Optimización continua

Equipo organizador
- Rubén Campoy (Universidad de Alicante)
- César López Pastor (Universidad de Alicante)

Descripción
Esta sesión está dedicada a la presentación y discusión de avances recientes en investigación teórica y aplicada en el ámbito de la optimización continua. Se abordarán temas que incluyen, entre otros, optimización lineal, convexa, o no lineal; programación semiinfinita y optimización infinito-dimensional; optimización paramétrica, estabilidad, sensibilidad y buen planteamiento; optimización vectorial y conjunto-valuada; optimización estocástica o bajo incertidumbre; y aplicaciones en finanzas e ingeniería, entre otras. La sesión también pone especial énfasis en el desarrollo de herramientas y métodos matemáticos relacionados, como los provenientes del análisis convexo, el análisis variacional, la derivación generalizada o el diseño de algoritmos, los cuales resultan fundamentales para el estudio y la resolución de problemas de optimización.

Palabras clave: Optimización; Análisis convexo y variacional; Estabilidad y sensibilidad; Algoritmos numéricos.

Programa

JUEVES, 22 de enero

11:00 – 11:30	Miguel A. Goberna (Universidad de Alicante) *Farkas' lemma revisited*
11:30 – 12:00	Sorin-Mihai Grad (ENSTA Paris) *A fresh look at algorithms for solving smooth multiobjective optimization problems*
12:00 – 12:30	Abderrahim Hantoute (Universidad de Alicante) *Some new dual formulations in infinite convex optimization*
12:30 – 13:00	Juan Parra (Universidad Miguel Hernández de Elche) *Lispchitz modulus of quadratic optimization problems with an application to metric projection*
16:00 – 16:30	María Dolores Fajardo (Universidad de Alicante) *Perturbational approach to duality in evenly convex set-valued optimization*
16:30 – 17:00	F. Javier Toledo (Universidad Miguel Hernández de Elche) *Parametrization of the characteristic curve of the photovoltaic single-diode model: applications to optimization problems*
17:00 – 17:30	César López Pastor (Universidad de Alicante) *A unifying graph-based analysis of projection algorithms for linear subspaces*
18:00 – 18:30	Tereso del Río (Johannes Kepler University Linz) *Domain Specific Language to Optimise Industrial Processes*
18:30 – 19:00	Rubén Campoy (Universidad de Alicante) *Designing proximal-gradient algorithms through graph sctructures*

VIERNES, 23 de enero

11:00 – 11:30	David Torregrosa Belén (Universidad de Alicante) *Randomized block coordinate descent beyond global Lipschitz gradient continuity*
11:30 – 12:00	Jan-J. Rückmann (University of Bergen) *MPCC: Strong Stability for different stationarity concepts*
12:00 – 12:30	Jesús Camacho (Universidad Miguel Hernández de Elche) *Lipschitz upper semicontinuity of fully perturbed linear systems*

Farkas' lemma revisited

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Resumen. The original Farkas' lemma (1902) is more than just a result: it is a method for solving inclusion problems and characterizing the optimality of feasible solutions in optimization problems, among others. In this talk, we revisit various versions of Farkas' lemma, focusing on problems formulated in infinite-dimensional spaces and involving infinitely many constraints.

A fresh look at algorithms for solving smooth multiobjective optimization problems

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Resumen. We propose a new approach for constructing practical algorithms for solving smooth multiobjective optimization problems based on determining decreasing directions via suitable linear programming problems. The presented iterative method is specialized for unconstrained and linearly constrained multiobjective optimization problems. In all cases, the objective function values sequence is decreasing with respect to the corresponding nonnegative orthant, and every accumulation point of the sequence generated by the algorithm is a substationary point to the considered multiobjective optimization problem, becoming, under convexity assumptions, a weakly Pareto efficient solution. Different to similar algorithms from the literature, the ones proposed in this work involve decreasing directions that are easily computable in polynomial time.

Some new dual formulations in infinite convex optimization

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Resumen. We propose two new dual formulations in infinite convex optimization, relying on Lagrangian-type functions that involve infinitely many dual variables and infinite sums of functions. We prove that the Slater condition guarantees the strong duality, in contrast with the Haar duality, where the Slater condition does not ensure strong duality even in the case of semi-infinite linear optimization. We apply extended concepts of uniform lower semicontinuity of infinite collections of functions, and establish general duality results via fuzzy multiplier rules for infinite sums.

Lispchitz modulus of quadratic optimization problems with an application to metric projection

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Resumen. This talk was initially motivated by the computation of the Lipschitz modulus of the metric projection on polyhedral sets in the Euclidean space. In our framework, both the reference point and the polyhedron where it is projected are subject to perturbations. As far as the metric projection in the current setting is nothing else but the solution set of a particular strictly convex quadratic problem, our initial problem is solved as a particular case of the results of this work. In fact, we deal with the optimal set (argmin) mapping of a canonically perturbed convex quadratic model; i.e., where linear perturbations of the objective function together with perturbations of the right-hand side are allowed. In this framework, we provide an implementable formula (only appealing to the initial problem's data) for computing the Lispchitz modulus of the optimal set mapping through the concept of minimal Karush-Kuhn-Tucker subset of indices. These subsets of indices have played a decisive role in the computation of Lipschitz and calmness moduli in linear optimization.

Perturbational approach to duality in evenly convex set-valued optimization

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Resumen. A general perturbation approach to conjugate duality theory in set-valued optimization considering set criterion, where the image space is a complete lattice whose elements are evenly convex sets, is presented. This image space structure is suitable for the conjugation scheme for set-valued functions called c-conjugation, and it allows to obtain a dual problem for a general primal one verifying weak dualty. Fenchel and Lagrange dual problems are presented as examples. We also obtain zero duality gap and strong duality theorems.

Parametrization of the characteristic curve of the photovoltaic single-diode model: applications to optimization problems

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Resumen. In this talk, we present the first parametrization in the literature of the characteristic curve, also called I-V curve, of the photovoltaic single-diode model. A key insight in obtaining this parametrization is the fact that the I–V curve has a left-hand oblique asymptote, since the chosen parameter turns out to be the vertical distance from the curve to this asymptote. This parametrization has recently been applied to solve various optimization problems, including the computation of the Euclidean distance from a point to the I–V curve, the efficient graphical representation of the curve, and the computation of its maximum power point.

A unifying graph-based analysis of projection algorithms for linear subspaces

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Resumen. This work develops a general analysis for the fixed points of the operators defining the graph splitting methods by Bredies, Chenchene and Naldi. We particularize it to the case of projection algorithms for closed linear subspaces and provide an explicit formula for the limit points of the graph splitting schemes. We exemplify these results on some particular algorithms, unifying in this way some results previously derived as well as obtaining new ones.

Domain Specific Language to Optimise Industrial Processes

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Resumen. Many industrial processes involve decisions that affect their speed, cost, and/or waste generated. We present a Domain-Specific Language prototype that transforms simple code descriptions of machines into formal constraints and objective functions. This allows industrial partners to model their pipelines and solve their optimisation problems through symbolic solvers without requiring expertise in these areas. As a case study, we focus on a rolling-horizon optimization problem under uncertainty deduced from a wood processing pipeline, in which the decisions taken determine the amount of material that is wasted.

Designing proximal-gradient algorithms through graph sctructures

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Resumen. In this talk, we present a general framework for designing forward-backward methods, which include proximal-gradient algorithms for optimization problemas as a particular class. Our methodology builds on recent techniques and extends them to settings involving multiple smooth functions, where gradients are directly evaluated instead of using proximal mappings. The algorithms are constructed through three interacting graphs that define how the variables are coupled and how iterations are computed. This unified framework not only recovers several known schemes but also enables the derivation of new ones.

Randomized block coordinate descent beyond global Lipschitz gradient continuity

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Resumen. Randomized block-coordinate algorithms are recognized to furnish efficient iterative schemes for addressing large-scale problems, especially when the computation of full derivatives entails substantial memory requirements and computational efforts. Classically, the convergence analysis of these methods relies on a standard assumption of global Lipschitz continuity of partial gradients of differentiable functions. This compromises its applicability to situations where gradient Lipschitz continuity is violated, for instance, in nonnegative matrix factorization or recovery of signals from quadratic measurements. In this talk, we present a randomized block proximal gradient algorithm for addressing the sum of a separable (nonsmooth) proper lower-semicontinuous function and a differentiable function whose partial gradients are assumed to be Lipschitz continuous only locally. At each iteration, the method adaptively selects a proximal stepsize to satisfy a sufficient decrease condition without prior knowledge of the local Lipschitz moduli of the partial gradients of the differentiable function. We conduct a thorough analysis of the convergence of the method and illustrate its performance in an experiment in image compression.

MPCC: Strong Stability for different stationarity concepts

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Resumen. In this lecture we consider the problem class of mathematical problems with complementarity constraints (MPCC) in a finite-dimensional setting. Contrarily to standard nonlinear programming problems (that is, with finitely many equality and/or inequality constraints) when exactly one stationarity concept is used, for MPCC several stationarity concepts have been introduced. For some of them, e.g. for C-, M- and S-stationarity points, we discuss algebraic and topological equivalent characterizations for the strong stability of such a stationary point. Strong stability was originally introduced by Kojima for standard nonlinear programming and it refers to existence, uniqueness and continuous dependence of a stationary point for each sufficiently small perturbed problem with perturbations up to second order. This property of strong stability is therefore an important feature for sensitivity analysis and parametric optimization.

Lipschitz upper semicontinuity of fully perturbed linear systems

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Resumen. This presentation aims to show the process of computing the Lipschitz upper semicontinuity modulus of linear inequality systems under full perturbations, i.e., when all coefficients are allowed to be perturbed. This talk is preluded by the obtention of a point-based (only relying on the nominal data) formula for such a quantity in the right-hand side framework. The differences between the two parametric contexts will be emphasized.