Applied Non-Linear Optimization Day

Sponsored by CORS and D-Drive (Dalhousie University)

November 19, 2007
D-Drive Lab
Faculty of Computer Science, Dalhousie University

Schedule

9:00 - 9:45	**My Favourite Convexity Results** Jonathan Borwein, CRC, Dalhousie University
9:45 – 10:00	Coffee Break
10:00 - 10:45	**Adaptive Direction Methods in Direct Search Algorithmic Frameworks** Mason Macklem, Dalhousie University
11:00 - 11:45	**From Convex to Nonconvex Optimization: Properties and Models** Carl-Louis Sandblom, Department of Industrial Engineering, Dalhousie University
12:00 - 12:45	**Global Optimization in Practice: Modeling Environments, Solvers, and Applications** Janos D. Pinter, PCS Inc. & Dalhousie University
12:45	Luncheon with further discussion possibilities

Abstracts

My Favourite Convexity Results
Jonathan Borwein, CRC, Dalhousie University

The title says it all!

Adaptive Direction Methods in Direct Search Algorithmic Frameworks
Mason Macklem, Dalhousie University

Recent years have seen renewed interest in direct search methods, spawned by the landmark convergence results of Virginia Torczon's Multidirectional Search (MDS) and

Generalized Pattern Search (GPS). These methods select a set of search directions, and define a lattice structure on the search space from which specific points are selected to perform function evaluations, with the precision of the grid adjusted based on the success or failure of the current precision at each iteration. Since the original MDS formulation and the GPS extension, a number of competing algorithmic frameworks have been proposed, from the Generating Set Search (GSS) methods of Torczon, Lewis and Kolda, to the frame-based frameworks of Coope and Price, to the Mesh Adaptive Direct Search (MADS) algorithm of Abramson, Audet and Dennis. These frameworks each adopt some definitions and ideas from the others, and all focus the choice of search directions around the central notion of a positive basis (a set of vectors such that their nonnegative linear combinations span the entire search space). These frameworks largely differ on their flexibility in the choice of basis directions, and in their ease of updating the search directions, with a balancing act between the flexibility in the choice of directions and the ability to choose when in the algorithm to make such updates. This talk will provide an overview of the various frameworks, and will discuss and compare several approaches to updating the search directions in specific algorithms that fit within each framework. We will also develop and propose our own algorithm which is specifically designed to detect the presence of valleys, and to enable the basis directions to be chosen to better align to detected valleys. We present some preliminary test results on a class of problems with one-dimensional valleys which require methods with adaptive directions.

From Convex to Nonconvex Optimization: Properties and Models

Carl-Louis Sandblom, Dept. of Industrial Engineering, Dalhousie University

The well-established field of convex optimization has in the last two decades been extended to the nonconvex case. We review some of these developments.

Global Optimization in Practice: Modeling Environments, Solvers, and Applications

Janos D. Pinter, PCS Inc. & Dalhousie University

The objective of global optimization (GO) is to find the best solution in nonlinear models with multiple (local) extrema. We will briefly review the state-of-the-art in GO software implementations, with a range of application examples from the sciences and engineering.