Optimization Theory and Algorithms.

Specific Interest : Convex Optimization, Nonsmooth Optimization, Vector Optimization (Pareto optimization), Bilevel Programming, Eror Bounds for variational inequalities and optimization
problems.

I am deeply interested in the issue of non-differentiability in optimization. Trying to understand nonsmoothness and the associated calculus of subdifferentials and optimality conditions had been my focus for quite a long time. Recently I have spent my energy in trying to understand some important algorthmic issues like the proximal point algorthms for convex optimization problem, the use of approximate optimality conditions in actual computations etc. I have lately tried to develop theory which in some way or the other would be useful for numerical techniques. This has lead me to the study of error bounds for variational inequalities and optimization problems. To look into very specific class of nonsmmoth optimization problem I have studied the very challenging issue of bilevel programmimg and continue to remain involved in it.

Optimization is a beautiful part of mathematics and lies and the very foundation of modern economics. Convex optimization deals with optimization problem where we minimize a convex function over a convex set or maximize a concave function over a convex set. This is problem is of fundemantal importance to engineering and economics and truly lies at the boundary between mathematics and these disciplines. Recently the power of convex optimization was revealed in handling the sum of squares problem in algebraic geometry.

Convex Analysis on which convex optimization rests is a fascinating area in which one can remain immersed for a lifetime. This subject can at any time throw in an unexpected surprises. Apart from my research in the above mentioned areas I have set myself to the task of collecting the gems of convex analysis and combine them into a book called “ How to enjoy convex analysis”.

Bilevel programming which a optimization formulation of the Stackelberg game is recently back to focus due to its applications in the study of de-regulated electricity markets in which I am going to devote myself in the coming years. Further from a mathematical point of view bilevel programming remains challenging since it is very difficult to develop a computationally simple optimality condiitons for it. This is essentially due to the lack of regularity of the problem with the added non-smoothness and non-convexity.

I had till a few years ago concentrated on studying Pareto minimization problems from the view point of the optimality conditions specially when the ordering cone has an empty interior. Recently I have focussed on developing error bounds for convex vector optimization problem which by itself is appearing to be quite challenging when we have the presence of non-

smoothness in the data.

My future goals is to study the use of bilevel programming in electricity markets and also devote a considerable time to undestand the use of the Douglas-Rachford method for non-convex feasibility problems. I aim to work on these new and exciting things while continuing to work in the fields in which I am actively involved at present.

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