

AN APPLICATION OF BILEVEL PROGRAMMING IN INVERSE OPTIMAL VALUE PROBLEM

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Abstract. In this paper, we transform the inverse optimal value problem into a corresponding nonlinear bilevel programming problem equivalently. For the nonlinear bilevel programming problem, the duality gap of the lower level problem is appended to the upper level objective with a penalty, then a corresponding penalized problem is obtained. We give via an exact penalty method an existence theorem of solutions and analyze the optimality condition of the penalized problem. Then, an algorithm is proposed for the inverse optimal value problem and an example is given to illustrate the algorithm.

Keywords. Inverse optimal value problem; Inverse optimal problem; Bilevel programming; Duality; Penalty method

1 Introduction

An inverse optimization problem consists of inferring the value of the model parameters, such as objective function and constraint coefficient. A standard inverse optimization problem is as follows: given an optimization problem with a linear objective $P : \min\{c^T x : x \in X\}$ and a desired optimal solution $x^* \in X$, find a cost vector c^* such that $x^* \in X$ is an optimal solution of P , and at the same time c^* is required to satisfy some additional conditions, such as the deviation $\|c^* - c'\|_p$ is to be minimum under some ℓ_p norm for a given preferred cost c' .

Geophysical scientists were the first ones to study inverse problems. The book by Tarantolac[11] gives a comprehensive discussion of the theory of inverse problems in the geophysical sciences. From then on, this challenge topic has attracted more and more attention, which leads to a rapid development in theories, algorithms and applications. For detailed expositions, the reader is referred to [1,3,4,11,14].

Different from the ordinary inverse optimization problem[14], recently Ahmed and Guan[2] put forward inverse optimal value problem, which is