THE WEST COAST OPTIMIZATION MEETING

Depts. of Mathematics and Applied Mathematics, University of Washington

All talks will be in Guggenheim 317

FRIDAY, FEBRUARY 5

6:30–9:30+ Party at Terry Rockafellar's home, 4531 NE 93rd Street, 206–527–9637

The cost per person will be \$10/"student" and \$15/"others."

SATURDAY, FEBRUARY 6

8:30–9:00 ————Refreshments in Guggenheim 408, the Applied Math Lounge

9:00–9:10 "Convexity in Two-Player Zero-Sum Differential Games," Rafal Goebel, PhD student in Mathematics, Univ. of Washington

9:10–9:50 "A Baire Categorical Approach to Integration" Warren Moors, Victoria University/CECM

9:50–10:15 ————Refreshments in Guggenheim 408, the Applied Math Lounge

10:15–10:25 "Dualization of Generalized Equations of Maximal Monotone Type," Teemu Pennanen, PhD student in Mathematics, Univ. of Washington

10:25–11:05 "Nonsmooth Optimization in a Lagrangian Relaxation Framework," Sharon Filipowski, Boeing Co.

11:05–11:20 ————Refreshments in Guggenheim 408, the Applied Math Lounge

11:20–11:30 "The Value Function and the Hamilton-Jacobi Equation," Grant Galbraith, PhD student in Mathematics, Univ. of Washington

11:30–12:10 "Non-Lipschitz Eigenvalue Optimization," Michael Overton, Courant Institute (New York Univ.)

12:10–14:00 ————Lunch expedition to University Avenue

14:00–14:40 "Some New Mean Value Theorems for C^1 Functions in Finite and Infinite Dimensions," Jon Borwein, CECM (Simon Fraser Univ.)

14:40–15:20 "Nonparametric Population Analysis: A Case Study in the Application of Smoothing and Interior Point Methodology," Jim Burke, Dept. of Mathematics, Univ. of Washington

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The **West Coast Optimization Meeting** occurs twice each year. Contact:

Prof. J. M. Borwein at the Dept. of Mathematics and Statistics, Simon Fraser University, Vancouver: (604) 291-3070, e-mail jborwein@cecm.sfu.ca

Prof. R. T. Rockafellar at the Dept. of Mathematics, University of Washington, Seattle: (206) 543-1916, e-mail rtr@math.washington.edu

TALK ABSTRACTS for WCOM

Seattle, February 6, 1999

Rafal Goebel, *Convexity in Two-Player Zero-Sum Differential Games*

The talk presents characterizations of equilibria in two-player zero-sum differential games with convex-concave cost. Equilibrium strategies for each player are given in terms of the subdifferential of the convex-concave function, conjugate to the cost. A Hamiltonian inclusion describes equilibrium trajectories of the game.

Warren Moors, *A Baire Categorical Approach to Integration*

I will describe recently disovered methods for showing that a given multifunction is a generalized subdifferential. A special case yields that in every Banach space "most" Lipschitz functions have a Clarke subdifferential that is a constant multiple of dual ball at each point. This is joint work with Xianfu Wang and Jon Borwein.

Teemu Pennanen, *Dualization of Generalized Equations of Maximal Monotone Type*

The convex programming duality framework is extended to generalized equations governed by arbitrary set-valued mappings. Many useful applications of convex programming duality theory can be extended to a more general class of problems. In the monotone case, we obtain e.g. generalized multiplier methods and a new maximality criterion for composite mappings. Even in the non-monotone case, the abstract duality scheme can be used to derive locally convergent multiplier methods for generalized equations.

Sharon Filipowski, *Nonsmooth Optimization in a Lagrangian Relaxation Framework*

A common approach for addressing the solution of a combinatorial optimization problem is the method of Lagrangian relaxation. A bundle algorithm was implemented to optimize the nonsmooth functions that arise when using this method. The combinatorial optimization problem that has motivated our work in this area, the multidimensional assignment problem, and issues concerning nonsmooth optimization and reoptimization in the Lagrangian relaxation framework will be discussed.

Grant Galbraith, *The Value Function and the Hamilton-Jacobi Equation*

This brief talk will outline some of my current research which involves characterizing the value function of a generalized Bolza problem as the unique solution to a subgradient version of the Hamilton-Jacobi equation.

Michael Overton, *Non-Lipschitz Eigenvalue Optimization*

This concerns joint work with Jim Burke. We consider eigenvalue functions $f \circ \lambda$, where f is any function mapping C^n to R and λ is the eigenvalue map from $C^{n \times n}$ to C^n. Here we assume for convenience that the eigenvalues are ordered lexicographically, and that f is invariant with respect to permutations of its arguments. For example, if f is the function "maximum real part", then $f \circ \lambda$ is the spectral abscissa, while if f is "maximum modulus", then $f \circ \lambda$ is the spectral radius. The eigenvalue map λ is neither convex nor Lipschitz. We use the notion of subgradient introduced by Mordukhovich and extensively analyzed

in the recent book of Rockafellar and Wets. This approach is particularly well suited to non-Lipschitz eigenvalue analysis. We derive several necessary conditions for subgradients, applicable to any f, and necessary and sufficient conditions for the spectral abscissa. We identify the case where subdifferential regularity holds, and discuss its implications. We conclude by introducing the notion of positive stable programming: minimizing a linear function of a matrix subject to linear constraints, together with the constraint that the eigenvalues of the matrix all lie in the right half-plane. This is a generalization of semidefinite programming for non-Hermitian matrices, and local optimality conditions can be derived using non-Lipschitz eigenvalue analysis.

Jon Borwein, *Some New Mean Value Theorems for C^1 Functions in Finite and Infinite Dimensions*

I will describe and refine some striking mean value theorems of a kind first exhibited in 1994 by Francis Clarke and Yuri Ledyaev. The proofs mix fixed point and variational techniques. A special case is the assertion that given a smooth function from R^n to R, the maximum value of the odd part of the function on the unit ball is an upper bound for the minimum of the gradient of the norm. I will also sketch some open questions. This is joint work with Simon Fitzpatrick from the University of Western Australia.

Jim Burke, *Nonparametric Population Analysis: A Case Study in the Application of Smoothing and Interior Point Methodology*

Population analysis is one of the primary statistical tools used in pharmacokinetic analysis. In this talk, we will briefly introduce the nonparametric version of this problem and show how it can be reduced to a convex programming problem in finite dimensions. We then show how one can apply smoothing and interior point methods to derive numerical solution procedures.