THE WEST COAST OPTIMIZATION MEETING

Depts. of Mathematics and Applied Mathematics, University of Washington

All talks will be in Guggenheim 317

FRIDAY, OCTOBER 20, 2000

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, OCTOBER 21, 2000

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

9:00–9:10 "Numerical results for neo-classical economic growth models using path-following algorithms," Brett Berger, Univ. of Washington

9:10–9:50 "On Legendre functions and Bregman distances," Heinz Bauschke, Okanagan UC and Univ. of Guelph

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

10:15–10:25 "Nonlinear least-squares and non-convex projection algorithms," Russell Luke, Univ. of Washington

10:25–11:05 "Optimization applications to industrial problems," Zelda Zabinsky, Univ. of Washington

11:05–11:30 ————Refreshments in Guggenheim 408, the Applied Math Lounge

11:30–12:10 "Convexification in stochastic integer programming," Suvrajeet Sen, Univ. of Arizona

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

14:00–14:40 "A production application for M-convexity," Tom McCormick, Univ. of British Columbia

14:40–15:20 "Ample parameterization of variational inequalities and generalized equations," Terry Rockafellar, Univ. of Washington

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

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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, October 21, 2000

Brett Berger, *Numerical results for neo-classical economic growth models using path-following algorithms*

Numerical results were obtained for the three basic types of neo-classical vintage capital models. The existing literature only analyzed the asymptotic steady states resulting from systems of dynamic equations. These new results allow the examination of the entire time path of the key primal and dual variables of these models structured as optimization problems. Two of the three models are convex programming problems and therefore have unique global solutions. The convex programming problems' results were obtained using an interior point algorithm. The results of the non-convex model were obtained using a non-interior path following algorithm based on Burke and Xu (2000).

Heinz Bauschke, *On Legendre functions and Bregman distances*

Based on joint work with Jon Borwein (SFU) and Patrick Combettes (Paris VI), I will present some recent results on Legendre functions in reflexive Banach spaces, and on the joint convexity of the Bregman distance.

Russell Luke, *Nonlinear least-squares and non-convex projection algorithms*

Projection algorithms are commonly used to reconstruct the phase of an electromagnetic field from magnitude information alone. The constraint sets underlying these applications are non-convex. To date convergence of these algorithms has not been proven. We fill this gap in the theory of such algorithms by showing that the steepest descent method applied to the minimization of a least squares objective is equivalent to a specific implementation of a projection algorithm. The convergence properties of the steepest descent method are derived from standard results in the optimization literature.

Zelda Zabinsky, *Optimization applications to industrial problems*

Over the past few years I have supervised several student projects with industrial sponsors. The projects involve mathematical modeling including linear optimization, nonlinear optimization, and some integer programming. The students include master's and PhD students. I will describe three projects: one analyzing the design of oceanic air traffic management systems, one scheduling a production process, and one analyzing manufacturing tolerances of a composite panel. The air traffic management problem uses network optimization expanded over time, the production scheduling problem uses a collection of integer optimization models, and the manufacturing tolerances problem uses two global optimization methods.

Suvrajeet Sen, *Convexification in stochastic integer programming*

One of the more formidable classes of optimization problems arises from the incorporation of uncertainty in integer programming models. We will consider two stage models in which integer-valued decisions are allowed in either the first or the second stage. We will discuss various approaches to convexifying these problems. It is shown that for problems with fixed recourse, there is substantial commonality between the convex hull representations associated with alternative scenarios. Based on this characterization we devise a class of methods called Disjunctive Decomposition algorithms. We show that when the second stage consists of 0-1 MILP problems, we can obtain accurate second stage objective function estimates after finitely many steps. We will also compare the degree of difficulty associated with convexifying problems involving 0-1 first-stage variables, with the situation involving continuous first-stage variables (with second stage being 0-1 MILP).

Tom McCormick, *A production application for M-convexity*

We consider a model of a production system where multiple component parts are assembled in a tree structure into various final products, subject to convex revenue functions. This can be modeled as a flow in two networks, one for the components, the second for the final products, with constraints that the flows on certain pairs of arcs are equal.

We show how to represent the component network as a set of side constraints for the final product network. This leads to showing under what assumptions there exist optimal, integral flows. For some versions of the model, the resulting network flow problem is a submodular flow problem with non-separable convex costs.

We show that these special cases belong to the class of M-convex optimization problems developed by Murota. We discuss the implications of this for characterizing optimility, and for developing algorithms.

This is joint work with Julie Swann of Northwestern, David Simchi-Levi of MIT, and Ann Chan of Toronto.

Terry Rockafellar, *Ample parameterization of variational inequalities and generalized equations*

Variational inequalities are important in expressing optimality conditions, modeling equilibrium in games and economics, and much more. A fundamental question is how the set of solutions varies with respect to shifts in the parameters on which a variational inequality depends. In this talk a concept of ample parameterization will be discussed which conveniently supports an array of results of implicit-function type—where properties of the solution mapping can be derived from properties of an associated “linearization” of the variational inequality.