Mathematical Optimisation Down Under (MODU2016)
18–22 July 2016, Melbourne, Australia
Sunday 17 July

15:00-16:00 Early Registration
16:00-18:00 Welcome Reception

Monday 18 July

08:30 – 09:00  Registration
09:00 – 09:45 Welcome Address

Morning session, chair Jeya Jeyakumar

09:45-10:45 Gabriele Eichfelder, Set optimization and Robust Multi-objective Optimization
10:45-11:30 Coffee break
11:30-12:00 Julien Ugon, Constructive proof for polynomial spline approximation
12:00-12:30 Marc Demange, The art of BBQ down under: applications to online colouring
12:30-14:00 Lunch break

Afternoon session, chair Julien Ugon

14:00-14:30 Constantin Zalinescu, Convex series of convex functions with applications to Statistical Mechanics
14:30-15:00 Alexander Kruger, Transversality of collections of sets: dual characterizations
15:00-15:30 Robert Baier, Geometric Calculation of Convex and Nonconvex Subdifferentials for Quasidifferentiable and Directed Subdifferentiable Functions
15:30-16:15 Coffee break
16:15-17:15 Jeya Jeyakumar, Global Polynomial Optimization and Conic Programming
Tuesday 19 July

Morning session, chair Guoyin Li

09:00-10:00 Jie Sun, A Distributionally Robust Model for Multi-Stage Stochastic Optimization

10:00-10:30 Coffee break

10:30-11:00 Regina Burachik, A duality scheme for dynamically updated Lagrangians for nonconvex and nonsmooth optimization

11:00-11:30 Reinier Diaz-Millan, Extragradient algorithm for variational inequalities without monotonicity

11:30-12:00 Buthinah Abdullatif Bin Dehaish, Fixed Point Results for Monotone Nonexpansive Mappings in Metric Spaces

12:00-12:30 Hossein Mohebi, Approximate Global Minimum of the Difference of Increasing and Positively Homogeneous Functions

12:30-14:00 Lunch break

Afternoon session, chair Regina Burachik

14:00-14:30 Fabrício Oliveira, Penalty-based Alternating Direction Method for Solving Large-Scale Mixed-Integer Stochastic Problems

14:30-15:00 David Kirszenblat, Minimal curvature-constrained networks

15:00-15:30 Yalçın Kaya, Shortest Planar Path Planning

15:30-16:00 Yousong Luo, Optimal Wentzell Boundary Control of Parabolic Equations

16:00-16:30 Coffee break

16:30-17:30 Xiaojun Chen, Penalty methods for a class of non-Lipschitz optimization problems
**Wednesday 20 July**

*Morning session, chair Robert Baier*

09:00-10:00 **Pablo Parrilo**, Dimension reduction for semidefinite programming

10:00-10:30 Coffee break

10:30-11:00 **Fabian Rigterink**, Convex hulls of graphs of bilinear functions on the unit cube

11:00-11:30 **James Saunderson**, Semidefinite approximations of the matrix logarithm

11:30-12:00 **Tian Sang**, On the conjecture by Demyanov-Ryabova in converting finite exhausters

12:00-13:30 Lunch break

*Afternoon session, chair Brian Dandurand*

13:30-14:00 **Peter Dickinson**, Partitioning Simplices

14:00-14:30 **Scott Lindstrom**, The Lambert W Function in Optimization

14:30-15:00 **Hamid Mokhtar**, Cube-connected circulants as an efficient communication network

15:00-15:45 Coffee break

15:45-16:45 **Guoyin Li**, On two interesting aspects of polynomial optimization

19:00-21:00 Conference Dinner (Tsindos)
Thursday 21 July

**Morning session, chair Fabricio Oliveira**

09:00-10:00 **Jonathan Borwein**, Convex analysis on groups and semigroups

10:00-10:30 Coffee break

10:30-11:00 **Nadezda Sukhorukova**, A generalisation of de la Vallée-Poussin procedure to multivariate polynomials

11:00-11:30 **Thomas Weber**, Global Optimization on an interval

11:30-12:00 **Andreas Fischer**, A globally convergent LP-Newton method

12:00-12:30 **Fusheng Bai**, An Adaptive Framework for Global Optimization of Expensive Functions Based on Response Surface Models

12:30-14:00 Lunch break

**Afternoon session, chair Andreas Fischer**

14:00-14:30 **Sergei Schreider**, Optimization methods in water allocation management

14:30-15:00 **Daniel McInnes**, Optimisation of gas flows in South Eastern Australia via controllable Markov chains

15:00-15:30 **Brian Dandurand**, Improvements to the Progressive Hedging method for Computing Lagrangian Dual Bounds in Stochastic Mixed-Integer Programming

15:30-16:00 Coffee break

16:00-17:00 **Jeff Linderoth**, One Relaxation to Rule Them All: Strong Convex Nonlinear Relaxations of the Pooling Problem
Friday 22 July

**Morning session, chair Heinz Bauschke**

09:30-10:30 **Aris Daniilidis**, Controlling the size of Clarke critical values for Lipschitz functions

10:30-11:00 Coffee break

11:00-11:30 **Hyam Rubinstein**, Multisections of manifolds

11:30-12:00 **David Yost**, Meta-optimization: lower bounds for higher faces

12:00-12:30 **Andrew Eberhard**, U-V decomposition, Tilt stability and Manifolds

12:30-14:00 Lunch break

**Afternoon session, chair David Yost**

14:00-14:30 **Vera Roshchina**, Grassmann condition for conic feasibility problems

14:30-15:00 **Mahboubeh Rezaie**, Enlargement of monotone operators with applications

15:00-15:45 Coffee break

15:45-16:45 **Heinz Bauschke**, On the Douglas-Rachford algorithm
Gabriele Eichfelder, TU Ilmenau  
**Title:** Set Optimization and Robust Multi-objective Optimization  
**Abstract:** Set optimization problems arise in multi-objective optimization for instance whenever robust solutions are considered. We will study the concept of decision robust efficiency which allows to handle decision uncertainty in multi-objective optimization. This occurs when values of decision variables cannot be put into practice exactly. Then, for each feasible point, we have to consider the set of all of its possible realizations. Thus, for this optimality notion, one has to compare sets instead of points. We discuss how this concept is related to optimality notions in set optimization. We also give an overview over related concepts in set optimization based on different set relations and discuss their practical relevance. First approaches to solve such problems are also presented.

Julien Ugon, Federation University Australia  
**Title:** Constructive proof for polynomial spline approximation  
**Abstract:** Approximating continuous functions with piecewise polynomials is, from a practical point of view, an attractive extension to classical polynomial approximation. Although this problem is already reasonably well understood, existing work focuses either on generalising characterisation results for best approximants (in a non-constructive way), or generalising algorithms to construct them, but never both. We will describe a new constructive proof for the existing characterisation results and discuss how it can be used to develop new algorithms.

Marc Demange, RMIT University  
**Title:** The art of BBQ down under: applications to online colouring  
**Abstract:** We consider different online colouring problems in overlap graphs (also called circle graphs) - defined by a set of intervals - that are motivated by some one-dimensional stacking logistics problems or track assignment problems in train shunting operations. To this end we consider two strategies for partitioning the set of intervals. The first strategy partitions the intervals with respect to their length so that the lengths of intervals in each part differ at most by a constant factor. We then solve independently each sub-instance. The second strategy partitions the intervals into so-called BBQ arrangements. In terms of graphs it corresponds to partitioning the overlap graph into permutation graphs and allows to transform any online algorithm for permutation graphs into an online algorithm for overlap graphs. We analyse the competitiveness behaviour of these strategies, seen as reductions between two online problems. For the usual colouring problem, if intervals are revealed in non-decreasing order of their left endpoint, these strategies give optimal online colouring algorithms. Moreover, the second strategy remains valid for different kinds of colouring problems and leads, for instance, to an online algorithm for bounded online colouring in overlap graphs.
Afternoon session

Constantin Zalinescu, Universitatea Alexandru Ioan Cuza, Iaşi, Romania

Title: Convex series of convex functions with applications to Statistical Mechanics

Abstract: Consider \( f, f_n \) proper convex functions defined on a Banach space \( X \) such that

\[
f(x) = \sum_{n \geq 1} f_n(x) \quad (x \in X).
\]

X. Y. Zheng (1998) showed that the subdifferential \( \partial f(x) \) of \( f \) at \( x \) is given by the formula

\[
\partial f(x) = w^* - \sum_{n \geq 1} \partial f_n(x)
\]

for all \( x \in \text{int} \ (\text{dom} \ f) \) whenever \( f \) and \( f_n \) are continuous on \( \text{int} \ (\text{dom} \ f) \).

Besides showing that the above result remains true in locally convex spaces, we prove that

\[
f^*(x^*) = \min \left\{ \sum_{n \geq 1} f_n^*(x_n^*) \mid x_n^* \in \text{dom} \ f_n^* \forall n \geq 1, x^* = w^* - \sum_{n \geq 1} x_n^* \right\}
\]

for all \( x^* \in \partial f \ (\text{int} \ \text{dom} \ f) \) under the same conditions on \( f \) and \( f_n \).

Then we apply the previous results for studying rigorously the entropy maximization problem in the case of ideal gases. A complete study is done in the case of Maxwell–Boltzmann entropy.

Additional information

Alexander Kruger, Federation University Australia

Title: Transversality of collections of sets: dual characterizations

Abstract: Transversality properties of finite collections of sets will be discussed with the main emphasis on their dual characterizations in terms of Fréchet, limiting and proximal normals.

Connections with the corresponding regularity properties of set-valued mappings will be demonstrated.

Additional information
Robert Baier, University of Bayreuth
Title: Geometric Calculation of Convex and Nonconvex Subdifferentials for Quasidifferentiable and Directed Subdifferentiable Functions

Abstract: The geometric computation of subdifferentials depends on arithmetic set operations as the Minkowski sum and on a suitable choice of a difference notion for convex sets. Both the geometric (Pontryagin-Hadwiger) difference and the Demyanov one deliver convex sets as results (the former may often be empty). Alternatively, one may first define an embedding of convex compact sets into a vector space and then calculate the difference there.

DC (difference of convex) functions and quasidifferentiable functions, whose directional derivative is a difference of two, both use a subtraction in their definition. These two classes are both studied with embeddings mapping into pairs of sets equipped with an equivalence relation resp. into the space of continuous functions. As known in the literature this embedding yields good calculus rules for the quasidifferential: there are exact formulas for the sum, difference, maximum or minimum of two quasidifferentiable functions (without extra regularity assumptions).

With the help of the geometric or the Demyanov difference of two convex sets, the Dini subdifferential and superdifferential as well as the small subdifferential and a subset of Clarke's generalized gradients can be recovered for quasidifferentiable, locally Lipschitz functions.

In the second part another available embedding into the Banach space of directed sets and directed subdifferentiable functions are considered for which the function and certain restrictions to recursively defined orthogonal hyperplanes are uniformly directionally differentiable. This class contains quasidifferentiable, amenable, lower-$C^k$ and locally Lipschitz, definable functions on o-minimal structures.

Some advantages and nonconvex visualizations of the corresponding directed subdifferential are compared to convex/nonconvex subdifferentials for simple examples in the context of necessary and sufficient optimality conditions.

Jeya Jeyakumar, University of New South Wales
Title: Global Polynomial Optimization and Conic Programming

Abstract: Global polynomial optimization problems are multi-extremal optimization problems, which often have numerous local optimal solutions that are not global. They are important and intrinsically hard optimization problems. In addition to the usual tools of nonlinear optimization, such as convex analysis and linear algebra, powerful techniques of real algebraic geometry, such as representation theorems for polynomials, and conic programming methods, such as semi-definite programming, can be employed to study these problems. In this talk, I will describe the key results in this area, highlighting my recent work on the development of global optimization principles and associated relaxation methods.
Tuesday 19 July

Morning session

Jie Sun, Curtin University
Title: A Distributionally Robust Model for Multi-Stage Stochastic Optimization

Abstract: We discuss a new model for multi-stage linear-quadratic stochastic optimization that uses a risk measure as the objective function of the recourse action, where the risk measure is defined as the worst-case expected values over a set of constrained distributions. It is shown that under a standard set of assumptions, this model is equivalent to a conic optimization problem that can be solved in polynomial time.

Regina Burachik, University of South Australia
Title: A duality scheme for dynamically updated Lagrangians for nonconvex and nonsmooth optimization

Abstract: We propose a deflected subgradient method for nonconvex and nonsmooth optimization in which the Lagrangians are dynamically updated. We analyse strong duality for this new scheme by introducing the concept of "asymptotic duality". Then we establish a set of assumptions on the updates that ensure dual and primal convergence of the iterates generated by the deflected subgradient method.

Reinier Diaz-Millan, Federal Institute of Education, Science and Technology, Goiânia, Brazil
Title: Extragradient algorithm for variational inequalities without monotonicity

Abstract: In this work, we present a projection-type algorithm to solve the variational inequality problem for point-to-set operator in $\mathbb{R}^n$. No monotony hypothesis is required, we just need the existence of solutions of the dual problem and continuity of the operator. The convergence of the algorithm is given, and numerical experiment presented.

Buthinah Abdullatif Bin Dehaish, King Abdulaziz University
Title: Fixed Point Results for Monotone Nonexpansive Mappings in Metric Spaces

Abstract: Let $X$ be a metric space and $T: C \rightarrow C$ be a monotone nonexpansive mapping on a nonempty, bounded, closed, and convex subset of $X$. In this talk, we will show that if $X$ is a uniformly convex metric space, then $T$ has a fixed point.
Hossein Mohebi, UNSW
Title: Approximate Global Minimum of the Difference of Increasing and Positively Homogeneous Functions

Abstract: In this paper, we first obtain a formula for conjugate and \(\varepsilon\)-subdifferential of the difference of two abstract functions under a mild condition. Also, we characterize global \(\varepsilon\)-minimum of the difference of two abstract convex functions. Next, by using abstract Rockafellar's antiderivative, we present the \(\varepsilon\)-subdifferential of abstract convex functions in terms of their subdifferential. Finally, as an application, we give a necessary and sufficient condition for (global) \(\varepsilon\)-minimum of the difference of two increasing and positively homogeneous (IPH) functions.

Afternoon session

Fabrício Oliveira, RMIT University
Title: Penalty-based Alternating Direction Method for Solving Large-Scale Mixed-Integer Stochastic Problems

Abstract: Despite its wide applicability in real-world problems, stochastic mixed-integer programming (SMIP) problems are known for being challenging due to its inherent large-scale nature. In this talk, we will present an alternative decomposition heuristic for obtaining solutions to SMIP problems. This method is inspired in the combination of Augmented Lagrangian relaxations using polyhedral penalty functions and the Alternating Direction approach. Numerical results obtained using instances available in literature illustrate the superior numerical performance of the method when compared with state-of-the-art approaches used to solve SMIP problems.

David Kirszenblat, The University of Melbourne
Title: Minimal curvature-constrained networks

Abstract: In this talk, I will present an exact algorithm for the construction of a shortest curvature-constrained network interconnecting a given set of directed points in the plane and an iterative method for doing so in 3D space. Such a network will be referred to as a minimum Dubins network, since its edges are Dubins paths (or slight variants thereof). The problem of constructing a minimum Dubins network appears in the context of underground mining optimization, where the aim is to construct a least-cost network of tunnels navigable by trucks with a minimum turning radius. The Dubins network problem is similar to the Steiner tree problem, except that the terminals are directed and there is a curvature constraint. We propose the minimum curvature-constrained Steiner tree algorithm for determining the optimal location of the Steiner point in a 3-terminal network in 3D space. We show that there is a construction analogous to the Melzak algorithm for Steiner trees. That is, when two terminals are fixed and the third varied, the Steiner point traces out a limaçon.
Yalçın Kaya, University of South Australia  
**Title: Shortest Planar Path Planning**

**Abstract:** Markov-Dubins path is the shortest planar curve joining two points with prescribed tangents, with a specified bound on its curvature. Although the problem was posed by Andrey Andreyevich Markov in 1889, it was Lester Eli Dubins who reported the first solution in 1957 using geometric arguments. The structure of Dubins' solution is elegantly simple: a selection of at most three arcs are concatenated, each of which is either a circular arc of maximum curvature (the prescribed bound) or a straight line. Markov-Dubins path has since been extensively used for path planning of unmanned aerial vehicles (or drones) and robots. It has also been used for tunnelling in underground mines, where it is paramount to minimize the amount of earth excavated in opening a tunnel between two specified points and keep the tunnels short for ease of operations. In 1992, the original Dubins problem was transformed into an optimal control problem and the same solution was obtained by using optimal control theory. A realistic generalisation of the Markov-Dubins problem is the requirement that the path passes through a number of prescribed intermediate points, giving rise to an interpolation problem. I will talk about how one can obtain a solution to this interpolation problem using optimal control theory.

Yousong Luo, RMIT University  
**Title: Optimal Wentzell Boundary Control of Parabolic Equations**

**Abstract:** This work deals with a class of optimal control problems governed by an initial-boundary value problem of a parabolic equation. The case of semi-linear boundary control is studied where the control is applied to the system via the Wentzell boundary condition. The differentiability of the state variable with respect to the control is established and hence a necessary condition is derived for the optimal solution in the case of both unconstrained and constrained problems. The condition is also sufficient for the unconstrained convex problems. A second order condition is also derived.

Xiaojun Chen, The Hong Kong Polytechnic University  
**Title: Penalty methods for a class of non-Lipschitz optimization problems**

**Abstract:** We consider a class of constrained optimization problems with a possibly nonconvex non-Lipschitz objective and a convex feasible set being the intersection of a polyhedron and a possibly degenerate ellipsoid. Such problems have a wide range of applications in data science, where the objective is used for inducing sparsity in the solutions while the constraint set models the noise tolerance and incorporates other prior information for data fitting. To solve this class of constrained optimization problems, a common approach is the penalty method. However, there is little theory on exact penalization for problems with nonconvex and non-Lipschitz objective functions. In this paper, we study the existence of exact penalty parameters regarding local minimizers, stationary points and $\varepsilon$-minimizers under suitable assumptions. Moreover, we discuss a penalty method whose subproblems are solved via a nonmonotone proximal gradient method with a suitable update scheme for the penalty parameters, and prove the convergence of the algorithm to a KKT point of the constrained problem. Preliminary numerical results demonstrate the efficiency of the penalty method for finding sparse solutions of underdetermined linear systems.

**Additional information**  
Joint work with Zhaosong Lu and Ting Kei Pong
Pablo Parrilo, Massachusetts Institute of Technology
Title: Dimension reduction for semidefinite programming

Abstract: We introduce a new approach to simplifying semidefinite programs (SDP), inspired by symmetry-reduction techniques. The method is based on the computation of an orthogonal projection, satisfying certain invariance conditions. When such a projection exists, restricting to its range yields an equivalent primal-dual pair over a lower-dimensional symmetric cone — namely, the cone-of-squares of a Jordan subalgebra of symmetric matrices.
We give a simple algorithm for minimizing the rank of this projection (and hence the dimension of this cone), and discuss the case of combinatorially-described subspaces. Through the theory of Jordan algebras, the proposed method naturally extends to linear programming, second-order cone programming, and more, generally, symmetric cone optimization. We demonstrate effectiveness of the methods on SDPs from the literature. Joint work with Frank Permenter (MIT).

Fabian Rigterink, University of Newcastle
Title: Convex hulls of graphs of bilinear functions on the unit cube

Abstract: In his 1989 seminal paper, The boolean quadric polytope: Some characteristics, facets and relatives, Padberg introduced five classes of valid inequalities for the boolean quadric polytope: triangle, clique, cut, generalized cut and odd cycle inequalities. These inequalities outer-approximate the convex hull of a bilinear function. In this talk, we study classes of bilinear functions where some of the Padberg inequalities characterize the convex hull. Furthermore, we study which of the inequalities are strongest, i.e., outer-approximate the convex hull best. We then apply the strong inequalities to (QC)QP instances from the literature to find good lower bounds fast.

James Saunderson, Monash University, Australia
Title: Semidefinite approximations of the matrix logarithm

Abstract: In this talk I will describe a natural family of approximations to the matrix logarithm that are matrix concave and monotone, and have compact descriptions in terms of the feasible regions of semidefinite programs. This allows us to (approximately) solve optimization problems involving, for instance, the quantum relative entropy function, using standard numerical methods for semidefinite programming. Specialized to the scalar setting, this gives new second-order-cone approximations for conic optimization problems over the exponential cone, such as geometric programs.

Additional information
Joint work with Hamza Fawzi (MIT) and Pablo Parrilo (MIT)
Tian Sang, RMIT University
Title: On the conjecture by Demyanov-Ryabova in converting finite exhausters

Abstract: In this talk, we prove the conjecture of Demyanov and Ryabova on the length of cycles in converting exhausters in an affinely independent setting and obtain a combinatorial reformulation of the conjecture.
Given a finite collection of polyhedra, we can obtain its "dual" collection of polyhedra by forming another collection of polyhedra, which are obtained as the convex hull of all support faces of all polyhedra for a given direction in space. If we keep applying this process, we will eventually cycle due to the finiteness of the problem. Demyanov and Ryabova claim that this cycle will eventually reach a length of most two. We will prove that the conjecture is true in the special case, that is, when we have affinely independent number of vertices in the given space. Then we have also obtained an equivalent combinatorial reformulation for the problem, which should advance insight for the future work on this problem.

Afternoon session

Peter Dickinson, University of Twente (Netherlands)
Title: Partitioning Simplices

Abstract: Partitioning simplices can be a useful tool in optimisation, and for theoretical purposes we require this partitioning to be 'exhaustive'. We will see that a commonly used 'obviously true' condition for this is in fact subtly false, and we will look at how to repair this condition.

Additional information
Work carried out whilst at University of Groningen (Netherlands).

Scott Lindstrom, University of Newcastle
Title: The Lambert W Function in Optimization

Abstract: The Lambert's W function is the inverse, properly defined, of $x \mapsto x \exp(x)$. Its role in convex analysis and optimization is under-appreciated. I will provide a basic overview of the convex analysis of $W$ and go on to explore its role in duality theory where it appears quite naturally in the closed forms of the convex conjugates for certain functions. I will demonstrate a numerical approach for solving some examples, obtaining illustrative primal solutions which model the importance of checking solutions through more than purely symbolic means.

This is a joint work with Jonathan Borwein [1].
Hamid Mokhtar, University of Melbourne
Title: Cube-connected circulants as an efficient communication network

Abstract: Cayley graphs are highly attractive structures for communication networks because of their many desirable properties, including vertex-transitivity and efficient routing algorithms. The diameter, forwarding and optical indices, bisection width and Wiener index of a network are among the most important parameters to measure the efficiency of the network.
We introduce cube-connected circulants as a new family of cube-connected Cayley graphs. We give an algorithm for computing shortest path routing and the exact value of the diameter of a cube-connected circulant. We develop results for 'proportional' graphs which will be useful in obtaining bounds for the edge-forwarding index of cube-connected circulants. We give sharp lower and upper bounds for the Wiener index, vertex-forwarding and edge-forwarding indices of cube-connected circulants.
The cube-connected cycles and cube-of-rings are special cube-connected circulants, and our results apply to these well-known networks. We show that cube-connected circulants outperform a few well-known network topologies in many aspects.

Guoyin Li, University of New South Wales
Title: On two interesting aspects of polynomial optimization

Abstract: Optimization problems involving polynomial functions are of great importance in applied mathematics and engineering, and they are intrinsically hard problems. They arise in important engineering applications such as the sensor network localization problem, and provide a rich and fruitful interaction between algebraic-geometric concepts and modern convex programming.

The talk will be divided into two parts. In the first part, I will describe the key results in this exciting area, highlighting the geometric and conceptual aspects as well as recent work on exact semi-definite program relaxation for polynomial optimization problems. In the second part, I will explain how the semi-algebraic structure helps us to analyze the explicit convergence rate of some important and powerful algorithms such as alternating projection algorithm, proximal point algorithm and Douglas-Rachford algorithm. Applications to tensor computations and sparse optimization problems will be discussed (if time is permitted).
**Thursday 21 July**

**Morning session**

**Jonathan Borwein**, University of Newcastle  
**Title:** Convex analysis on groups and semigroups

**Abstract:** We define convexity canonically in the setting of monoids. We show that many classical results from convex analysis hold for functions defined on such groups and semigroups, rather than only vector spaces. Some examples and counter-examples are also discussed, as are some topological results.

**Additional information**
This is joint work with Ohad Giladi. Associated papers are

**Nadezda Sukhorukova**, Swinburne University of Technology  
**Title:** A generalisation of de la Vallée-Poussin procedure to multivariate polynomials

**Abstract:** The necessary and sufficient optimality conditions for univariate polynomial approximation and de la Vallée-Poussin procedure are based on the notion of alternation. An extension of this notion to the case of multivariate approximation is not straightforward. In this talk, we will present a generalisation of alternation to the multidimensional case and provide its geometric interpretation. We will also demonstrate how the univariate de la Vallée-Poussin's procedure can be extended to the case of multivariate polynomials.

**Thomas Weber**, École Polytechnique Fédérale de Lausanne  
**Title:** Global Optimization on an interval

**Abstract:** This paper provides expressions for solutions of a one-dimensional global optimization problem using an adjoint variable which represents the available one-sided improvements up to the interval "horizon." Interpreting the problem in terms of optimal stopping or optimal starting, the solution characterization yields two-point boundary problems as in dynamic optimization. Results also include a procedure for computing the adjoint variable as well as various necessary and sufficient global optimality conditions.
Andreas Fischer, TU Dresden
Title: A globally convergent LP-Newton method

Abstract: We will present a globally convergent algorithm based on the LP-Newton method. This method has been recently proposed for solving possibly nonsmooth constrained equations that can have nonisolated solutions. The new algorithm employs a linesearch for the merit function that is naturally associated with the subproblems of the LP-Newton method. Moreover, the algorithm preserves the strong local convergence properties of the original LP-Newton scheme. Computational experiments on a set of generalized Nash equilibrium problems will be presented as well.

Additional information
Authors:
Andreas Fischer, TU Dresden,
Markus Herrich, TU Dresden,
Alexey Izmailov, Lomonosov Moscow State University,
Mikhail Solodov, IMPA Rio de Janeiro

Fusheng Bai, Chongqing Normal University
Title: An Adaptive Framework for Global Optimization of Expensive Functions Based on Response Surface Models

Abstract: In this talk, we present an adaptive response surface framework for global optimization using radial basis function interpolation. The framework is divided into two phases. In the first phase, a mixture of local search and global search is implemented to get a rough solution point. A classification algorithm is employed within this phrase to find out whether a small neighborhood of a global minimizer of the current response surface model is fully explored and then either a local search or a global search is applied accordingly. In the second phrase, only local search is implemented in the vicinity of the current best solution point to obtain a better solution point. Computational experiments on some standard test problems indicate that the proposed framework yields very good performance on most of the test problems.

Additional information
Joint work with Zhe Zhou, Chongqing Normal University

Afternoon session

Sergei Schreider, RMIT University
Title: Optimization methods in water allocation management

Abstract: The presentation will be focused on different optimization methods used for water resource management. It will outline projects based on the applications of single objective LP, non-linear optimization and multi-objective optimization methods employed for water allocation modelling in Australia and worldwide.
Daniel McInnes, Monash University
Title: Optimisation of gas flows in South Eastern Australia via controllable Markov chains

Abstract: We consider the optimal flows of intra-day gas supply for the production and pipeline network for Adelaide, Melbourne and Sydney. We model the demand in the network of three major cities as a system of connected three state Markov chains subject to shortfall, pipeline capacity and production capacity constraints. A comparison with a static optimisation model is provided to show the improved capacity for the analysis of demand satisfaction in this model.

Additional information
Joint work with Boris Miller and Sergei Schreider.

Brian Dandurand, RMIT University
Title: Improvements to the Progressive Hedging method for Computing Lagrangian Dual Bounds in Stochastic Mixed-Integer Programming

Abstract: We consider different primal-dual algorithms for improving Lagrangian bounds of a stochastic mixed-integer program (SMIP), where the Lagrangian bounds are due to the relaxation of the nonanticipativity constraints. This dual is widely used in decomposition methods for computing the solutions of SMIPs. In particular, we consider modifications of approaches based on augmented Lagrangians such as the progressive hedging method. Our improvements to these approaches draw on ideas from the Frank-Wolfe method, proximal bundle methods, and nonlinear Gauss-Seidel methods. Key developments in the convergence analysis associated with the modified algorithms are presented. Furthermore, computational experiments based on these algorithms applied to standard test problems are provided, demonstrating their effectiveness both in serial and in parallel.

Additional information
Co-presented by Jeffrey Christiansen.

Jeff Linderoth, University of Wisconsin-Madison
Title: One Relaxation to Rule Them All: Strong Convex Nonlinear Relaxations of the Pooling Problem

Abstract: Our quest is to derive convex relaxations for the pooling problem, a nonconvex production planning problem in which products are mixed in intermediate pools in order to meet quality targets at their destinations. The story begins with a description of the problem and discussion of state-of-the-art solution approaches. In the second chapter, we derive a tractable, non-convex relaxation to form the basis of our continuing adventure. We characterize the extreme points of the convex hull of our non-convex set, we derive valid nonlinear convex inequalities, and we demonstrate that we have characterized the convex hull of our relaxation. Computational results demonstrate that the inequalities can significantly strengthen the convex relaxations of even the most sophisticated formulations of the pooling problem.

Additional information
Joint work with Claudia D’Ambrosio (Ecole Polytechnique), Jim Luedtke, (UW-Madison), and Jonas Schweiger (Zuse Institute Berlin)
Friday 22 July

Morning session

Aris Daniilidis, University of Chile
Title: Controlling the size of Clarke critical values for Lipschitz functions

Abstract: We shall review nonsmooth versions of Sard theorem for particular classes of Lipschitz functions and we shall provide applications in semi-infinite programming.

Hyam Rubinstein, The University of Melbourne
Title: Multisections of manifolds

Abstract: This is joint work with Stephan Tillmann at Sydney. Gay and Kirby developed a theory of trisecting 4-manifolds, arising from their theory of Morse 2-functions. We have extended this using polyhedral maps and decompositions to multisections of triangulated n-manifolds. Here a closed n-manifold is divided into k handlebodies, where n=2k or 2k+1. The handlebodies have disjoint interiors. Properties will be discussed.

David Yost, Federation University Australia
Title: Meta-optimization: lower bounds for higher faces

Abstract: For a d-dimensional polytope with v vertices, \( d + 1 \leq v \leq 2d \), we calculate precisely the minimum possible number of m-dimensional faces, when \( m = 1 \) or \( m \geq 0.62d \). This confirms a conjecture of Grünbaum, for these values of m. We also characterise the minimising polytopes. For \( v = 2d + 1 \), the same problem is solved for \( m = 1, d - 1 \) or \( d - 2 \).

Andrew Eberhard, RMIT University
Title: U-V decomposition, Tilt stability and Manifolds

Abstract: In recent years there has been a growing interest in what one can say about the "substructure" of nonsmooth functions that may be inferred from the structure of their subdifferentials. Many theories propose the existence smooth manifolds to which a non-smooth function has a smoother restriction, often smooth to the second order. We obtain some conditions under which such manifolds may be shown to exist around a tilt stable local minimum.
Afternoon session

Vera Roshchina, RMIT University
Title: Grassmann condition for conic feasibility problems

Abstract: We give new insight into the Grassmann condition measure for homogeneous conic feasibility problem. This condition measure allows to characterise the geometry of the problem disregarding the particular mapping that defines the linear constraint. We define a general version of this condition number that relies on two possibly different norms in the underlying space. We establish the equivalence between the Grassmann distance to ill-posedness and a natural measure of the least violated trial solution to the alternative conic problem. We also show a tight relationship between the Grassmann and Renegar's condition measures, and between the Grassmann measure and a symmetry measure.

Additional information
Joint work with Javier Peña, Carnegie-Mellon University.

Mahboubeh Rezaie, Isfahan University of Iran
Title: Enlargement of monotone operators with applications

Abstract: Several decades after the blossoming of convex analysis, the subject of subdifferential calculus rule is still very active. Also, it is important to be able to calculate the subdifferentials of various combinations of convex functions, such as sum of two such functions. As we know the ε-subdifferential operator can be regarded as an enlargement of the subdifferential, hence the ε-subdifferential calculus is as important as the subdifferential calculus. In this paper, we utilize operations with enlargements to calculate the ε-subdifferential.

Additional information
Joint work with Zahra Mirsaney

Heinz Bauschke, University of British Columbia
Title: On the Douglas-Rachford algorithm

Abstract: The Douglas-Rachford algorithm is a popular splitting method for finding a minimizer of the sum of two convex (possibly nonsmooth) functions; or, more generally, a zero of the sum of two maximally monotone operators. My talk will focus on recent joint works on this algorithm.

This booklet was prepared by Gabriela Raducan, PhD student at RMIT University, School of Mathematical and Geospatial Sciences.