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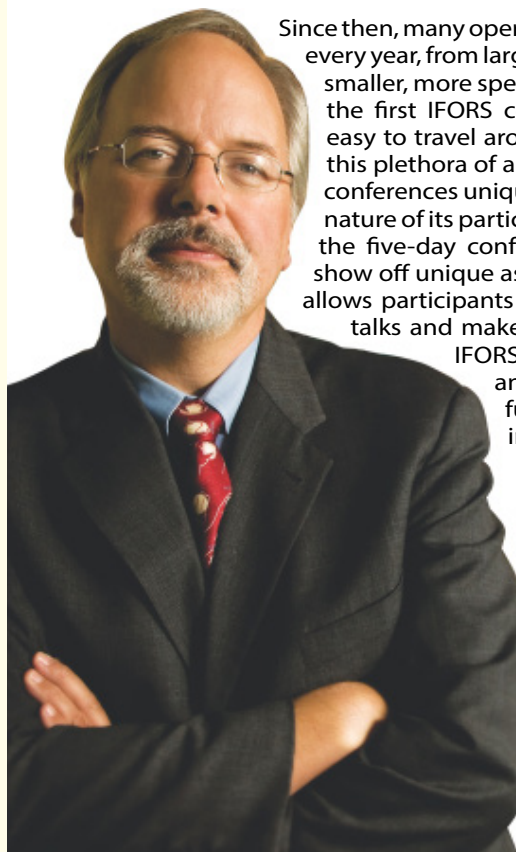
### Editorial Box

## From the President

## IFORS and Conferences

Mike Trick <trick@cmu.edu>

My first operations research conference was thirty-six years ago in Toronto. It was not an IFORS conference, but it was a conference jointly sponsored by the Canadian OR Society, CORS, and the two US OR societies, ORSA and TIMS. I was an undergraduate student, and was just beginning my operations research journey. I was astounded at the number of talks and the sheer variety of topics being covered: optimization, logistics, voting, system dynamics, military applications, and far, far more. It was there that I realized that choosing Operations Research as a field wasn't limiting my choices: it was opening them up.



Since then, many operational research conferences had been held every year, from large ones organized by INFORMS and EURO to smaller, more specialized workshops. And, unlike 1960 when the first IFORS conference was held, it is now reasonably easy to travel around the world to these conferences. With this plethora of alternatives, IFORS has managed to make its conferences unique. This begins with the highly international nature of its participants, and a social outing halfway through the five-day conference. The purpose of this outing is to show off unique aspects of the area, but, more importantly, it allows participants to meet each other outside of the formal talks and make new friends. This year, there will also be IFORS-specific sessions on the history of IFORS and its Distinguished Lecturers, and on the future of IFORS. And the banquet, with its international audience, is always a highlight.

I feel I am coming full circle with this IFORS conference in another Canadian city of Québec, thirty-six years after my first conference in Toronto. One strong memory I have from that long-ago conference is the friendliness of the more experienced participants, and how they encouraged my interest in the field. So if you are in Québec City, or other large OR conference this year, please be kind to newcomers to our field: you may be sparking a life-long interest or maybe even igniting a passion of a lifetime! 🌐

*M. Trick is 2016-2018 IFORS President and Professor of OR at the Carnegie Mellon's Tepper School of Business where he also serves as Sr Associate Dean for Faculty and Research.*

	<p><b>IFORS 2017</b></p> <p>July 17-21, 2017</p> <p>Join us in Québec City!</p> <p>REGISTRATION IS NOW OPEN!</p> <p>Take advantage of the early bird rate before April 15, 2017: <a href="http://www.euro-online.org/ifors2017/registration/register/">www.euro-online.org/ifors2017/registration/register/</a>.</p> <p>BOOK YOUR ACCOMMODATION</p> <p>Hotel space is limited. Book early: <a href="http://ifors2017.ca/accommodation">ifors2017.ca/accommodation</a>.</p>	<p><b>IFORS</b> International Federation of Operational Research Societies</p> <p><b>ICORD 2017</b></p> <p>THEME: OR: IMPACTING DEVELOPMENT</p> <p>July 13 to 14 this year at the Université Laval, Québec, Canada</p> <p>Co-sponsored by: CIRRELT, EJOR, ORS, OPERATIONS RESEARCH FOR DEVELOPMENT</p>
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## IFORS Triennial is Here!

Elise del Rosario <elise.del.rosario@stepforward.ph>

Occurring only every third year, the much-awaited IFORS 2017 is here to play host to the global OR community reunion. As in most reunions, we look back at the events that brought this family together – and that would be 60 years ago, when OR pioneers thought about an international organization for OR. The historic account of events is included as this issue's Feature story, an interesting reading for history buffs.

Of course, we do look forward to sharing of recent trends during the IFORS 2017 paper presentations, carefully organized by the Technical Program committee. We get to see both new theories and algorithms and their applications. Two such applications of which all OR professionals can be truly be proud are, respectively, the *OR Impact* and *Tutorial* features: use of OR for the World Cup and for a high-profile national auction. Happening in South America and the US, these applications show the global impact that OR has been making.

Global impact of OR for development has been in the IFORS agenda since 30 years ago, when it sponsored the first IFORS Prize for OR in Development. The *OR for Development* section gives us a glimpse of the applications that made it to the final round of the Prize competition. Five teams will present their work during the Conference.

Of course, the business part of the Conference is where the current Administrative Committee shares its

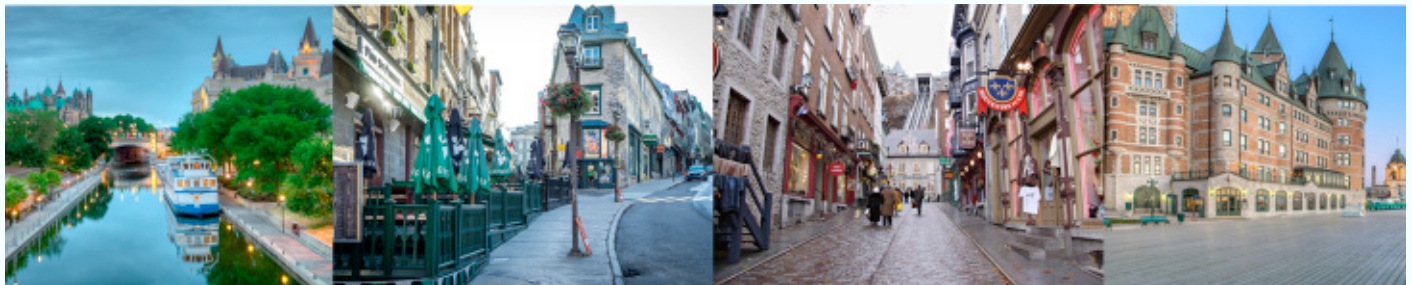
accomplishments for the past year, as you can read in the *Annual Report*. The general membership meeting is also an opportunity to share member issues, challenges and questions. While the meeting may not allow everyone to share stories of their societies in the same way that the *OR Society in Focus* highlights the Portuguese OR Society, personal sharing of experiences may spell for some societies, the difference between flourishing, barely functioning, and disbanding!

Successes and practices shared in this issue include: the Latin American region's conclusion of its regular *Summer School* that trains the leaders of tomorrow, as well as the 40th year commemorative issue launch of the EURO publication. One of the books EURO publishes in a Tutorial series is also featured in our *Book Review*. Interregional activities, this time, between EURO and Operations Research Society of China are covered in the *News*.

OR people do enjoy each other's company – one only has to see the *Regional Conferences* lined up for 2018! For this 2017 conference, much credit goes to the local organizing committee which has done its best to ensure that we have a fruitful and fun-filled family get-together! 🌐



## IFORS 2017 Welcomes One and All to Quebec



Organizing Committee Chair Irène Abi-Zeid, Program Committee Chair M. Grazia Speranza

The 21st IFORS triennial conference is here and we hope you share our excitement at this unique opportunity to get together as an international community of academics and practitioners from all corners of the world. IFORS 2017 presents you with a chance to meet colleagues you are not likely to meet at any other conference, to exchange ideas on your area of research, and to enlarge your network, thus paving the way for collaborative research projects.

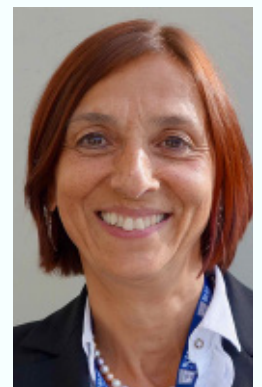
The scientific program offers four plenary speakers, an exceptional grouping of really big names that is not likely to be found elsewhere, along with ten well-known keynote speakers who will deliver tutorials on a variety of topics. The more than 1800 abstracts submitted attest to the huge interest in the conference. Special prize competitions and a history of IFORS session promise to enliven the scientific program. Technological advances are changing the world and IFORS 2017 provides a forum to discuss new research directions, challenges and opportunities.



Needless to say, touching base with new and old friends is made memorable with a great social program: meet and greet old and new colleagues at the welcome reception on Sunday evening; take part in one of the four excursions in beautiful Quebec City and its surroundings on Wednesday afternoon; and attend the IFORS banquet on Thursday evening.

Outside of the conference, enjoy outdoor activities, music, entertainment, and all things that have garnered for Quebec City the Culture City of 2016 Award. The added bonus is all the grand celebrations going on in conjunction with the 150th anniversary of Canada.

Indeed, a great conference, at a great time in a great place – no one can ask for more! 🌐





# 2018 South American Football World Cup: OR Scores a Goal

## Guillermo Durán

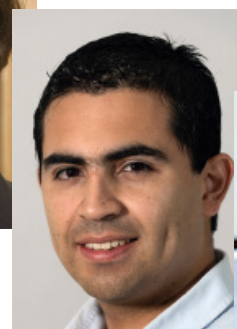
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Chosen as a finalist in the INFORMS Edelman competition in 2016, this application was used to schedule the South American qualifying games that will determine the qualifiers for the 2018 World Cup in Russia. This collaborative work of an OR team from universities in Chile, Norway and Argentina was first used to schedule matches in the Chilean football leagues. The result was improved fairness and attractiveness of fixtures leading to huge increases in revenues.



## Scheduling Chilean Football Fixtures

For the past 12 years, the Chilean Professional Football Association (ANFP) has applied OR techniques to schedule matches in their football leagues. Using integer programming-based methods, the ANFP decides which matches are played in each round of a tournament, taking into account various objectives, such as reducing costs and ensuring engaging tournaments for the fans. More than 50 tournaments have been scheduled using this approach, resulting in an estimated direct economic impact of around \$59 million, including reductions in television broadcaster operating costs, growth in football pay-television subscriptions, increased ticket revenues, and lower travel costs for the teams and fans. Benefits also include non-economic ones, such as improved process transparency and schedule fairness.

## The Approach

The essence of the contribution has been in formulating and

implementing a series of integer programming models to generate the schedules defining which pairs of teams play each other at which venue in each round of a tournament. Incorporating various constraints of the stakeholders has made it an enormous challenge to just arrive at a feasible solution. In response, an array of OR tools such as constraint programming, exact integer programming formulations, heuristics, and decomposition techniques are used to enable very good solutions to be found in relatively short running times. These models have been used to schedule all 24 tournaments of Chile's first division football league over the 12 years between 2005 and 2016 and have been spread to lower football leagues. Further technical details are given in references 1 and 2.

At the start, a number of desirable features were built into the formulation, such as scheduling matches between the stronger teams in tourist cities on public holidays so as to maximise attendance and avoid matching weaker teams with stronger ones in consecutive matches. The new schedules proved to be very effective in meeting the requirements of the various stakeholders and increasing the already high profile of football in Chile.

## Scheduling the Qualifying Rounds for the 2018 FIFA World Cup

**Figure 1. FIFA Affiliated South American Countries**

Draw position	Team	
1	Colombia	5*
2	Chile	9
3	Paraguay	61
4	Argentina	1
5	Brazil	7
6	Ecuador	31
7	Venezuela	69
8	Bolivia	67
9	Peru	50
10	Uruguay	20

\*FIFA rankings October 2015 out of 209 affiliated teams

The football World Cup takes place every 4 years and 209 countries enter the qualifying rounds to become one of 32 finalists. South America has 10 affiliated countries (see Figure 1) which compete for finalist places. FIFA dictates the dates for 'double rounds' of matches i.e. two matches in a period of 4-5 days (say Saturday and Wednesday) but the double rounds may be separated by several months during a 2-year qualifying period. Teams receive 3 points for a win and one point for a draw and the top four teams at the end of the tournament qualify for the finals, with the fifth team in a play-off with a team from another region. The South American qualifying competition consists of the ten teams playing each other twice (home and away), resulting in 90 matches in 9 double rounds from October 2015 to October 2017.

## Previous Qualifying Schedules

Starting with the 1998 World Cup up till 2014, CONMEBOL, the South American football federation, used a *mirrored* schedule for the qualifying tournament: that is, a team would face every rival once during the first 9 rounds (in some order), and then again during the last 9 rounds, following the same order, but reversing the home-away status. Moreover, the exact same schedule was used for the five World Cup qualifiers between 2002 and 2014 (i.e. teams played rivals in the same order in all these tournaments). The preference is for each team to have one home and one away game in each double round and also to have a fair balance of a home game first in a double round, so as to reduce the travelling times for players based in other countries. The previous schedule was clearly unfair as several teams had consecutive home or away games in a double round as can be seen in Table 1. Thus, for example, Bolivia had two double away rounds, meaning that they did not have a home fixture for nearly a year, whereas Brazil and Argentina had none at all. It is not surprising that several teams complained about the unfairness of this schedule.

## A New Approach

CONMEBOL decided that a new and fairer approach would be used for the 2018 qualifiers and invited proposals from the 10 member countries. Research by the Chilean team showed that the mirrored approach in use could not meet the main objectives: to ensure that each team plays one home and one away game in each double round; and that no team plays the two strongest teams, Brazil and Argentina, in consecutive games. At the same time, they demonstrated that this is achievable with a previously developed variation known as the *French Scheme*, which is the same as the mirrored approach but with the last match in the tournament being the same as the first match, with home and away location reversed. This proved to be acceptable to the stakeholders and the Chilean approach was accepted unanimously. Moreover, the approach also enabled the best possible balance of home advantage first in the nine double rounds, ie 5 home/4 away or 4 home/5 away for each team, decided randomly. CONMEBOL was given the template that enabled a much improved and fairer schedule.

A comparison of the new schedule and the previous one is shown in Table 1 and illustrates the increased fairness of the new schedule.

Double home games and double away games do not exist in the new schedule, compared to 18 in the previous one. In addition, the balance of home advantage first in a double round is much improved compared to the previous schedule. Finally, no team plays consecutively against Brazil and Argentina. The allocation of the teams to the schedule was randomly drawn by two famous international players, Ronaldo and Forlan, in July 2015 in the host site St. Petersburg, Russia. The first round of matches is shown in Figure 2.

Figure 2. The first matches of the Opening Round (October 2015)  
The final matches in October 2017 are the reverse



## Remarks

To the knowledge of the authors, this is the first time sports scheduling has been applied to an international football tournament and is therefore a historic milestone for OR scheduling research. Furthermore, the models and methods used have been disseminated widely, helping to promote OR as an effective tool for addressing practical problems. For example, outreach activities have reached thousands of high school and university students in four countries and millions more of television viewers and internet users.

The OR approach was accepted for the world cup qualifiers in part because of the successful application to Chilean football for over 10 years. Despite initial resistance, its eventual adoption owes much to its transparency: the objective criteria incorporated are clear to all stakeholders and the resulting schedules can be seen to be fair to all participants. The current President of ANFP, Arturo Salah, recently commented that "his officials could not even imagine trying to schedule the Chilean league seasons without using OR".

Readers can follow the progress of the South American qualifiers here: [https://en.wikipedia.org/wiki/2018\\_FIFA\\_World\\_Cup\\_qualification\\_\(CONMEBOL\)](https://en.wikipedia.org/wiki/2018_FIFA_World_Cup_qualification_(CONMEBOL))

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Table 1: Comparison of Schedules of the 2002-2014 and 2018 South American Qualifiers

Team	2002-2014			2018			H - A	A - H	Total	H - A	A - H
	H - H	A - A	Total	H - A	A - H	H - H					
ARG	0	0	0	9	0	0	0	0	0	5	4
BOL	2	2	4	2	3	0	0	0	0	5	4
BRA	0	0	0	0	9	0	0	0	0	4	5
CHI	1	1	2	1	6	0	0	0	0	5	4
COL	1	1	2	6	1	0	0	0	0	5	4
ECU	1	1	2	4	3	0	0	0	0	4	5
PAR	1	1	2	3	4	0	0	0	0	4	5
PER	1	1	2	6	1	0	0	0	0	4	5
URU	1	1	2	4	3	0	0	0	0	4	5
VEN	1	1	2	1	6	0	0	0	0	5	4
Total	9	9	18	36	36	0	0	0	0	45	45

Note: H - H means two home (A-A two away) games were played in a double round. The figures give the number of instances for each team in the 9-double round tournament.

H - A means that in a double round the home game is played first; in A - H the away game is played first. The figures give the number of instances for each team.



# Optimizing the U.S. Billion-Dollar Spectrum Auction

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The Federal Communications Commission (FCC) concluded its first-ever “incentive auction” designed to repurpose spectrum for new uses. The auction was designed to accommodate the increasing demand for bandwidth as more people within the US use their smartphones, tablets, and other wireless devices in new ways, requiring massive amounts of data to be downloaded. The 600 MHz band (where many TV broadcasters reside today) has ideal propagation properties for transmitting signals into buildings and across wide areas. It is therefore ideal for wireless use in large urban areas where demand is growing exponentially. Coincidentally, over-the-air TV digital broadcasting is capable of providing the same content using less spectrum. For example, stations can be repacked onto closer frequencies or multiple stations can broadcast high-definition programming simultaneously on a single 6MHz TV license.



## The Auction

In this auction, over-the-air TV broadcasters could voluntarily relinquish their spectrum usage rights by either going off the air, moving to a channel in another portion of the spectrum band (VHF), or relinquishing their spectrum and sharing spectrum with another station, labeled “channel sharing”. At the end of the TV auction, broadcasters will be pushed into a smaller contiguous band of spectrum allowing the new spectrum to be repurposed for wireless use. These new wireless licenses are then auctioned off to wireless carriers. The band plans are designed with “guard bands” to limit any interference between these two licensed spectrum uses. This 14MHz of spectrum is available for “unlicensed use” as long as such uses do not create interference with the licensed uses.

## Financial Impact

The auction ended on March 29, 2017 with the wireless industry agreeing to pay a total of \$19.8 billion (gross revenue) for 70 MHz of spectrum for nationwide mobile use. More than \$10 billion of this total will go to 175 broadcasters who participated in this auction and had their bids accepted. Additionally, expenses incurred by the auction will come from this total, including \$1.75 billion to provide the broadcasters remaining on the air with the equipment and services needed in order to move to their new channel assignments. The remainder, over \$7 billion, will be deposited in the US Treasury for deficit reduction.

## Optimization

Since the auction design and software is extremely complex and required the use of optimization software in a variety of ways, the FCC hired an optimization team to perform a wide range of analysis and develop the optimization models that were necessary for the auction. One unique feature of this auction was that the design itself would determine the *amount* of spectrum that would be reallocated for wireless uses, with the auction done in “stages”. The auction would not end until the revenue received from wireless carriers

exceeded the “reserve cost” which included the amount paid to broadcasters to relinquish spectrum rights, \$1.75 billion to pay for the costs of channel movement for stations remaining on the air, and an amount specified before the auction began to offset the costs of the auction.

The custom optimization software solved a set of very difficult optimization problems to determine how much spectrum to auction in Stage 1, and every stage thereafter. This optimization procedure had to assure that all stations that would remain on the air after the auction could be assigned to the reconfigured TV band, or to the new wireless band if all could not fit in the TV Band. If a station is assigned to the wireless band, then that spectrum will be unavailable for wireless use since wireless transmissions cannot interfere with broadcast communications. Such spectrum is labeled “impaired”. A spectrum clearing target would not be considered if the optimization could not create a pre-specified amount of unimpaired spectrum.

Based on broadcasters’ collective willingness to participate in the auction and the optimization software’s ability to minimize impairments below the allowable threshold, the initial spectrum clearing target was set at the highest level possible (126 MHz). At this clearing target, the gap between what the broadcasters were asking and what the wireless carriers were willing to pay was too large. Again, optimization determined the next clearing target. In all, four stages were required to meet the reserve costs set by the FCC. At the last stage (84 MHz), the optimization found an assignment with zero impairments.

## Role of optimization

Although complex, the auction design did exactly what it was intended to do: It found – through market forces – not only *the price* at which spectrum would be traded but also the *amount* of spectrum to be reallocated.



In addition, optimizations were used at the end of the auction to provide the final channel assignments to each broadcast station remaining on the air. The team also, for every stage of the auction, determined the TV stations that could not win because there would always be a space for the station no matter what participants bid, thereby freeing up these stations to resume their normal business activities. Finally, the team assisted in the determination of a phased transition plan for stations that must move to a new channel.

Throughout the entire process, the optimization team analyzed the consequences of alternative transition rules and goals for the FCC’s Incentive Auction Task Force (IATF). These analyses assisted the IATF in obtaining buy-in from various industry stakeholders with competing interests. The team also had the opportunity to write and edit the portions of the rules that related to its work.

One major accomplishment of the auction is that it resulted in a *repacking of spectrum for all of North America*. Thus, this auction allowed the repacking of stations in both Canada and Mexico with the end result that all three nations will have 70 MHz of new spectrum allocated for wireless use. The optimization team was involved in assisting the FCC throughout these negotiations by analyzing the consequences of a variety of contemplated rules and regulations.

Throughout the planning stages for this auction, there were those that were concerned that many regions in the US would lose access to educational broadcasting. The auction has ended and we now can report that while almost \$2 Billion dollars will be going to noncommercial educational TV stations who were willing to relinquish spectrum rights, most of these stations plan on channel-sharing. Thus, for the most part, viewers will see little difference in their over-the-air educational TV viewing options, while these stations will have additional funds to improve and expand their programming and equipment.

### Comments from Clients

Harry A. Jessell in the TV News Check online blog came to a similar conclusion for commercial TV broadcasting: "But the overall takeaway from Appendix A is just how little the incentive auction will affect commercial broadcasting as we know it today. I didn't find many network affiliate stations on the list and they are the blood and guts on the business. What's more, most of the stations that were 'sold' have indicated that they are not going out of business. Rather, they will continue broadcasting through channel sharing arrangements with other stations in the market. In some cases, they own the other station. In some, they don't."

The FCC webpage [www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions](http://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions) asserts: "The auction preserves a robust broadcast TV industry while enabling stations to generate additional revenues that they can invest into programming and services to the communities they serve. And by making valuable 'low-band' airwaves available for wireless broadband,

the incentive auction will benefit consumers by easing congestion on wireless networks, laying the groundwork for 'fifth generation' (5G) wireless services and applications, and spurring job creation and economic growth."

FCC Chairman Ajit Pai said, "The conclusion of the world's first incentive auction is a major milestone in the FCC's long history as steward of the nation's airwaves. Consumers are the real beneficiaries, as broadcasters invest new resources in programming and service, and additional wireless spectrum opens the way to greater competition and innovation in the mobile broadband marketplace."

### The Optimization Team

The optimization team is honored to have been part of this endeavor. The team consists of: Steve Charbonneau, James Costa, Anthony Coudert, Paul, Salaszyk, Brian Smith, Rudy Sultana, all of NCI, Inc. and Karla Hoffman, George Mason University. Michael Trick of Carnegie Mellon University served as a consultant to the team.

### Acknowledgements

The team thanks Gary Epstein (Chair, Incentive Auction Task Force [IATF]), Melissa Dunford (Director of Systems, IATF), and Sasha Javid (Chief Data Officer and Legal Advisor, IATF) for involving it so thoroughly in all aspects of the decision-making process. Finally, it commends Evan Kwerel, Senior Economist at the FCC who conceived of an auction to determine how to convert spectrum to new uses.

### Notes

All rules and regulations related to the FCC incentive auctions can be found at: [www.fcc.gov/wireless/auction-1000](http://www.fcc.gov/wireless/auction-1000). The appendices of Public Notice DA 15-1183 include the optimization models and an explanation of the interference constraints that are used within the optimizations. The FCC now begins a 39-month transition period to move broadcast stations to new channel assignments. The team looks forward to be of assistance to the FCC Transition Team. 🌐

## INVITATIONS TO REGIONAL CONFERENCES



### EURO 2018 in Valencia Spain

**Greet Vanden Berghe** <[greet.vandenbergh@cs.kuleuven.be](mailto:greet.vandenbergh@cs.kuleuven.be)>

The Association of European Operational Research Societies (EURO) regularly organizes conferences which represent

the largest and most important Operational Research events within Europe. EURO's next conference, EURO XXIX, will take place July 8th-11th in the beautiful city of Valencia.

Valencia is Spain's third largest city and is associated with over 2000 years of rich Mediterranean history. Not only is it

connected to many other European destinations directly, but it is also accessible through intercontinental flights via Madrid or Barcelona. Valencia combines good weather, superb dining, excellent hotel infrastructure and unbeatable value for money. The EURO meeting to be held there is jointly organized by the University of Valencia and Polytechnic University of Valencia.

EURO's XXIX's organizers proudly invite you to not only attend and discover firsthand the most recent Operational Research scientific breakthroughs, but to also submit and share your own recent research achievements. 🌐

### APORS 2018 in Kathmandu, Nepal

**Sunity Shrestha Hada** <[sunity.shresthahada7@gmail.com](mailto:sunity.shresthahada7@gmail.com)>

The Triennial Conference of the Association of Asia Pacific Operational Research Societies will take place in Kathmandu, Nepal from August 6 to 9, 2018.

The capital of Nepal, Kathmandu is a city in a valley of inexhaustible historic, artistic and cultural interest. It boasts of famous sites, ancient shrines, golden pagodas and inspiring deities. The majestic Himalayan peaks are visible from several points on the mountains around the valley.

The whole world witnessed the massive earthquake and numerous after-shocks on April 26, 27 and May 12 of 2015 that rocked the country. More than a year later, Nepal is still trying to

recover and rebuild itself. This is where Operations Research can help the country deal with the aftermath of this natural disaster. It is but fitting that Operations Researchers see for themselves how relevant OR can be in this situation. Thus, the selection of the Conference theme, *OR and Development*.

Research papers related to theory and applications related to development in any sector such as education, health, financial institutions, governance, energy, environment, energy, water and agriculture are welcome. The Conference also welcomes research works of PhD scholars and graduate students. 🌐





# Five Finalists vie for IFORS Prize at IFORS 2017

Mikael Rönnqvist <mikael.ronnqvist@gmc.ulaval.ca>

Awarded at every IFORS Triennial conference since 1987, the IFORS Prize for OR in Development aims to showcase and acknowledge high quality use of practical OR in a developing country. The study must have been conducted to assist a specific organization in its decision-making process with regard to areas such as education, health, and other basic services, water, technology, resource use (physical or financial), infrastructure, agricultural / industrialization and environmental sustainability, with original features in methodology or implementation, aimed at helping development in developing countries.

Papers are initially evaluated on the following criteria: problem definition, creativity and appropriateness of approach, MS/OR/Analytics content, stress on developmental issues, innovative methodology, impact of the study, paper organization and structure, participation of local researchers and quality of written paper. Those making the initial cut present their work during the IFORS conference and evaluated also on the quality of presentation and handling of questions. The finalist papers are automatically considered for publication in the IFORS

journal, *International Transactions in Operational Research* (ITOR).

The members of jury for 2017 are: Peter Bell, Guillermo Duran, Mario Guajardo, Dick Larson, Ke Liu, Sue Merchant, Victor Parada, Mikael Rönnqvist (chair), Roman Slowinski, and Jan van Vuuren. This year's competition recognized 12 full papers as valid entries. The process of selection was very rigorous and the jury was unanimous in selecting five high quality finalists with cases from Brazil, Cameroon, China, Colombia and Egypt. Prizes of US\$ 4,000 and US\$ 2,000 await the first and runner-up winners, to be awarded during the Triennial conference banquet.



IFORS 2017 conference participants are welcome to listen to the finalists' presentations and if time allows, ask their questions. These sessions had been scheduled for Monday, July 17.



2017 IFORS Prize for OR in Development

## THE FINALISTS



### A Decision Support Methodology To Obtain The Most Of Pedagogical Resources In Brazil: Efficient Education Through Optimal Teacher/Student/Class/School Allocations

**Sérgio F. Mayerle** - Federal University of Santa Catarina, Trindade, Florianópolis, SC, Brazil

**Hidelbrando F. Rodrigues** - Federal University of Amazonas, N. Sra. Rosário, Itacoatiara, AM, Brazil

**João Neiva de Figueiredo** - Saint Joseph's University, 5600 City Ave., Philadelphia, USA

**Daiane De Genaro Chirolí** - Maringá State University, 5700 Colombo Ave., Maringá, PR, Brazil



Sérgio F. Mayerle



Hidelbrando F. Rodrigues



João Neiva de Figueiredo



Daiane De Genaro Chirolí

This paper presents a decision support methodology to increase public school education efficiency at the municipal/metropolitan level in Brazil by optimizing the allocation of public school resources. An important consideration for efficient use of resources is the appropriate matching of supply (e.g., teachers of specific subjects, classroom availability and characteristics, and ultimately slots per school) with demand (students requiring enrollment in each grade). This dynamic matching of supply and demand conditions, namely the optimization of student/teacher/class/classroom/school allocations, has not yet been emphasized in the literature on OR applications to education and was solved through a mixed integer linear programming formulation. The paper develops the conceptual framework, provides the mathematical formulation, and describes the implementation of the resulting decision support system. The method is applied to the rationalization of public schooling in Itacoatiara, a municipality on the banks of the Amazon River in a resource-constrained and low-HDI region of Brazil.

**Keywords:** education; allocation problems; decision support systems; developing countries; school efficiency

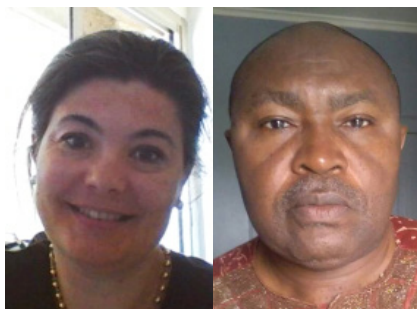




## Performance Assessment and Definition of Improvement Paths Towards the Double Bottom-Line of Microfinance Institutions: An Application to the MC<sup>2</sup> Network in Cameroon

**Isabelle Piot-Lepetit** - INRA MOISA, Economics and Management Division, Montpellier, France

**Joseph Nzongang** - Faculty of Economics and Management, University of Dschang, Cameroon



Isabelle Piot-Lepetit    Joseph Nzongang



Microfinance institutions must be financially sustainable and provide sufficient outreach to the poor. Managing both objectives calls for a performance assessment along both dimensions of sustainability and impact. This application provides an approach for assessing the financial and social performance of village banks of the MC<sup>2</sup> (*Mutuelles Communautaires de Croissance*) network in Cameroon. In order to support decision-making towards performance, a three-phase analytic framework is developed. First, Data Envelopment Analysis (DEA) models are implemented for measuring efficiency, identifying best practices, and setting benchmarking goals to less efficient MFIs. Then, a DEA operating frontier (DEA-OF) approach is designed to identify improvement paths, setting short-term goals towards their long-term target. Finally, DEA results are translated into indicators for daily use of village bank managers, who get a) guidance on actions that will take them closer to their mission and an b) opportunity to learn from other village banks within the MC<sup>2</sup> network.

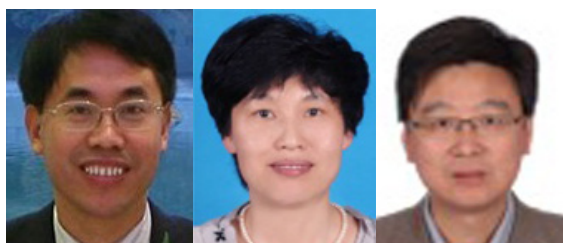
**Keywords:** Microfinance; Data Envelopment Analysis; Operating frontiers; Benchmarking; Performance indicators; Financial and social efficiency; Financial sustainability; Outreach to the poor



## Optimization Models and Algorithms for Fingerprint Recognition and Its Applications in AFIS of China

**Guo Tian-De, Han Cong-Ying, Zhao Tong, A Yong, Bai Chao-Chao, Tang Si-Qi and Wu Min**

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Guo Tian-De    Han Cong-Ying    Zhao Tong



A Yong    Bai Chao-Chao    Tang Si-Qi    Wu Min

This application uses a general optimization model for the automatic fingerprint identification system (AFIS) in China. Taking into consideration local conditions, the model employs a series of optimization models and algorithms, with two main modules of feature extraction and minutiae matching. To deal with low-quality fingerprint images and a large database, the following were used: a) global optimization model for orientation field computation, b) variable dimension optimization model for singular point detection, and c) bipartite graph optimization model for minutiae matching. Novel algorithms were designed for these three models to deal with given characteristics of fingerprint images. Embedded in the AFIS of China, the optimization has played an important role in cracking and preventing all kinds of criminal cases in many Chinese provinces and cities.

**Keywords:** Optimization model; Automatic Fingerprint Identification System; Fingerprint; Orientation field; Singular point; Fingerprint matching





## A Robust DEA-Centric Location-Based Decision Support System for Expanding Recreovía Hubs in the City of Bogotá (Colombia)

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Multi-sectoral community programs to promote healthy living in public spaces are crucial for building a “culture of health” and could contribute to achieving the specific 2030 Agenda for Sustainable Development goals on: reduction of inequalities; provision of inclusive, safe, resilient and sustainable cities; and promotion of just, peaceful and inclusive societies. In this context, the Recreovía program of Bogotá (Colombia) provides physical activity classes in parks mainly for vulnerable communities. This application addresses the challenge of efficiently locating new Recreovía hubs by developing a robust DEA-centric location-based decision support system (DSS). The Institute of Sports and Recreation of District of Bogotá has used this in locating the best hubs throughout the city for Recreovía program expansion. This DSS serves as a model for analytics-based decision making for expanding equivalent programs in other cities.

**Keywords:** location problems; Data Envelopment Analysis (DEA); robust optimization; community programs; physical activity; decision support systems.



## An Exact Solution for the Joint-Pollution Routing Problem Between Two Collaborating Cold Supply Chain Networks

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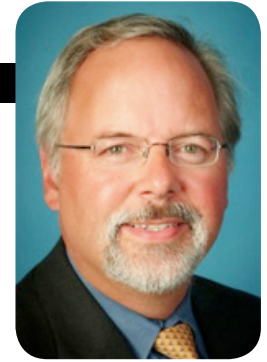
The Cold Supply Chain is noted for its highly negative environmental impact. The Pollution Routing Problem (PRP) is integrated with collaborative logistics approaches in order to evaluate the effects of collaborative green routing decisions while considering energy consumed from running the refrigeration unit by solving the proposed Joint-Pollution Routing Problem for Cold Chains (J-PRP).

Solving the PRP for Cold Supply Chains shows possible energy consumption savings ranging from 3.8% to 11.1% depending on the operating temperature ranges. Considering the J-PRP for two collaborating Cold Supply Chain Networks, energy-minimizing collaborative relationship theoretically reduces energy consumed by 10.22% associated with 22.86% reduction in transportation costs compared to other non-collaborative cold shipments.

**Keywords:** Pollution Routing Problem, Cold Supply Chains, Green Routing, Sustainable Chains. 🌍

# Report of the President

Mike Trick <trick@cmu.edu>



The year 2016 was the first year of the current Administrative Committee.

**Assignments and Thrusts.** Organizing itself was thus the first item on the agenda, resulting in the assignments given to the various AC members. The AC recognized and formalized the importance of its key committees by inviting committee chairs Sue Merchant (Developing Countries), Graham Rand (Publications) and Elise del Rosario (Website/Newsletter) to join the AC as non-voting members. Monthly meetings by Skype were arranged where your President charted directions and sought AC opinions on various matters and where AC members discussed issues they face in the performance of their assignments. The AC held its first formal meeting in conjunction with the CLAIO conference in Santiago, Chile in October, marking the first time the AC formally met in South America outside of IFORS conferences.

**More Frequent Meetings with Members.** During the period, an initiative was started to meet with representatives of national societies during regional conferences. Since IFORS General membership meetings are held only every three years, it was thought that it is important to keep in touch with the members. A series of breakfasts were held during the EURO, ALIO and INFORMS conferences to bring together Presidents and IFORS representatives of national societies to discuss common interests and opportunities.

**Reaching Out to Non-members.** In line with expanding its membership and spreading our discipline, your President met with a group of representatives of various African countries who are united by their desire to create a pan-African society to support operations research in the region.

It was also during this year that the regional VPs worked hard on adding to the membership of IFORS, resulting in the receipt of two applications for membership from Russia and Colombia. These applications are up for a decision within 2017.

**The Triennial Conference.** Plans have come together for the IFORS 2017 conference in Québec City under the excellent

direction of Organizing Committee Chair Irène Abi-Zeid and Program Chair Grazia Speranza. The Korean Operations Research Society was chosen as the host for IFORS 2020, with Seoul selected as the site. A site visit by IFORS Secretary Mary Magrogon, Treasurer Richard Hartl, Conference Chair Karla Hoffman, and your President confirmed the availability of wonderful facilities for the conference, along with excellent hotels, restaurants, and social venues nearby.

**Continuing Activities.** *International Transactions of Operational Research* continues to improve in terms of its impact and the quality of the papers published. The IFORS Newsletter continues to be an excellent source of news and insight into the operational research world. The Developing Countries Committee continues to be very active in supporting societies, workshops, and individuals to increase the influence of operational research in the developing world. IFORS presence in the various regional conferences was assured with its tradition of IFORS Distinguished Lecture and IFORS Tutorial Lecture sponsorships.

**Finances.** The finances of the organization remain excellent, with significant funds in reserve. The year showed a net loss, which is expected during years without a triennial conference.

**Coping with Future Challenges.** There are certainly challenges ahead. IFORS conferences need to be made more distinctly IFORS if they are to thrive in a highly competitive market; *International Abstracts in Operational Research* will be losing its publisher later this year, leading to questions as to the continued viability of the publication; the association's administrative structure and organization needs to be made more formal.

With the help of the AC, the volunteers, the member societies, and the staff, IFORS will continue to be an effective, innovative, voice for international operational research. 🌐



## Report of the Vice-President at Large

Luciana Salete Buriol <buriol@inf.ufrgs.br>

In the process of giving administrative and executive support to the President, the Office of the IFORS Vice President has mainly helped analyse and process the requests and proposed activities received by IFORS in 2016. These include evaluating proposals for running the next IFORS conference,

and other IFORS events (venue, prices, schedule, conditions, etc); evaluating new member society applications (analyzing bylaws, historical activities, documentation); interacting and discussing details of the formation of OR groups and OR African societies; discussing concerns of OR societies put forward to IFORS; as well as analyzing and discussing all other activities promoted by IFORS related to publications and communication with people and societies. As a member of the Developing Countries Committee, your Vice President has been involved in deliberating on several pertinent issues concerning the developing countries committee activities.

A specific activity of the Office of Vice President was to put in place a system that will enable regions to access IFORS funds as they organize Summer/Winter Schools. Based on the ALIO experience and feedback, the School has proven to be a very productive activity in the training of future OR leaders and professionals. Upon getting consensus of the Administrative Committee, mechanics of the IFORS assistance for regional Summer/Winter Schools were finalized as published in the June 2016 issue of the IFORS News.

In line with the activities for the Developing Countries Committee, On line Resources at the IFORS website provides information about free materials available in the internet. The Office of the Vice President had consolidated materials available, with the resulting article appearing in the December 2016 issue of the IFORS News. This was an informative material on how to access great Massive Open Online Courses (MOOCs) in the area of OR.

The above coordinative activities were made possible through technology, i.e., twice a month Skype meetings. 🌐



# Report of the Treasurer

**Richard Hartl** <richard.hartl@univie.ac.at>

The year 2016 was relatively normal in financial terms. As in all years without a triennial IFORS conference, IFORS ran an operating deficit, but this was in line with the budget and supports a strong long term IFORS financial position.

Unaudited results for 2016 (all numbers in \$US) show publications revenues from IAOR and ITOR cash receipts at \$ 109,376 to be significantly below the budget of \$125,000. While income in £ from ITOR slightly increased from 2015 to 2016, the sudden drop of the £ compared to the \$ led to the lower ITOR Royalty income of \$44,797 compared to the \$60,000 budget. Members' dues collections at \$13,559 were also below the \$20,000 budget, owing to the delayed remittance of one large society. Interest revenue continued to decline with the continued global decrease in interest rates. The net effect of these revenue movements was an income of \$ 125,403, lower than the budget of \$147,000.

2016 spending at \$179,429 was down from 2015 (\$186,426), and was significantly below the 2016 budget (\$225,080). Only two items were slightly above budget, the expenses for the ITOR editors, and the expenses for IFORS distinguished lecturers, IFORS tutorial lecturers, Fellowships, & Grants. On the other hand, the Education and Developing Countries committees did not spend their full budgets, and expenses for the future IFORS conferences were lower than expected.

While a deficit of \$78,080 was budgeted, end of December deficit was at \$ 54,026. The audited statements will be slightly different as a result of the way that the auditors handle accruals.

For 2017, the IFORS conference is expected to yield earnings of about \$200,000. Additional activities of the Developing Countries Committee merited a temporary budget increase. The budgets for web page and newsletter also increased slightly. Finally, IFORS is taking steps towards a new legal structure for which a budget of \$10,000 was included. The 2017 budget as approved by the IFORS AC shows an operating profit of \$107,500. If history repeats, the actual profit will be higher than this. Profits from the triennial conference have traditionally been used to cover annual operating deficits in recurring items for the succeeding two years and it appears that this will be the case going forward.

On balance, 2016 did not materially change IFORS financial strength. The value of IFORS assets in other currencies moves with the \$US exchange rate. A very conservative investment strategy of reserves in US dollars makes for sound prospects for the future.

In view of the Federation's financial position and prospects, no change in member society dues is recommended at this time. 🌐



	2016 Budget	Unaudited 2016 Actual	Approved 2017 Budget
<b>INCOME</b>			
Member Society Dues	20,000	13,559	22,500
Royalties			
IAOR	65,000	64,579	65,000
ITOR	60,000	44,797	60,000
Interest	2,000	1,675	2,000
Triennial Conferences : Quebec 2017			200,000
Special Conferences		792	
<b>TOTAL INCOME</b>	<b>147,000</b>	<b>125,402</b>	<b>349,500</b>
<b>EXPENSES</b>			
Activities Administrative Committee	18,000	16,167	18,000
Publications Committee			
IAOR Editor	34,500	34,500	34,500
ITOR Editor	23,000	24,564	23,000
Scientific Activities & External Affairs			
IDL, ITL, Fellowships, & Grants	13,000	15,880	8,000
IFORS Website	5,000	2,927	7,000
Summer/Winter Schools	12,000	10,000	10,000
Education Committee	7,500		7,500
Meetings Committee			
Quebec 2017	5,000	180	15,000
Seoul 2020	10,000	5,664	
IFORS Newsletter	9,000	6,185	11,000
Developing Countries Committee	27,000	5,838	35,000
General Business Operations			
Office & Secretary	54,080	54,079	56,000
Auditor	3,000	1,858	3,000
Banking	1,500	1,588	1,500
Contingency	2,500		2,500
Preparation new legal structure	(239)		10,000
<b>TOTAL EXPENSES</b>	<b>225,080</b>	<b>179,429</b>	<b>242,000</b>
<b>OPERATING RESULT</b>	<b>(78,080)</b>	<b>(54,027)</b>	<b>107,500</b>

# Report of the Vice President representing ALIO

**Guillermo Durán** <gduran@dm.uba.ar>

Created in 1982, the Association of Latin-Iberoamerican Operational Research Societies (ALIO) is made up of the national OR societies of Argentina, Brazil, Chile, Cuba, Ecuador, México, Perú, Uruguay, Spain and Portugal. At the time of this writing, Colombia is applying for IFORS membership while Cuba and Ecuador will still have to file theirs. In 2016, several activities were organized by ALIO and the member societies comprising it (<http://www-2.dc.uba.ar/alio/eventos.htm>).

**CLAIO.** The Latin Iberian American Conference on Operations Research (CLAIO) is the biennial meeting of

ALIO. CLAIO XVIII was held from October 2 to 6 in Santiago, Chile. It was jointly organized by the School of Engineering at Pontificia Universidad Católica de Chile (PUC), the Chilean Institute for Operations Research (ICHIO) and ALIO. More than 430 researchers, students and professionals from Chile, Brazil, Colombia, Argentina, Mexico and other countries outside Latin America attended the conference. >>



>> More than 380 papers were presented during the conference, of which 123 were published in the conference proceedings. Showcasing OR developments in the region, presentations ranged from methods and algorithms to relevant applications in such fields as industrial management, health systems management, natural resources, logistics and supply chain management, as well as finance.

Plenary speakers included John Bartholdi from Georgia Institute of Technology, Shmuel Oren from Berkeley and Jorge Nocedal from Northwestern University, and Andrés Weintraub from University of Chile. Keynote sessions touched on diverse OR topics in agriculture, supply chain, computational algorithms and natural resources.

The IFORS talks included the IDL by Monique Guignard and the ITL by Abdel Lisser. The IFORS Administrative Committee held its annual strategic meeting in Santiago during the conference, where, the IFORS journal ITOR also conducted an editorial board meeting.

ALIO also held its annual meeting at CLAIO, where the new Executive Committee, led by Prof. Jaime Miranda as president, was introduced with the announcement that CLAIO XIX will be held in October, 2018 in Lima, Perú.

**XX Latin-American Summer School in Operational Research – ELAVIO.** The XX ELAVIO took place in Cali (Colombia) from May 9 to 13. The summer school was organized by ALIO and four local universities, namely: the School of Industrial Engineering of the Universidad del Valle, the Department of Civil and Industrial Engineering of the Pontificia Universidad Javeriana-Cali, the Department of Basics Sciences of the Universidad de Medellín, and the Department of Industrial Engineering of the Universidad de Antioquia, and had the support of the new Colombian Operational Research Society (ASOCIO- Asociación Colombiana de Investigación Operativa). The venue of the school was a convention center for personal development called Spirituality Center of the Compañía de Jesús, managed by the Pontificia Universidad Javeriana of Cali.

More than 60 students from ten countries (36 from Colombia, 9 from Mexico, 8 from Brazil, 4 each from Chile and Cuba, 2 each from Argentina, Spain and one each from Belgium, UK, and Venezuela. Full scholarships for food and accommodation were provided to 40 participants while 20 received half scholarships. The rest were invited students from the host universities.

Six mini-courses were given by the following invited professors: Rodrigo Linfati (Universidad del Bio Bio, Chile) *Design and Computational Implementation of Metaheuristics*; José Luis González Velarde (Tecnológico de Monterrey, México), *Metaheuristic Applications in Production and*

*Logistics*; Emilio Carrizosa Priego (Universidad de Sevilla, Spain) *Optimization Methods for Data Visualization*; Raha Akhavan Tabatabaei (Universidad de los Andes, Colombia) *Stochastic Modeling with Phase-type Distributions*; Juan G. Villegas (Universidad de Antioquia, Colombia) *Discrete Facility Location*; and Alejandro Crema (Universidad Central de Venezuela) *Sensitivity Analysis and Parametric Programming for Mixed Integer Linear Programs*. A national lecture was given by Elena Valentina Gutiérrez (Universidad de Antioquia) on *Home Health Care Logistics Management*. All participants presented and discussed their works in twelve parallel sessions spread over the week.

The cultural activity included a class of Latin-American rhythms and a sightseeing tour of the city in a typical Colombian bus. The Colombian typical dishes served during the week complemented the cultural exchange. The next ELAVIO will be held in Argentina in February 2017.

**LAND – TRANSLOG III - Joint Workshop on Location and Network Design - Transportation and Logistic** was organized by the Complex Engineering Systems Institute (ISCI, Chile) from March 13 to 17 in Santa Cruz, Chile. It continues from a series of successful events held in 2009 and 2011 in Chile. Members of the Chilean OR Society (ICHIO) composed the organizing committee.

**ICORD 2016 - International Conference on Operational Research for Development.** ICORD 2016 was held from June 9 to 10 at the Instituto Tecnológico Autónomo de México (ITAM) in México City. An annual event organized by the IFORS Developing Countries Committee, ICORD aims to bring together researchers around the world to present and discuss models and methods to overcome issues existing in developing countries. Members of SMIO (Mexican OR Society) comprised the local organizing committee. The theme of the Conference was *Constructing Pathways to Advanced Societies Through OR*.

Member societies held their annual events as follows: **45 JAIIO 2016** is the annual event of the Argentinian OR Society (SADIO), jointly organized by the Universidad Nacional de Tres de Febrero (UNTREF) and the Universidad Nacional de La Plata (UNLP). It took place on September 5-9 in Buenos Aires City. **XLVIII Simpósio Brasileiro de Pesquisa Operacional 2016** is the annual event of SOBRAPO (Brazilian OR Society) and for 2016 was organized by SOBRAPO and the Universidad Federal do Espírito Santo, taking place at Vitória, on September 27-30. **V SMIO 2016** of the Mexican OR Society "Congreso Nacional de la Sociedad Mexicana de Investigación de Operaciones" was organized by SMIO and the Instituto Tecnológico de Ciudad Madero. With the theme *Integrating Information Technology with OR: Trends and Applications*, it took place in Ciudad Madero on October 26-28, 2016. 🌐



## Report of the Vice President representing APORS

**Chang Won Lee** <leecw@hanyang.ac.kr>

Established in 1957, APORS aims to promote the cause of Operational Research and its applications in this region with a number of developing countries. It organizes the triennial APORS Conference, which has been scheduled for 2018 in Kathmandu. The APORS Council includes one representative from each of its 12 member countries. In 2016, Ilias Mamat from MSORSM represented APORS in the Administrative Committee. For health reasons,

he had to turn over the role to Chang Won Lee from the KORS.

**Operations Research Society of China (ORSC)** conducted its biennial national meeting in Kunming, Yunnan Province, with more than 700 participants from all over China. The 3-day program also included prize competition for applications and young researchers, as well as best paper awards of the JORS. Leading the new set of officers is President Xudong Hu with 9 vice presidents and 45 active council members, as well as heads for 8 working committees for publication, education, application, and OR promotion activities.



Its journals published in Chinese are OR transaction (4 issues/year) and OR/MS (to become monthly) that have been published online since 2011. Journal of the Operations Research Society of China, JORSC was launched this year, which also saw the establishment of two new special interest groups in Industrial Data Analytics and Optimization and Behavior OR.

**Operational Research Society of Hong Kong (ORSHK).** As reported by Lai Kin Keung, the Society sponsored four lectures at the City University of Hong Kong as follows: Dr Vincent Fu, "Robust Optimization models with application in Supply Chain" on March 11; Dr Jiangze Du, "Volatility Analysis of small cap stocks in Hong Kong" on May 17; Dr Paul He, "Electricity Market Risk Measurement using Vince-Copula based Monte Carlo Simulation Model" on Aug 25; and on Nov 25 with Dr. Vincent Fu, "A Distance based method for ppp project evaluation and selection".

**The Operations Research Society of India (ORSI)** has 16 chapters, with a membership of 1,119 as of end of 2016. Activities organized by chapters during the year include: The 1st International Conference on 'Frontiers in Optimization - Theory and Applications' during 24 – 26 November by the Kolkata chapter with the Mathematics Dept. of Heritage Institute of Technology and earlier, a Lecture meeting on 'Applications O. R. Concepts for Business Success' at Ace Institute for Career & Education on May 20 organized by the Kochi Chapter. ORSI conducts a Graduate Diploma course in Operational Research. Examinations for 2016 were held from November 16 to 20 at exam centers in Kolkata, Delhi, Mumbai and Chennai.

**Iranian Operations Research Society (IORS)** held its regular monthly meetings in 2016 and published two volumes of the Iranian Journal of Operations Research (IJOR). The annual Iranian Operations Research Conference (IIRC) was held, 205 paper (156 as oral and 49 as poster) presentations including talks from Iran, Sweden, Netherland, Nigeria, Czech Republic and India were given. The conference published a book of abstracts and featured workshops and sightseeing of the ancient city of Shiraz including the 2,500 year old Persepolis. In Shiraz, IORS held its annual assembly where a new Executive Council, composed of 8 main and 2 alternate members, was elected.

**Operations Research Society of Japan (ORSJ),** for its forthcoming 60th anniversary in 2017, co-organized with the Mathematical Optimization Society (MOS) the 5th International Conference on Continuous Optimization on August 6-11 at the National Graduate Institute for Policy Studies. Over 700 participants gathered at the Roppongi venue, where the summer school, opening ceremony, and the banquet were held. Publishing of a series of textbooks (in Japanese) focusing on modelling methodologies on OR were started, along with a launch of a program to support visits of OR researchers from Japan to institutes abroad. Plans were also made to fund workshops designed especially for young OR researchers and students. ORSJ also held its semi-annual national conferences in Keio University, Yokohama, on March 17 and 18 and in Yamagata University, Yamagata, on September 15 and 16, with traditional symposiums on the day before the conferences. Participants numbered more than 450 for the spring and 300 for the autumn conferences with 156 and 144 oral presentations, respectively.

**Korean Operations Research and Management Science Society (KORMS)** marked its 40th anniversary in 2016, with a membership of around 4,000. Its annual conference on October 21 held at the College of Business, Korea Advanced Institute of Science and Technology, Seoul hosted a 40th year celebration during the reception. With more than 200 participants and a total of 91 paper presentations, the conference featured a plenary speech of the President of Incheon International Airport Corporation.

As part of its winning the bid to host the IFORS2020, KORMS formed its organizing committee who met with IFORS

delegation led by President Mike Trick in Seoul. The proposed conference venue -KOEX in Seoul - was found satisfactory for its accessibility and world-class facilities. Members are hopeful that IFORS 2020 Seoul will be one of the most successful meetings in IFORS history.

**Management Science/ Operations Research Society of Malaysia (MSORSM),** in conjunction with its 25th Annual General Meeting (AGM) on May 14, co-organized with the Universiti Kebangsaan Malaysia (Faculty of Engineering and Built Environment and the School of Mathematical Sciences, Faculty of Science & Technology) a *Seminar in Management Science/Operation Research* (MSOR2016) with over 200 students, lecturers, industry representatives and three invited speakers in attendance. Conference theme was "OR Applications and Its Future in Malaysia".

Earlier in March 8-10, MSORSM partnered with other organizations for the Sixth International Conference on Industrial Engineering and Operations Management (IEOM 2016) in Kuala Lumpur. With a record number of over 500 participants, 500 papers/abstracts were accepted, from the initial 750 submissions coming from more than 70 countries.

**Operational Research Society of Nepal (ORSN)** was established in February 1, 2007 and celebrates its annual day on the first of February each year. ORSN celebrated its 10th annual day organizing 7th conference in Kathmandu with theme *Operations Research and Development*. There were 79 participants with two participants from India and Malaysia. ORSN conducted a workshop on "Data Envelopment Analysis " with resource person Prof. Dr. Ali Emrouznejad from Aston Business School, UK in August 10-11. There were 30 participants from the academe, bankers and government officers. ORSN is hosting 11th triennial APORS international conference on August 6-9 of 2018 at Kathmandu.

**Operations Research Society of the Philippines (ORSP)** installed a new set of officers during the year. For 2016 regular activities included: Student Congress (March 12) at the University of the Philippines themed *Road Quest: Operations Research in Transportation* featuring speakers from the transportation sector, a quiz and a case competition; Technical Workshop (June 17-18) at the Asia Pacific College with a hands-on training on *Machine Learning Using KNIME*; Technical Forum on September 17 at the Ateneo de Manila University themed *Latest Trends in Data Visualization*; and National Conference (November 25) held at the Richmond Hotel with the theme *OR in Analytics: Exploring New Frontiers*, with over a hundred participants. ORSP was also tapped by the Commission on Higher Education for its inputs on the curriculum for Data Analytics courses. ORSP publishes its newsletter covering the activities of the society and distributed to its membership.

**Operational Research Society of Singapore (ORSS)** organized a number of technical talks and seminars in 2016, along with a few industry visits. Talks include the impact of large scale systems design on the development of Singapore by Advisor of the National Research Foundation Lui Pao Chuen, as well as the implications of the resurgence of AI and machine learning in Singapore, delivered by Integrated Decision Systems Consultancy Managing Director Sim Cheng Hwee. ORSS members joined a group of CIOs to view how technologies enhance the curriculum in Nanyang Polytechnic. ORSS members also visited a community hospital to see the role of technology in improving efficiencies. In line with its goal of propagating OR knowledge and skills, ORSS entered into a Memorandum of Understanding with a leading management education institute to provide executive training programs in OR & Analytics. ORSS has a bi-monthly journal published by World Scientific.

**The Australian Society for Operations Research (ASOR) and Operational Research Society of New Zealand (ORNZ)** held their national conferences during the year. 🌐

# Report of the Vice President representing EURO

Jacek Blazewicz <jblazewicz@cs.put.poznan.pl>



**EURO, The Association of European Operational Research Societies**, [www.euro-online.org](http://www.euro-online.org), is a regional grouping within IFORS. At present it has 31 member societies. EURO is regulated by a Council consisting of representatives of all its members and an Executive Committee, which constitutes its board of directors. The 2016 Executive Committee of EURO was composed of President Elena Fernández (Spain), President Elect Richard Eglese (United Kingdom), VP1 Albert Wagelmans (The Netherlands), VP2 Kenneth Sörensen (Belgium), VP3 Silvano Martello (Italy), Secretary Jesper Larsen (Denmark), and the treasurer Marino Widmer (Switzerland). The Manager is Sarah Fores (United Kingdom), the Webmaster Bernard Fortz (Belgium) and the Website Editor and Administrator Marie-France Rogge (Belgium). In addition, IFORS Vice-President for EURO – Jacek Blazewicz (Poland) is responsible for the links between EURO and IFORS.

The 28th European Conference on Operational Research, EURO 2016, was held in Poznan, Poland from July 3rd to July 6th. The Conference attracted more than 1800 participants from 170 countries. The EURO Awards were delivered during the Opening and Closing Sessions (transmitted live on the Internet). For 2016, the *EURO Gold Medal* was awarded to two outstanding researchers: Yurii Nesterov and Maurice Queyranne; the *EURO Distinguished Service Medal* to Yannins Siskos; the *EURO Doctoral Dissertation Award* to Raca Todosijević; the *EURO Excellence in Practice Award* to a large group of researchers involved in the *Evaluating Gas Network Capacities* project and headed by Thorsten Koch; Fernando S. Oliveira, Carlos Ruiz, and Antonio J. Conejo; the *Best EJOR Paper* in the category *Innovative Applications of OR* to M. Steadie Seifi, N. P. Dellaert, W. Nuijten, T. Van Woensel, and R. Raoufi, and that for the *Theory and Methodology* category to Thibaut Vidal, Teodor Gabriel Crainic, Michel Gendreau, and Christian Prins. Finally, the winners of the *ROADEF/EURO Challenge* were Tamara Jovanović in the Junior category, Simon Crevals, Mieke Defraeye, Otto Carpentier, and Kay Van Wynendaele in the Special category and Ahmed Kheiri for the Senior category.

The scientific program prepared by the Program Committee chaired by Daniele Vigo from the University of Bologna offered excellent plenary and keynote lectures and included more than 1600 presentations organized in 465 sessions. The central plenary lecture was delivered by Prof. Robert Aumann, laureate of *Nobel Memorial Prize in Economic Sciences for 2005*. The lecture entitled “Why optimize? An evolutionary perspective” took place in the beautiful Earth Hall at the grounds of Poznan International Fair and got attention of the whole community of Poznan, which is really an academic town with students constituting 20% of the population. The 2016 IFORS Distinguished Lecture was delivered by Dimitris Bertsimas of MIT and Rolf Moehring of the Beijing Institute for Scientific and Engineering Computing gave the Closing Plenary Lecture. Finally, the two EURO Past Presidents Rolfe Tomlinson and Maurice Shutler, who have recently passed away, were remembered during a special Memorial Session which outlined their strong contribution to the growth of EURO. Plenary and keynote sessions and many of the special sessions mentioned here were broadcast on-line and professionally recorded. They are available at: <http://www.euro2016.poznan.pl/speakers/> and will be included into the resources of the EURO website.

The conference venue – the campus of Poznan University

of Technology, with modern facilities and friendly atmosphere, turned out to be a perfect choice for hosting the conference in a comfortable and efficient environment, complemented with excellent services and social activities provided by the Organizing Committee chaired by Joanna Józefowska.

On the other hand, a pretty high number of smaller workshops took place, associated with the activity of various EURO working groups.

The year 2016 also witnessed significant developments in the EURO journals. The European Journal of Operational Research (EJOR) kept its ranking among the best OR journals in Thomson Reuters’ JCR. The three new EURO journals: EURO Journal on Computational Optimization (EJCO), EURO Journal on Decision Processes (EJDP), and EURO Journal on Transportation and Logistics (EJTL) received an increasing number of submissions. The EURO e-newsletter continues to be a success.

There are 32 working groups in EURO (EWGs) which cover different areas within OR. The EWGs meet regularly during the EURO-k Conferences and, possibly, during other events, where thematic streams are organized. These meetings are all supported by EURO.

The *EURO PhD School (EPS)* is an educational instrument created by EURO in 2013 to encourage the organization of post-graduate education initiatives for PhD students under a school format. The 2016 EURO PhD School, devoted to *Sustainable Supply Chains*, was held in Koblenz and Aachen, Germany during the period June 26 – July 2, 2016. Also under this initiative, EURO supported 16 students across the region to attend NATCOR courses offered in the UK.

The series of EURO Summer and Winter Institutes (ESWIs) was launched in 1984. The basic idea is that ca 25 early stage researchers can meet for about two weeks, present their material, discuss with others including a handful of specially invited senior experts in the field, and finally prepare a paper to be considered for inclusion in a feature issue of an OR publication. In 2017 one EWI will be organized in Bressanone, (2017 EURO Winter Institute On “Methods And Models In Transportation Problems” at the University of Padova Winter-Summer Campus).

EURO supports the attendance of young European scholars in ELAVIO conferences. The 2017 ELAVIO will be held in Argentina; two students whose trips were supported by EURO are: Mr. Tulio A.M. Toffolo from KU Leuven (supervisor - Greet Vande Berghe) and Mr. Maxene Delorme from the University of Bologna (supervisor - Silvano Martello).

During the year, a decision was made to promote and further develop international cooperation by supporting joint conferences with national OR Societies outside Europe and other regional bodies within IFORS. Significant financial support can be made available for the organization of such events (other than EURO-k Conferences). It was also decided that EURO will not organize EURO-k Conference every third year, reserving this year for the IFORS Congress. 🌐



# Report of the Vice President Representing NORAM

Karla Hoffman <khoffman@gmu.edu>



The North American Research Societies (NORAM) is made up of two societies: The Canadian Operations Research Society (CORS) and the Institute for Operations Research and the Management Sciences (INFORMS). Activities of the two societies for 2016 are reported below.

## CORS ACTIVITIES

The Canadian Operational Research Society (CORS), a.k.a. Société canadienne de recherche opérationnelle (SCRO), ([www.cors.ca](http://www.cors.ca)) is the leading Canadian professional society for operational researchers. Established in 1958, CORS brings together OR professionals with annual conferences held across Canada, special interest groups, traveling speakers programs, and student support. CORS sponsors the INFOR journal and also publishes the Bulletin, a newsletter of the Society and related activities.

**Awards.** The 2016 *Harold Lardner Prize* was awarded to Professor Dimitras Bertsimas, Massachusetts Institute of Technology (United States). The 2016 recipient of the *Omond Solandt Award* was WestJet (Canada). The *Award of Merit* recipient was Professor Jean-François Cordeau (HEC Montréal), and the *Service Award* went to Corinne MacDonald, Dalhousie University. Finally, the 2016 *CORS Practice Prize* was awarded to Émilie Dufour (HEC Montréal), Gilbert Laporte (HEC Montréal), Julie Paquette (HEC Montréal), Marie-Ève Rancourt (Université du Québec à Montréal).

**Meetings.** The 58th Annual Conference of the Canadian Operational Research Society was held in Banff from May 30th to June 1st, 2016.

**Publications.** CORS publishes the journal INFOR, a quarterly journal on Information Systems and Operational Research, published by Taylor & Francis Publishing.

## INFORMS ACTIVITIES

INFORMS ([www.INFORMS.org](http://www.INFORMS.org)) promotes best practices and advances in operations research, management science, and analytics through an array of highly-cited publications, conferences, competitions, networking communities, and professional development services. INFORMS holds two major conferences each year: the Annual Meeting in Fall, which is mainly oriented towards academics, and the Analytics Conference in Spring for practitioners. INFORMS publishes 14 journals, and three newsletters. In addition, it has various subdivisions directed at members of the OR/MS community including 13 Societies, 21 sections directed at technical and application areas, 31 regional chapters, and 32 student chapters.

**Awards.** Prize winners for 2016 are:

*The Case and Teaching Materials Competition:* Frederik Odegaard, The University of Western Ontario; *The Daniel H. Wagner Prize for Excellence in Operations Research Practice:* Mikael Ronnqvist, Linköping Institute of Technology; Gunnar Svenson, The Forestry Research Institute of Sweden; Patrik Flisberg, The Forestry Research Institute of Sweden; and Lars-Erik Jönsson, SDC, Sweden; *The Doing Good with Good OR - Student Paper Competition:* Christine Barnett, Cornell University and Selin Merdan, University of Michigan; *The George B. Dantzig Dissertation Prize:* Eoin O'Mahony, Cornell

University; *George E. Kimball Medal:* Jeffrey D. Camm, Wake Forest University and Robin Lougee, IBM; *The George Nicholson Student Paper Prize:* Hamsa Bastani, Stanford University; *The INFORMS Impact Prize:* Peter P. Belobaba, MIT; Thomas M. Cook; Guillermo Gallego; and E. Andrew Boyd, University of Houston and Houston Public Media; *The INFORMS President's Award:* Gerald G. Brown, Naval Postgraduate School; *The INFORMS Prize* was awarded to General Motors; *The John von Neumann Theory Prize:* Martin I. Reiman, Columbia University; Ruth J. Will; *The Judith Liebman Prize:* Victor Wu, University of Michigan Student Chapter Thiago Serra, Carnegie Mellon University and Deepak Agrawal; *The Moving Spirit Award for Chapters:* Daniel Reich, Ford Motor Company; *The Moving Spirit Award for Fora:* I. Esra Büyüktaktın, Wichita State University and Julie Ivy, North Carolina State; *The Prize for the Teaching of the OR/MS Practice:* S. Raghu Raghavan, University of Maryland; *The Saul Gass Expository Writing Prize:* Paul Glasserman, Columbia University; *The Undergraduate Operations Research Prize:* Joy Chang, University of Michigan; *The UPS George D. Smith Prize* was awarded jointly to the following departments of Carnegie Mellon University: The H. John Heinz III College, School of Information Systems and Management, and School of Public Policy and Management; *The Franz Edelman Award for the Achievement in Operations Research and the Management Sciences* was awarded to UPS.

In addition, those inducted as *INFORMS Fellows* in 2016 included: Stephen P. Boyd (Stanford University), Kevin Glazebrook (Lancaster University), Peter J. Haas (IBM Research) Jeff Linderoth, (University of Wisconsin-Madison), Sanjay Mehrotra (Northwestern University), George J. Miller (Altair Institute), Georgia Perakis (Massachusetts Institute of Technology), Mauricio G. C. Resende (Amazon.com, Inc.), Ariela Sofer (George Mason University), Tamás Terlaky (Lehigh University), Paolo Toth (University of Bologna), and Pascal Van Hentenryck (University of Michigan);

**Meetings.** The two major meetings of INFORMS during 2016 were the INFORMS Conference on Business Analytics & Operations Research held April 10-12, 2016 in Orlando, Florida, and the INFORMS Annual Meeting held November 13-16, 2016 in Nashville, TN. In addition, it held its international summer meeting on June 12-15, 2016 in Hawaii.

**Publications.** INFORMS has a portfolio of 14 journals: *Decision Analysis*, *Information Systems Research*, *INFORMS Journal on Computing*, *INFORMS Transactions on Education*, *Interfaces*, *Management Science*, *Manufacturing and Service Operations Research*, *Marketing Science*, *Mathematics of Operations Research*, *Operations Research*, *Organizational Science*, *Service Science* and *Transportation Science* with most recent journal *Strategy Science*. In addition, the Institute publishes the series: *Tutorials in Operations Research*. It also publishes three newsletters: *Analytics*, *OR/MS Today*, and the student newsletter *OR/MS Tomorrow*. 🌐

# Report of the Chair, Conferences

Karla Hoffman <khoffman@gmu.edu>

Months of intensive preparation for the 2017 IFORS triennial meeting culminate on July 17 to 21, 2017. The theme *OR/Analytics For A Better World* takes center stage at the Quebec International Convention Center, Quebec City, Canada.

Organizing committee consists of Irene Abi-Zeid, Bernard Gendron and Angel Ruiz with Maria Grazia Speranza as Program Chair. Plenary speakers for the conference are Egon Balas (Harold Larnder Prize), Martine Labbé (EURO plenary speaker), Alvin Roth (2012 Nobel Prize) and Andres Weintraub (Harold Larnder Prize and the National Prize in Applied Science and Technology of Chile). Ten keynote speakers will deliver tutorials (one hour each) on a variety of topics. The social program includes tours of the historic city as well as trips to the surrounding countryside. On July 13 and 14 right before the Triennial is the IFORS-sponsored International Conference on OR for Development (ICORD) to be held at the nearby Laval University.

Three years after the Quebec City meeting, IFORS Triennial Conference will be held in Seoul, South Korea (June 21-26, 2020). The Korean Operations Research and Management Science Society hosts the meeting with Suk-Gwon Chang as chair and Chang Won Lee, Kun-Soo Park, Duk-Bin Jun, Yoonjin Yoon, Choonho Ryu, Joung-ho Lee, Seung Jae Park, Moon Gil Yoon, Young Jae Jang, Kyoung-Kuk Kim, Sungyong Choi,

Sungyong Choi, Kyungsik Lee and Bumsoo Kim as members of the organizing committee.

Four members of the IFORS AC visited Seoul from June, 7-12, 2017 and were impressed with the both the conference and hotel facilities. Based on this visit, the IFORS AC members believe that the 2020 IFORS Triennial Conference in Seoul is likely to be one of the most successful meetings in IFORS history. Planning for this meeting has already begun and the Program Chair will be announced shortly.

Other upcoming meetings include: The APORS (The Association of Asia-Pacific Operational Research Societies) meeting in Kathmandu, Nepal (6-9 August, 2018); the EURO (The Association of European Operations Research Societies) XXIX meeting in Valencia Spain (8-11 July 2018), and the Joint EURO and ALIO conference on combinatorial optimization will be held in Bologna, Italy (25-27, June 2018). In the meantime, detailed plans are being made for the Association of Latin-Iberoamerican Operational Research Societies ALIO conference, CLAIO 2018 to be held in Lima, Peru. 🌐

## Report of the Immediate Past President

**Nelson Maculan** <maculan@cos.ufrj.br>

### IFORS Distinguished Lecture (IDL)

Through the IFORS Distinguished Lectures (IDL), IFORS is sponsors lectures by distinguished OR scholars and analysts at conferences of members societies and regional groupings. In 2016, three IDLs were sponsored for the regional groupings.

**EURO July 2016 Dimitris Bertsimas** *Machine Learning and Statistics (ML/S) Via A Modern Optimization Lens* EURO Conference - Poznan, Poland

A Boeing Professor of Operations Research and the co-director of the Operations Research Center at the Massachusetts Institute of Technology, Dimitris Bertsimas has started several successful companies in the areas of financial services, asset management, health care, publishing, analytics and aviation. The talk presented cases showing that linking ML/S to modern optimization will lead to significant advantages.

**ALIO October 2016 Monique Guignard-Spielberg** *Lagrangian Relaxation And Different Ways It Can Be Used* CLAIO - Santiago, Chile

Monique Guignard is Professor at the Department of Operations and Information Management of the Wharton School, University of Pennsylvania. She has made significant methodological and practical contributions to Large Scale Optimization, particularly by using Lagrangian approaches. Presenting various applications in different areas of optimization, the lecture illustrated the flexibility of Lagrangian Relaxation.

**NORAM November 2016 Rolf H. Mohring** *Optimizing the Kiel Canal – Online Routing of Bidirectional Traffic* INFORMS Annual

Meeting - Nashville, Tennessee

Rolf H. Möhring is Professor for Applied Mathematics and Computer Science at Berlin University of Technology, where he heads the Combinatorial Optimization and Graph Algorithms (COGA) research group. His lecture introduced, discussed, and showed how a hard practical optimization problem that deals with routing bidirectional traffic on the Kiel Canal serves as a prototype problem for traffic management and routing in logistic systems.

### IFORS Tutorial Lecture (ITL)

Given by outstanding scholars, the ITL presents the fundamentals of emerging OR technologies, application areas or teaching approaches to a large diverse audience. It is intended to inspire and raise interest in pursuing these new ideas. One ITL was assigned for the ALIO region in 2016.

**ALIO October 2016 Abdel Lisser** *Introduction To Chance Constrained Optimization* CLAIO, Santiago, Chile

Abdel Lisser is Professor at the Laboratoire de Recherche en Informatique (LRI) at the Université Paris Sud. A research engineer in Orange Labs for more than a decade, he has several international projects with universities all over the world. The tutorial dealt with the basic ideas of chance-constrained optimization along with a brief survey of the state of art. He concluded with the main theoretical and practical challenges of the methodology. 🌐



## Report of the Chair, Publications Committee

**Graham Rand** <g.rand@lancaster.ac.uk>

Journals are an important component of what IFORS offers to the worldwide OR community. They raise IFORS' profile amongst researchers and authors while providing an important revenue stream that enables IFORS to undertake a wide range of activities.





### International Transactions in Operations Research (ITOR)

**ITOR is published by Wiley-Blackwell.**

Celso Ribeiro continues to do an excellent job as editor. The impact factor for 2015, reported in 2016, improved again from 0.977 to 1.255. This placed ITOIR 39th out of 82 Operations Research and Management Science journals. This is a significant achievement. An editorial board of 58 editors from 23 countries makes ITOIR a truly international journal. The number of submissions continues

to increase dramatically: at the start of the decade there were just over 100 annually, now there are about 600. The average acceptance ratio has remained constant, at just over 20%. The journal size, in terms of page numbers, will increase significantly in 2017.



▲ Celso Ribeiro

Papers published by year have increased from 25 (2006) to 54 (2016), and pages printed by year from 584 (2006) to 1232 (2016). There were over 50,000 full text downloads in 2016. Downloads via Wiley Online Library increased by 37% in 2016. This compares with an increase of 10% across all Wiley Journals in Business & Management.

The 2016 volume included special issues on Cutting and Packing and Many Faces of Distances. Special issues in the pipeline include Applied

Combinatorial Optimization; Variable neighborhood search; Improving healthcare: new challenges, new approaches; and Optimization of industrial systems with market disruptions.

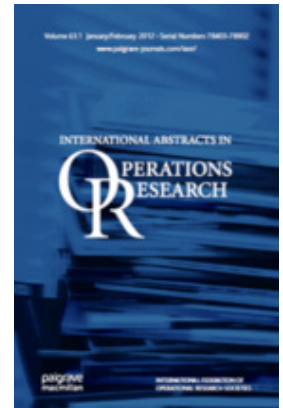
The income from ITOIR in 2016 was \$44.8K, down slightly from \$47.2 in 2015. Since the publication of Proceedings of the IFORS Conferences ceased after the 1990 conference, and ITOIR was launched, participants of IFORS conferences received a subscription to ITOIR for three years (from the following year until the year of the next conference), paid to Wiley by IFORS.

Since the practice ceased with the Barcelona conference in 2014, 2015 was the first year the effect of this was seen on the income received in 2016. The income from Wiley decreased by £8.5K, perhaps some \$10K depending on exchange rates, but the cost to IFORS decreased by \$20.5K.

The contract with Wiley-Blackwell ended in December 2016, and a revised contract was negotiated during the year. Key features of the new contract are: 1) An improved financial offer; 2) Clarity on the issue of confidentiality; 3) Reporting - Annual meeting between Wiley and the Publications Committee, which in the year of the IFORS conference will be a "Strategy" meeting, with some associate editors invited; and 4) Term - Contract is effective until 31 December 2021, with a review of and inputs to future marketing strategies within three months before the end of 2018.

### International Abstracts in Operations Research (IAOR)

Executive editor, K. Preston White, Jr. and editor Peter Whitehead have done a great job for the IAOR. Published by Palgrave Macmillan, IAOR gave \$41.5K net financial benefits to IFORS in 2016; an improvement on \$34.3K in 2015. The benefit will be even greater in 2017. The 2016 issues contained the target of 4000 abstracts at 500 per issue.



In May 2016, as a direct consequence of its merger with Springer, Palgrave announced that it would not renew its agreement with IFORS beyond the contract period that expires on 31st December 2017. The chief reason for this was a technical one – after close analysis, the publisher concluded that the enhanced content platform to which all Palgrave Journals migrated could not support the unique needs of IAOR. The editors are convinced of the positive contribution of a "hand crafted" OR archive and wish to see the continued publication of IAOR. Accordingly, with the support of Palgrave, several publishers have been approached. Whilst all these avenues are not yet exhausted, it is clear that there are major concerns for potential publishers because of the

unusual nature of the journal. It is likely that we will be unsuccessful in finding a new publisher, and IFORS will have to decide the future of the massive database that has been created. 🌐



▲ K. Preston White, Jr.



▲ Peter Whitehead

## Report of the Chair, Developing Countries Committee

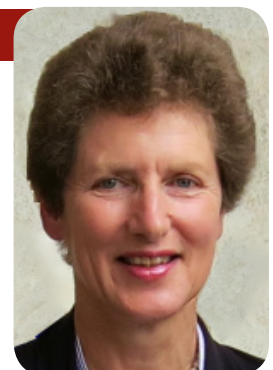
**Sue Merchant** <suemerchant@hotmail.com>

The DCC, composed of members Luciana Buriol (VP at large, IFORS), Elise del Rosario (Philippines, editor of IFORS News and the IFORS Website), Adam Ouorou (France/Benin), Yindong Shen (China), Theo Stewart (South Africa), continued its work of trying to support OR in developing countries and development work in a range of ways. The IFORS Office - Mary, Beth and Marisa, ably assisted the work of the DCC.

The Committee organised or helped organise several events and activities.

- In June, the DCC (in particular Elise del Rosario) helped with the organisation of the International Conference on OR for Development (ICORD) held in Mexico City. The 40 delegates

came from Mexico, Argentina, Chile, Cuba, Holland, UK and the USA, and plenary speakers included: Rafael Epstein (University of Chile), Andres Medaglia (University de Los Andes, Colombia), Jesus Velasquez (DO ANALYTICS LLC) and Gilberto Calvillo Vives (UNAM, Mexico). The DCC Chair was on hand to represent IFORS and to hand out IFORS certificates to the speakers and the participants. Lead organiser Adrian Ramirez Nafarrate, with his local organising team handled all the details that ensured a smooth conference.



- Through Elise del Rosario, IFORS DCC supported the EURO Working Group on OR for Development Workshop (EWG ORD). This 10th EWG ORD conference on OR for development in Poznan, Poland was held immediately prior to the EURO conference in July. The conference attracted 23 delegates from Australia, Colombia, India, Ireland, New Zealand, Nigeria, Philippines, Poland, Russia, Turkey, UK and USA. Cathal Brugha (University College Dublin) and Ashley Carreras (de Montfort University) conducted Workshops while talks were given by Elise del Rosario and Gerhard-Wilhelm Weber (University of Ankara).
- Theo Stewart led initial discussions on the staging of an OR Teachers' conference in South Africa in September 2016 but this had to be cancelled because of organisational problems.

Support was given to a number of organisations in furtherance of good OR research and practice. Continuing encouragement was given to Nigerian OR Society (INFORN) activities in taking steps to try to form an African OR regional society. The DCC passed on contact details of OR analysts in other African countries to Abdulfatai Lawal (INFORN) and he, with the help of Charles Malack Oloo (Kenya, ORSEA) and Serigne Gueye (ORPA), arranged a 'summit' meeting in Nairobi in November. IFORS President Mike Trick addressed the meeting. As a result of the summit, a fledgling regional African society has emerged (AFROS) with initial roles being allocated across several countries and an enthusiastic secretary appointed- Berndt Lindner (ORS

South Africa). Charles Malack Oloo wrote a report on the meeting for IFORS News.

Support was provided to on going IFORS activities.

- The developing countries resources website continues to evolve, thanks to the efforts of many interested individuals throughout the world, especially Gerhard Wilhelm Weber and Elise del Rosario and their wide range of contacts who provide many articles on issues connected with development for the site.
- Luciana Buriol added to the website details of how free MOOCs can be accessed to provide valuable training for OR researchers and practitioners. An article has been written for the News to introduce MOOCs and their usefulness to readers who might not otherwise be aware of them.
- A list of useful free software (provided and kept up to date by the UK ORS) was added to the IFORS website.
- Mikael Ronnqvist was appointed as Chair for the IFORS Prize competition to take place in Quebec City in July 2017 and publicity for the competition was circulated during the year. The deadline for entries was the end of November but this was extended by a few weeks to increase the number of good quality entries.
- Planning commenced for an ICORD2017 (to take place at the University of Laval in Quebec City in July. The committee agreed on 'OR – Impacting Development' as the conference theme. 🌐

## Report of the Chair, IFORS News and Website

Elise del Rosario <elise.del.rosario@stepforward.ph>



For 2016, the **IFORS News** has continued to focus on the organization's activities as well as those of its members and regional groupings, which include coverage of Summer Schools, national Conferences all over the world, Conferences on Development, Regional Conferences, and a quarterly feature on IFORS member societies called *OR Society in Focus*.

A regular column from the IFORS President has also enlightened

members of the IFORS plans, initiatives and perspectives. In the meantime, the IFORS AC has continued to make its presence felt, with every AC member contributing a piece in each quarterly issue.

In seeking to be relevant to the general OR public, the IFORS News has continued to feature updates on theory through its *Tutorials* as well as to showcase OR in action through the *OR Impact* section edited by Sue Merchant and John Ranyard. Reviews of latest books of interest to OR professionals were continuously brought to readers' attention through the *Book Review* Section authored by Hans Ittmann.

In the December issue, it is interesting to note that we had started *OR Resources*, an initiative that we hope will get more contributions and will get on the way to being a regular column. We also continue to recognize the contributions of IFORS personalities who have departed during the year through the efforts of IFORS historian, Graham Rand.

Two printed versions of the IFORS News were produced in 2016: the June issue containing the 2015 Annual Report distributed during the EURO Poznan and the September issue, which features ALIO activities, distributed during the CLAIO where the IFORS AC held its annual face-to-face meeting. All issues are hosted in the website, with announcements about the release of the electronic version sent out to national society officers.

IFORS News is the product of the ever-growing list of News

correspondents and contributors, the dedication of its section editors, as well as the continued support of the IFORS Administrative Committee.

IFORS Webmaster Ruel Tan exerted continuous efforts to make the **IFORS website**: *current* through timely updates of news and conferences, career opportunities, member profiles, and IFORS history; *easy to use* by converting the platform into a mobile-responsive format; and *welcoming* through a complete website redesign.



The website continues to host all the quarterly issues of the IFORS News and to provide a home for on line resources for teaching and learning OR through the *Educational Resources* as well as the *Developing Countries OR Resources*. Developing Countries Committee Chair Sue Merchant and Gerhard Wilhelm Weber are overseeing activities in this area. Contributed materials were continuously screened and uploaded into the website. Monitoring of access and improvement based on feedback were done throughout the year. The website continued maintaining its members-only section which logs the status of issues brought for a vote before the membership.

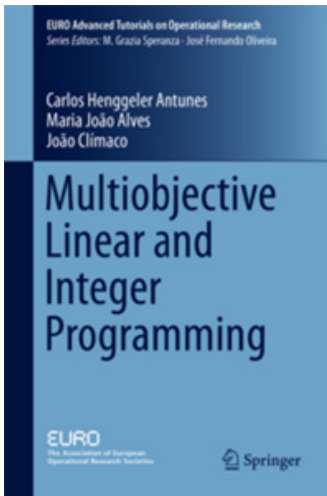
Page views averaged 6,000 with around 2,000 users a month during the year. With the objective of increasing engagement of members and the larger community of OR enthusiasts, an IFORS Facebook page was set up and maintained in the later part of the year. Page likes, reach, post engagements will continue to be monitored to see how site could attract more visitors, even as optimization to improve search engine rankings had been done.

As in the past years, the IFORS website also hosted microsites for the ICORD 2016 as well as the 2016 EURO EWG ORD Workshop. The 2017 ICORD has likewise been put up during the year and is continuing to receive queries, paper submissions and registrations. 🌐



# A Handle on MOP

Hans W. Iltmann, University of Johannesburg <hittmann01@gmail.com>



**Multiobjective Linear and Integer Programming** by Carlos Henggeler Antunes, Maria João Alves, João Climaco, 2016, Springer-Verlag, Berlin, pp.209, ISBN:978-3-319-28744-7, EURO 76.99 (Hardcover).

*In 2014, the Association of European Operational Research Societies (EURO) introduced the EURO Advanced Tutorials on Operational Research initiative. This entails the publication of a series of textbooks, each covering an advanced topic in Operations Research. Mainly serving young researchers, these tutorials are*

*also of value to senior researchers and practitioners who want to gain an insight and understanding of the specific topic. To date, three textbooks have been published with Multiobjective Linear and Integer Programming being the third book in the series.*

Multiobjective optimization is a very active research area and fast evolving with continuous new developments. A number of recent books\* covering the topic, e.g., Luc (2016), Antunes *et al* (2016), have been published, each one following a different approach and emphasizing different aspects.

As opposed to classical single objective function problems, multiobjective problems (MOP) typically have multiple conflicting objectives. Thus, improving one objective will impact the value of others, leading to a trade-off between solutions. The main aim of multiobjective programming is to assist in obtaining a preferred solution amongst all the trade-offs. Solution methods can involve the decision maker (DM) directly using interactive methods or approaches where non-interactive exact methods can be used. The tutorial covers linear (MOLP), integer (MOIP), and mixed integer (MOMIP) MOPs with solutions that are respectively: continuous, discrete, and both continuous and discrete. Real world problems tackled using MOPS include those in the fields of engineering, mining and finance.

The introduction of the book gives a historical overview of the development of optimization approaches. At the realization for the need to formulate and solve problems with multiple conflicting objectives, a new branch of mathematical programming, namely, multiobjective programming emerged. Two distinct approaches to address these problems were developed: (i) methods for decision support with multiple attributes; and (ii) methods of decision support with multiple objectives. The first refers to selection, ranking or categorization methods dealing with a finite set of alternatives while the second is concerned with problems where the alternatives are implicitly defined by a set of constraints. This tutorial is devoted to the latter approach.

MOP methods are classified according to the process used for aggregating the DM's preferences into three categories. With the aim of determining the best compromise solution, the methods are: (i) a *priori* aggregation of preferences; (ii) interactive, where the DM progressively articulates preferences; and (iii) generating, where there is no articulation of preferences. Aspects concerning all these approaches are discussed together with the process followed to arrive at an acceptable solution.

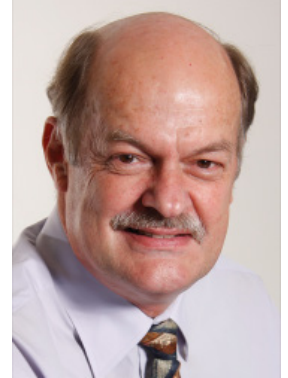
In Chapter 2 definitions, formulations and fundamental concepts of MOPs, which include linear problems, integer problems, mixed integer problems and non-linear problems, are presented in detail. These are richly illustrated with, for example, two dimensional graphic representations to demonstrate and show these concepts. Included are concepts such as efficient and nondominated solutions; weak and proper efficient/nondominated solutions; supported and unsupported efficient/nondominated solutions; the ideal solution as well as pay-off tables. At the end of the chapter, as in all chapters, a number of problem exercises are provided for further training.

The most common procedures to compute efficient/nondominated solutions in MOPs, namely, scalarizing techniques and surrogate scalar functions, are the focus of Chapter 3. Three techniques are discussed, namely: (i) selecting one of the  $p$  objective functions to be optimized and treating the other objective functions as constraints (the *e-constraint* technique); (ii) optimizing a weighted-sum of the  $p$  objective functions through assigning weighting coefficients to them (the *weighted-sum* technique); and (iii) minimizing a distance, or achievement, function to a reference point, such as the ideal solution, where the components represent aspiration levels that the DM would like to attain for each objective function (*reference point* techniques). As in Chapter 2, these are outlined in detail by describing the theory, showing different formulations, illustrating the solutions and associated concepts, through two dimensional graphic representations.

Chapter 3 also deals with classification methods to compute nondominated solutions. Different classifications have been proposed based on aspects such as the degree of intervention of the DM, how the preferences of the DM are modelled, and others. The role of preference information is discussed as well. Brief mention is made of the lexicographic method (ranking objective functions according to the DMs preferences), goal programming (minimizing deviations from targets established by the DM) and the multiobjective simplex method for MOLPs.

Five multiobjective interactive methods for MOLP problems are described and illustrated in Chapter 4. These methods are STEM (Step Method), the Zionts and Wallenius method, TRIMAP, Interval Criterion Weights (ICW) and Pareto Race. TRIMAP provides a more interactive computational environment than the formal method. It was developed specifically as a teaching tool. The methods included in this chapter differ mainly on the search strategies used.

An illustrative "guided tour" of an interactive software package iMOLPe (*interactive MOLP explorer*) is presented in Chapter 5. This package was developed by the authors mainly for teaching and decision support purposes. Features, among others, include: (i) scalarizing techniques (as outlined in Chapter 2); (ii) allowing for different search strategies and visualization of results; (iii) interactive versions of the STEM, Pareto Race and ICW methods. A step-by-step guided tour of four different examples is included, making full use of, and presenting, screen shots of outputs from the package. The iMOLPe package is a useful teaching tool, user friendly and can handle problems with four or more objectives although the graphical representation for the objective space and the weight space are only available for problems with up to three objectives.



The last chapter is devoted to multiobjective integer and mixed integer linear programming problems. These problems offer different challenges, although similarities with what is presented in the earlier chapters could be found. Different methods are discussed, namely: (i) generating methods and scalarizing processes; (ii) interactive methods; and (iii) an interactive reference point method using branch-and-bound: performing directional searches in MOMILP. Again, ample use is made of examples with the associated graphical representation of results. An adapted software package to deal with MOMILPs is discussed briefly. Both this package and the iMOLPe are supplied with the book.

This tutorial on multiobjective programming is based on the vast teaching and research experience of the authors. Concepts and methods are explained without any theorems or proofs. Readers do not require an advanced mathematics background to grasp the whole content of the book. It is clearly written, accompanied with exercises at the end of each chapter, making it a great contribution to acquiring knowledge in the field of multiobjective optimization. 🌐

\* Antunes CH, Alves MJ, Climaco J, 2016. Multiobjective Linear and Integer Programming. Springer, Cham, Switzerland.

Luc, Dinh The, 2016. Multiobjective Linear Programming, An Introduction. Springer.

## SUMMER SCHOOL

# ELAVIO 2017: Fun-filled Learning, Life-long Friendships

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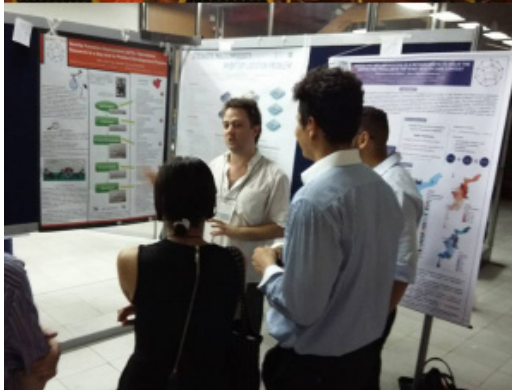
The Summer School ELAVIO XXI was held in 2017 in Argentina from February 24 to March 4, in the cities of Buenos Aires and Miramar. Located 450 km (280 mi) south of Buenos Aires on the Atlantic coast, Miramar is an attractive tourist destination known for its beautiful beaches and a wide range of cultural and culinary attractions that significantly enriched the experience for participants. Hosting the event was the University of Buenos Aires (UBA), one of the Argentina's main centres for scientific and academic activity, and the Alto Miramar Hotel in Miramar.

Opening at the UBA on February 24th, the School changed venue to Miramar on the 26th where closing ceremonies were held 6 days later on March 4th. Thirty of the students presented posters highlighting the key points of their research on the first day of the School at a session held during the inaugural cocktail.

A total of 61 students and young researchers participated, 58 of whom came from various Latin American institutions- 21 from Argentina, 10 from Brazil, 9 from Chile, 7 from Colombia, 4 from Mexico, 3 from Uruguay, 2 from Cuba and 1 each from Ecuador and Peru – who were joined by 3 from Europe, namely, Belgium, Italy and Macedonia. the first two on EURO scholarships and the third on an IFORS grant).

Along with other organizations, IFORS and EURO supported participants to the School. The IFORS Scholarship was bestowed on **Violeta Cvetkoska** from Macedonia. Besting other applicants to the post, she was awarded airfare from home country to the School. Airfare was also granted to scholars selected by EURO, namely: **Tulio A.M. Toffolo** (KU Leuven, Belgium) and **Maxence Delorme** (University of Bologna, Italy). For its part, ELAVIO provided hotel, meals and local transport to these scholars.

The fourteen academics present gave four plenary 45-minute lectures, two 3-hour tutorials and four mini-courses. Ranging



▲ Summer School participants shown intently absorbing: lessons from the lecturer, sharing of fellow delegates during the poster sessions and the glorious sun at the beach!

from 4½ hours to 6 hours each, the courses covered several Operations Research topics. Lecturers from Argentina included Flavia Bonomo, Guillermo Durán, Luciano Grippo, Javier Marengo, Martín Safe; from Brazil were Luciana Buriol, Rosiane de Freitas, Ana Friedlander, Mario Martínez; from Chile were Cristián Cortés, Pablo Rey, Denis Sauré with Stefano Smriglio from Italy and Mario Guajardo from Norway joining them.

The closing fun activity was the “Who wants to be an operations researcher?” quiz consisting of 15 questions relating to materials covered in the courses. Participants responded to the questions one by one, with a wrong answer disqualifying them. Six made it to the last question, which no one got right!

Social and recreational activities included a walkabout in Buenos Aires on the first weekend, a dune buggy excursion along the beach at Miramar ending with a sand boarding activity, a trip to the famous beach resort town 50 km from Miramar, Mar del Plata. Here, the participants saw the sights and took in an important professional basketball game. Participants also had free time to enjoy the beach, experience the local night life, lounge around the comfortable facilities at the hotel where the event was held and even to take part in soccer or pool mini-tournaments.

The first edition of ELAVIO was held in Chile in 1994. Since then, the School has run the event every summer to promote education in operational research among young researchers and graduate students (PhD and Master's degree levels), mainly from Latin America.

The purpose of ELAVIO is to stimulate new collaborations and encourage the involvement of young people in OR by bringing them up to date on research topics through short courses and plenary conferences. >>



>> Participants also have the opportunity to present and discuss their works. At every edition of the School, a strong sense of camaraderie is always fostered, solidifying contacts between the members of research groups from different countries.

This year, the School was financed primarily by CELFI, a programme run by the Argentine Ministry of Science and Technology, with significant support provided by IFORS, EURO and CONICET (Argentina's main scientific research institution).

The Calculus Institute and the Department of Computer Science in the Faculty of Exact and Natural Sciences at the University of Buenos Aires (UBA), and ALIO (the Ibero-American OR society) jointly organized the School.

The next ELAVIO, edition XXII, will be organized in Chile by the Instituto Chileno de Investigación de Operaciones (ICHIO) in 2018. Watch out for the exact dates and location! 🌐

## Interregional Cooperation for Combinatorial Optimization

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The 30th annual conference of the *European Chapter on Combinatorial Optimization* within EURO (ECCO) was made more significant as it was held in conjunction with the second joint conference between EURO and the Operations Research of China (ORSC). Promoted by former EURO President Gerhard Wäscher, the joint EURO/ORSC conference was first held in Shanghai in 2015. On the other hand, ECCO holds a Spring meeting that is usually attended by around 100 participants.

A beautiful Venetian-style town on the Adriatic Coast, Koppe, Slovenia was the venue for this joint EURO/ORSC/ECCO Conference in Combinatorial Optimization 2017 (ECCO XXX). There were about 90 presentations and 140 participants from 19 countries all over the world. Among the delegates, around 35 came from China.

The General Conference Committee of the conference was composed of ORSC President Xiaodong Hu, Silvano Martello, and Gerhard Wäscher. Andrej Brodnik co-chaired the Program Committee with Guochuan Zhang. The Organizing Committee was led by Degang Liu.

EURO supports international meetings on relevant OR topics held in one of its member countries through its sponsorship of a plenary presentation by an internationally renowned operations researcher from a EURO member country. Called the *EURO Plenary*, the talk was delivered by Gerhard Woeginger for this conference. He delivered a stimulating talk on lower bound techniques for algorithmic problems.

Other thought-provoking plenary lectures were given by Robert Bixby on *Progress In Linear And Mixed-Integer Programming*, Xiaotie Deng on *Constructive Output of Existentially Proved Structures in Combinatorics*, and Bernard Ries, *On Some Graph Modification Problems*.



▲ The General Conference Committee: Silvano Martello, Gerhard Wäscher, Xiaodong Hu

The social activities included a bus tour in Piran and a visit to the Piran salt pans, where the *fleur de sel* (flower of salt) is still produced using age-old methods. The tour was concluded with a social dinner in a local wine farm.

It is worth noting here that every fourth year, the ECCO conference is jointly held with the *International Symposium on Combinatorial Optimization* (CO), a series of conferences that started in the UK in 1977.

Submissions are currently encouraged for two special issues of *Discrete Applied Mathematics* and *Journal of the Operations Research Society of China*, dedicated to the Koper EURO/ORSC/ECCO conference, and open to all ECCO, CO, and ORSC members. The next ECCO-CO conference will be held in Fribourg (Switzerland) from June 14 to June 16, 2018. 🌐

## EJOR Turns Forty

Roman Słowiński <roman.slowinski@cs.put.poznan.pl>



The European Journal of Operational Research (EJOR) published its first issue in 1977, and thus in 2017, the journal celebrates its 40th anniversary. On this occasion, the editors presented a special anniversary issue composed of 40 influential papers in the history of EJOR.

The selection has been made from among 14,617 articles published in EJOR until the end of 2016. It is composed of two parts: 20 most cited papers according to the Scopus ranking, and 20 papers characteristic for recent trends, published in each of the last 20 years. In spite of high citation scores some papers were excluded from the list in favor of papers shaping the field with new ideas.

Besides the above anniversary selection of 40 influential EJOR papers, the editors and three other authors published a special

anniversary paper in EJOR: S. Laengle, J.M. Merigó, J. Miranda, R. Słowiński, I. Bomze, E. Borgonovo, R.G. Dyson, J.F. Oliveira, R. Teunter: *Forty years of the European Journal of Operational Research: A bibliometric overview*.

This paper presents a general overview of the journal over its lifetime by using bibliometric indicators. We discuss its performance compared to other journals in the field and identify key contributing countries/ institutions/ authors as well as trends in research topics based on the Web of Science Core Collection database. The results indicate that EJOR is one of the leading journals in the area of OR & MS, with a wide range of authors from institutions and countries from all over the world. Graphical visualization of similarities (VOS) provides further insights into how EJOR links to other journals and how it links researchers across the globe.

During the IFORS conference in Québec City, there will be a special session "Meet the Editors of EJOR on its 40th Anniversary". Please reserve your time for it and come to meet us on Tuesday, July 18, 15:30-17:00. 🌐

# A Nostalgic Look at 60 Years of OR

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IFORS is holding its 21st conference in Quebec City this July, almost sixty years since the first international conference, held in Oxford, England, in September 1957. During this meeting, steps were taken that led to the creation of IFORS on 1st January 1959.

## Oxford 1957



The 1st international conference was initiated by two American societies, the Institute of Management Sciences (TIMS) and the Operations Research Society of America (ORSA), which merged in 1995 to form INFORMS. In January 1955, the vice-president of ORSA, Russ Ackoff, from the Case Institute of Technology, Cleveland, proposed to Pat Rivett, secretary of the OR Society, that a conference should be held. The proposal was received enthusiastically.

Committees were formed in early 1956: the early decisions included limitation of the size of the conference to 250 delegates, pre-publication of the selected papers and solicitation of delegates from 30 countries. The selection of papers proved to be a major task: many potential participants were turned down. It was also agreed that an evening meeting should be held when selected delegates would discuss continuation of the international conference.

Delegates from USA., UK, France, Australia, Austria, Belgium, Canada, Denmark, Germany, India, Israel, Italy, Japan, The Netherlands, Norway, Poland, South Africa, Spain, Sweden, Switzerland and Turkey made it truly an international meeting. Female delegates, though there were not many, and couples were housed in hotels and guest houses. Single males discovered in Balliol and Magdalen colleges, according to Thornton Page in a report to ORSA, that "Oxford undergraduates get along without plumbing on every floor and with the nearest bath sometimes 100 yards away along an outside path". Everyone ate together, in medieval halls, "seated on long oaken benches, and served by the famous Oxford scouts".

David Hertz reported to TIMS that "we were housed and fed (although as one of those who stayed at Balliol, I'm not sure you can call it 'fed' - with no apologies to the hosts, since apparently Balliol college is very proud of its very bad food) all for \$56.00, everything included. Very smoothly run: entertainment at the banquet, nightly informal sessions after we were locked in the colleges by the head porter, being awakened rather brusquely every morning by the under porter - this should convey some of the flavour".

Page reported that speakers, presumably in the discussion sessions, were allowed 7 minutes each, and the timing was controlled by a set of green and red lights. The speaker was not to start another sentence after the red light came on. Hugh Miser recalled that all concerned obeyed this discipline, though at a meeting some years later he heard Tjalling Koopmans complain that he had been cut off by the red light, and would now finish his remarks.

The Proceedings of the conference, which includes a group photograph of the participants, were published the same year. In addition to the formal papers, the opening session, discussions on the papers, panel discussions, reports on OR developments in the countries represented, and the summing-up are also included. The Proceedings were distributed widely, including to all the membership of ORSA. Some of the leading participants are shown below, taken from the group photograph.



▲ Leading participants at the first International Conference in Operational Research, Oxford, 1957. (from left to right: Sir Charles Goodeve, Thornton Page, Philip Morse, George Dantzig, Pat Rivett, David Hertz, E.L. Arnoff).

The following week, the prestigious British journal, *The Economist*, reported on the conference (Anon, 1957). In a perceptive comment, the reporter notes that it is not easy to be sure what OR is "since this co-operative application of the scientific method to the workings of business and other organisations is apt to push its elastic frontiers out round wherever it happens to stray: but many of the activities upon which its gaze happens to light benefit from its scrutiny". The reporter noted a difference between British and American OR: "the experts from the United States were concerned more with the elaboration of its techniques, and with the study of large working systems in all their ramifications, than with the practical case studies and applications British speakers described".

On the last day of the conference, the participants dispersed in seven groups to meet OR workers at their place of work. Tours away from the conference are still an important feature of IFORS conferences, but are now touristic rather than professional. However, the opportunity for social interaction continues to be the main aim of these activities.



## Woodstock: Thursday 5 September 1957

On the last evening of the conference, 26 of the senior delegates met at a "pub", The Bear, in Woodstock, a village outside Oxford close to Blenheim Palace, to discuss plans for another conference. In addition to the UK, the USA and France, the countries represented were Australia, Canada, India, Japan, The Netherlands, Norway and Sweden.



Thornton Page proposed that another conference should be held in 3 years' time in Europe, that it should be of the same size and nature as the Oxford conference, and that in the meantime an international federation of national operational research societies should be formed.

It was agreed that another conference should be held in spring 1960. Although there was a feeling that it should be held in the USA or Canada, it was agreed that expense would prevent many Europeans attending. The sense of the meeting was that a location in Europe, not a large city, should be selected later, and, in fact, Germain Kreweras' suggestion of Aix-en-Provence in France was later approved, though the date turned out to be September 1960.

There was a great deal of discussion about the nature and size of the conference. Philip Morse, from MIT, the first president of ORSA (1952-53), wanted it limited to 100 delegates; others thought that 1000 delegates would be more desirable. It was agreed to restrict attendance to between 200 and 500 delegates, and that a limitation on the size of an individual country's delegation might be desirable.

In the discussion about a permanent Federation, several potential objectives of such an organisation were suggested. They included co-ordinating OR effort on international problems, establishing an abstracting and translating service in OR, ensuring continuity and consistent high quality of international conferences and obtaining travel funds and publication funds, possibly from UNESCO, UN or OEEC. It was agreed that Sir Charles Goodeve and his Committee would continue to act as a secretariat until a federation was established, and that they should prepare a draft charter. Although no formal instructions were given, it was understood that the federation would consist of member societies, not individuals, that the secretariat (committee) should be elected on a rotating basis, that votes would be on some proportional basis, that finance would be raised by subscription, that new member societies would be elected on evidence of qualification, and that the charter could be amended by a majority vote. Sir Charles Goodeve and those members of his Committee who were present accepted these responsibilities, on the understanding that others may be co-opted, and so the ground was laid for the birth of IFORS some 15 months later.

## The birth of IFORS

IFORS came into existence on 1 January 1959. There were initially three member societies: ORSA, the OR Society and the French society, SOFRO. The statutes gave control of the Federation to a Board of Representatives of one member per society: the initial members were John Lathrop (ORSA), Germain Kreweras (SOFRO) and Pat Rivett (OR Society). To discharge the affairs of the Federation, the Statutes provided for a Secretariat consisting

of a Secretary (an executive officer, essentially the President) and Treasurer, to be nominated by a designated "Foster" Society. The first such society was the OR Society, whose nominations of Sir Charles as Secretary and Donald Hicks as Treasurer were accepted by the Board of Representatives.

The Statutes set out the purpose of the new Federation: "the development of operational research as a unified science and its advancement in all nations of the world". Perhaps the most striking aspect of the Statutes is the provision that in all formal votes taken by the Board, the voting strength of each member society is in proportion to the square root of the qualified membership (defined in the by-laws as "broadly those who have a university degree or its equivalent and have worked in the field of operational research for at least 2 years") of that society. This is clearly meant to give greater weight to larger societies, but not to overwhelm the smaller societies. The effect now is that the largest national society (USA with over 12,000 members) has a voting strength of just over 100, compared to the smallest society (Tunisia with 21 members), whose voting strength is less than 5.

## IFORS' first AGM

The first conference following the founding of IFORS was held in Aix-en-Provence in September 1960, but was designated the 2nd IFORS conference. During the conference, the first general meeting of IFORS was held, attended by the official delegates of the ten member societies (The Netherlands, Australia, Sweden, Belgium, Canada, India and Norway had by now joined IFORS). Sir Charles Goodeve reported that the Oxford Conference had yielded a surplus of nearly £1000, that the ten member societies had a combined membership of over 4000, of whom 1700 were "qualified", and that an application for membership had been received from Japan. Four proposals were discussed and later approved by ballot: (i) that ORSA be designated the next foster society, (ii) that the next conference be held in Oslo in 1963, with Norway the host society, (iii) that IFORS sponsor a new abstracting journal and (iv) that the annual membership levy would be 5 shillings (\$0.30) per qualified member.

## IFORS now and the future

In the years since 1955, IFORS had been conceived, born and grown. Many of the societies that were to play key roles in the development of IFORS were already members of the federation, and were drawn from three of the four regional groups that were later to be created. Now over 50 societies are members, representing some 30,000 individuals. But the OR world is very different. The growth of the regional groups, particularly EURO, and INFORMS requires IFORS to continually reassess its role. No doubt there will be discussions along those lines in Quebec, during what is likely to be a very enjoyable and fruitful conference. 🌐

## OR SOCIETY IN FOCUS

# APDIO: Big Accomplishments, Bigger Ambitions

**Ana Carvalho** <anacarvalho@tecnico.ulisboa.pt>  
**Tânia Ramos** <tania.p.ramos@tecnico.ulisboa.pt>

Almost forty years since the Portuguese Association of Operational Research, a.k.a. APDIO (Associação Portuguesa de Investigação Operacional) was founded in 1978, membership has grown from 140 to 250 individual and 11 collective members. Researchers, college professors and individuals from Portuguese industry and services comprise its membership.

In pursuit of its goal to stimulate wider public interest in OR, APDIO has been active in publications. A scientific magazine, "Investigação Operacional" (Operational Research) was produced from 1981 to 2008. Since 1984, a semiannual newsletter has continued to keep members updated in the field. >>



▲ APDIO officers (l to r): Isabel Cristina Lopes, António Ismael Vaz, Luís Dias, Jorge Orestes Cerdeira, José Fernando Oliveira, and Tatiana Tchemisova Cordeiro. Not in photo is Susana Relvas.

>> APDIO has also produced two books, "Casos de Aplicação da Investigação Operacional" (Cases of Operational Research Application) in 2000 and "Investigação Operacional em Ação - Casos de Aplicação" (Operational Research in Action - Case Studies) in 2014, both of which demonstrate how OR can provide the most efficient solution to a variety of real world problems.



of EURO in July 2010.

Nevertheless, international involvement does not detract from APDIO's national focus of making OR an integral part of decision making in Portugal. This effort is being spearheaded by its most

A high point in the APDIO calendar is its national conference that has been held every two years since 1982. The latest one held in 2015, the 17th APDIO National Conference themed "OR and Big Data" attracted around 160 participants. Thus far, these biannual gatherings have led to the publication of four books of Proceedings for the conferences held in 2009, 2011, 2013 and 2015. The next conference will be held in June 2017, with the theme "Solidary Operational Research".

Apart from organizing several OR-themed courses, conferences and seminars, APDIO provides support to scientific or technical OR-related initiatives that take place in Portugal. In particular, APDIO has played an active role in several international congresses like OPTIMIZATION which is regularly held in Portugal, IFORS Triennial Conference held in Lisbon in 1993 and EURO conferences held in Lisbon in 1986 and 2010.

APDIO plays an active role in the international arena, being a long-standing member of IFORS, ALIO, IFAC (International Federation of Automatic Control) and CIM (Centro Internacional de Matemática). Apart from participating in their meetings and occasionally organizing conjoint initiatives with them, APDIO members have been assigned leadership roles in these organizations. For example, current APDIO President José Fernando Oliveira was elected Vice-President

influential members, who show the way towards an ever-increasing reliance on OR-assisted decision making both in the public and private sectors. Along this line, APDIO regularly engages in such activities as brainstorming sessions with representatives of Portugal's industry, extending support towards hiring of OR-related personnel by these companies, and promoting events that raise awareness of the role of OR in management, marketing and general decision-making.

While not forgetting its roots and rich history, APDIO continuously strives for a better tomorrow. APDIO's new initiative *Investigação Operacional Solidária* (Solidary Operational Research) is in place to aid in the management, organization and operation of IPSSs (*Instituições Particulares de Solidariedade Social*), the country's primary welfare providers, through the application of a variety of OR techniques, completely free of charge. Inspired by UK's *Operational Research Society's* OR Pro Bono (<http://www.theorsociety.com/Pages/Probono/Probono.aspx>), this initiative aims to bring the benefits of OR to a general public suffering from the effects of the current financial crisis, while at the same time changing old paradigms and raising awareness of the relevance of OR in real-life everyday situations. APDIO has put this at the top of its agenda, and as earlier mentioned, takes center stage at its 2017 national conference. Supported by its international partners, APDIO will continue to tirelessly work for OR to gain recognition as a foundation of proper decision making and an essential part of society in Portugal. 🌐

## IFORS NEWS

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NORAM	Grace Lin

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Greece	Evangelos Grigoroudis
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India	N.M. Ganguli
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Japan	Jun-ya Gotoh.
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Norway	Marielle Christiansen
Netherlands	LCM Kallenberg
Peru	Orestes Cachay Bosa
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Poland	Jan W. Owsinski
Portugal	Ana Carvalho, Tânia Ramos
Singapore	Huang Boray
Slovenia	Lidija Zadnik-Stirn
South Africa	Martin Kidd
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