



A REDUCTION TYPE METHOD FOR NONLINEAR SEMI-INFINITE PROGRAMMING BASED ON AN EXACT PENALTY TECHNIQUE

Alzira M. Teixeira da Mota and A. Ismael F. Vaz
Department of Production and Systems
E-mail: atm@isep.ipp.pt

KEYWORDS

Semi-infinite programming, reduction type methods, multi-local optimization, penalty function.

ABSTRACT

Semi-infinite programming (SIP) problems arise in several engineering areas such as, for example, robotic trajectory planning, production planning, digital filter design and air pollution control.

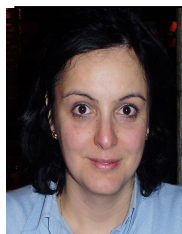
This thesis is devoted to SIP problems in the most general form. These problems are characterized to have a finite number of variables and an infinite set of constraints. The existing numerical methods for solving SIP problems can be divided into three major classes: discretization, exchange and reduction type methods. The reduction type methods are the ones with better theoretical properties, but they are also the most demanding in computation terms, since they require to solve sub-problems to the local and global optimality (multi-local optimization).

In last decades several algorithms were proposed for SIP, but there are not many publicly available software and none provides an implementation of a method belonging to the reduction type class.

In this work we propose a reduction type algorithm based on a penalty technique. The penalty function used is an extension of a penalty function of ∞ -norm, allowing the inclusion of finite constraints. In order to define the best penalty function, a numerical study of penalty functions based on the standard 1, 2 and ∞ norms are performed, considering test problems

without finite constraints. A theoretical study of the extended penalty function is also performed.

The proposed reduction algorithm is implemented in a solver coined as SIREdAl (Semi-Infinite Reduction Algorithm). The solver has been implemented in MATLAB and is capable of solving SIP problems in the most general form with a maximum of two infinite variables. The solver code uses two different algorithms in the minimization of the penalty function and also two different algorithms for solving the multi-local problems. The solver has been tested with 117 test problems from the database SIPAMPL and numerical results confirmed the algorithm potential.



ALZIRA M. TEIXEIRA DA MOTA was born in V. N. de Gaia, Portugal. She is graduated from the Science Faculty at the Porto University, in Applied Mathematics and Computer Science, in 1995. Her master degree was obtained from Economy Faculty at the Porto University in Artificial Intelligence and Computation, in 2000. She teaches in the Mathematics Department of the Engineering Institute of Porto since 1997. Her e-mail address is : atm@isep.ipp.pt