JP Journal of Applied Mathematics
Volume 7, Issues 1 & 2, 2013, Pages 13-26

ALIENOR METHOD FOR SOLVING THE 0-1 QUADRATIC KNAPSACK PROBLEM

Dalomi Bahan and Blaise Somé

Abstract

The quadratic knapsack problem (QKP) is the problem of maximizing a quadratic objective function subject to a single knapsack constraint. It is a well-known NP-hard combinatorial problem. In this paper, we examine the use of Alienor method for solving QKP. Alienor method is a new global optimization algorithm based on a simple idea consisting in approximating an n variables function by a single variable function by using α- dense curves. These curves have the property to "fill the space". The results show that the performance of the Alienor method is confirmed for problems with fewer than 80 variables.

Keywords and phrases: global optimisation, Alienor method, O.P.O.*, linearization technique.

Received March 29, 2013

References

[1] K. Somé, B. Somé and B. Ulungu, A theoretical foundation meta-heuristic method to solve some multiobject if optimization problems, Pioneer J. Adv. Appl. Math. (2012) (accepted).

[2] K. Somé, B. Ulungu, I. H. Mohamed and B. Somé, A new method for solving nonlinear multiobjective optimization problems, JP J. Math. Sci. 2(1&2) (2011), 1-18.

[3] Lucas Létocart, Anass Nagih and Gérard Plateau, Reoptimization in Lagrangian Methods for the 0-1 Quadratic Knapsack Problem, 2010.

[4] Nergiz Kasimbeyli, Tugba Saraç and Refail Kasimbeyli, Solving the Quadratic Knapsack Problem using the Linearized Version of the msg Algorithm, 2010.

[5] Mahamat Maimos, Balira O. Konfe, Souleymane Koussoube and Blaise Somé, Alienor Method for Nonlinear Multi-objective Optimization, 2010.

[6] Carlos-Diego Rodrigues, Dominique Quadri, Philippe Michelon and Serigne Gueye, A *t*-linearization to Exactly Solve 0-1 Quadratic Knapsack Problems, 2009.

[7] D. Pisinger, A. B. Rasmussen and R. Sandvik, Solution of large-sized quadratic knapsack problems through aggressive reduction, INFORMS J. Comput. 19(2) (2007), 280-290.

[8] H. Kellerer, U. Pferschy and D. Pisinger, Knapsack Problems, Springer-Verlag, 2005.

[9] T. Benneouala and Y. Cherruault, Alienor Method for Global Optimization with a Large Number of Variables, Kybernetes 34(7/8) (2005), 1104-1111.

[10] Y. Cherruault and G. Mora, Optimisation Globale, Théorie des Courbes des Courbes-denses Economica, Kybernetes, 2005.

[11] B. O. Konfé, Y. Cherruault, B. Somé and T. Benneouala, A new "optimization-preserving-operator" applied to global optimization, Kybernetes 34(7/8) (2005), 1112-1124.

[12] B. O. Konfé, T. Benneouala, Y. Cherruault and B. Somé, Alienor method applied to operational reseach, Kybernetes 34(7/8) (2005), 1211-1222.

[13] B. A. Julstrom, Greedy, genetic, and greedy genetic algorithms for the quadratic knapsack problem, Proceedings of the Genetic and Evolutionary Comput. Confer. 1 (2005), 607-614.

[14] A. Billionnet and E. Soutif, An exact method based on Lagrangean decomposition for the 0-1 quadratic knapsack problem, Euro. J. Oper. Res. 157(3) (2003), 565-575.

[15] G. Mora, Y. Cherruault and A. Benabidallah, Global-optimization-preserving-operators, Kybernetes 32(9/10) (2003), 1473-1480.

[16] C. Helmberg, F. Rendl and R. Weismantel, A semidefinite programming approach to the quadratic knapsack problem, J. Combin. Optim. 4 (2000), 197-215.

[17] A. Ziadi, Y. Cherruault and G. Mora, The Existence of α- desnse Curves with Minimal Length in a Metric Space, Kybernetes, 2000.

[18] A. Billionnet, A. Faye and E. Soutif, A new upper bound for the 0-1 quadratic knapsack problem, Euro. J. Oper. Res. 112 (1999), 664-672.

[19] Y. Cherruault, Optimisation: Méthodes Locales et Globales, P.U.F., 1999.

[20] A. Caprara, D. Pisinger and P. Toth, Exact solution of the quadratic knapsack problem, INFORMS J. Comput. 11 (1999), 125-137.

[21] Y. Cherruault, Modèles et Méthodes Mathématiques Pour les Sciences du Vivant, P.U.F., 1998.

[22] A. Billionnet and F. Calmels, Linear programming for the 0-1 quadratic knapsack problem, Euro. J. Oper. Res. 92 (1996), 310-325.

[23] P. Michelon and L. Veuilleux, Lagrangean methods for the 0-1 quadratic knapsack problem, Euro. J. Oper. Res. 92 (1996), 326-341.

[24] S. Martello and P. Toth., Knapsack Problems: Algorithms and Computer Implementations, John Wiley & Sons, Inc., 1990.

[25] P. Chaillou, P. Hansen and Y. Mahieu, Best network ow bound for the quadratic knapsack problem, Combi. Optim. Lect. Notes Math. 1403 (1986), 225-235.

[26] G. Gallo, P. L. Hammer and B. Simeone, Quadratic knapsack problems, Math. Program. Study 12 (1980), 132-149.

[27] M. R. Garey and D. S. Johnson, Computers and Intractability. A Guide to the Theory of NP-completeness, San Francisco, 1979.

[28] R. Fortet, Applications de l'algèbre de Boole en recherche opérationnelle, Revue Française d'Automatique, d'Informatique et de Recherche Opérationnelle 4 (1959), 5-36.