Strictly increasing positively homogeneous functions with applications to exact penalization

Rafail N. GASIMOV

Osmangazi University, Department of Industrial Engineering, Bademlik 26030, Eskişehir, TURKEY.
e-mail:gasimovr@ogu.edu.tr

Alex M. RUBINOV

SITMS, University of Ballarat Victoria 3353, AUSTRALIA
e-mail:a.rubinov@ballarat edu.au

Abstract We study a nonlinear exact penalization for optimization problems with a single constraint. The penalty function is constructed as a convolution of the objective function and the constraint by means of IPH (increasing positively homogeneous) functions. The main results are obtained for penalization by strictly IPH functions. We show that some restrictive assumptions which have been made in earlier researches on this topic, can be removed. We also compare the least exact penalty parameters for penalization via different convolution functions. The significance of this question is the following: we can use different convolution functions for penalization of the initial constrained problem; which of them is better in the sense that which of them allows us to obtain an optimal solution for a smaller penalty parameter? We introduce the notion of equivalence of convolution functions and show that many strictly increasing sublinear functions are equivalent via penalization. These results are based on some properties of strictly IPH functions, which are established in the paper.

Key words Nonlinear penalization, Exact penalty parameter, IPH functions, Strictly IPH functions, Associated functions, Equivalence.