

4th South Pacific Continuous Optimization Meeting (SPCOM 2015)

University of South Australia
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Background

SPCOM brought together 60 researchers, including 11 PhD students and 4 early career researchers. Of these researchers, 39 came from many other parts of the world: Austria, Brazil, Canada, China, Finland, France, Germany, Hong Kong, Italy, Malaysia, New Caledonia, Singapore, Spain, and USA.

This was the fourth edition of the successful South Pacific meetings, South Pacific Conferences in Mathematics (SPCM) in 2005 and 2010 held in Noumea, New Caledonia, and South Pacific Optimization Meeting in 2013 (SPOM 2013) held in Newcastle, Australia. SPCOM 2015 was hosted by the University of South Australia (UniSA) and held at UniSA's City West Campus in Adelaide, between 8 and 12 February 2015. SPCOM 2015 took place soon after another Australian mathematics meeting, ANZIAM 2015.

The meeting was generously sponsored by University of South Australia (UniSA), School of Information Technology and Mathematical Sciences (ITMS) at UniSA, Centre for Industrial and Applied Mathematics (CIAM) at UniSA, Australian Mathematical Sciences Institute (AMSI), Centre for Computer Assisted Research Mathematics (CARMA) at the University of Newcastle, University of New Caledonia, Australian Mathematical Society (AustMS), Australian and New Zealand Industrial and Applied Mathematics (ANZIAM), and ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS).

Program

SPCOM 2015 offered a rich scientific program, addressing a diverse range of researchers, from early career to senior. The topics included variational analysis, optimal control theory, convex analysis, numerical optimization, vector optimization, stochastic optimization, functional analysis, and their applications.

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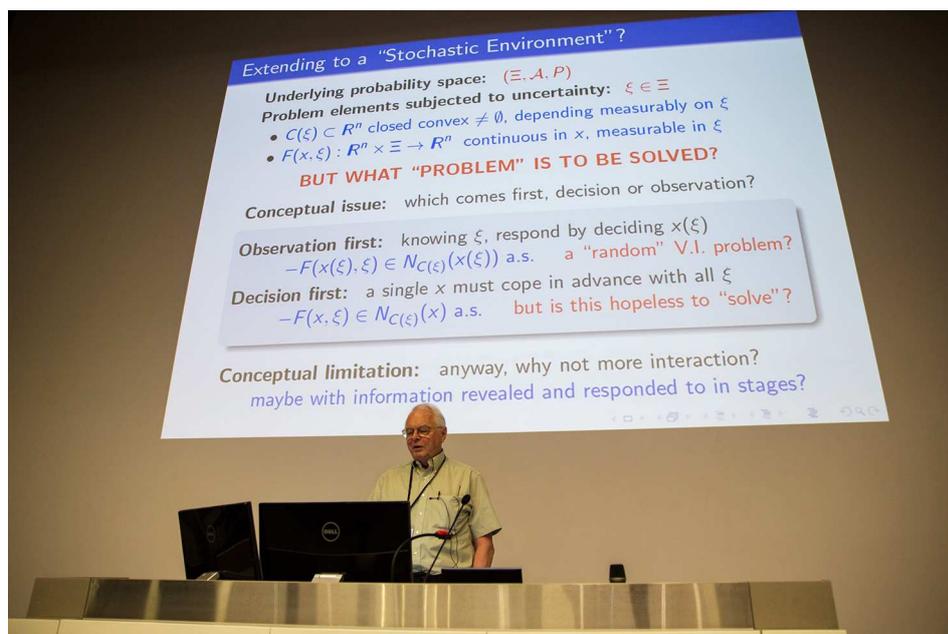
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The activities consisted of general conference talks, the Fitzpatrick Workshop (see below), two half-day tutorials on numerical optimization, and a student poster session. The program at a glance, as well as the detailed program, are still available at the conference website <https://carma.newcastle.edu.au/meetings/spcom/>. Between Monday and Thursday, there were 12 plenary talks, 31 invited talks, and 2 contributed talks.

The meeting started with the two tutorials on Sunday 8 February, one in the morning and one in the afternoon. José Mario Martínez delivered the morning tutorial, which was on numerical smooth optimization. The afternoon tutorial was on numerical non-smooth optimization, delivered by Claudia Sagastizábal. Both tutorials were free of charge for all registered participants, and were indeed very well attended (by 20–25 participants)



Terry Rockafellar gave a stellar opening talk on Monday showing how Stochastic Variational Inequalities can provide the right framework for studying problems of optimization and equilibrium in a stochastic setting. All participants joyfully celebrated his 80th birthday on Tuesday during the meeting banquet, by means of live piano performances, singing and dancing.

Tuesday morning, the Fitzpatrick Workshop celebrated the 25th anniversary of the publication of a seminal paper on maximal monotone operators by the late Australian mathematician Simon Fitzpatrick.

PhD students had the opportunity to showcase their research, and find out more about their peers' research, in a session also held on Tuesday.



SPCOM 2015 further promoted collegiality via a Wineries Tour to McLaren Vale on Wednesday afternoon, which 27 participants joined. The tour featured lunch at a winery, visits to wineries and a stroll at the beach.

SIAM and Springer supported the meeting by sending hard copies of books authored by the SPCOM speakers. These books were displayed on desks during the meeting, and then distributed to the students on the last day of the meeting. SIAM made three of these books available electronically, which were given to students as gifts.

Mathematical significance



Simon Fitzpatrick (b. 1953 Perth, d. 2004 Perth)

Fitzpatrick function and its impact. Simon Fitzpatrick was an outstanding Australian mathematician. His contributions have an increasing impact in Functional Analysis, both in theoretical and applied aspects. The now celebrated Fitzpatrick

function,

$$F_T(x, x^*) = \sup_{y^* \in T(y)} \langle y^* - x^*, x - y \rangle + \langle x, x^* \rangle,$$

where T is a maximally monotone map, has been cited and used extensively in a wide range of applications from PDEs to modern economic theory. It has become a fundamental tool in maximal monotone theory. The Fitzpatrick function was unnoticed for several years until Martínez-Legaz and Théra rediscovered it in 2001. This function provides a bridge between certain monotone phenomena and convex functions. This allows use of powerful variational techniques for studying problems such as (i) first-order monotone flows, (ii) nonlinear evolutionary PDEs and (iii) quasilinear models in continuum mechanics, electromagnetism and heat conduction. In a surprisingly different field, Flam has recently given an economic interpretation of the Fitzpatrick function in terms of a supply curve, which couples prices to quantities in a non-Walrasian market.

In terms of theoretical advances, the Fitzpatrick function has led to considerable simplifications of the proofs of some classical properties involving maximally monotone operators. For example, Simons and Zalinescu used it to obtain a new and short proof of Rockafellar's characterization of maximal monotone operators. Within the theory of maximally monotone maps, Burachik and Svaiter used it to define a one-to-one correspondence between a family of convex functions associated with a maximally monotone operator, and a family of enlargements of these operators. These enlargements, in turn, generated a new way for the efficient approximation and analysis of variational inequality problems. Marques Alves and Svaiter have used it recently to define a new constraint qualification ensuring maximality of the sum of maximally monotone operators in non-reflexive Banach spaces.

Stephen Simons opened the Fitzpatrick Workshop with a plenary talk in which, using concepts emanating from Fitzpatrick's work, he obtained a generalization of Rockafellar's theorem on the maximal monotonicity of subdifferentials, and, among other results, he obtained an extension of Brezis–Browder theorem to non-reflexive Banach spaces (The Brezis–Browder theorem proves that, in a reflexive Banach space, the adjoint of a linear monotone mapping with closed graph is monotone if and only if the original mapping is maximally monotone.) The plenary talk was followed by four 20-minute talks by Jonathan Borwein, Samir Adly, Radu Bot and Regina Burachik. Borwein's talk introduced the strong Fitzpatrick inequality and used it to define a gap function for the monotone inclusion problem and variational inequalities. Bot's talk furnished new duality results for certain convex optimization problems. Adly showed how non-smoothness naturally arises in dynamical systems, such as those induced by electrical circuits, and some problems from mechanics. Burachik presented a new family of enlargements, which is inspired by Fitzpatrick's 1988 paper, in which every member is structurally closer to the epsilon-subdifferential enlargement.

Stochastic variational inequalities and other stochastic problems. Variational inequality modeling, analysis and computations are important for many applications, but most of the subject has been developed in a deterministic setting. In recent years research has proceeded on a track to incorporate stochasticity in one way or another. However, the main focus has been on a rather limited idea of what a stochastic variational inequality might be. Because variational inequalities are especially tuned to capturing conditions for optimality and equilibrium, stochastic variational inequalities ought to provide such service for problems of optimization and equilibrium in a stochastic setting. Therefore they ought to be able to deal with multistage decision processes involving recourse actions, which has so far hardly been the case. Terry Rockafellar showed that this can be accommodated by bringing in the tools of nonanticipativity and its martingale dualization. Roger Wets put these new contributions into a historical perspective in his plenary talk, which described the highlights of Terry Rockafellar's results. To reinforce the stochastic flavor, Claudia Sagastizábal's plenary talk was about a new variant of bundle methods, which has 'on-demand' accuracy, and Jong Shi Pang's plenary talk concerned Nash equilibria for games with stochastic recourse functions.

Theoretical aspects of variational analysis. The plenary talks by Boris Mordukhovich and Asen Dontchev concerned some important theoretical issues of variational analysis. Mordukhovich discussed a new approach of variational analysis and generalized differentiation to characterizations of maximal monotonicity and strong maximal monotonicity properties for set-valued mappings in both global and local frameworks. Dontchev gave an overview of recent advances in the study of Lipschitz properties of solution mappings, which is of paramount importance in the sensitivity study of constrained optimization problems.

Theory and applications of numerical optimization. A common denominator in most talks at SPCOM has been the numerical approaches to several types of optimization problems. Some talks encompassed theory, some applications, and some others both theory and applications. An example of the latter type was Bož's plenary talk, which showed us how duality can be exploited for solving complexly structured non-smooth optimization problems. Jeya Jeyakumar presented new results in global polynomial optimization. José Mario Martínez presented new results on sequential optimality conditions for differentiable constrained optimization. Helmut Maurer spoke about optimal control problems from biology and biomedicine whose solutions exhibit bang-bang and singular control. Xiaoqi Yang presented first- and second-order necessary conditions for nonlinear programming problems from the viewpoint of exact penalty functions. He also presented an interior point method to solve the L_p relaxed penalty problem, together with promising numerical experiments.



Feedback

We have had good feedback from many people who attended the meeting, both face-to-face and in writing. After the conference, the organizers received numerous emails from participants commending them for organizing a high-quality meeting.