Discrete Global Descent Method for Discrete Global Optimization and Nonlinear Integer Programming*

Chi-Kong Ng[1] Duan Li[2] Lian-Sheng Zhang[3]

[1] Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong S.A.R., P.R.China. E-Mail: ckng@se.cuhk.edu.hk

[2] Corresponding author. Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong S.A.R., P.R.China. E-Mail: dli@se.cuhk.edu.hk

[3] Department of Mathematics, Shanghai University, Baoshan, Shanghai 200436, P.R.China

Abstract

Optimization of a general cost function f over discrete variables arises frequently in various applications such as combinatorics, scheduling, design and operations problems. Various deterministic solution methods have been proposed during the last two decades, however, these methods can only tackle relative small scale integer optimization problems.

A novel method, entitled the discrete global descent method, is developed in this paper to solve discrete global optimization problems and nonlinear integer programming problems. This method moves from one discrete minimizer of the cost function to another better one at each iteration with the help of an auxiliary function, entitled the discrete global descent function. The discrete global descent function guarantees that its discrete minimizers coincide with the better discrete minimizers of f under some standard assumptions. This property ensures that a better discrete minimizer of f can be found by some classical local search methods. Numerical experiments on several test problems with up to 100 integer variables and up to 1.38×10^{104} feasible points have demonstrated the applicability and efficiency of the proposed method.

Keywords: Discrete global descent method, discrete global optimization, nonlinear integer programming, integer programming

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