Publicacions més rellevants de la línia de recerca:
Optimització de gran escala

Referència: Castro, J. An interior-point approach for primal block-angular problems. *Computational Optimization and Applications*, **36** (2007), pp. 195–219.

Abstract: Multicommodity flows belong to the class of primal block-angular problems. An efficient interior-point method has already been developed for linear and quadratic network optimization problems. It solved normal equations, using sparse Cholesky factorizations for diagonal blocks, and a preconditioned conjugate gradient for linking constraints. In this work we extend this procedure, showing that the preconditioner initially developed for multicommodity flows applies to any primal block-angular problem, although its efficiency depends on each particular linking constraints structure.We discuss the conditions under which the preconditioner is effective. The procedure is implemented in a user-friendly package in the MATLAB environment. Computational results are reported for four primal block-angular problems: multicommodity flows, nonoriented multicommodity flows, minimum-distance controlled tabular adjustment for statistical data protection, and the minimum congestion problem. The results show that this procedure holds great potential for solving large primal-block angular problems efficiently.

Referència: Castro, J. A stochastic programming approach to cash management in banking. *European Journal of Operational Research*, **192** (2009), pp. 963–974.

Abstract: The treasurer of a bank is responsible for the cash management of several banking activities. In this work we focus on two of them: cash management in automatic teller machines (ATMs), and in the compensation of credit card transactions. In both cases a decision must be taken according to a future customers demand, which is uncertain. From historical data we can obtain a discrete probability distribution of this demand, which allows the application of stochastic programming techniques. We present stochastic programming models for each problem. Two short-term and one mid-term models are presented for ATMs. The short-term model with fixed costs results in an integer problem which is solved by a fast (i.e. linear running time) algorithm. The short-term model with fixed and staircase costs is solved through its MILP equivalent deterministic formulation. The mid-term model with fixed and staircase costs gives rise to a multistage stochastic problem, which is also solved by its MILP deterministic equivalent. The model for compensation of credit card transactions results in a closed form solution. The optimal solutions of those models are the best decisions to be taken by the bank, and provide the basis for a decision

support system.

Referència: Alabi, A. and Castro, J. Dantzig-Wolfe and block coordinate-descent decomposition in large-scale integrated refinery-planning. *Computers and Operations Research*, **36** (2009), pp. 2472–2483.

Abstract: The integrated refinery-planning (IRP), an instrumental problem in the petroleum industry, is made of several subsystems, each of them involving a large number of decisions. Despite the complexity of the overall planning problem, this work presents a mathematical model of the refinery operations characterized by complete horizontal integration of subsystems from crude oil purchase through to product distribution. This is the main contribution from a modelling point of view. The IRP, with a planning horizon ranging from 2 to 300 days, results in a large-scale linear programming (LP) problem of up to one million constraints, 2.5 million variables and 59 millions of nonzeroes in the constraint matrix. Large instances become computationally challenging for generic state-of-the-art LP solvers, such as CPLEX. To avoid this drawback, after the identification of the nonzero structure of the constraints matrix, structure-exploiting techniques such as Dantzig-Wolfe and block coordinate-descent decomposition were applied to IRP. It was also observed that interior-point methods are far more efficient than simplex ones in large IRP instances. These were the main contributions from the optimization viewpoint. A set of realistic instances were dealt with generic algorithms and these two decomposition methods. In particular the block coordinate-descent heuristic, with a reverse order of the subsystems, appeared as a promising approach for very large integrated refinery problems, obtaining either the optimal or an approximate feasible solution in all the instances tested