On Solving Nonsmooth multi-Objective Environmental and Economic Dispatch Problem.

Mohamed Tifroute[1], Anouar Lahmdani[2], Hassane Bouzahir[3]

[1] Higher School of Technology - Guelmim - Morocco
mohamed.tifroute@gmail.com
[2] FSA-Ait Melloul, UIZ, Morocco.
a.lahmdani@uiz.ac.ma
[3] ENSA-UIZ, LISTI, 80000 Agadir, Morocco
hbouzahir@yahoo.fr

Mots-clés : *Multi-objective Nonsmooth optimization, Locally lipschitz function, Smoothing functions.*

1 Introduction

The Environmental and Economic Dispatch problem (EEDP)[9, 6] is a nonlinear Multi-objective Optimization Problem (MOP) which simultaneously satisfies multiple contradictory criteria, and it's a nonsmooth problem when valvepoint effects, multi-fuel effects and prohibited operating zones have been considered. It is an important optimization task in fossil fuel fired power plant operation for allocating generation among the committed units such that fuel cost and pollution (emission level) are optimized simultaneously while satisfying all operational constraints. The purpose of this paper is to use smoothing functions with the gradient consistency property [2] to approximate the nonsmooth EEDP. Our approach based on the smoothing functions, where a sequence of smooth multiobjective subproblems that progressively approximate the nonsmooth multiobjective problem is presented. We show that any accumulation point of a selected subsequence of the iteration sequence generated by the smoothing MOP algorithm is a Clarke stationary point. So the Pareto optimal solutions (stationary points) of the approximate problems converge to a Pareto optimal solution (stationary point) of the original multiobjective programming problem. In this paper, The formulation of EEDP include absolute value function. The constrained nonsmooth multiobjective problem is transformed into a set of single-objective subproblems using the ϵ-constraint method [1], for both methods, the objective function of the subproblems are smoothed by the smoothing method and the subproblems are solved by the Interior point barrier method [4].

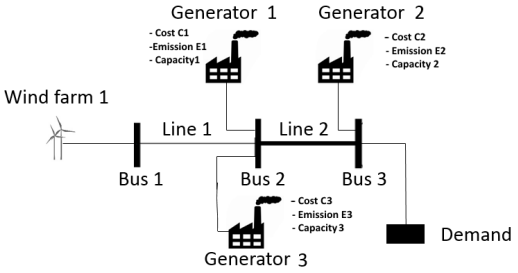

FIG. 1 – Bi-objective Non-smooth Environmental and Economic Dispatch Problem.

2 Conclusion

In this paper, a class of nonsmooth multi-objective optimization problems that include min, max, absolute value functions or composition of the plus function $(t)^+$ with smooth functions is introduced, and a smoothing method is presented. Numerical results show that the smoothing MOP is promising for the nonsmooth problem.

Références

[1] Miettinen K. Nonlinear multiobjective optimization. Boston : Kluwer ; 1999.

[2] X. Chen, Smoothing methods for nonsmooth, nonconvex minimization. Math Program 2012 ;134(1) :71 -99.

[3] C. Chen and O. L. Mangasarian, A class of smoothing functions for nonlinear and mixed complementarity problems, Math. Programming, 71 (1995), pp. 51-70.

[4] M. Schmidt, An Interior-Point Method for Nonlinear Optimization Problems with Locatable and Separable Nonsmoothness. EURO J. Comput. Optim. 3 (2015), 309-348.

[5] Zhan J, Wu QH, Guo C, Zhou X. Economic dispatch with non-smooth objectives- part ii : dimensional steepest decline method. IEEE Trans Power Syst 2015 ;30(2) :722-33.

[6] A. Farag, S. Al-Baiyat, T.C. Cheng, "Economic load dispatch multiobjective optimization procedures using linear programming techniques", IEEE Transactions on Power Systems, vol. 10, no.2, pp : 731-738, 1995.

[7] J. Nocedal, A. Wächter and R. A. Waltz, Adaptive Barrier Update Strategies for Nonlinear Interior Methods. SIAM J. Optim. 19 (2008), 1674-1693.

[8] J. Borwein and A. Lewis, Convex Analysis and Nonlinear Optimization : Theory and Examples. Canadian Mathematical Society, 2000.

[9] Zhan J, Wu QH, Guo C, Zhou X. Economic dispatch with non-smooth objectives- part ii : dimensional steepest decline method. IEEE Trans Power Syst 2015 ;30(2) :722-33.