Schedule for **AVOCADO**

Sponsored by **CARMA**, University of Newcastle

August 25-26, 2018

	Saturday		**Sunday**
		8:30	**Coffee**
			Chair: Scott Lindstrom
		9:00	Andrew Eberhard
10:00	**Morning Tea**	10:00	**Morning Tea**
	Chair: Minh Dao		*Chair: Andrew Eberhard*
10:30	Bishnu Lamichhane	10:30	Scott Lindstrom
11:15	Mahdi Abolghasemi		
11:50	Vera Roshchina	11:30	Mesius Alfeus
12:00	**Lunch**	12:00	**Lunch**
	Chair: Jeffrey Hogan		*Chair: Vera Roshchina*
1:15	Riya Aggarwal	1:15	Rubén Campoy
2:00	Ricardo Campello	2:00	Hoa Bui
2:40	**Afternoon Tea**	2:40	**Afternoon Tea**
	Chair: Bishnu Lamichhane		*Chair: Mike Meylan*
3:10	Mike Meylan	3:10	Minh Dao
3:45	Jeff Hogan		
4:15	Neil Dizon		
6:30	**Dinner (location TBA)**		

CARMA

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Abstracts

Speaker: Mahdi Abolghasemi (University of Newcastle)

Title: Machine learning applications in supply chain hierarchical demand forecasting

Abstract: Demand forecasting is the basic for a lot of managerial decisions such as production planning, material resource planning and scheduling in supply chain. Hierarchical forecasting in supply chain is needed in many situations because managers often need different levels of forecasts in different levels of supply chain to make decision. “Bottom-up” and “top-down” are the common methods of hierarchical forecasting. In this talk, first we propose alternative static and dynamic statistical models which outperform “top-down” models. These include a median based “top-down”, weighted mean, a dynamic linear model and a hybrid model. These models work well, but the main disadvantage of these approaches is that they are prone to sudden changes and sporadic events such as promotions. Hyndman et all. (2010) presented a model which provides optimal forecast. The advantage of their model is that they use all the information in the hierarchy by independently forecasting all series at all levels of the hierarchy. Then, they use a regression model to optimally combine and reconcile these forecasts. This model can be computationally expensive and difficult. We propose a new model using machine learning algorithms that generates better forecasts than their model and any other existing models in the literature. The proposed models are empirically validated using real data of a manufacturing company in Australia.

Speaker: Riya Aggarwal (CARMA, University of Newcastle)

Title: Finite element approach to Bragg Edge neutron strain tomography

Abstract: Neutron Transmission methods have recently shown promising results in terms of tomographic reconstruction of strain tensor fields within samples. This technique involves reconstruction from sets of Bragg-edge transmission strain images as measured by pixelated time-of-flight neutron detectors at pulsed neutron sources. As opposed to conventional Radon based CT, this revolves around the inversion of the Longitudinal Ray Transform (LRT) which has known issues surrounding uniqueness. In this work, reconstruction is approached via a least squares approach constrained by equilibrium formulated through the finite element method. An example of this approach is provided for a 2D plane-stress situation.

Speaker: Mesias Alfeus (University of Technology Sydney)

Title: The term structure of roll-over risk a gentle calibration

Abstract: In this talk we present simultaneous model calibration to all market instruments relevant to credit and roll-over risk. We consider a credit default swap (CDS) contract, designed to pro-vide protection from a credit event associated with a risky bond. We derive an analytical expression for CDS within the roll-over risk (consisting of two components, namely credit risk and pure funding liquidity risk) dynamics proposed in Alfeus, Grasselli and Schlögl (2017) and perform model calibration to the CDS spread term structures for USD LIBOR panel banks observed in the market. In addition, the model is calibrated to liquid market-quotes for OIS, vanilla Interest Rates Swaps (IRS), and Basis Swaps (BS) for all available maturities. To make the calibration computationally feasible, we conduct it in several stages. As a result, we extract forward-looking information about the credit and the pure funding liquidity components from market prices of interest rates derivatives.

Speaker: Hoa Bui (Federation University)

Title: Robustly quasiconvex functions

Abstract: Some important generalised convexity properties like quasiconvexity, explicit quasiconvexity and psedoconvexity are not stable when the function is perturbed by a linear functional with small norm. In this talk, we will consider a class of generalised convex functions so-called robustly quasiconvex function that some expected optimisation properties remain stable under a sufficiently small linear perturbation. We will recall some known results for continuously differentiable functions, and discuss on how to deal with non-smooth functions by the means of Fréchet subdifferentials.

Speaker: Ricardo J. G. B. Campello (University of Newcastle)

Title: Pruning trees as an optimisation problem in cluster analysis

Abstract: Data clustering is a classic exploratory data analysis technique and an important sub-field of statistical learning and data mining. In this talk I will discuss, from an optimisation perspective, the problem of extracting a clustering partition from a cluster tree consisting of a hierarchy of nested partitions. In particular, the problem of performing optimal local cuts through cluster trees is formulated, and a dynamic programming solution is presented that is globally optimal and computationally efficient provided that certain assumptions about the adopted optimisation criterion are satisfied. Practical unsupervised and semi-supervised criteria that satisfy the required assumptions are briefly discussed. Interesting variants of the optimisation problem in question, which are still open, will be briefly surveyed as opportunities for future research and possible collaborations.

Speaker: Rubén Campoy (University of Alicante)

Title: A modified Douglas-Rachford splitting algorithm for computing the resolvent of a sum of maximally monotone operators

Abstract: In this talk we present a new iterative projection method. This method, termed AAMR for averaged alternating modified reflections method, can be viewed as an adequate modification of the Douglas-Rachford algorithm that yields a solution to the best approximation problem. We show how the scheme can be generalized so that it can deal with monotone operators. This gives rise to a new splitting algorithm for computing the resolvent of a sum of maximally monotone operators.

Joint work with Francisco J. Arag´on Artacho (University of Alicante).

Speaker: Minh N. Dao (CARMA, University of Newcastle)

Title: Linear convergence of projection algorithms under quasi Fejér monotonicity and quasi coercivity

Abstract: Projection algorithms are well known for their simplicity and flexibility in solving optimisation and feasibility problems. They are particularly important in practice due to minimal requirements for software implementation and maintenance. In this talk, we present linear convergence results of several projection algorithms for feasibility problems with finitely many closed possibly non-convex sets. Two key ingredients of this convergence analysis are what we call quasi firm Fejér monotonicity and quasi coercivity. Our findings not only relax some regularity conditions but also improve linear convergence rates in the literature. In the presence of convexity, the linear convergence is global.

Speaker: Neil Dizon (CARMA, University of Newcastle)

Title: An optimization approach to the construction of multidimensional wavelets: part 2

Abstract: The optimisation techniques produced by Franklin, Tam and Hogan (see part 1 of this series) use variables which are generated from uniform samples of the so-called quadrature filters associated with the multiresolution structure. Here we instead use samples of the scaling functions and associated wavelets as variables. This allows for the construction of scaling functions and wavelets with optimal ``cardinality'' and symmetry properties. We also consider the extension of the Douglas-Rachford constructions of part 1 to the case of quaternion-valued functions on the plane, raising the possibility of fast algorithms for the processing of multi-variable, multi-channel signals such as colour images.

Speaker: Andrew Eberhard (RMIT University)

Title: A fixed point operator in discrete optimisation duality

Abstract: I will discuss some duality structures that have appeared in discrete optimisation in conjunction with studies of discrete proximal point algorithm, augmented Lagrangian duality, supporting theory for the "Feasibility Pump" and more recently with regard to Stochastic Integer programming. A common theme appears involving a fixed point operator associated with the local minima of a regularised dual function. This has enabled the one to describe some MIP heuristics in terms of so continuous optimisation ideas.

Speaker: Jeffrey Hogan (CARMA, University of Newcastle)

Title: An optimisation approach to the construction of multidimensional wavelets: part 1

Abstract: Ingrid Daubechies' construction of compactly supported smooth orthogonal MRA wavelets on the line relied heavily on techniques of complex analysis (such as spectral factorization), many of which are unavailable in the higher-dimensional setting. Constructions of compactly supported, smooth orthogonal MRA wavelets in higher dimensions (with isotropic dilations), on the other hand have proven to be elusive. I will report on joint work with David Franklin (Newcastle) and Matthew Tam (Goettingen) in which we search for (non-separable) multidimensional wavelets with the help of techniques from optimisation such as the Douglas-Rachford algorithm.

Speaker: Bishnu Lamichhane (CARMA, University of Newcastle)

Title: A new minimisation principle for elliptic problems

Abstract: I talk about a new minimisation principle for the Poisson equation using two variables: the solution and the gradient of the solution. This principle allows us to use any conforming finite element spaces for both variables, where the finite element spaces do not need to satisfy a compatibility condition.

Speaker: Scott B. Lindstrom (CARMA, University of Newcastle)

Title: Nonlinear optimization: case studies in experimental discovery

Abstract: I will provide an overview of some of the modern methods of experimental mathematics which have proven useful for analysing a variety of interesting problems related to nonlinear optimization.

Speaker: Mike Meylan

Title: The forced vibration of a floating elastic plate

Abstract: The floating elastic plate is a canonical problem in hydroleasticity which can model a range of application from sea ice to floating airports. I will present a solution to thetime-dependent vibration of a floating elastic plate subject to a transient force. The solution is found in the frequency domain by the eigenfunction matching method. It is shown that the eigenfunction matching in two and three dimensions is almost identical when this symmetry is exploited, and the ease of implementation of this method is demonstrated. The time domain solution is calculated for the case of a Gaussian forcing applied at various points on the plate. The subsequent motion of the plate and its decay due to wave radiation is shown.

Speaker: Vera Roshchina (School of Mathematics and Statistics, UNSW)

Title: A Counterexample to the Demyanov-Ryabova Conjecture

Abstract: It was conjectured by Vladimir Demyanov and Julia Ryabova in 2011 that the minimal cycle in the sequence obtained via repeated application of Demyanov converter to a finite family of polytopes has length at most two. In spite of the strong positive results due to Tian Sang and Aris Daniilidis and Colin Petitjean, who proved the conjecture for two different special cases, we construct a two-dimensional counterexample for which the minimal cycle has length 4.