On a class of large-scale problems in mathematical programming: Optimization under uncertainty

A. Alonso-Ayuso[1], L.F. Escudero[2], A. Garín[3], M. Merino[4],

J.F. Monge[5] M.T. Ortuño[6], G. Perez[7] and C. Pizarro[8]

[1] *Dpto. de Estadística e Investigación Operativa*
Universidad Rey Juan Carlos, Móstoles (Madrid).
e-mail: antonio.alonso@urjc.es

[2] *Centro de Investigación Operativa*
Universidad Miguel Hernández, Elche (Alicante).
e-mail: escudero@umh.es

[3] *Dpto. de Economía Aplicada III*
Universidad del País Vasco, Bilbao (Vizcaya).
e-mail: mariaaraceli.garin@ehu.es

[4] *Dpto. de Matemática Aplicada, Estadística e I.O.*
Universidad del País Vasco, Leioa (Vizcaya).
e-mail: maria.merino@ehu.es

[5] *Centro de Investigación Operativa*
Universidad Miguel Hernández, Elche (Alicante).
e-mail: monge@umh.es

[6] *Dpto. de Estadística e Investigación Operativa*
Universidad Complutense de Madrid, Madrid.
e-mail: mteresa@mat.ucm.es

[7] *Dpto. de Matemática Aplicada, Estadística e I.O.*
Universidad del País Vasco, Leioa (Vizcaya).
e-mail: gloria.perez@ehu.es

[8] *Dpto. de Estadística e Investigación Operativa*
Universidad Rey Juan Carlos, Móstoles (Madrid).
e-mail: celeste.pizarro@urjc.es

Abstract

We present the main ideas for solving multistage mixed 0-1 problems under uncertainty in the objective function coefficients, the right-hand-side vector and the constraint matrix. A scenario analysis scheme is used. The problem is modelled by a splitting variable representation of the mixed 0-1 Deterministic Equivalent Model, jointly with a compact representation for the scenario-cluster models in the problem. So, a mixed 0-1 model for each scenario cluster is considered plus the non-anticipativity constraints that equate the 0-1 and continuous variables from the same group of scenarios in each stage. The non-anticipativity constraints for the 0-1 variables are satisfied by using a Twin Node Family scheme. Benders Decomposition, Lagrangian Decomposition, Disjunctive Decomposition, Branch-and-Cut, Branch-and-Fix Coordination and stochastic dynamic programming approaches can be used. In these approaches the original problem is decomposed in clusters and scenario groups at each iteration of the algorithm, such that they can be solved in parallel. So, parallel optimization is a crucial discipline for solving this type of large-scale problems. The application field primarily lies in the finance, energy generation, telecommunication networks, production planning, vehicle routing, supply chain, water resources usage sectors, etc.