4th South Pacific Continuous Optimization Meeting

Programme and Book of Abstracts

City West Campus, University of South Australia

Adelaide, Australia

8-12 February 2015

February 6, 2015

Contents

Welcome to SPCOM 2015

It is a great pleasure to welcome you to the fourth of a series of meetings in the South Pacific region. This edition is a continuation of the successful South Pacific meetings (South Pacific Conferences in Mathematics (SPCM) in 2005 and 2010 held in New Caledonia, and South Pacific Optimization Meeting in 2013 (SPOM 2013) held in Newcastle, Australia.

The Fourth South Pacific Continuous Optimization Meeting (SPCOM 2015) is hosted by the University of South Australia (UniSA) and is held in the City West campus of UniSA in Adelaide, Australia, between 8 and 12 February 2015.

This meeting features 12 plenary talks, 37 invited and contributed talks, and poster presentations by PhD students. Participants come from all over the world, including Australia, Austria, Brazil, Canada, China, Finland, France, Germany, Hong Kong, Italy, Malaysia, New Caledonia, Singapore, Spain, and USA.

As you will see from the list of the keynote speakers, this is probably the most impressive collection of optimizers to gather at one time down under. Add to this the pleasures of Adelaide and the fine South Australian red wines, and a successful meeting is guaranteed.

We are very proud to be 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 Mathematics Science 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) . We acknowledge the professional help given by David Allingham of CARMA in managing the abstract submission system and mantaining the conference website.

We hope you enjoy SPCOM 2015,

Regina Burachik and Yalçın Kaya (University of South Australia) (local organizers)
Jonathan Borwein (University of Newcastle)
Henri Bonnel (University of New Caledonia)

Tutorials

SPCOM 2015 hosts two half-day tutorials on Sunday 8 February. These cover modern numerical optimization techniques, their theory and applications. They target postgraduate students, early career researchers, as well as any other researchers interested in the latest developments of the topic. The tutorials are free of charge for all registered participants. The description of both tutorials are as follows.

- **Numerical smooth optimization**, delivered by José Mario Martínez (State University of Campinas), from 9:00-12:00 in room H6-03 in Hawke building.
- **Numerical non-smooth optimization**, by Claudia Sagastizábal (Instituto Nacional de Matemática Pura e Aplicada), from 14:00-17:00 in room H6-03 in Hawke building.

Plenary Talks

Plenary Talk: Monday 17:30

Allan Scott Auditorium, H2-16

Primal-dual methods for solving complexly structured nonsmooth optimization problems

Radu Ioan Boţ—Faculty of Mathematics, University of Vienna, Austria
[Plenary talk]

In this talk we address the solving of a primal-dual pair of convex optimization problems with complex and intricate structures, by actually solving the corresponding system of optimality conditions, which involves mixtures of linearly composed, Lipschitz single-valued and parallel-sum type monotone operators. We propose two iterative schemes relying on different paradigms that have as common feature the fact that they process the set-valued maximally monotone operators individually via backward steps, while the single-valued operators are evaluated via explicit forward steps. After carrying out a convergence analysis for the two splitting algorithms, we illustrate their performances by several numerical experiments with real-life problems arising in location theory, image and video processing, convex risk minimization and machine learning.

Plenary Talk: Thursday 14:30

Allan Scott Auditorium, H2-16

Lipschitz Stability in Variational Analysis

Asen Dontchev—American Mathematical Society and University of Michigan, USA
[Plenary talk]

The classical sensitivity analysis developed in the early days of optimization revolves around determining derivatives of optimal values, states and controls with respect to various parameters in the problem. In problems with constrains however standard differentiability typically fails. One way to deal with this is to employ concepts of generalized differentiability, and we will illustrate this on a problem of convex best interpolation, or to study directly Lipschitz properties of solution mappings. The idea to use Lipschitz continuity instead of differentiability goes back to Hildebrandt and Graves in their paper from 1927 and has culminated in the work of S. M. Robinson from 1980. This talk gives an overview of recent advances in the field.

Plenary Talk: Wednesday 9:00

Allan Scott Auditorium, H2-16

Global Polynomial Optimization: From Single-level to Bi-level Optimization Problems

Jeya Jeyakumar—School of Mathematics and Statistics, University of New South Wales, Australia
[Plenary talk]

In this talk I will present semidefinite relaxation approaches for examining and solving classes of global polynomial optimization problems. I will also discuss the associated approximation schemes for studying bi-level global polynomial optimization problems. In addition to the usual tools of nonlinear optimization, such as convex analysis and linear algebra, powerful techniques of real algebraic geometry allow us to examine and solve hard global optimization problems involving polynomials.

What has real algebraic geometry to do with optimization? The answer is: quite a lot. And all this is due to innovative ideas and links discovered in the last two decades between pure and applied mathematics. A good understanding of convexity in real algebraic geometry will lead to insights into solving hard global optimization problems.

Plenary Talk: Tuesday 15:00

Allan Scott Auditorium, H2-16

Stopping criteria and optimality conditions for constrained optimization algorithms

Jose Mario Martínez—Department of Applied Mathematics, State University of Campinas, Brazil
[Plenary talk]

Sequential optimality conditions for smooth constrained optimization will be discussed (AKKT, CAKKT, AGP, L-AGP). These conditions do not require constraint qualifications and are natural generators of stopping criteria in practical optimization. Strict constraint qualifications will be defined as the constraint qualifications that, together with AKKT, imply the popular pointwise KKT conditions. Some optimization algorithms have the property of converging to AKKT points, but other algorithms do not enjoy that property.

Plenary Talk: Tuesday 14:00

Allan Scott Auditorium, H2-16

Applications of bang-bang and singular control problems in biology and biomedicine

Helmut Maurer—Institute for Computational and Applied Mathematics, University of Muenster, Germany
[Plenary talk]

We present some recent optimal control applications in biology and biomedicine. A critical issue in such control models is the appropriate choice of an objective functional. While many authors use L2-type objectives with quadratic control, we argue that L1-type objectives with linear control are more appropriate in a biological framework. Pontryagin's Maximum Principle then implies that optimal controls are concatenations of bang-bang and singular arcs. This talk focusses on three applications: (1) optimal control of the chemotherapy of HIV, (2) optimal control of an epidemiological SEIR model of disease transmission, and (3) restoration of circadian rhythms by model-based optimal control. To compute optimal solutions we either use discretization methods or solve the Induced Optimization Problem with respect to switching times. For bang-bang controls we are able to verify second-order sufficient conditions which recently have been obtained in the literature. Application (2) is joint work with Maria Rosario de Pinho (Porto), application (3) is work in progress with Dirk Lebiedz (Ulm).

Plenary Talk: Monday 14:30

Allan Scott Auditorium, H2-16

Coderivative chacterizations of maximal monotonicity

Boris Mordukhovich—Department of Mathematics, Wayne State University, USA
[Plenary talk]

This talk discusses 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. In this way we develop complete coderivative characterizations of maximal monotonicity (resp. strong maximal monotonicity) of set-valued mappings in terms of pointwise positive-semidefiniteness (resp. positive-definiteness) conditions imposed on their coderivatives. Applications of these results are given to second-order subdifferential characterisations of convexity for remarkable class of nonsmooth functions, which frequently appear in problems of variational analysis and optimization. Some open questions are formulated.

The talk is based on the recent joint papers by the author with N. H Chieu, G. M. Lee and T. T. A. Nghia.

Plenary Talk: Thursday 10:00

Allan Scott Auditorium, H2-16

Topics in Computing Nash Equilibria

Jong-Shi Pang—Industrial and Systems Engineering, University of Southern California, USA
[Plenary talk]

Reporting joint work with Francisco Facchinei and Gesualdo Scutari, this talk presents results on two topics pertaining to the computation of Nash equilibria in non-cooperative games. These are: (a) equilibrium constrained optimization, and (b) games with minmax players. The former topic is treated more broadly under the framework of variational-inequality constrained hemivariational inequality. Interestingly, a particular pull-out approach for solving the latter class of games can be applied to a sampled version of games with stochastic recourse functions. This latter topic is our preliminary foray into the broad class of non-cooperative games with uncertainty that involves the joint efforts of Suvrajeet Sen and Uday Shanbhag.

Plenary Talk: Monday 9:00

Allan Scott Auditorium, H2-16

Stochastic Variational Inequalities: Extended Territory and Motivation

Terry Rockafellar—Department of Mathematics, University of Washington, USA
[Plenary talk]

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. This can be accommodated by bringing in the tools of nonanticipativity and its martingale dualization.

Plenary Talk: Wednesday 10:00

Allan Scott Auditorium, H2-16

Bundle Methods and On-demand Accuracy: a winning combination in nonsmooth optimization

Claudia Sagastizábal—National Institute for Pure and Applied Mathematics- IMPA, Brazil
Co-authors: W. van Ackooij, W. de Oliveira
[Plenary talk]

We discuss a general algorithmic framework for nonsmooth optimization, suitable for dealing with ”on-demand accuracy”. This recent bundle variant was designed to solve nonsmooth problems for which the oracle providing information can perform its calculations with varying precision, following the directives of the bundle solver.

To illustrate the versatility and interest of such a setting, we consider probabilistically constrained problems, that involve computing difficult multidimensional integrals at each iteration. The interest of the considered technique is in the fact that it is possible to solve the problem exactly by starting the algorithmic procedure with coarse estimations, making the oracle calculations increasingly more exact, only at some iterations. On-demand algorithms keep the convergence properties of classical bundle methods and, as shown by our numerical experiments, can provide very significant gains in CPU time without losing accuracy in the solution.

An interesting by-product of our study is a partly inexact variant of the well-known Multiplier Method of Hestenes and Powell.

Plenary Talk: Thursday 9:00

Allan Scott Auditorium, H2-16

From hiking to stochastic variational inequalities

Roger Wets—Department of Mathematics,
University of California, Davis, USA
[Plenary talk]

Since 1963, before I completed my Ph.D., R.T. Rockafellar had been on my radar. We finally met briefly in 1965 in Princeton but our friendship developed seriously as hiking partners after he joined the University of Washington in 1966. We both were interested in hiking the Olympics and the Cascades. Although we clearly knew that there was some overlap in our research interest an intensive collaboration developed only in the early 1970s. This lecture is mostly about having access to an absolutely splendid mind and how it contributed so much to the objectives that I pursued and would never have been able to reach without Terry's!

Plenary Talk: Monday 10:00

Allan Scott Auditorium, H2-16

Non-Lipschitzian Reformulation Method for Constrained Optimization Problems

Xiaoqi Yang—Department of Applied Mathematics, Hong Kong Polytechnic University, Hong Kong
[Plenary talk]

In this talk we discuss first- and second-order necessary conditions for nonlinear programming problems from the viewpoint of exact penalty functions. By applying the variational description of regular subgradients, we first establish necessary and sufficient conditions for a penalty term to be of KKT-type by using the regular subdifferential of the penalty term. In terms of the kernel of the subderivative of the penalty term, we also present sufficient conditions for a penalty term to be of KKT-type. We then derive a second-order necessary condition by assuming a second-order constraint qualification which requires that the second-order linearized tangent set is included in the closed convex hull of the kernel of the parabolic subderivative of the penalty term. In particular, for an $L_{2/3}$ penalty term, by assuming the nonpositiveness of a sum of a second-order derivative and a third-order derivative of the original data and applying a third-order Taylor expansion, we obtain the second-order necessary condition. We also design an interior-point method to solve the relaxed L_p penalty problem and carry out numerical experiments. Our numerical results show that our method is competitive with the existing interior-point L_1 penalty method.

Fitzpatrick Workshop

This half-day workshop celebrates 25 years of the publication of a seminal paper on maximal monotone operators published by the Australian mathematician Simon Fitzpatrick. Fitzpatrick's 1988 paper introduced a key tool in functional analysis, with important implications in mathematical optimization. An objective of this workshop is to review, after a quarter of a century passed, some of the open questions posed by Simon Fitzpatrick in this paper. Stephen Simons will give a keynote talk in connection with Fitzpatricks contributions to Functional Analysis. Then a number of 20-minute talks will follow. The organizers of this half-day workshop are Jon Borwein and Regina Burachik.

Plenary Talk: Tuesday 9:00

Allan Scott Auditorium, H2-16

Part of the legacy of Simon Fitzpatrick: r_L–density and maximal monotonicity

Stephen Simons—Department of Mathematics, University of California, Santa Barbara, USA

[Plenary talk at Fitzpatrick Workshop]

We introduce SN spaces, which include Hilbert spaces, negative Hilbert spaces and spaces of the form $E \times E^*$, where E is a nonzero real Banach space. We introduce L–positive subsets, which include monotone subsets of $E \times E^*$. We introduce the concept of r_L–density. In the $E \times E^*$ case, every closed r_L–dense monotone set is maximally monotone, but there exist maximally monotone sets that are not r_L–dense. The graph of the subdifferential of a proper, convex lower semicontinuous function on E is r_L–dense. The closed monotone and r_L–dense sets have a number of very desirable properties, including a sum theorem under both natural and unnatural constraint conditions, so r_L–density satisfies the ideal calculus rule. We also give a generalization of the Brézis–Browder theorem on linear relations. Most of our results are consequences of Simon Fitzpatrick's seminal 1988 paper.

Invited Talks at the Fitzpatrick Workshop: Tuesday 10:30-12:30

Room H6-12

The Fitzpatrick function as a gap function for maximal monotone inclusions

Jonathan Borwein - CARMA, University of Newcastle, Australia, Joydeep Dutta

[Invited talk - Fitzpatrick Workshop - Tuesday 10:30-11:00]

Consider a maximal monotone operator T on a reflexive Banach space X with dual X^*. The *Fitzpatrick Function* [1,2], defined by

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

is a closed convex function that satisfies the *strong Fitzpatrick inequality* [2, Thm 9.7.2]

$$[F_T(x, x^*) \geq \frac{1}{2} d^2_{\mathrm{graph}T}(x, x^*),]$$

with equality exactly on the graph and with the distance taken in the Euclidean product norm. This inequality has remarkable power. In this talk we will use it to develop properties of the *gap function* $[G_T(x) := \sup_{y^* \in T(y)} \langle y^*, x - y\rangle,]$ and associate *gap-value* $[\gamma_T(x) := \inf_x G_T(x) \geq 0.]$

We shall apply these to the study of the *monotone inclusion*, $0 \in T(x)$, and the associated *monotone variational inequality* $0 \in T(x) + N_C(x)$ for a closed convex set C (see [1, §8.3] and [2, §9.3.2]). This is joint work with Joydeep Dutta (`http://www.carma.newcastle.edu.au/jon/inclusion.pdf`).

References.

[1] J.M. Borwein and A.S. Lewis, *Convex Analysis and Nonlinear Optimization. Theory and Examples*, Canadian Mathematical Society Books in Math, Volume 3, Springer-Verlag, New York, 2000. Revised edition 2005.

[2] J.M. Borwein and J. Vanderwerff, *Convex Functions: Constructions, Characterizations and Counterexamples*, Encyclopedia of Mathematics and Applications, **109**, Cambridge University Press, 2010.

Related papers are available on the CARMA document server `http : //docserver.carma.newcastle.edu.au/` and on my web pages `http : //www.carma.newcastle.edu.au/jon`

Qualification conditions formulated via the quasi-relative interior in convex programming

Radu Ioan Boţ - University of Vienna, Austria
[Invited talk - Fitzpatrick Workshop - Tuesday 11:00-11:30]

A challenge in convex programming is to provide weak sufficient conditions which guarantee strong duality for a primal-dual pair of optimization problems. In this talk we discuss some recently introduced qualification conditions for strong Fenchel duality formulated in terms of the notions of quasi interior and quasi-relative interior. Comparisons with the most classical interiority-type conditions and also with the closedness-type conditions are made. By using a classical approach, we also furnish duality statements for a convex optimization problem with cone inequality constraints and its Lagrange dual problem, which correct some results given in the literature.

An invitation to the world of nonsmooth dynamical systems

Samir Adly - University of Limoges, France
[Invited talk - Fitzpatrick Workshop - Tuesday 11:30-12:00]

Nonsmooth dynamical systems is a part of differential inclusions. With the emergence of many engineering applications, nonsmooth dynamical systems have played a central role in the understanding of many phenomena. The mathematical formulation of the unilateral dynamical system involved inequality constraints and necessarily contains natural nonsmoothness. The nonsmoothness could originate from the discontinuous control term, or from the environment of the system e.g. impact with dry friction in mechanical systems. Due to the lack of smoothness, classical mathematical methods are applicable only to a limited amount and require naturally extensions for both analytical and numerical methods by using modern tools of variational analysis. In this talk, we will review the following class of problems: i) Linear Complementarity Systems and their applications in electrical circuits ii) Evolution Variational inequalities and their applications in mechanics iii) Moreau's sweeping process

An additive subfamily of enlargements of a maximally monotone operator

Regina Burachik, University of South Australia, Juan Enrique Martinez-Legaz, Mahboubeh Rezaei, Michel Thera
[Invited talk - Fitzpatrick Workshop - Tuesday 12:00-12:30]

We introduce a subfamily of additive enlargements of a maximally monotone operator. Our definition is inspired by the early work of Fitzpatrick presented in 1988. These enlargements are a subfamily of the family of enlargements introduced by Svaiter in 2000. For the case of the operator being the subdifferential of a convex function, we prove that some members of the subfamily are contained in the ε-subdifferential enlargement. In this case, we construct a specific enlargement which coincides with the ε-subdifferential. Since they are all additive, the enlargements in our subfamily can be seen as structurally closer to the ε-subdifferential enlargement.

Invited Talks

Invited Talks in Alphabetical Order

Some historical aspects about Newton's method: from smooth to nonsmooth equations.

Samir Adly - University of Limoges, France
[Invited talk]

In this talk, we will focus on the well-known Newton's method or Newton-Raphson-Simpson method for solving nonlinear equations. Some short historical facts on this method will be presented. We will particularly focus on nonsmooth Newton's method for solving generalized equations. We will present Newton's method for solving variational inclusion using set-valued approximation and its superlinear convergence. The semismooth case and the inexact proximal point algorithm will be presented in details. We will present also a Kantorovich type theorem and show the quadratic convergence of the Newton sequence under the metric regularity assumption.

Trust region methods in nonsmooth optimization

Adil Bagirov - Federation University, Australia
[Invited talk]

In this talk, first we give a brief overview of existing methods of nonsmooth optimization. Then, we present a new trust region method for solving nonsmooth nonconvex optimization problems and discuss its convergence. Finally, we report computational results with well-known nonsmooth optimization academic test problems and compare this method with other nonsmooth optimization methods.

Mixed-Integer Optimal Control Problems: Theory, Numerical Solution and Nonlinear Model Predictive Control

Hans Georg Bock - Heidelberg University, Germany, F. Kehrle, C. Kirches, E. A. Kostina, R. W. Longman, S. Sager and J. P. Schlöder
[Invited talk]

In this presentation we discuss theoretical and numerical aspects of optimal control problems with integer-valued control variables, a problem class that combines nonlinear continuous optimization complexity with that of mixed-integer optimization. Despite the practical relevance and ubiquity of integer or logical decision variables such as valves, gears or the start-up of sub-units in chemical plants, numerical optimization methods capable of solving such nonlinear mixed-integer optimal control problems for large-scale systems and in real-time have only recently come within reach. Nonlinear mixed-integer optimal control problems such as the minimum energy operation of subway trains equipped with discrete acceleration modes were solved as early as the late seventies for the city of New York. Indeed one can prove that the Pontryagin Maximum Principle holds which makes an indirect solution approach feasible. Based on the Competing Hamiltonians Algorithm, open loop and feedback solutions for problems with discontinuous dynamics were computed that allowed a tested reduction of 18 per cent in traction energy. However, such "indirect" methods are relatively complex to apply and numerically less suitable for large-scale real-time optimization problems for various reasons. To overcome these difficulties, we have developed a new "direct" approach, which is based on a control specific relaxation. This so-called outer convexification convexifies the velocity space - rather than the control region - and the resulting problem can then be solved by a modification of the direct multiple shooting method as an "all-at-once" approach. Using arguments from functional analysis it can be shown that the relaxed problem yields an optimal solution without any integer gap. Moreover, it can be arbitrarily closely approximated by an integer solution with finitely many switches, which can be computed by sophisticated, but fast rounding procedures. The gain in performance is enormous, orders of magnitude of speed-up over a state-of-the-art MINLP approach to the discretized problem, and even for smaller instances where the NP hardness of the problem is not yet computationally prohibitive for the latter, as e.g. in a moderate horizon automobile test drive problem. Real-time NMPC results for on-board energy optimal cruise control of heavy duty trucks are presented. Meanwhile, even the minimum time NMPC problem of a race car with changing gears has been solved numerically on a whole formula 1 race track. (based on joint work with F. Kehrle, C. Kirches, E. A. Kostina, R. W. Longman, S. Sager and J. P. Schlöder)

Semivectorial Bilevel Optimization on Riemannian Manifolds

Henri Bonnel - University of New Caledonia, L. Todjihounde, C. Udriste
[Invited talk]

In this talk we deal with the semivectorial bilevel problem in the Riemannian setting. The upper level is a scalar optimization problem to be solved by the leader, and the lower level is a multiobjective optimization problem to be solved by several followers acting in a cooperative way inside the greatest coalition and choosing among Pareto solutions with respect to a given ordering cone. For the so-called "optimistic problem", when the followers choice among their best responses is the most favorable for the leader, we give optimality conditions. Also for the so-called "pessimistic problem", when there is no cooperation between the leader and the followers, and the followers choice may be the worst for the leader, we present an existence result. The results are new even for the Euclidean setting.

Optimal Backward Error and the Dahlquist Test Problem

Robert Corless - Western University, Canada, Yalçın Kaya, Robert H.C. Moir
[Invited talk]

The Dahlquist test problem is the simple linear first order ODE $\dot{y} = \lambda y,\ y(t_n) = y_n$, to be solved on $t_n \le t \le t_n + h$. Taking $\lambda \in \mathbb{C}$ gives rise to the classical theory of stiffness (when Re$\lambda \ll 0$). Several mathematical theories emerged from study of this equation: A-stability, L-stability, and the so-called theory of "order stars". These theories connected approximation theory over $\mathbb{C}$ with the theory of stability of numerical methods.

Recently, we have made some progress understanding numerical methods for initial-value problems (IVP) $\dot{y} = f(y), y(0) = y_0$ from the point of view of "optimal backward error". That is, a numerical method, say $y_{n+1} = y_n + h\Phi$, produces a *skeleton* $\{(t_n, y_n)\}_{n=0}^{N}$ of a solution, which is usually interpolated by a piecewise polynomial to give a continuously differentiable solution. By interpolating instead with the solution of either

$$\dot{z} = f(z) + \Delta(t) \qquad t_n \le t_{n+1}$$

or

$$\dot{z} = f(z)(1 + \delta(t)) \qquad t_n \le t_{n+1}$$

we ask for the "smallest" Δ (or δ) that still has both $z(t_n) = y_n$ and $z(t_{n+1}) = y_{n+1}$. This computational *a posteriori* analysis can be applied to any problem and any method. For the Dahlquist test problem, the results are surprising. This talk uses the calculus of variations and optimal control theory. But only just.

Symmetry, Invariance and Criticality

Andrew Eberhard - RMIT University, Vera Roshchina
[Invited talk]

The aim of this talk is to summarise, relate, explain and generalise a range of results in nonsmooth, and predominantly nonconvex analysis, that exploit the symmetry of underlying problems. Results of this kind date back to the work of Palais on the principle of symmetric criticality but there are more recent results that can be placed in a similar framework that revolves around the application of groups of symmetries. Some new results of this kind will be discussed including one involving monotone operators.

Detecting Non-Hamiltonicity in Cubic Graphs

Jerzy Filar - Flinders University, Kieran Clancy, Michael Haythorpe
[Invited talk]

The famous Hamiltonian cycle problem (HCP) "to determine whether a graph possesses a simple cycle that passes through all vertices exactly once" is known to be NP-complete even for the relatively simple class of cubic graphs. With the help of: (i) A stochastic embedding of a graph in a Markov decision process, and (ii) Symmetry reductions we develop a large order, but still polynomial algorithm, that is very promising in correctly identifying Hamiltonicity of cubic graphs.

Numerical Method in Optimization as a Multi-Stage Discrete-Time Control System

Bean San Goh - Curtin University Sarawak Malaysia
[Invited talk]

Numerical methods to solve optimization problems can be considered as a multi-stage decision control systems. Furthermore, it is intrinsically a two phase system. When the local search region does not contain the minimum point, ideally iterations should be defined so that the next point is on the boundary of the local search region. These ideal iterations should then be approximated to define practical iterations. Many numerical methods tend to use quadratic models to construct iterations with assumptions some of which are analyzed here. In the final stages, the local search region contains the minimum point. Then, the Newton method or equivalent should be used and fast convergence is achieved.

A set-valued approach to zero-sum matrix games with vector payoffs

Andreas H. Hamel - Free University Bolzano, Italy, Andeas Loehne
[Invited talk]

Classical theory states that zero-sum matrix games are always in equilibrium when mixed strategies are allowed. Moreover, the optimal strategies are obtained by solving a dual pair of linear programming problems. It is shown that games with vector payoffs are hardly in equilibrium, and reasons for this phenomena are given. The question of what should the players actually do is addressed using the framework of set-valued duality theories recently established by the two authors.

The Sylvester equation, spectral separation and generalised resolvents.

Phil Howlett, University of South Australia
[Invited talk]

When $A, B \in \mathbb{C}^{n\times n}$ have distinct eigenvalues $\{\lambda_i\}_{i=1}^n \in \mathbb{C}$ and $\{\mu_j\}_{j=1}^n \in \mathbb{C}$ the Sylvester equation $AX - XB = C$ has a unique solution for all $C \in \mathbb{C}^{n\times n}$ if and only if $\lambda_i \neq \mu_j$ for all $i, j = 1, 2, \ldots, n$. The sets $\sigma(A) = \{\lambda_i\}_{i=1}^n$ and $\sigma(B) = \{\mu_j\}_{j=1}^n$ are called the spectral sets of A and B respectively. This is an elementary example where spectral separation $\sigma(A)\cap\sigma(B) = \emptyset$ is important. I will show how these ideas extend to a generalised Sylvester equation $A_0XB_1 - A_1XB_0 = C$ where $B_0, B_1 \in \mathcal{B}(F,G)$, $A_0, A_1 \in \mathcal{B}(H,K)$ and $C \in \mathcal{B}(F,K)$ are known bounded linear operators, F, G, H and K are Banach spaces and $X \in \mathcal{B}(G,H)$ is an unknown bounded linear operator. These equations will be used to motivate discussion about Laurent series representations $R(z) = \sum_{j\in\mathbb{Z}} R_j z^j$ on a region $s < |z| < r$ for generalised resolvents in the form $R(z) = (A_0 + A_1 z)^{-1}$, the relevance of spectral separation for the spectral set $\sigma(A_0, A_1)$ of $R(z)$ and the numerical calculation of $R(z)$ using a system of fundamental equations for the coefficients $\{R_j\}_{j\in\mathbb{Z}} \subset \mathcal{B}(K,H)$.

Duality results for approximate proper solutions in vector optimization

Lidia Huerga - Universidad Nacional de Educacion a Distancia, Spain, C. Gutiérrez, V. Novo, C. Tammer
[Invited talk]

An approximate dual scheme for vector optimization problems is presented, in such a way that the dual problem is formulated in terms of a scalar Lagrangian and an approximation set C. Under stability and generalized convexity assumptions, weak and strong duality results are derived for a type of approximate proper solutions of the primal problem, called Benson (C,ε)-proper solutions. These results extend and improve several others proved in the literature, since for a suitable C, the set of Benson (C,ε)-proper solutions has a good limit behaviour when the error ε tends to zero, in the sense that all of its elements are close to the efficient set.

A diagonal bundle method for sparse nonsmooth problems

Napsu Karmitsa - University of Turku, Finland
[Invited talk]

Many practical optimization problems involve nonsmooth functions with thousands of variables. Usually, the Hessian of the problem — if it exists — is sparse. In this talk I describe an efficient diagonal bundle method (D-Bundle) for sparse nonsmooth, possibly nonconvex optimization. The method combines the limited memory bundle method with sparse updating of matrices. The numerical experiments have been made using problems with up to million variables. The results to be presented confirm the usability of the D-Bundle especially for extremely large-scale problems.

Polynomial Optimization via Mean Filter Regularization and Trajectory Methods

Yalçın Kaya - University of South Australia, Orhan Arıkan, Regina S. Burachik
[Invited talk]

We introduce a new regularization technique, called the mean filter regularization, and apply this technique to computing the global minimum of univariate polynomials of even degree. The mean filter regularization is shown to convexify a given univariate polynomial of even degree. By using the regularization parameter as the independent variable, a trajectory is constructed on the surface associated by the mean filter function. For quartic polynomials, we prove that this trajectory converges to a global minimum. The technique is illustrated numerically to be successful also for polynomials of higher even degree.

Efficient Optimization Methods for Model Validation in Dynamical Processes

Ekaterina Kostina - University of Marburg, Germany, Hans Georg Bock, Max Natterman
[Invited talk]

A successful application of model-based simulation and optimization of dynamic processes requires an exact calibration of the underlying mathematical models. Here, fundamental tasks are the estimation of unknown model coefficients by means of real observations and design of optimal experiments.

After an appropriate numerical treatment of the differential systems, which is based on simultaneous boundary value problems methods, the parameters can be estimated as the solution of a finite dimensional nonlinear constrained parameter estimation problem. Due to the fact that the measurements always contain defects, the resulting parameter estimate cannot be seen as an ultimate solution and a sensitivity analysis is required, to quantify the statistical accuracy. The goal of the design of optimal experiments is the identification of those measurement times and experimental conditions, which allow a parameter estimate with a maximized statistical accuracy. Also the design of optimal experiments can be formulated as an optimization problem, where the objective function is given by a suitable quality criterion based on the sensitivity analysis of the parameter estimation problem.

Special emphasis in this talk is placed on sensitivity analysis of second order and corresponding design of optimal experiments. New numerical methods will be presented, and numerical experiments will be discussed that indicate a wide scope of applicability of the methods, and an enormous potential for reducing the experimental effort and improving the statistical quality of the models.

About Uniform Regularity of Collections of Sets in Hilbert Spaces

Alexander Kruger, Federation University Australia
[Invited talk]

In this talk, we discuss uniform regularity of collections of sets in the Hilbert space setting having in mind applications to convergence analysis of projection algorithms. Primal and dual characterisations of this property will be presented in terms of certain regularity constants. The relationships between the constants (and the properties) will be demonstrated.

Error Bounds for Classes of Polynomial Systems and their Applications: A Variational Analysis Approach

Guoyin Li - University of New South Wales, Australia
[Invited talk]

Error bound is an important tool which provides an effective estimation of the distance from an arbitrary point to a set in terms of a computable "residual function". The study of error bound plays an important role in the convergence analysis of optimization algorithms and accurate identification of active constraints. In this talk, we are interested in error bound for classes of polynomial systems. Using variational analysis technique, we first establish a global Holderian type error bound with an explicit estimate of the Holderian exponent extending the known results of convex quadratic functions to convex polynomials. Next, we examine the cases for nonconvex polynomial system. Finally, as applications, we apply the error bound results to (1) provide a quantitative convergence analysis of some classical algorithms such as the cyclic projection method and proximal point methods. (2) obtain high-order stability for polynomial optimization problem. This talk is based on joint work with J.M. Borwein, V. Jeyakumar, B.S. Mordukhovich, L.Q. Qi, T.S. Pham and L. Yao.

Dynamic Optimization Techniques for Parameter Estimation

Qun Lin - Curtin University, Australia, Ryan Loxton, Chao Xu, Kok Lay Teo
[Invited talk]

This talk considers the problem of using noisy output data to estimate unknown time-delays and unknown system parameters in a general nonlinear time-delay system. We formulate the problem as a dynamic optimization problem in which the unknown quantities are decision variables to be chosen optimally, with the cost function penalizing the mean and variance of the least-squares error between actual and predicted system output. Since the time-delays and system parameters influence the cost function implicitly through the governing time-delay system, the cost function's gradient -which is required to solve the problem using gradient-based optimization techniques - cannot be computed analytically using standard differentiation rules. We instead develop two computational methods for evaluating this gradient: one involves solving an auxiliary time-delay system forward in time; the other involves solving an auxiliary time-advance system backward in time. On this basis, we propose an efficient optimization algorithm for determining optimal estimates for the time-delays and system parameters.

Optimisation on Manifolds, and Optimisation Geometry

Jonathan Manton - University of Melbourne, Australia
[Invited talk]

The past decade has seen a surge of interest in optimisation on manifolds, driven by the fact that some real-world problems are best formulated on a manifold such as a Grassmann or Stiefel manifold, or even on a more structured space such as a Lie group. A basic question to ask, and one with a long history, is how the Newton method can be extended to a manifold. A partial answer, in the form of a general framework, has been given recently (http://arxiv.org/abs/1207.5087). Interestingly, studying the more general context of optimisation on manifolds leads to new insight into the Euclidean case. Having reviewed this, the talk then focuses on what we call real-time optimisation. Here, geometry plays a prominent role because the class of cost functions as a whole can be treated as a fibre bundle. This research is in its infancy but it is speculated there will be close connections between geometry and the complexity of (real-time) optimisation; a link with Smale's notion of topological complexity can already be made. Finally, the question is asked whether the current dichotomy in optimisation, that convex problems are easy and all other problems are hard, is an artefact of focusing on the Euclidean case and neglecting other rich geometric structures.

Alternance for multivariate functions

Nadezda Sukhorukova - Swinburne University of Technology, Australia, Julien Ugon, David Yost
[Invited talk]

We derive optimality conditions (Chebyshev approximation) for multivariate functions. The theory of Chebyshev (uniform) approximation for univariate functions is very elegant. The optimality conditions are based on the notion of alternance (maximal deviation points with alternating deviation sign). It is not very straightforward, however, to extend the notion of alternance to the case of multivariate function. There have been several attempts to extend the theory to the case of multivariate functions. We propose an alternative approach, which is based on the notion of nonsmooth analysis.

Transformation Properties of Optimal Control Problems with Infinite Horizon - a Hilbert Space Approach

Sabine Pickenhain - BTU Cottbus-Senftenberg, Germany, Diana Wenzke
[Invited talk]

We consider a class of infinite horizon optimal control problems involving dynamics linear with respect to state and control and objective convex with respect to the control. The functional spaces which the state and control functions belong to are the weighted Sobolev- and weighted Lebesgue spaces. We apply different kinds of transformations to infinite horizon optimal control problems. Firstly we make a transformation of state and control to generate a density. Secondly a time transformation is used to generate a control problem on a finite horizon. It turns out that the transformed problems are again optimization problems in weighted Sobolev- or Lebesgue spaces. In general, the second transformation does not lead to a classical control problem on the finite horizon and the well known Pontryagin Maximum Principle can not be applied.

Using results for infinite horizon problems, as a Pontryagin type Maximum Principle involving the necessary transversality condition as well as an existence theorem, we generate new theoretical results for optimal control problem with finite horizon in weighted spaces. The theoretical results are confirmed by examples.

Algebraic rules for regularizing optimization methods

Sandra Santos - State University of Campinas, Brazil, Elizabeth W. Karas, Benar F. Svaiter
[Invited talk]

This talk addresses unconstrained minimization and nonlinear least-squares problems, assuming Lipschitz continuity of the Hessian or of the Jacobian, respectively. Regularizing rules are devised so that the full Newton-like step or the full Levenberg-Marquardt step are likely to be accepted by the Armijo sufficient descent condition. Indeed, under availability of the corresponding Lipschitz constant, full steps are accepted. Otherwise, an estimate of such a constant is dynamically updated. Convergence properties are analyzed and the numerical performance is investigated, with encouraging results.

Discretization and Dualization of Linear-Quadratic Control Problems with Bang-Bang Solutions

Christopher Schneider - University of Jena, Germany
[Invited talk]

We analyze the behavior of solutions for a general class of convex linear-quadratic optimal control problems (LQPs) with control appearing linearly. Assuming that the optimal control is of bang-bang type we show that the solutions are calm functions with respect to perturbation and regularization parameters. The calmness result is applied to prove convergence of the Euler discretization. We then derive the dual problem of the LQP and find that strong duality with zero duality gap holds in this case. These results will be transferred to the discretization of the dual problem. Numerical experiments conclude the talk. We compare the numerical solution of the primal and dual problem, and figure out if computational savings can be obtained.

Globalizing stabilized SQP by smooth primal-dual exact penalty function

Mikhail Solodov - National Institute for Pure and Applied Mathematics- IMPA, Brazil, A. Izmailov, E. Uskov
[Invited talk]

An iteration of the stabilized sequential quadratic programming method (sSQP) consists in solving a certain quadratic program in the primal-dual space, regularized in the dual variables. The advantage with respect to the classical sequential quadratic programming (SQP) is that no constraint qualifications are required for fast local convergence (i.e., the problem can be degenerate). However, unlike for SQP, designing natural globally convergent algorithms based on the sSQP idea proved quite a challenge and, currently, there are very few proposals in this direction. For equality-constrained problems, we suggest to use for the task the smooth two-parameter exact penalty function, which is the sum of the Lagrangian with squared penalizations of the violation of the constraints and of the violation of the Lagrangian stationarity with respect to primal variables. Global convergence is established under natural assumptions. Moreover, we show that the globalized algorithm preserves the superlinear rate of sSQP under the same weak condition.

Stochastic Optimisation with Ambiguity in Distribution

Jie Sun - Curtin University, Australia
[Invited talk]

Solving stochastic optimization problems often requires full information on distribution of the random variables involved. When such information is not available, an alternative scheme is to use robust optimization models that only require moment or support information. However, the choice of the robust models must incorporate considerations in computation such as preservation of convexity. This talk will discuss a general stochastic optimization model that can be exactly or conservatively converted to conic optimization problems and allows ambiguity in the distribution of the random variables.

Reflection methods for Euclidean distance matrix reconstruction

Matthew Tam - CARMA, University of Newcastle, Australia, F.J. Aragón Artacho, J.M. Borwein
[Invited talk]

The Douglas-Rachford reflection method is a general purpose algorithm useful for solving the feasibility problem of finding a point in the intersection of finitely many sets. Despite a lack of theoretical justification, the method has recently been experimentally observed to successfully solve a variety of difficult non-convex optimisation and inverse problems including Sudoku puzzles, finding Hadamard matrices, and numerous image reconstruction problems. In this talk I will focus on application of the Douglas-Rachford method to the (non-convex) problem of reconstructing a Euclidean distance matrix from a priori knowledge, and a small subset of its entries. The framework is then applied to the problem of protein conformation determination.

A unified approach to uncertain optimization

Christiane Tammer - Martin-Luther-University Halle-Wittenberg, Germany, Kathrin Klamroth, Elisabeth Köbis, Anita Schöbel
[Invited talk]

Most optimization problems involve uncertain data due to measurement errors, unknown future developments and modeling approximations. For companies, these uncertainties could be future demands that have to be predicted in order to adapt the production process. In risk theory, assets are naturally affected by uncertainty due to market changes, changing preferences of customers and unforeseeable events. Consequently, it is highly important to introduce uncertain parameters to optimization problems.

Different approaches regarding uncertain optimization problems have been concentrated on in the literature. First, stochastic optimization assumes that the uncertain parameter is probabilistic. The second approach is called robust optimization, which expects the uncertain parameter to belong to a set that is known prior to solving the optimization problem. The focus lies on looking at the worst case, hence no probability distribution is needed. Other approaches to deal with uncertainty concern online optimization and a posteriori approaches including parametric optimization.

In this talk we consider scalar uncertain optimization problems. We show that it is possible to apply methods from vector optimization in general spaces, set-valued optimization and scalarization techniques for developing a unified characterization of different concepts of robustness and stochastic optimization also for the case of infinite uncertainty sets. Furthermore, we use our interpretations as vector and set-valued optimization problems as well as our expression via nonlinear scalarization in order to derive new concepts of robustness.

Nonsmooth nonconvex optimisation approach to clusterwise linear regression

Julien Ugon - Federation University Australia, Adil Bagirov
[Invited talk]

The aim of this talk is to present an algorithm for solving clusterwise linear regression problems with the absolute regression error function. This problem is formulated as a nonsmooth nonconvex optimization problem and it is showed that the objective function in this problem can be represented as a difference of convex functions. Optimality conditions are derived using this representation, based on the codifferentials. An algorithm is designed based on such a representation.

Parametric Simplex Algorithm for Linear Vector Optimization Problems

Firdevs Ulus - Princeton University, USA, Birgit Rudloff, Robert Vanderbei
[Invited talk]

We propose a parametric simplex algorithm for solving linear vector optimization problems (LVOPs). It is a generalization of the parametric self-dual simplex algoritm, which originally is designed for solving single objective linear optimization problems, and capable of solving two objective LVOPs whenever the ordering cone is the positive orthant. Our algorithm works for any dimension, and it is possible to extent it to any polyhedral ordering cone C. In each iteration, the algorithm provides a set of inequalities, which defines the current partition of the parameter space and correspond to a vertex of the upper image. In addition to the usual simplex arguments, one needs to eliminate the redundant inequalities from that set. This extra step is similar to the vertex enumeration procedure, which is used in most of the objective space based LVOP algorithms. Different from those, this algorithm doesn't require to solve a scalar linear program in each iteration.

Global Optimality Conditions and Optimization Methods for Polynomial Programming

Zhiyou Wu - Chongqing Normal University, China, Jing Tian and Julien Ugon
[Invited talk]

This paper is concerned with the general polynomial programming problem with box constraints, including global optimality conditions and optimization methods. First, a necessary global optimality condition for a general polynomial programming problem with box constraints is given. Then we design a local optimization method by using the necessary global optimality condition to obtain some strongly or $\varepsilon-$strongly local minimizers which substantially improve some KKT points. Finally, a global optimization method, by combining the new local optimization method and an auxiliary function, is designed. Numerical examples show that our methods are efficient and stable.

Lower bound theorems for general polytopes

David Yost - Federation University Australia, Guillermo Pineda, Julien Ugon
[Invited talk]

We give precise lower bounds on the number of edges of an arbitrary d-dimensional polytope with V vertices, for an interesting range of values of V and d. Previously this problem had only been studied in detail for simplicial polytopes. We also calculate precisely the possible values of E for which there is a 5- or 6-dimensional polytope with V vertices and E edges. The corresponding 4-dimensional problem was solved nearly 50 years ago, but there appears to have been no progress in higher dimensions until now.

Modelling rainfall using the principle of maximum entropy

Julia Piantadosi - University of South Australia, Jonathan Borwein, Phil Howlett
[Invited talk]

We use the principle of maximum entropy to propose a model for generation of simulated rainfall during the wettest season at a typical location on the east coast of Australia. The model uses a checkerboard copula of maximum entropy to model the joint probability distribution for total seasonal rainfall and a set of two-parameter gamma distributions to model each of the marginal monthly rainfall totals. The model allows us to match the grade correlation coefficients for the checkerboard copula to the observed Spearman rank correlation coefficients for the monthly rainfalls and hence provides a model that correctly describes the mean and variance for each of the monthly totals and also for the overall seasonal total.

Contributed Talks

New Algorithms to Generate the Pareto Front of Multiobjective Optimization Problems

Mustafa Rizvi - University of South Australia, Regina Burachik, C. Yalçın Kaya
[Contributed talk]

We present a new scalarization technique for nonconvex multiobjective optimization problems, which is particularly useful for disconnected Pareto fronts or disconnected feasible sets. First we establish the theoretical features of the proposed scalarization. Then, combining this scalarization and existing grid generation techniques from the literature, we propose practical algorithms to solve tri-objective and four-objective optimization problems. It is well-known that generating especially the boundary of the (bounded) Pareto front of problems with three or more objectives is quite a challenging task. We illustrate the algorithms we propose on synthetic test problems, as well as a problem involving a rocket injector design. We show that our algorithms outperform the existing ones, such as the Normal Boundary Intersections method due to Das and Dennis and the Successive Approach due to Mueller-Gritschneder, Graeb and Schlichtmann.

Characterising an EEG signal through linear least squares and convex optimization modellings

Zahra Roshan Zamir - Swinburne University of Technology, Australia, Nadezda Sukhorukova
[Contributed talk]

For clinical use, the analysis of an electroencephalogram (EEG) signal is important to detect the K-complex wave that contributes to sleep stage scoring. Automated detection of K-complexes in an EEG signal is a crucial component of sleep stage monitoring. Much research focused on K-complex detection via methods such as neural networks, wavelet transform, filters, pulsers, and threshold detectors and non-smooth optimization. However, drawbacks may include the false classification of a severe noise or a spindle as a K-complex and long computational time. While some attempts were made to develop algorithms to detect K-complex, the reported success rates are subject to change from person to person and no standard algorithm has been accepted by the medical community. To address these difficulties we propose the use of linear least squares and convex optimization modellings to extract the key features of an EEG signal. The proposed models significantly reduce the dimension of the problem and the computational time. We provide a formal study to analyse the singularity of a matrix that obtained from linear least squares modelling. The modelling approaches are examined with reference to a scored EEG signal at Tenon Hospital in Paris.

Monday Sessions

Session 1A Monday 11:30-13:00

Room H6-12

Speaker	Time	Title
Jie Sun	11:30-12:00	Stochastic Optimisation with Ambiguity in Distribution
Andreas Hamel	12:00-12:30	A set-valued approach to zero-sum matrix games with vector payoffs
Andrew Eberhard	12:30-13:00	Symmetry, Invariance and Criticality

Session 1B Monday 11:30-13:00

Room RR5-09

Speaker	Time	Title
Christiane Tammer	11:30-12:00	A unified approach to uncertain optimization
Henri Bonnel	12:00-12:30	Semi vectorial Bilevel Optimization on Riemannian Manifolds
Jonathan Manton	12:30-13:00	Optimisation on Manifolds and Optimisation Geometry

Session 2A Monday 16:00-17:30

Room H6-12

Speaker	Time	Title
Guoyin Li	16:00-16:30	Error Bounds for Classes of Polynomial Systems and their Applications: A Variational Analysis Approach
Zhiyou Wu	16:30-17:00	Global Optimality Conditions and Optimization Methods for Polynomial Programming
C. Yalçın Kaya	17:00-17:30	Polynomial Optimization via Mean Filter Regularization and Trajectory Methods

Session 2B Monday 16:00-17:30

Room RR5-09

Speaker	Time	Title
Adil Bagirov	16:00-16:30	Trust region methods in nonsmooth optimization
Napsu Karmitsa	16:30-17:00	A diagonal bundle method for sparse nonsmooth problems
Phil Howlett	17:00-17:30	The Sylvester equation, spectral separation and generalised resolvents

Tuesday Sessions

Session 2A Tuesday 16:30-18:00

Room H6-12

Speaker	Time	Title
Lidia Huerga	16:30-17:00	Duality results for approximate proper solutions in vector optimization
Firdev Ulus	17:00-17:30	Parametric Simplex Algorithm for Linear Vector Optimization Problems
Mustafa Rizvi	17:30-18:00	New Algorithms to Generate the Pareto Front of Multiobjective Optimization Problems

Session 2B Tuesday 16:30-18:00

Room RR5-09

Speaker	Time	Title
Georg Bock	16:30-17:00	Mixed-Integer Optimal Control Problems: Theory, Numerical Solution and Nonlinear Model Predictive Control
Sabine Pickenhain	17:00-17:30	Transformation Properties of Optimal Control Problems with Infinite Horizon - a Hilbert Space Approach
Ekaterina Kostina	17:30-18:00	Efficient Optimization Methods for Model Validation in Dynamical Processes

Wednesday Sessions

Session 1A Wednesday 11:30-12:30

Room H6-12

Speaker	Time	Title
Alexander Kruger	11:30-12:00	About Uniform Regularity of Collections of Sets in Hilbert Space
David Yost	12:00-12:30	Lower bound theorems for general polytopes

Session 1B Wednesday 11:30-12:30

Room RR5-09

Speaker	Time	Title
Rob Corless	11:30-12:00	Optimal Backward Error and the Dahlquist Test Problem
Matthew Tam	12:00-12:30	Reflection methods for Euclidean distance matrix reconstruction

Thursday Sessions

Session 1A Thursday 11:30-13:00

Room H6-12

Speaker	Time	Title
Samir Adly	11:30-12:00	Some historical aspects about Newtons method: from smooth to nonsmooth equations
Mikhail Solodov	12:00-12:30	Globalizing stabilized SQP by smooth primal-dual exact penalty function
Sandra Santos	12:30-13:00	Algebraic rules for regularizing optimization methods

Session 1B Thursday 11:S30-13:00

Room RR5-09

Speaker	Time	Title
Bean San Goh	11:30-12:00	Numerical Method in Optimization as a Multi-Stage Discrete-Time Control System
Qun Lin	12:00-12:30	Dynamic Optimization Techniques for Parameter Estimation
Christopher Schneider	12:30-13:00	Discretization and Dualization of Linear-Quadratic Control Problems with Bang-Bang Solutions

Session 2A Thursday 16:00-17:00

Room H6-12

Speaker	Time	Title
Jerzy Filar	16:00-16:30	Detecting Non-Hamiltonicity in Cubic Graphs
Julia Piantadosi	16:30-17:00	Modelling rainfall using the principle of maximum entropy

Session 2B Thursday 16:00-17:30

Room RR5-09

Speaker	Time	Title
Julien Ugon	16:00-16:30	Nonsmooth nonconvex optimisation approach to clusterwise linear regression
Nadezda Sukhorukova	16:30-17:00	Alternance for multivariate functions
Zahra Roshan Zamir	17:00-17:30	Characterising an EEG signal through linear least squares and convex optimization modellings

Poster Session: Tuesday 10 February 14:00-16:30

Bradley Forum

Maximising revenue for concentrated solar power with storage

Luigi Cirocco - University of South Australia, Peter Pudney
[Poster]

In a wholesale spot energy market, opportunities exist to capture greater revenues, as currently achieved by peaking power plants.

This poster presents the use of two complementary methods to determine how storage should be operated to maximise revenue, a linear programming method and then using Pontryagin's principle to confirm that the optimal operating strategy has three distinct control modes:

1. store all collected power, without generating,
2. generate using collected power only,
3. generate at maximum capacity using both collected and stored power.

The mode that should be used at any instant depends only on the spot price of electricity relative to a pair of critical prices. These critical prices depend on the total energy that will be collected and the turnaround efficiency of the storage system.

A bundle method for nonsmooth DC optimization

Kaisa Joki - University of Turku, Finland, Adil M. Bagirov, Napsu Karmitsa, Marko M. Mäkelä
[Poster]

We have developed a version of the bundle method to locally solve unconstrained difference of convex (DC) programming problems. The novelty of our method is that it utilizes explicitly the DC decomposition of the objective function in the model construction. Due to this the main idea is to use subgradients of both the first and second components in the DC representation. This subgradient information is gathered from some neighborhood of the current iteration point and it is used to build separately an approximation for each component in the DC representation. By combining these approximations we obtain the so-called nonconvex cutting plane model of the original objective function. We have designed the proximal bundle method for DC programming based on this approach and proved the convergence of the method to an ε-critical point. The algorithm has also been tested by using some academic test problems and the preliminary numerical results have shown the good performance of the new method.

Convergence of bundle methods with linear programming for convex minimization

Shuai Liu - RMIT University, Australia, Andrew Eberhard
[Poster]

A form of bundle methods with linear programming is proposed. Given a convex function and an iteration point, we minimize the cutting plane model of the function over a neighborhood of the point. The neighborhood is constructed by infinity norm, so we only have box constraints and hence a linear subproblem. We present a minimal framework to establish convergence of such methods.

Venues, Location and Access details

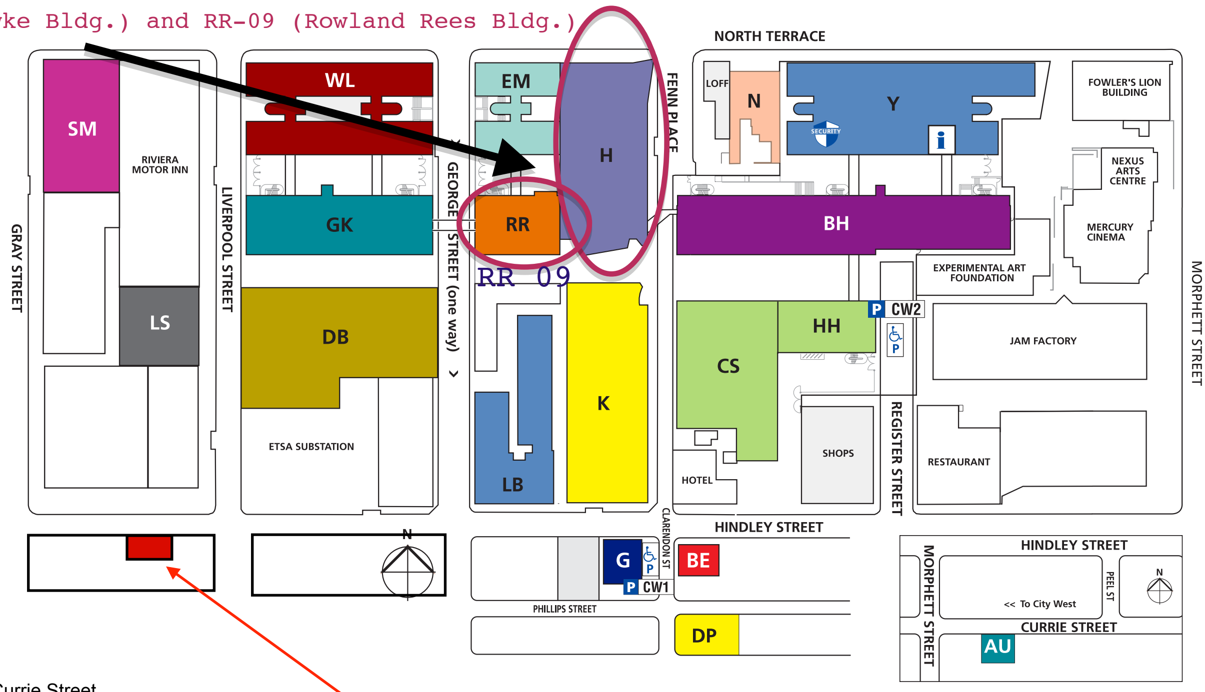
- Tutorials are held in room H6-03. This room is located at level 6 of the Hawke Building (indicated as H in the maps).
- Plenary talks are held in the Allan Scott Auditorium, also called H2-16. This room is located at the entry level of Hawke Building (indicated as H in the maps).
- Special sessions Mon 1A, Mon 2A, Tue 2A, Wed 1A, Thu 1A, Thu 2A are held in room H6-12. This room is located at level 6 of the Hawke Building (indicated as H in the maps).
- Special sessions Mon 1B, Mon 2B, Tue 2B, Wed 1B, Thu 1B, Thu 2B are held in room in RR 5-09. This room is located in Building RR in the maps. This room is at level 5 of RR building (indicated as RR in the maps). The shortest path to the level 5 of RR building is through a connecting passage located at level 5 of Hawke building.
- The poster session is held on Tuesday 10 February between 14:00 and 16:30 in the Bradley Forum. The Bradley Forum is at level 5 of the Hawke building.

City West campus

UniSA

Plenary talks are held in Hawke building,
at Allan Scott auditorium, H2-16
Special sessions are held at rooms
H6-12 (Hawke Bldg.) and RR-09 (Rowland Rees Bldg.)

Map A



BreakFree Adelaide

Building legend

AU	101 Currie Street
BE	189 Hindley Street
BH	Barbara Hanrahan Building
CS	Catherine Helen Spence Building
DB	Dorrit Black Building
DP	David Pank Building
EM	Elton Mayo Building
G	Child Care Centre
GK	Sir George Kingston Building
H	Hawke Building
HH	Sir Hans Heysen Building
K	Kaurna Building
LB	Law Building
LS	Liverpool Street Studios
N	West Bar
RR	Rowland Rees Building
SM	27-29 North Terrace
WL	Way Lee Building
Y	Yungondi Building

	Location
Allan Scott Auditorium	H
Anne & Gordon Samstag Museum of Art	H
Australia Post	Y
Bob Hawke Prime Ministerial Centre	H
Bob Hawke Prime Ministerial Library	H
Bookshop	BH
Bradley Forum	H
Cafe	K
Cafeteria	BH
Campus Central	Y
Chancellery	H
Child Care Centre (221 Hindley Street)	G
Computer Barn	BH, CS
Computer Pools	CS, GK
CRC for Irrigation Futures	WL
CRC for Sustainable Tourism	EM
David Unaipon Collage of Indigenous Education and Research	Y
Division of Business	
Division Office	DP
Transnational Support Services (189 Hindley Street)	Y
Division of Education, Arts and Social Sciences	Y
Ehrenberg-Bass Institute for Marketing Science	GK, Y
Facilities Management Unit (101 Currie Street)	AU
Finance Unit (101 Currie Street)	AU
FM Assist	Y
Human Resources Unit (101 Currie Street)	AU
OHS&W Services	AU
Indigenous Student Services	Y
International & Prospective Students Office	AU
International Graduate School of Business (IGSB)	WL
International Students Common Room	BH, HH

	Location
Kerry Packer Civic Gallery	H
Learning and Teaching Unit	DP, Y
Lecture Theatres	BH, HH, H
Library	CS
Marketing and Development Unit (101 Currie Street)	AU
Multi-Access Suite	CS
'Nunga' Research	Y
Planning & Assurance Services	DP
Prayer Rooms	GK
Program Information (101 Currie Street)	AU
School of Art, Architecture and Design	
SASA Galley	K
School Office	K
School of Commerce	WL
School of Computer & Information Science	SM
School of Law	LB
School of Management	EM
School of Marketing	Y
School of Mathematics and Statistics	Y
Security	Y
Student & Academic Services Unit	AU
Graduation and Transcripts Office	AU
Student Finance (101 Currie Street)	AU
Student Lounge	BH
UniSA College	DP
UniLife	Y
UniSA International	AU
West Bar	N

All Enquiries to:
Campus Central

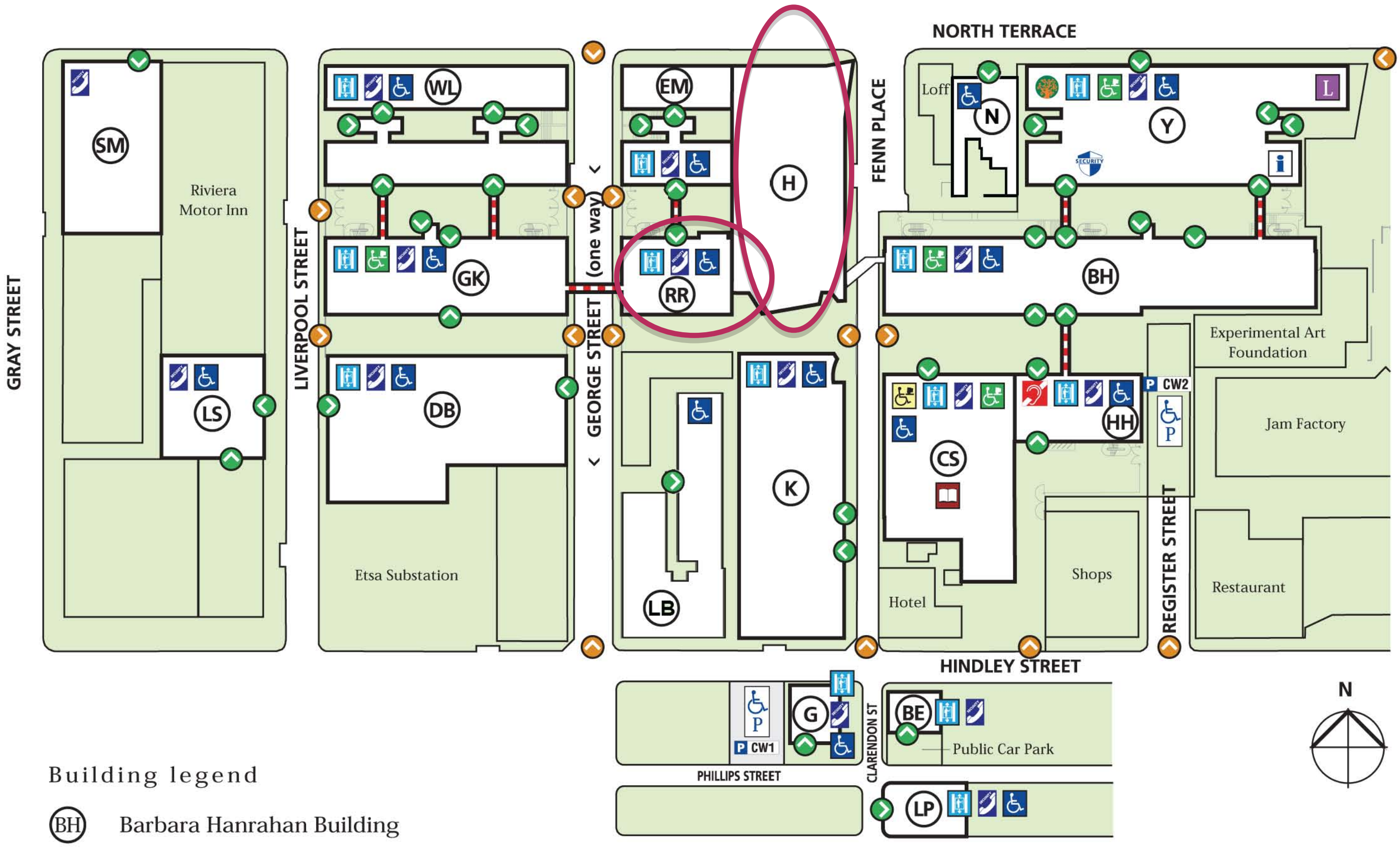
Information & Campus Services, Level 1 — Y

Security

Freecall	1800 500 911
Internal	88 888
Contact Numbers	
Campus Central	8302 3511
Learning and Teaching Unit	1300 657 133
Library	1300 137 659
UniLife	8302 6338
UniSA Switchboard	8302 6611
FM Assist	8302 0555

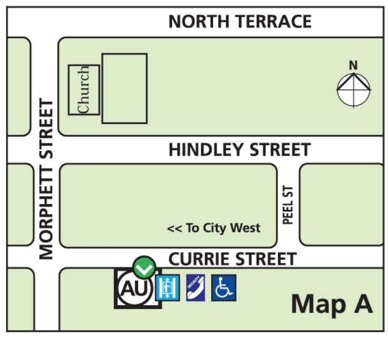
UniSA

City West campus access map



Building legend

- BH Barbara Hanrahan Building
- CS Catherine Helen Spence Building
- G Child Care Centre
- DB Dorrit Black Building
- EM Elton Mayo Building
- H Hawke Building
- K Kaurna Building
- LS Liverpool Street Studios
- RR Rowland Rees Building
- GK Sir George Kingston Building
- HH Sir Hans Heysen Building
- WL Way Lee Building
- Y Yungondi Building
- SM 27-29 North Terrace
- AU 101 Currie Street
- LP 160 Currie Street
- BE 189 Hindley Street



There is direct access between RR and H building al level 5 of Hawke Bldg.

Access legend

- Access car parks
- Adaptive Technology Suite
- Campus Central
- Entry & Exit points to campus
- Entry & Exit points to buildings
- Hearing loops - lecture theatres
- Learning Connection
- Library
- Lifts
- Links to other buildings
- Priority Access Computers
- Security
- Security Call Points
- Students Association
- Toilet facilities

Time	Sunday 8	Monday 9		Tue 10		Wed 11		Thu 12		Time
8:30-9:00		Opening								
9:00-10:00	Tut Martínez 1	Plenary talk **Rockafellar** Chair: Borwein		Plenary talk **Simons** Chair: Jeyakumar		Plenary talk **Jeyakumar** Chair: Li		Plenary talk **Wets** Chair: Adly		9:00-10:00
10:00-10:30		Plenary talk **Yang** Chair: Bonnel		Coffee break		Plenary talk **Sagastizábal** Chair: Bot		Plenary talk **Pang** Chair: Dontchev		10:00-10:30
10:30-11:00	Coffee break			Borwein						10:30-11:00
11:00-11:30	Tut Martínez 2	Coffee break		Bot		Coffee break		Coffee break		11:00-11:30
11:30-12:00		Mon 1A Sun	Mon 1B Tammer	Adly		Wed 1A Kruger	Wed 1B Corless	Thu 1A Adly	Thu 1B Goh	11:30-12:00
12:00-12:30	Lunch	Hamel	Bonnel	Burachik Chair: Li		Yost Chair: Bon-nel	Tam Chair: Sagasti-zábal	Solodov	Lin	12:00-12:30
12:30-13:00		Eberhard Chair: Yost	Manton Chair: Filar	Poster session	Lunch	Excursion 12:45-19:00		Santos Chair: Mar-tínez	Schneider Chair: Bock	12:30-13:00
13:00- 13:30		Lunch						BBQ Lunch		13:00- 13:30
13:30-14:00										13:30-14:00
14:00-14:30	Tut Sagastizábal 1			Plenary talk **Maurer** Chair: Kaya						14:00-14:30
14:30-15:00		Plenary talk **Mordukhovich** Chair: Maurer						Plenary talk **Dontchev** Chair: Kruger		14:30-15:00
15:00-15:30				Plenary talk **Martínez** Chair: Bagirov						15:00-15:30
15:30-16:00	Coffee Break	Coffee Break						Coffee Break		15:30-16:00
16:00-16:30	Tut Sagastizábal 2	Mon 2A Li	Mon 2B Bagirov	Poster session	Coffee Break			Thu 2A Filar	Thu 2B Ugon	16:00-16:30
16:30-17:00		Wu	Karmitsa	Tue 2A Huerga	Tue 2B Bock			Piantadosi	Sukhorukova	16:30-17:00
17:00-17:30		Kaya Chair: Pickenhain	Howlett Chair: Kostina	Ulus	Pickenhain			Chair: Santos	Zamir Chair: Tam	17:00-17:30
17:30-18:00		Plenary talk **Bot** Chair: Burachik		Rizvi Chair: Ugon	Kostina Chair: Lin					17:30-18:00
18:00-18:30										18:00-18:30
18:30-19:00										18:30-19:00
19:00	Welcome Reception	Plenaries held in Allan Scott, H2-16		Banquet						19:00
Venues of sessions	Tutorials at H6-03	Sessions A, H6-12	Sessions B, RR5-09	Tue 2A H6-12	Tue 2B RR5-09	Wed 1A H6-12	Wed 1B RR5-09	Thu 1A, 2A H6-12	Thu 1B, 2B RR5-09	Venues of sessions

Figure 3: Program at a Glance