

Abstract: The talk is a potpourri of my recent research interests with 3 independent parts. First, I will describe recent work on computing the biconjugate (aka convex envelope) and conjugate. Computing the closed convex envelope or biconjugate is the core operation that bridges the domain of nonconvex with convex analysis. We focus here on computing the conjugate of a bivariate piecewise quadratic function defined over a polytope. The conjugate has a parabolic subdivision such that over each member of its subdivision, it has a fractional form (linear function over square root of a linear function). This computation of the conjugate is performed with a worst-case linear time complexity algorithm. The second part will focus on checking whether a piecewise function is convex. I will present an algorithm to detect convexity in linear time with respect to the number of edges of the partition defining the domain. The results have interesting applications in optimization problems under convexity constraints. In the 3rd part, I will discuss the road design problem and our recent work on multi-fidelity surrogate. The goal is to speed up the computation of the lower level problem in a bilevel optimization. The surrogate built has 2 interesting properties: it is very precise, and it has several level of approximations. The results lead to very significant speedups.

This is joint work with MSc students D. Kumar, S. Singh, M. Aziz for part 1, 2 and 3 respectively, with additional collaboration with postdoctoral fellow Dr. D. Monnet and my colleague Dr. W. Hare on part 3.

Bio: Dr. Yves Lucet received his PhD in convex analysis and optimization in 1997 from Universite de Toulouse III, France. He moved to Canada for a postdoctoral fellowship between Simon Fraser University, University of Edmonton, and University of Victoria. In 2002, he accepted a faculty position in what became the Okanagan campus of the University of British Columbia at which he is a professor of computer science. He has been pursuing his research in computational convex analysis with recent focus on conjugate, biconjugate and convexity detection algorithms. He is also interested in modeling and optimization, and has a long running project with industry-sponsored funding on the optimization of road designs.