Variational Analysis: Theory and Applications
Analyse variationnelle : théorie et applications
(Org: **Heinz Bauschke** and/et **Xianfu Wang** (UBC Kelowna))

THEO BENDIT, University of British Columbia, Okanagan
Doubleton Projections in Real Hilbert Spaces

Suppose X is a real Hilbert space. We say a set $C \subseteq X$ admits a Continuous Doubleton Projection if there is a point $x \in X \setminus C$ that projects onto exactly two points of C, and that the metric projection map P_C is upper-semicontinuous at x.

We present two conditions equivalent to C failing to admit a doubleton projection: a property related to (but stronger than) connectedness called B°-Connectedness, and a property we call Locally-Determined Set Curvature.

These results tell us some non-trivial geometric facts about Chebyshev sets in real Hilbert Spaces. Such sets are the subject of a long-standing open problem known as the Chebyshev Conjecture.

MANISH KRISHAN LAL, University of British Columbia, Okanagan
Directional asymptotics of Fejér monotone sequences

In this paper, we present directionally asymptotical results of strongly convergent subsequences of Fejér monotone sequences. We also provide examples to show that the sets of directionally asymptotic cluster points can be large and that weak convergence is needed in infinite-dimensional spaces.

WALAA MOURSI, University of Waterloo
Uniformly monotone operators and their reflected resolvents

The correspondence between the class of nonexpansive mappings and the class of maximally monotone operators via the reflected resolvents of the latter played an instrumental role in the convergence analysis of the splitting methods. Indeed, the performance of some of these methods hinges on iterating the so-called splitting operators associated with the individual operators. These splitting operators in the case of Douglas–Rachford and Peaceman-Rachford methods are functions of the composition of the reflected resolvents of the underlying operators. In this talk, we provide a comprehensive study of the reflected resolvents of uniformly monotone operators. We show that this class is closely related to the class of the strongly nonexpansive operators introduced by Bruck and Reich. Connection to duality via the inverse operators is systematically studied. We provide applications to Douglas–Rachford and Peaceman-Rachford methods. Examples that illustrate and tighten our results are presented. (Based on joint work with L. Liu and J. Venderwerff.)

HUI OUYANG, University of British Columbia, Okanagan
Weak and strong convergence of generalized proximal point algorithms

In this talk, we first present a framework of generalized proximal point algorithms associated with a maximally monotone operator. We indicate sufficient conditions on the regularization and relaxation parameters of generalized proximal point algorithms for the equivalence of the boundedness of the sequence of iterations generated by this algorithm and the non-emptiness of the zero set of the maximally monotone operator, and for the weak and strong convergence of the algorithm. Improvements of our results are illustrated by comparing our results with related known ones.

MATTHEW SAURETTE, University of Waterloo
On the convergence of Douglas-Rachford method for inconsistent optimization problems.

In this talk we consider the behavior of the Douglas-Rachford method when applied to solve inconsistent optimization problems. We extend and refine currently known results. Strong convergence results are provided. Several examples illustrate our work.

SHAMBHAVI SINGH, University of British Columbia Okanagan
Projecting onto rectangular matrices with prescribed row and column sums

In 1990, Romero presented a beautiful formula for the projection onto the set of rectangular matrices with prescribed row and column sums. Variants of Romero's formula have been rediscovered by Khoury and by Glunt, Hayden, and Reams, for bistochastic (square) matrices in 1998. These results have found various generalizations and applications.

In this paper, we provide a formula for the more general problem of finding the projection onto the set of rectangular matrices with prescribed scaled row and column sums. Our approach is based on computing the Moore-Penrose inverse of a certain linear operator associated with the problem. In fact, our analysis holds even for Hilbert-Schmidt operators and we do not have to assume consistency. We also perform numerical experiments featuring the new projection operator.

JON VANDERWERFF, La Sierra University
Uniformly Monotone Operators on Hilbert Spaces

Some properties of uniformly monotone operators on Hilbert spaces, such as surjectivity and their connections with nonexpansive mappings via the reflected resolvent will be presented. Self-dual properties and characterizations of operators such that A and A^{-1} are uniformly monotone will be given. (Based on joint work with L. Liu and W. Moursi)

ZIYUAN WANG, UBCO
The Malitsky-Tam forward-reflected-backward splitting method for nonconvex problems

We extend the Malitsky-Tam forward-reflected-backward (FRB) splitting method to the full nonconvex setting. By assuming the generalized concave Kurdyka-Łojasiewicz (KL) property of a quadratic regularization of the objective, we show that the FRB method converges globally to a stationary point of the objective and enjoys finite length property. The sharpness of our approach is guaranteed by virtue of the generalized concave KL property.