Book reviews

Kybernetika, Vol. 28 (1992), No. 2, 167

Persistent URL: http://dml.cz/dmlcz/125775

FLOYD J. GOULD, JON W. TOLLE

Complementary Pivoting on a Pseudomanifold Structure with Applications in the Decision Sciences

Sigma Series in Applied Mathematics 2.
Heldermann Verlag, Berlin 1983.
iv + 204 pages; numerous figures; DM 58,00.

The topics of monograph under review concerns a wide-spread method for solving a number of problems arising in the decision sciences – a complementary pivoting technique. It should be stated in advance that the author succeeded in presenting a unifying framework in which most of commonly used algorithms fit and presentation of common substantial features of these algorithms shed a new light on their combinatorial structure. The approach is based on combinatorial methods and refuses the central idea of standard analytical algorithms – the idea of gradual improving at each step of solution (simplex algorithm for solving the linear programming problem). The proposed algorithms seem in general to be less dependent on the analytical properties which the problem may possess. These algorithms do not proceed by generating a monotone sequence of approximate solutions.

Let us briefly survey the contents of the reviewed book, using the characteristics given by authors themselves. The text is divided into 8 chapters. In the first chapter a few relevant definitions and properties of basic objects of finite-dimensional linear algebra are given. The chapter 2 provides a further theoretical background. In the third chapter several examples of pseudomanifolds are presented by means of constructing new manifolds from given ones. The construction shown here are frequently used in the following exposition. In a standard way the notions concerning the linear programming problem are introduced. Going through this chapter enables the beginner to understand fully both the combinatorial and algebraic means generally used in the convex programming theory.

The focus of exposition is concentrated in the chapter 4, where the algorithms which are central to the theory of complementary pivoting and its applications are derived. One of basic underlying structure which derives the algorithms is that of pseudomanifold. In the fifth chapter the complementary pivot algorithm is applied to the linear complementarity problem (LCP), which in general plays a central role in game theory, engineering, optimization theory and economic equilibria, and which solution is difficult to find. In the chapter 6 the problem of locating fixed points of mappings via complementary pivot algorithm is investigated. Two types of fixed points are considered: the fixed point of a continuous mapping of a set in R^n onto itself and the fixed point of a upper semicontinuous point-to-set mapping in R^n. Typically, each application of fixed point theory gives rise to a different set of restrictions on the mapping and its domain. The proofs of the classical fixed point theorems were, except in the simples case, nonconstructive. The fact that the complementary pivot algorithm could be used both to prove the existence of and also to approximate the fixed points of certain mappings has led to significant advances in the subject. The chapter 7 is devoted to the solution of the unconstrained problem of finding a minimum value of finite convex function by means of complementary pivoting methods. The similar problem is treated in the concluding chapter. The monograph is supplied by a voluminous list of references.

The authors succeeded in balancing theory and practicality and thus the book can be recommended to wide distribution in the research environment. The monograph proves high qualities in the way of explanation which is lucid and easy to understand even for a beginner. The study of this text does not require any preliminary special knowledge and everybody interested in the topics of mathematical programming theory will take a profit from its study. From a formal point of view the volume keeps the graphic standard of titles from Heldermann Verlag publishing house.

Pavel Trska