anjou	Bourgogne	Chablis	Anjou	Bourgogne
<i>Very Good</i>	<i>Excellent</i>	<i>Excellent</i>	<i>Very Good</i>	<i>Excellent</i>
<i>Very Good</i>	<i>Very Good</i>	<i>Excellent</i>	<i>Very Good</i>	<i>Very Good</i>
<i>Good</i>	<i>Good</i>	<i>Very Good</i>	<i>Good</i>	<i>Good</i>
<i>Good</i>	<i>Good</i>	<i>Passable</i>	<i>Passable</i>	<i>Mediocre</i>
<i>Passable</i>	<i>Mediocre</i>	<i>Mediocre</i>		

The Chablis is *Very Good*, the other two *Good*. How are the two to be distinguished? They have the same majority-grade, so the remaining grades must distinguish them. Drop the majority-grade from each, then find the (“second”) majority-grade of the grades that remain (see table on the right): both are again *Good*. So drop the second-majority-grade to find their third-majority-grades: *Very Good*, again the same; drop it from each, to find that Anjou’s fourth-majority-grade is *Passable*, Bourgogne’s merely *Mediocre*, so the final *majority-order* is first Chablis, second Anjou, and last Bourgogne. As is obvious, two wines can always be distinguished unless their grades are identical.

## ELECTIONS: MANY VOTERS

Consider, now, the example of a national election with many voters. INFORMS members were kindly invited to participate in an electoral experiment on the web (131 responded). The ballot posed the question: “*To be the President of the United States of America, having taken into account all relevant considerations, I judge, in conscience, that this candidate would be:*”, and there followed the names of eight candidates, together with their affiliations (see table below), and grades with which to answer the question. The grades were: *Excellent, Very Good, Good, Acceptable, Poor, to Reject*, or “No opinion.” The ballot clearly stated that “No opinion” counts as *Reject*. The usual method offers voters nine possibilities to express their opinions: to indicate one of eight candidates, or none. The majority judgement offers  $6^8 = 1, 679, 616$  possibilities to express their opinions. The results were:

	Exclt	VyGd	Good	Accpt	Poor	tRej
Barack H. Obama, Dem.	35.9%	32.1%	12.2%	8.4%	7.6%	3.8%
Hillary R. Clinton, Dem.	16.0%	29.0%	21.4%	16.8%	11.5%	5.3%
Colin L. Powell, Indep.	10.7%	22.1%	26.0%	26.7%	6.9%	7.6%
Michael R. Bloomberg, Indep.	3.1%	14.5%	24.4%	26.7%	9.2%	22.1%
John R. Edwards, Dem.	1.5%	13.0%	22.1%	30.5%	18.3%	14.5%
John S. McCain, Rep.	3.1%	7.6%	23.7%	21.4%	30.5%	13.7%
W. Milt Romney, Rep.	0.8%	7.6%	10.7%	27.5%	30.5%	22.9%
Michael D. Huckabee, Rep.	3.8%	3.8%	6.1%	19.8%	19.1%	47.3%

<sup>1</sup> It grades each of 14 characteristics of a wine with these grades, assigns points to each, then adds them. The majority judgement has been generalized to this “multi-criteria” case.

>>



When there are many voters, a majority of voters assign a candidate at least his or her majority-grade, and also a majority of voters assign the candidate at most his or her majority-grade. For example, Clinton's majority-grade is *Good*: 16.0% + 29.0% + 21.4% = 66.4% assign her at least *Good* and 21.4% + 16.8% + 11.5% + 5.3% = 55.0% assign her at most *Good*.

The procedure for finding the majority-ranking when there are many voters or judges may be simplified. Suppose  $\alpha$  is the majority-grade,  $p$  the % of grades higher than  $\alpha$ ,  $q$  the % of grades lower than  $\alpha$ . Then the *majority-gauge* is  $(p, \alpha^\pm, q)$ , where  $p > q$  implies  $\alpha$  is endowed with a +, and otherwise it is endowed with a -. Thus Clinton's majority-gauge is (45.0%, *Good*+, 33.6%). The majority-gauges determine the rank-order of the candidates. Naturally,  $\alpha^+$  ranks higher than  $\alpha^-$ , which suffices to rank-order all the candidates except Bloomberg and Edwards who both have the majority-grade *Acceptable*+. If two candidates have an  $\alpha^+$ , then the one with the larger  $p$  ranks higher; and if two candidates have an  $\alpha^-$ , then the one with the higher  $q$  ranks lower. So Bloomberg with  $p = 42.0\%$  ranks higher than Edwards with  $p = 36.6\%$ .

It is easy to see that the majority judgement is *strategy-proof-in-grading*. One or *all* of those who gave Clinton the grade *Very Good* cannot change her majority-gauge *except* to lower it (presumably not their intention). Similarly, one or *all* of those who gave her *Acceptable*, *Poor* or to *Reject* cannot change her majority-gauge *except* to raise it (presumably not their intention).

	$p$	$\alpha^\pm$	$q$
Barack H. Obama	35.9%	<i>Very Good</i> +	32.0%
Hillary R. Clinton	45.0%	<i>Good</i> +	33.6%
Colin L. Powell	32.8%	<i>Good</i> -	41.2%
Michael R. Bloomberg	42.0%	<i>Acceptable</i> +	31.3%
John R. Edwards	36.6%	<i>Acceptable</i> +	32.8%
John S. McCain	34.4%	<i>Acceptable</i> -	44.2%
W. Milt Romney	46.6%	<i>Poor</i> +	22.9%
Michael D. Huckabee	33.5%	<i>Poor</i> -	47.3%

## CONCLUSION

The age old model of social choice is inconsistent. Moreover, neither voters or judges of figure skating or diving think in terms of rank-ordering competitors: the old model is bad because it is unreal. Experiments have proven this for voters. For judges confronted with many competitors, the task of rank-ordering them is too difficult. Although this is obvious there is evidence to support it. When (in the past) figure skating procedures demanded that judges rank-order competitors, the judges were asked to announce points: their rank-orders were deduced from the points.

"During the Middle Ages," Richard Feynman wrote, "there were all kinds of crazy ideas, such as that a piece of rhinoceros horn would increase potency. Then a method was discovered for separating the ideas - which was to try one to see if it worked, and if it didn't work, to eliminate it. This method became organized, of course, into science." The time has come to discard the traditional model, replace it with a more realistic model, and accept its logical implications. . . : a method that feels natural even to those who are unable to follow the arguments that show it dominates every known method of voting or judging.

## REFERENCES:

1. U.S. Patent pending for "The qualified-majority judgement" (including the multi-criteria case).
2. Michel Balinski and Rida Laraki, "Le jugement majoritaire : l'expérience d'Orsay," *Commentaire* no. 118, etc 2007, pp. 413-419.
3. Michel Balinski and Rida Laraki, "A theory of measuring, electing and ranking," *Proceeding of the National Academy of Sciences USA*, May 22, 2007, vol. 104, no. 21, pp. 8720-8725.
4. Michel Balinski and Rida Laraki, "Election by Majority Judgement: Experimental Evidence." *Cahier du Laboratoire d'Econometrie de l'Ecole Polytechnique*, December 2007, no. 2007-28.
5. Michel Balinski and Rida Laraki, *One-Value, One-Vote: Measuring, Electing, and Ranking* (tentative title), to appear 2009.
6. Web-site: <http://ceco.polytechnique.fr/jugement-majoritaire.html> ■

# Call for Proposals to Host Workshops on OR in Development

Since 1992, IFORS has organized a series of International Conferences on OR for Development (ICORD), approximately every three years. In an effort to enhance continuity and sustain interest in the field, IFORS is launching a program to conduct more frequent workshops in different regions. Such workshops must be devoted to a particular theme for OR in Development (ORD), such as health, food, poverty, etc. The intention is that representatives from such workshops would present their findings and follow up work at a full meeting held in conjunction with the IFORS Triennial Conference.

The aims of the new structure are to achieve:

- A greater momentum for the ORD programme through greater frequency and visibility of actions; and
- Improved focus for ORD activities on selected problem-oriented themes.

A further possibility is to include educational workshops linked to some or all of the regional workshops, aimed at developing appropriate OR skills in the region.

IFORS has provisionally reserved funds of US \$10000 for the costs of each such workshop, and discussions are being undertaken with potential sponsors for the associated educational workshops.

At this stage, we are inviting proposals from member societies of IFORS to host and organize such an ORD workshop. One or two workshops are being planned for 2009. Proposals should be sent to the secretary of IFORS ([secretary@ifors.org](mailto:secretary@ifors.org)), and should contain detailed proposals on at least the following issues:

1. Proposed theme of the workshop, which should preferably represent application of OR methods to a specific development problem;
2. The region at which the workshop is targeted, which should include one or more developing countries;
3. Expected number of attendees and region/country to be represented;
4. Benefits (social, economic, organizational, etc) and relevance of the workshop theme to the region/country;
5. Dates and venue for the workshop;
6. Names of the local organizing committee (IFORS will appoint a programme advisory committee.); and
7. A provisional budget.

Those intending to put forward a proposal are invited first to discuss the proposals informally with any of:

- Elise del Rosario ([elise@JGdelRosario.com](mailto:elise@JGdelRosario.com)), IFORS President;
- Horacio Yanasse ([horacio@lac.inpe.br](mailto:horacio@lac.inpe.br)), IFORS vice president; or
- Theo Stewart, ([theodor.stewart@uct.ac.za](mailto:theodor.stewart@uct.ac.za)), Chair of the IFORS Developing Countries Committee. ■



# IFORS Prize for OR in Development - 1st and 2nd prize winners

*As part of the IFORS triennial conferences it has now become tradition to run the IFORS competition for OR in Development. As indicated by Paul Fatti, chair of the adjudication committee, in the September 2008 edition of the IFORS newsletter the OR in Development Prize competition is an IFORS initiative aimed at encouraging papers of good applications of OR in developing countries by OR practitioners from these countries with an emphasis on development issues.*

We present extended summaries of the winning paper as well as the runner-up paper. The full papers will be submitted to ITOR (International Transactions in Operations Research). In the case of the winning paper the extended summary was prepared by myself, the editor of the IFORS newsletter, using the full paper that was submitted for the competition. Due to health reasons the main author, Mohamed Haouari, was not able to prepare this in time for publication in the newsletter.



▲ *Mohammed Haouari, the winner, with Paul Fatti and Elise del Rosario*

## *Winning Paper: Integrated Aircraft Fleeting and Routing at TunisAir*

### Introduction

This paper describes models and solution approaches for integrated airline operational planning problems that arise at the Tunisian national carrier TunisAir, where the fleeting and aircraft routing problems are considered simultaneously. During the last decade, TunisAir has become a preeminent successful carrier, ranking among the top five largest African airline companies. During 2007, TunisAir transported nearly 4 million passengers and operated a state-of-the-art fleet including a mix of 30 Boeing and Airbus aircraft. Also, TunisAir has just obtained its IOSA (IATA Operational Safety Audit) certification, which is regarded as being the highest certification for airline companies on an international scale. Operating in a highly competitive environment, TunisAir is compelled to control its costs by managing flights and aircraft effectively. Similar to most airline companies, TunisAir uses a sequential procedure in its complex operations planning process, which includes schedule planning, fleet assignment, aircraft routing, and crew scheduling. Accordingly, each problem is modelled and solved independently of the remaining ones, even though there is a clear interaction between them. This procedure considerably reduces the complexity of the process but, since the solution of one problem does not take into account the considerations which affect subsequent problems, it results in overall suboptimal solutions that may be far from optimality. Moreover, finding feasible solutions may become difficult because flexibility is reduced by previously decisions. Consequently, TunisAir asked the authors of this paper to investigate novel approaches to model and solve these problems simultaneously so as to obtain improved solutions that would lead to substantial savings over the sequential approach. Such a lower cost is an immediate necessity for TunisAir in today's extremely competitive market. Instead of acquiring sophisticated ready-made commercial airline planning software, TunisAir has chosen to develop homemade customized software, which offers significant advantages of simplicity, adaptability, and substantially lower investments.

In the paper, the authors address the Aircraft Fleeting and Routing Problem (AFRP) which can be described as follows. Given a schedule of flights to be flown, the problem consists of determining a minimum cost route for each aircraft so as to cover each flight by exactly one aircraft while satisfying maintenance requirements and other activity constraints. The inputs for the problem include a schedule of flights with their demands,

a set of aircraft of different types or fleets, maintenance requirements and activity restrictions (i.e., turn-time restrictions at each station, which specify the minimum time that is required after the landing of an aircraft to prepare it for its next takeoff), costs of assigning aircraft to flights, as well as maintenance and deadhead costs. A deadhead flight, or deadhead, is a passive flight used to reposition an aircraft to a different station where it is needed to cover a flight leg. These costly deadhead flights stem from the current TunisAir's network where international flights depart from five different airports located at the cities of Tunis, Monastir, Sfax, Jerba, and Tozeur. A solution to this problem specifies the individual aircraft assigned to each flight as well as the sequence of flights to be flown by each aircraft. The problem is to find a solution having a minimum total cost, where the cost of assigning an aircraft to a flight includes operating costs (fuel, taxes, etc.), deadhead (or repositioning) costs, and opportunity costs induced by losing "spilled passengers" due to excess demand.

The objective is to develop fast network flow-based heuristic approaches for solving the AFRP, as well as for several interesting extensions including flexible fleeting (i.e. with the possibility of chartering and/or renting aircraft) and flexible departure times. The proposed approaches exhibit several interesting characteristics: they are based on well-known network flow techniques, fast, easy-to-implement, and robust. Computational experiments carried out on real-data provided by TunisAir provide strong empirical evidence that the proposed heuristics consistently provide very near-optimal solutions.

### Literature review

The author's briefly review the literature pertaining to aircraft fleeting and routing as well as some recent integrated models. They looked specifically at the Fleet Assignment Problem (FAP) and the Aircraft Routing Problem. Despite the considerable effort that has been devoted thus far to model and solve the foregoing airline planning processes, an integration of these processes has received relatively lesser attention because of the complexity of the considered problems.

### Problem formulation

Initially a valid 0-1 formulation for the AFRP problem is developed along with a lower bounding scheme which will be subsequently used to assess the performance of the proposed heuristic procedure.

Next a two-phase heuristic for solving the AFRP was developed. First, an initial feasible solution is constructed by iteratively solving a sequence of standard (non-square) linear assignment problems. Then, in a second step or phase 2, an improved solution is obtained through solving a minimum cost flow problem for each aircraft type. >>



Given a feasible solution  $\sigma$ , the authors derive an improved solution  $\sigma^*$  after solving a number of minimum cost flow problems. In this implementation, the authors successively consider as an input of the improvement procedure, the H solutions  $\sigma^h$  ( $h = 1, \dots, H$ ) that are produced in Phase 1, and then provide the best improved solution as the final one.

It is worth noting that there is a variant of the AFRP that requires the delivered aircraft assignment and routing to be periodic, that is, the schedule repeats itself every time period (typically, the schedule should repeat itself every week). Thus, each aircraft  $i \in F$  must serve its first assigned flight immediately after the last scheduled one. While a slight modification of Phase 1 permits to take heed of this constraint and then to get periodic solutions, there is no simple modification of Phase 2 that can guarantee that this periodicity constraint would be satisfied.

The two-phase network-flow based approach can be modified to account for two interesting extensions namely flexible fleetings and flexible departure times.

### Computational results

The proposed heuristic procedures as well as the Lagrangian bound have been coded in Microsoft Visual C++ (Version 6.0) and implemented on a Pentium IV 3.2 GHz Personal Computer with 1.5 GB RAM.

Limited results are presented here. A first series of tests were conducted on a set that includes six real-data instances provided by the Tunisian airline company, TunisAir (TU). These instances are labeled TU01, ..., TU06, respectively. They correspond to typical weekly periodic schedules covering the entire year. Depending on the season, these schedules might be very different both in terms of the number of flights as well as the flight timings. Actually, each of these instances includes a set of scheduled daily rotations where each rotation is a short sequence of flight legs that should be consecutively flown by a single aircraft, most of them being round trip rotations. The largest tested instances include 507 rotations corresponding to 1050 flight legs. The main characteristics of these different instances are summarized in Table 1. In this table, the second and the third columns contain respectively the number of rotations and the number of flight legs in each instance. The fourth column indicates the number of available aircraft and the fifth column gives the number of fleet types.

Table 1: Characteristics of the real-data instances

Instances	Rotations	Flight Legs	Aircraft	Aircraft types
TU01	192	426	29	6
TU02	223	482	29	6
TU03	4	590	29	6
TU04	318	673	29	6
TU05	355	736	30	7
TU06	507	1050	34	8

Table 2 displays the computational results of the cost minimization. The second and the third columns give the percentage gap of the Lagrangian lower bound and of the TunisAir solution, respectively, from the heuristic solution value of the problem AFRP. The fourth column indicates the total CPU time in seconds.

Table 2: Cost minimization

Instances	GAP-LB(%)	GAP-TU(%)	CPU(s)
TU01	0.00	-2.06	1.98
TU02	0.07	-0.35	2.70
TU03	0.43	-1.10	4.42
TU04	0.69	-0.04	7.84
TU05	0.58	-0.34	2.56
TU06	1.02	-1.65	5.53

Table 2 shows that the network flow based heuristic produces near-optimal solutions while requiring very short computational times (less than 8 seconds). Indeed, it exhibits a very small gap with respect

to the lower bound (less than 0.47% in average), ranging from 0.0% to 1.02%. More importantly, one can observe that within this very short computational time, the proposed solution approach leads to significant cost savings over TunisAir's solutions (0.92% in average), reaching 2.06%, which corresponds to significant monetary amounts. Hence, its efficiency makes it a valuable simulation tool for conducting what-if analyses in order to investigate the impact of changing the input data (flight schedules, aircraft fleet, planned maintenance, etc...).

### Conclusion

Airlines internationally are experiencing high competition, uncertain demand, and narrow profit margins and this has prompted TunisAir to examine approaches to integrate their operational problems in order to make more profitable decisions. The authors have addressed an integrated aircraft fleetings and routing problem arising at this company. They have developed an optimization based two-phase heuristic procedure that requires iteratively solving minimum-cost flow problems. The proposed approach has been tailored to tackle several interesting extensions including flexible flight departure times as well as the possibility of chartering and/or renting aircraft.

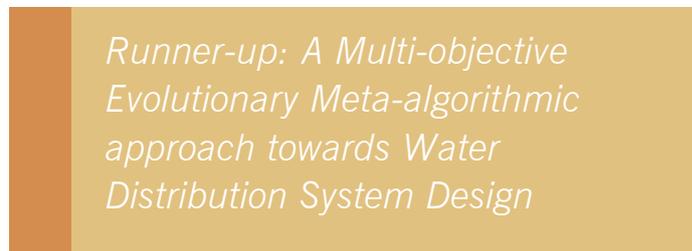
Computational results on real-data provided by TunisAir attest to the efficacy of the proposed algorithm, which consistently produced near-optimal solutions (less than 1%) while requiring very short CPU times. The proposed approach is effective, fast, easy-to-implement, and robust. It is expected that the investigation and development of similar tailored solution procedures for airline operations planning problems arising in small-and medium-sized airlines will positively impact on the profitability of these companies.

by Najla Aissaoui<sup>1</sup>, Kamel Berrima<sup>2</sup>, Mohamed Haouari<sup>1</sup>, Hanif D Sherali<sup>3</sup> and Farah Zeghal Mansour<sup>1</sup>

(1)Combinatorial Optimization Research Group – ROI, Ecole Polytechnique de Tunisie, BP 743, 2078, La Marsa, Tunisia.

(2)TunisAir Headquarters, Boulevard du 7 Novembre 1987, 2035 Tunis-Carthage, Tunisia.

(3)Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA.



▲ Jan van Vuuren and Darian Raad the runners-up with Elise del Rosario

In this article we demonstrate the application of a recent meta-algorithm called AMALGAM (Vrugt and Robinson, 2007) to the multi-objective design of urban water networks, a problem which is both technically and computationally very challenging. Design optimization using AMALGAM with three meta-heuristics as sub-algorithms was applied to a real South African water system case study, demonstrating significant improvements in terms of cost and reliability over a preliminary engineered design. >>



## The meta-algorithm AMALGAM

AMALGAM is a generic evolutionary (population-based) framework which allows for the concurrent implementation of multiple diverse optimization sub-algorithms, partitioning the creation of offspring during each generation amongst these sub-algorithms based on their recent performance. The actual algorithm is very simple if one is already familiar with the Non-dominated Sorting Genetic Algorithm (NSGA-II) by Deb et al. (2002), a popular multi-objective evolutionary algorithm (MOEA). It has an almost identical main loop, including the fast sorting of solutions into non-dominated fronts in objective space, and elitist selection based on front membership depth and a crowding distance measure which promotes diversity by favouring isolated solutions. The main difference between the two algorithms lies in the formula which controls offspring partitioning. For AMALGAM with  $k$  sub-algorithms, the number of offspring to be generated by sub-algorithm  $i$  during generation  $t+1$  is given by

$$N_i(t+1) = \left[ N \frac{S_i(t)}{N_i(t)} / \sum_{h=1}^k \frac{S_h(t)}{N_h(t)} \right],$$

where  $N$  is the total population size, where  $S_i(t)$  denotes the number of sub-algorithm  $i$ 's offspring which survive the selection process during generation  $t$ , and where the whole is scaled by the sum total of the survival ratios of all the sub-algorithms. Each sub-algorithm has access to the entire population from which to harvest and exploit chromosomes in its unique manner, and the best individuals are selected from the union of the parent and combined offspring populations to survive to the next generation. In the hope of extracting utility from sub-algorithms during a later phase of the search, sub-algorithm deactivation (i.e. the situation where  $N_i(t) = 0$  during some generation  $t$ ) is avoided by specifying a low minimum number of offspring. The philosophy underlying AMALGAM is that the diverse strengths of these different meta-algorithms are combined and exploited dynamically to produce a faster, more robust search than is possible with any one of the sub-algorithms on its own.

Vrugt and Robinson tested AMALGAM using four competitive sub-algorithms, each with very different search mechanisms and strengths. These were NSGA-II, Adaptive Metropolis (Gelman et al., 1995), Differential Evolution (Price et al., 2005), and Particle Swarm Optimization (Hu et al., 2003). They applied AMALGAM to a set of challenging multi-objective benchmark problems in the continuous domain, and reported a tenfold improvement in efficiency versus the best of the sub-algorithms used on its own. Together with Alexander Sinske (GLS Software, Stellenbosch, South Africa), the authors of this article were involved in a project (the masters study of the first author) in which AMALGAM was applied for the first time to a discrete, real-world optimization problem – namely that of multi-objective WDS design. The problem is that of finding a combination of pipe sizes (chosen from a discrete set) for a given network specification which satisfies consumer demands over time within the required pressure and velocity constraints (see Figure 1 for an example of a subterranean pipe in a WDS). This

Figure 1: A subterranean pipe in a WDS.

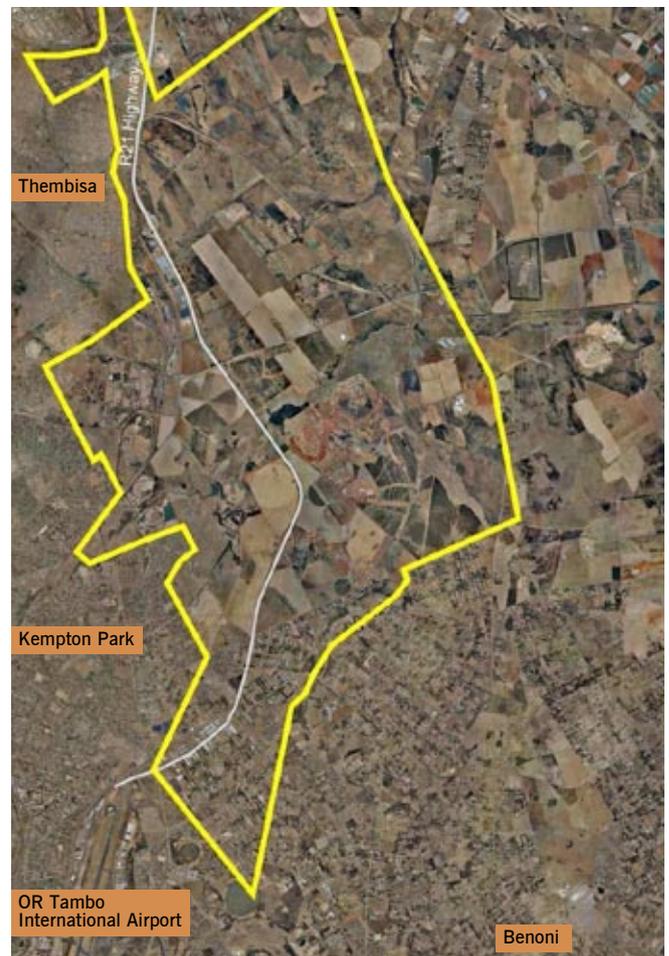


formulation also allows for the design of the actual network layout by inputting one which is redundant and allowing for pipe elimination. For each potential configuration, a hydraulic simulation must be conducted to calculate the system flows and pressures so as to be able to estimate the stochastic reliability of the design (the proportion of time that the design meets pressure specifications). For this purpose the popular hydraulic simulator EPANet 2 (Rossman, 2000) was employed in this project. AMALGAM was implemented with three meta-heuristics as sub-algorithms, namely NSGA-II, Differential Evolution and a Univariate Marginal Distribution Algorithm (Olsson et al., 2008).

## South African WDS Design Application

The South African case study for this research project is a new WDS development project in Ekurhuleni (East Rand, Gauteng Province, South Africa) called the R21 Corridor development area, where currently no water distribution infrastructure exists. An aerial photograph of the R21 Corridor development area appears in Figure 2. The objective is to design the bulk infrastructure (the mains pipes) for a gravity WDS (i.e. one without pumps), which will supply water to new residential and industrial areas, in order to minimize the associated costs and maximize some measure of reliability. The measure adopted in this project was that of network resilience (Prasad and Park, 2004), which is correlated with stochastic reliability, but which may be computed much more rapidly.

Figure 2: Aerial photograph of the R21 Corridor development area.

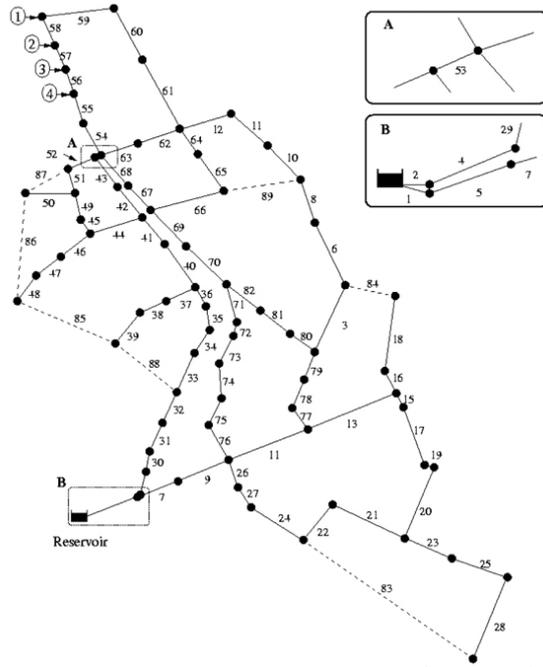


The basic network layout and technical information for the R21 WDS development area was supplied to the authors by GLS Software (Pty), a consulting engineering firm. There is a single reservoir whose capacity has been designed separately and is taken as given. The design guidelines for hydraulic limits and demand scenarios were taken from the Johannesburg Water and Tshwane Municipality guidelines (including the 100090 South African National Standard for fire fighting).

The proposed system comprises 82 pipes, which makes it larger than the majority of the WDS benchmarks typically found in the literature. It has been augmented by an additional seven pipes so as to create a practical, redundant layout, yielding a total of 89 pipes. The WDS layout is shown in Figure 3, with the seven additional pipes represented >>>



Figure 3: Pipe layout of the proposed R21 Corridor WDS.



as dotted lines. The pipes have been numbered from 1 to 89. Two regions of interest have been magnified to show detail. Region A represents a pipe connecting two nodes which crosses a road, incurring an additional expense of 100 000 South African Rands (denoted ZAR 100 000). Region B represents the two unconnected pipe sections leaving the reservoir, supplying water to two major sub-networks, which may be isolated by the removal of the pipe in region A. If this pipe were to be removed, no node would have more than a single independent path to the source.

### Pipe Sizing Options

Since each pipe can be assigned one of twenty-six diameter values (see Table 1) or the option of elimination, the size of the search space is  $27^{89}$ , which is approximately  $10^{127}$ . The pipe option costs in Table 1 include both cost (ZAR) per unit pipe length, and the connection cost, which must be applied once-off at each junction where pipes intersect, using the value of the pipe with the largest diameter.

Table 1: Pipe internal diameter options and associated costs.

Diameter (mm)	Cost (ZAR/m)	Connect (ZAR)	Diameter (mm)	Cost (ZAR/m)	Connect (ZAR)
127	263	31 000	726	2 557	254 000
145	293	36 000	777	2 687	279 000
182	374	46 000	828	3 060	306 000
227	500	59 000	878	3 060	332 000
286	714	77 000	929	3 062	361 000
322	869	89 000	976	3 335	387 000
363	1 058	103 000	1 074	3 539	446 000
428	1 353	126 000	1 176	4 564	511 000
479	1 472	146 000	1 366	5 078	643 000
530	1 684	166 000	1 568	7 599	798 000
574	1 832	185 000	1 773	9 551	971 000
626	2 228	207 000	1 970	10 634	1 153 000
675	2 346	230 000	2 174	14 688	1 356 000

### Water demand loading conditions

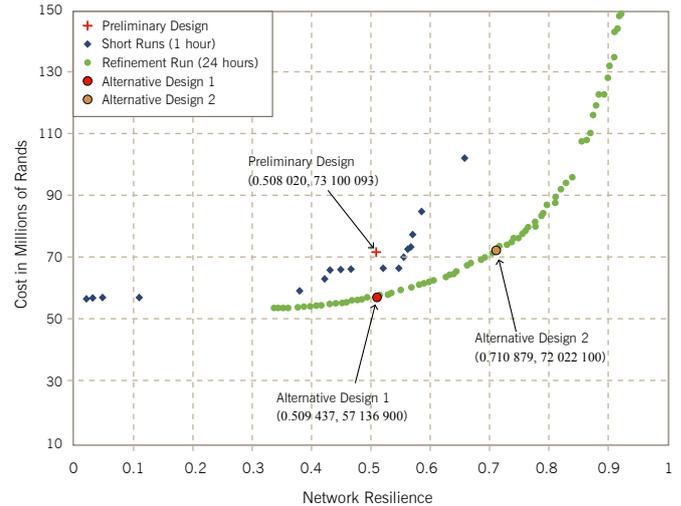
Three types of demand nodes were considered, classified as industrial, intermediary or residential, each with different average demands and minimum head specifications. Twenty-three demand loading conditions were considered, each employing typical expected values of the average

annual daily demand (AADD) of the different node classes (multiplied by the area of the region being serviced by the node), and factors by which the hourly demand is multiplied. Two typical 24-hour demand patterns with hourly factors were analyzed simultaneously; one for residential zones and another for the other zones.

### Numerical Results

Five short optimization runs considering objectives of maximizing minimum network resilience and minimizing total cost were performed for an hour each and the final approximation sets were aggregated. The length and number of runs were chosen to demonstrate what could be achieved in a fast design time-frame. The attainment front in (network resilience, cost)-space for the combined five optimization runs (labelled "Short Runs") appears in Figure 4. The objective function vector of the preliminary design appears as a cross, clearly showing that AMALGAM produces superior results.

Figure 4: Numerical result plotted in (network resilience, cost)-space.



The solutions from the previous attainment front were used to seed a 24-hour refinement optimization run of AMALGAM to determine what improvements could be achieved. The resulting attainment front also appears in Figure 4 (labelled "Refinement Run"), showing moderate improvements over the previous solutions. Two AMALGAM solutions are highlighted and marked with their minimum network resilience and cost values. The solution with a reliability of 0.509 437 (Alternative Design 1) incurs a cost of ZAR 57 136 900, resulting in a significant saving of ZAR 14 963 193 for a design with a slightly higher reliability than the preliminary design for which the network resilience is 0.508 020 and the cost is ZAR 72 100 093. The solution with a reliability of 0.710 879 (Alternative Design 2) incurs a cost of ZAR 72 022 100 and is the most reliable solution found with a cost less than that of the preliminary design for a significant increase in network resilience.

Pipes 83 – 89 are the seven additional pipes which all have a zero diameter in the preliminary solution. However, in Alternative Design 1, non-zero diameters were assigned to additional pipes 83, 84, 87 and 89, while pipes 20, 50 and 67 were eliminated. In Alternative Design 2 two non-zero diameters were assigned to all additional pipes and no pipes were eliminated. Alternative Design 2 also includes three large diameter pipes of size 1 074 mm near the source (whereas the largest diameter in the preliminary design is 976 mm). It is interesting to note that pipe 53 in region A has not been eliminated in any of the solutions, despite the additional cost incurred, thus ensuring that the bulk of the nodes have at least two independent paths to the source.

### Conclusion

In summary, it was demonstrated that AMALGAM is able to improve rapidly and significantly upon a preliminary engineered design for the R21 Corridor WDS, both in terms of cost and reliability (a significant saving of 20.75 % of the project cost (i.e. ZAR 14 963 193) was achieved by Alternative Design 1). The technique of design with redundant layouts proved fruitful in providing alternative layouts for the system. The duration of optimization is sufficiently short for such a medium-sized WDS that AMALGAM may easily be employed in practice. >>>



## References

1. Deb K, Pratap A, Agarwal S, Meyarivan T, 2002, A fast and elitist multi-objective genetic algorithm - NSGA-II, *IEEE Transactions on Evolutionary Computation*, 6(2): 182 – 197.
2. Gelman A, Carlin JB, Stren HS, and Rubin DB, 1995, *Bayesian data analysis*, Chapman and Hall, New York, NJ.
3. Hu X, Eberhart R, and Shi Y, 2003, Engineering optimization with particle swarm, *IEEE Swarm Intelligence Symposium*, 53 – 57.
4. Prasad TD and Park N-S, 2004, Multiobjective genetic algorithms for design of water distribution networks, *Journal of Water Resources and Planning Management*, 130(1): 73 – 82.
5. Price KV, Storn RM, and Lampinen JA, 2005, *Differential Evolution: A Practical Approach to Global Optimization*, Springer, Berlin.
6. Rossman LA, 2000, Computer Models/EPANET, in Mays LW (Ed), *Water distribution systems handbook*, McGraw-Hill, New York (NY).
7. Vrugt JA and Robinson BA, 2007, Improved evolutionary optimization from genetically adaptive multi-method search, *Proceedings of the National Academy of Sciences*, 104(3): 708 – 711.

**Darian Raad and Jan van Vuuren**

*Department of Logistics, Stellenbosch University, South Africa*  
([darianr@sun.ac.za](mailto:darianr@sun.ac.za)) / ([vuuren@sun.ac.za](mailto:vuuren@sun.ac.za)) ■

# EURO Doctoral Dissertation Award EDDA 2009 Announcement

*The EDDA (EURO Doctoral Dissertation Award) is a EURO instrument consisting in a prize that is awarded at each EURO-K conference. The purpose of the prize is to distinguish an outstanding PhD thesis in Operational Research defended in the countries having an OR society that is member of EURO. It will be awarded for the fourth time at the closing session of the EURO 2009 conference (Bonn, July 5–8, 2009).*

## ELIGIBILITY OF APPLICATIONS

The EDDA 2009 jury will only consider PhD theses in Operational Research defended between 15 February 2007 (i.e., the deadline for the preceding edition of the prize) and 15 January 2009 (the deadline for the present edition). The dissertation should have been defended in a University located in a member country of EURO. The author of the dissertation should be a member of a member society of EURO.

To be considered, a dissertation should be nominated by the supervisor of the thesis (one of them in case of multiple supervisors). The supervisor of the dissertation is asked to provide the jury with the following information:

1. The text of the dissertation,
2. An extended abstract (up to 5 pages) of the dissertation; this abstract should be written in English and should include precise keywords,
3. If the dissertation is not written in English, a paper in English authored (or co-authored) by the author of the dissertation and describing the core ideas of the thesis. This paper should preferably have been published in or submitted to an international journal,
4. Nomination letters (or reports) from two referees selected by the dissertation supervisor, supporting the submission and stating their assessment of why the thesis should win the award,
5. An up-to-date CV of the candidate, including a list of publications.

No nomination will be considered without these items.

All information should be sent to the chairman of the jury (Denis Bouyssou: [bouyssou@lamsade.dauphine.fr](mailto:bouyssou@lamsade.dauphine.fr)) in electronic form using a compressed format to save space and bandwidth.

Since many PhD theses in OR are defended each year, the jury would like to remind supervisors that only outstanding pieces of work have a reasonable chance of winning the award.

## JURY

The jury consists in:

- Denis Bouyssou (Chairman),
- Mikael Rönnqvist (Chairman of the 2010 edition of the EDDA),
- Jacques Teghem (Chairman of the 2012 edition of the EDDA),
- Silvano Martello,
- Hartmut Stadler.

## SELECTION PROCESS

The selection process consists in two phases.

Phase 1:

The jury studies each application and selects a shortlist of three finalists. The jury evaluates the applications taking the following points into account:

- Originality and novelty of the subject,
- Pertinence of the subject for OR,
- Depth and breadth of the results,
- Contributions of the dissertation to the theory and practice of OR,
- Applications and/or potential applicability of the results,

- Impact on related fields,
- Quality of the related publications.

Phase 2:

The three finalists are invited to present their contribution in front of the jury and any other interested participant during a special EDDA session scheduled at the EURO 2009 conference (July 5–8, 2009, Bonn, Germany). The jury selects the final laureate after the session.

## AWARD

The final winner will receive 1000 € and a certificate.

The three finalists are granted the early registration fee at the EURO 2009 conference, at which they will register. EURO will also contribute to their travel and journey expenses.

## DEADLINES

The deadline for submitting applications is 15 January 2009.

The nomination of the three finalists will be made public before 15 April 2009.

**Contact Denis BOUYSSOU**  
**CNRS - LAMSADE UMR7024**  
**Université Paris Dauphine**  
**Place du Marechal de Lattre de Tassigny**  
**F-75775 Paris Cedex 16 – France**  
**Tel : + 33 1 44 05 48 98**  
**Fax : + 33 1 44 05 40 91**  
**<http://www.lamsade.dauphine.fr/~bouyssou/>**



# ORPA 4

## Using Operations Research to address Urban Transportation and Water Resource Management Issues in Africa

*Operations Research Practice for Africa (ORPA, <http://www.orpagroup.net/>) recently hosted its fourth annual conference in Washington, D.C. The theme of the ORPA 4 conference was the use of operations research to address urban transportation and water resource management issues in Africa (<http://www.orpagroup.net/ORPA2008/index.html>)*



▲ Etienne Toussaint and Kristen Downs review their sustainable irrigation

The dates (October 10 & 11) and location (the Marriott Wardman Park Hotel) of ORPA 4 were chosen to facilitate participation by attendees of the 2009 INFORMS Conference (<http://meetings.informs.org/DC08/index.html>) that was held on October 12-15 at the same venue.

ORPA 4 differed from purely academic conferences - its purpose was to provide a forum in which researchers, students, policy makers, and representatives from NPOs/ NGOs involved in African urban transportation and water issues could learn from each other and develop lasting collaborative relationships. While the conference was intended to help operations researchers connect with individuals who are working on these issues and need analytic help, we also believed it to be imperative that the conference also help operations researchers understand the enclavic considerations and complexities (political, linguistic, cultural, social, technological, etc.) they may face when working on such problems in Africa. Finally, ORPA 4 was intended to help participants currently working on water or urban transportation problems in Africa to better understand how operations research could help them resolve these problems.

We invited individuals from several disciplines and from a wide range of educational backgrounds to discuss their efforts (this reflected our belief that the strongest approaches to these problems are intercultural and interdisciplinary). Speakers from academia, the private sector, the public sector/government, NPOs, and NGOs participated. Conference registrants included engineers, chemists, biologists, business executives, medical researchers, operations researchers, statisticians, computer scientists, anthropologists, economists, and ecologists/environmental scientists. Participants learned from the speakers' first-hand knowledge and experience of current problems and potential

solutions as well as recent problems and their ultimate solutions. The program included open and frank discussions of i) problems and issues that need to be addressed, ii) works-in-progress, and iii) implementation of recent solutions to problems and issues related to African water and transportation systems. We hoped to use ORPA 4 to encourage the emergent discussion on i) how operations research can be used to help solve problems in Africa and ii) the issues (at both the policy maker and end-user levels) one faces when working on such problems. We asked the speakers to remain for the entire conference to encourage discussions and the development of potential collaborative relationships.

ORPA 4 provided several examples and generated several exciting opportunities to use operations research in interesting and meaningful ways. For example, in *The Perfect Storm: Development Challenges in South Kordofan State of Sudan*, Nuba Water Project ([www.nubawaterproject.org](http://www.nubawaterproject.org)) cofounder and Executive Director Stephen Riley discussed his organization's efforts to construct water infrastructure such as wells and irrigation systems that are in desperately short supply throughout Sudan (especially in the Nuba Mountain regions). With limited funds, the Nuba Water Project must judiciously select sites for wells and irrigation systems. This issue is further compounded by reports of groundwater contamination, including uranium (when told about the possibility that his village was drinking contaminated well water, Steve quoted one fatalistic village leader as responding, "We have only two choices. We can either die now of thirst or risk dying later from uranium poisoning").

Steve was very interested to learn of the ongoing work by Rice University's Colvin Group (<http://nanonet.rice.edu/>). J.T. Mayo (a Ph.D. candidate in chemistry at Rice University whose

research is focused on development and use of nano-scale materials for water purification) explained how magnetic nano-scale particles (iron oxides such as magnetite) could be used for the sorption and removal of heavy metals from water. This work has led to the advancement of methods for inexpensive synthesis of nano-scale magnetite (that can be made from readily accessible kitchen materials) for accessible water purification resources in remote or developing communities.

*... we could learn from each other and develop lasting collaborative relationships.*

The geographic focus of researchers with the Colvin Group has been Latin America, but through Steve Riley's presentation on the Nuba Water Project they have become aware of the pressing need for their technology in Sudan. Through J.T.'s presentation (*Clean Water from Small Materials: Nanotechnology in the Environment*), Steve learned of the Colvin Group's work on affordable and potentially sustainable techniques for filtering heavy metals (such as uranium) from well water. Unsurprisingly, the two groups are now exploring collaborative efforts.

The OR applications? Where do we dig the wells? How do we ensure that the filtration systems are maintained? How do we design the filtration systems to maximize their sustainability?

In another example, three graduate students (Kristen Downs, Stefanie Falconi, and Etienne Toussaint) of environmental engineering in The Johns Hopkins University Department >>



of Geography and Environmental Engineering (<http://engineering.jhu.edu/~dogee/>) explained their efforts to promote sustainable agriculture in the KwaZulu-Natal (KZN) province of South Africa. They are attempting to do so through the introduction of a locally developed 'ram-pump' irrigation system. In Sustainable Irrigation Project for Rural Communities in KwaZulu-Natal, South Africa, Kristen, Stefanie, and Etienne explained the partnership they (and other students) and their advisor (Professor Bill Ball) had forged with partners in KZN through the Johns Hopkins University Chapter of Engineers Without Borders (EWB, <http://www.ewb-usa.org/>). The partnership has resulted in the introduction of this irrigation system to multiple communities since January 2006, enabling many farmers in KZN to overcome the challenges of water transportation in a sustainable manner. They are now exploring potential collaboration with the Council for Scientific and Industrial Research (CSIR, <http://www.csir.co.za/>) in South Africa through Hans Ittmann (another ORPA 4 presenter and Acting Executive Director of CSIR Built Environment for the CSIR)

The OR applications? How do we deal with the "systems" nature of the challenges facing rural communities - interconnected economic, social, and political issues that extend beyond the scope of water problems addressed by sustainable agricultural technologies like the ram pump? How do we create efficient transportation networks for the movement of surplus agricultural goods to local markets? How do we optimally develop agricultural cooperatives to improve production efficiency across various communities and promote economic development?

In yet another example, Network Design and Evaluation: Only the State-of-the-Art will do when your Network is in a Real 'State' featured a presentation by Johan Joubert of the University of Pretoria (<http://web.up.ac.za/>) on his group's multimodal approach to transit network design for Gauteng Province in South Africa. After Johan's presentation he engaged in discussions about this work with several interested ORPA 4 participants. While the OR applications may be more obvious in this case, the outcome of Johan's participation in ORPA 4 is still important - he is now discussing the potential use of marketing analytic techniques to select the terminals, routes, and stops that are most desired by the potential users of the system with several ORPA 4 participants (including the author).

Hans Ittmann discussed similar issues in Perspectives on Urban Transport in South Africa with Specific Reference to OR Applications. Hans provided a high level overview of problems faced in the urban transport arena in South Africa. He further highlighted and explained BESTUFS (<http://www.bestufs.net/>), a project funded by the European Union with the primary focus on sharing best practices in the urban freight transport environment.

In ORTRANS PROJECT: A Transportation Network Equilibrium Study of Dakar Agglomeration, Serigne Gueye (Associate Professor in the Laboratoire de Mathématiques

Appliquées du Havre at Université du Havre, <http://awal.univ-lehavre.fr>) discussed issues that have arisen in similar work on easing traffic congestion, reducing automobile generated air and noise pollution, and increasing road safety in Dakar. He also shared his experiences working in partnership with faculty at the University of Dakar.

Still other examples? David Goldsman's (Georgia Institute of Technology, <http://www.gatech.edu/>) presentation on simulating the propagation of Guinea worm that may occur as millions of transients return to their homes at the conclusion of the Sudanese civil war. In A Simulation Model of Guinea Worm Disease in Sudan: Public Health Consequences of Massive Refugee Movement, Dave explained how this simulation could be to assess the potential efficacy of various control measures/strategies for confining and ultimately reducing the incidence of the disease.

In Systems Approaches to Water Resource Management in Mali: Exploring Opportunities to use Engineering Frameworks in Social Sciences Research, Kim Bothi (a Ph.D. candidate in the Cornell University Department of Natural Resources) described her doctoral research on collaborations in water supply management. She specifically discussed her field work with the West Africa Water Initiative (WAWI, <http://www.wawipartnership.net/>) in Mali that was supported by the Cornell International Institute for Food, Agriculture and Development (CIIFAD, <http://ciifad.cornell.edu/>). Kim also elaborated on the WAWI partnership's wide range of development projects that are designed to improve rural and peri-urban livelihoods through the provision of safe water, hygiene, sanitation and sustainable water resource management in Ghana, Mali and Niger. These initiatives certainly could generate many opportunities for application of operations research.

On a slightly different note, Robin Lougee-Heimer (Research Scientist with the IBM TJ Watson Research Center and an open-source evangelist) explained the Computational Infrastructure for Operations Research project (COIN-OR, [www.coin-or.org](http://www.coin-or.org)). Robin's presentation, Free and Open Software for OR Practice and Research: An Introduction to COIN-OR, featured information on the code available through COIN-OR. She also detailed the history of this project from its inception as a three year experiment at IBM to its current status as a leading website for open-source OR software (with more than two dozen packages available). Beyond the obvious cost advantage, Robin stressed that use of a common platform for analysis in OR projects could facilitate communication between research collaborators across cultures.

Finally, Population Services International (PSI, [www.psi.org](http://www.psi.org)) President and CEO Karl Hofmann explained the role of nonprofit social marketing organizations such as PSI. He discussed PSI's promotion of PSI promotes products, services and healthy behavior that enable low-income and vulnerable people to lead healthier lives. Karl also explained how through PSI, products and services that address malaria, reproductive health, child survival and HIV are sold at highly

*... use of a common platform for analysis in OR projects could facilitate communication between research collaborators across cultures.*

subsidized prices to low-income and vulnerable populations in more than 60 developing countries.

He also reviewed how this was accomplished through partnerships with private sector providers in the countries where PSI works with international consumer goods companies, focusing on PSI's work in point-of-use safe water solutions. Finally, Karl explained how PSI's in-house Research Department provides tools and methodologies that are used to track the effectiveness of its interventions over time (for example, in terms of water-borne disability and deaths averted). This discussion of an alternative strategy for distributing social goods and services was extremely provocative and enlightening.

The ORPA Executive Committee - Serigne Gueye ([serigne.gueye@univ-lehavre.fr](mailto:serigne.gueye@univ-lehavre.fr)), Claude Yugma ([yugma@emse.fr](mailto:yugma@emse.fr)), Eric Soubeiga ([eric.soubeiga@orpagroup.net](mailto:eric.soubeiga@orpagroup.net)), and the author (ORPA 4 General Chair) were very pleased with the outcome of ORPA 4 and are very grateful for the support of our sponsors:

- The Institute for Operations Research and the Management Sciences (INFORMS, <http://www.informs.org>)
- The International Federation of Operational Research Societies (IFORS, <http://www.ifors.org>)
- The American Statistical Association (ASA, <http://www.amstat.org>)
- IBM
- SAS

We are now planning and organizing ORPA 5 for 2009. Babacar Ndiaye and Diaraf Seck of Dakar University - Senegal will serve as hosts and co-chairs, and the conference will be held in Dakar in August of 2009. Check the ORPA website (<http://www.orpagroup.net/>) or contact one of the ORPA Executives for details and updates. We hope to see many of you at ORPA 5!

**James J. Cochran**  
*Bank of Ruston Endowed Research Professor,*  
*Louisiana Tech University,*  
[jcochran@cab.latech.edu](mailto:jcochran@cab.latech.edu)  
 011-318-257-3445 ■





# Call for Papers: Land Workshop

We invite you to participate in a workshop being held in Pucón, Chile on Location and Network Design. The fields of Location and Network Design have progressed in parallel, although some researchers have made contributions to both fields, and some problems touch both sides, being the hub problem an example.

From a different perspective, there are conferences, meeting or symposia in both fields, but these are organized separately –Tristan and Isolde for instance. And none of these take place in South America.

Presentation are encouraged focusing on theory, modeling or applications of Location and Network Design, including but not limited to Health, Energy, Transportation, Telecommunications, Retail, Natural Resources, Environment, etc. Also, papers dealing with methodology, including exact methods, heuristics and simulation.

## CONFIRMED SPEAKERS

- Rajan Batta (State University of New York-Buffalo)
- Oded Berman (Rotman School of Management-U. of Toronto)
- Richard Church (U. of California-Santa Barbara)
- Mark Daskin (Northwestern University)
- Abilio Lucena (U. Federal de Río de Janeiro)
- Michel Gendreau (Université de Montréal)
- Nelson Maculan (U. Federal de Río de Janeiro)
- Thomas Magnanti (Massachusetts Institute of Technology)
- Vladimir Marianov (Pontificia Universidad Católica de Chile)
- Celso Ribeiro (U. Federal Fluminense)

## IMPORTANT DATES & GENERAL INFORMATION

Abstract submission: 30 December, 2008

Abstract length: 500 words

Workshop: 22-25 March, 2008

Early Registration: 30 January, 2009

Location: Gran Hotel Pucón, Pucón, Chile

Abstract submission and more information: Karla Jaramillo at [land@sistemasdeingenieria.cl](mailto:land@sistemasdeingenieria.cl) > [land@sistemasdeingenieria.cl](mailto:land@sistemasdeingenieria.cl) ■

# An UPDATE on ITOR

*In the last issue of the Newsletter (September 2008), some questions were raised regarding the direction in which ITOR is heading and whether or not the Administrative Committee (AC) of IFORS had discussed any change that might have taken place regarding this direction. Considering the role of ITOR within IFORS, it is of utmost importance to provide clear answers to these questions and clarify any misunderstanding regarding the editorial policy of the journal and its management by the AC.*

Since his appointment as Editor-in-Chief in early 2007, Celso Carneiro Ribeiro has put forward an editorial policy that aims at making *ITOR* a world-class journal with ISI recognition. A key element of this policy is a significant reduction of the space devoted to papers presented at the triennial conferences with the objective of moving *ITOR* away from the image that it has had in the past of being a "proceedings" journal. Instead, a spirited effort has been made to attract high-quality papers in the context of special issues devoted to topics of current interest. Emphasis is also put on *ITOR*'s specific niche, namely, the international perspectives of operations research, a subject that is seldom covered by other major O.R. journals.

The AC is kept informed on a very regular basis of any new development regarding *ITOR* by Celso. The new editorial policy that he has put in place follows broadly the recommendations of the 2005-2006 *ITOR* review committee headed by Bill Pierskalla. Celso's policy has been discussed extensively by the AC who wholeheartedly supports it.

At this time, the results of Celso's actions are starting to show. In 2008, *ITOR* published 38 papers, which is significantly more than in previous years, and for the first time in several years, the number of printed pages exceeded *ITOR*'s contractual annual page budget. *ITOR* has also moved to an online submission system, Manuscript Central, since October. This move should greatly streamline the process of submitting and reviewing papers in the future.

Becoming a top-rated journal with world-wide recognition still remains a challenging objective for *ITOR*, but immense progress has been made over the last two years towards reaching this goal. We can definitely look to the future with optimism.

**Michel Gendreau**

*IFORS Vice-President and Publications Chair* ■

# ICOREM 2009 - International Conference on Operations Research applications in Engineering and Management

May 27-29, 2009, ANNA UNIVERSITY TIRUCHIRAPPALLI  
CONFERENCE WEBSITE: [www.tau.edu.in/~icorem](http://www.tau.edu.in/~icorem)

The Department of Management Studies of Anna University Tiruchirappalli (AU-T) is pleased to announce that an International Conference on Operations Research applications in Engineering and Management ICOREM will be held the 27th to 29th May, 2009. The theme of the conference is "Applications of Operations Research in Decision Making". This conference will gather Operations Research practitioners, engineers, scientists, academicians, policy makers in the government and enthusiasts to discuss the possible applications, past successful implementations, and future potential of Operations Research in all Engineering Disciplines and in all functional areas of Management.

## IMPORTANT DATES

- February 20, 2009: deadline for paper submission
- March 20, 2009: notification of acceptance/reject
- April 20, 2009: deadline for final paper.

## CORRESPONDENCE

Please address all correspondence to ICOREM Secretarial:

Dr M Mathirajan - Prof. & HOD, Dept. of Management Studies  
Anna University Tiruchirappalli

Tel: 0091 431 2407667 / 0091 98407 76331

Fax: 0091 431 2407999

Email: [msdmathi@yahoo.com](mailto:msdmathi@yahoo.com) / [drmathu.mathirajan@gmail.com](mailto:drmathu.mathirajan@gmail.com)



# Special track on "Scheduling in Manufacturing Systems" for INCOM 2009

June 3-5, 2009, Moscow, Russia

<http://incom09.org/>

## Track Chairs:

- Prof. Alexander A. Lazarev, Institute of Control Sciences, Moscow, Russia
- Prof. Vincent T'Kindt, University of Tours, Tours, France
- Prof. Frank Werner, Otto-von-Guericke-University, Magdeburg, Germany

The track tries to give the state-of-the-art of scheduling research that satisfies practical needs of modern manufacturing and resource planning. Interdisciplinary methodologies may be presented, based on advanced scheduling and combinatorial optimization techniques, in order to provide efficient solution procedures for practical scheduling problems.

This track intends to bring together experts to exchange recent developments of models and solution techniques used for scheduling manufacturing systems which include parallel as well as multi-stage facilities, coordinating scheduling with transportation decisions, and scheduling in segments of a supply chain.

The track encourages submissions both from practitioners presenting real case studies and from the scheduling community that deals with modern manufacturing systems.

## Topics:

The topics to this invited track include but are not restricted to:

- hybrid systems
- grouping and sequencing operations in multi-stage systems
- scheduling with precedence constraints, batching, setups and further technological constraints either with a single (regular or non-regular) and multi-criteria objectives
- scheduling heuristics
- robotic cells
- scheduling in parallel computing and GRID
- scheduling for segments of a supply chain

## Submission:

The special track encourages not only formal academic paper, but also scientific contributions describing real case studies in the field of scheduling.

Submitted papers (6 pages in IFAC double column format) will be reviewed by at least two referees (see <http://ifac.paperecept.net/>). Both academic and industrial oriented communications will be considered. All papers accepted for presentation will appear in the Preprints of the symposium and will be distributed to the participants. Papers duly presented at the Symposium will be archived in the form of Proceedings published at IFAC-PapersOnline.net by Elsevier. Further submission instructions are available on the IFAC website

<http://www.ifac-control.org/>. Several international journals are associated with the symposium for publication of special issues.

## Important dates:

- October 1, 2008: deadline for paper submission
- January 6, 2009: notification of acceptance/reject
- March 15, 2009: deadline for final paper.

# OR-RELATED CONFERENCES

## *The 9th International Conference on Artificial Intelligence (EA'09)*

Website: <http://isiit.u-strasbg.fr/ea09>

Date: 26-29 October 2009

Place: Strasbourg, France

Contact person: Laetitia Jourdan  
[laetitia.jourdan@lifl.fr](mailto:laetitia.jourdan@lifl.fr)

## *21st International Teletraffic Congress (ITC 21) "Traffic and Performance Issues in Networks of the Future"*

Website: <http://www.i-teletraffic.org/itc21>

Date: 15-17 September 2009

Place: Paris, France

Contact person: Prosper Chemouil  
[itc21oc@i-teletraffic.org](mailto:itc21oc@i-teletraffic.org)

## *EMO 2009*

5th International Conference devoted to "Evolutionary Multi-Criterion Optimization"

Website: <http://www.emo09.org/>

Date: 7-10 April 2009

Place: Nantes, France

Contact person: Xavier Gandibleux  
[Xavier.Gandibleux@univ-nantes.fr](mailto:Xavier.Gandibleux@univ-nantes.fr)

## *WCSMO-8*

8th World Congress on Structural and Multidisciplinary Optimization

Website: <http://www.wcsmo8.org/>

Date: 1-5 June 2009

Place: Lisbon, Portugal

Contact person: Helder C Rodrigues

## *ASOR 2009*

20th National Conference of the Australian Society for Operations Research (ASOR) incorporating the 5th International Intelligent Logistics Systems Conference

Website: <http://www.asor.org.au/conf2009/>

Date: 27-30 September 2009

Place: Holiday Inn Surfers Paradise, Gold Coast

Contact person: Prof. Erhan Kozan  
[e.kozan@qut.edu.au](mailto:e.kozan@qut.edu.au)

## *38th Annual Conference of the Operations Research Society of South Africa (ORSSA)*

Website: [www.orssaconf.co.za](http://www.orssaconf.co.za)

Date: 20-23 September 2009

Place: University of Stellenbosch, Stellenbosch

Contact person: Prof. Jan van Vuuren  
[vuuren@sun.ac.za](mailto:vuuren@sun.ac.za)

