The interactive decomposition method for multiobjective linear programming and its applications

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In this paper, an interactive step trade-off decomposition method (simply, ISTDM) for solving large scale multiobjective linear programming with the coupled block-diagonal structure (simply, DMOLP) and its applications are proposed. In our proposed method, the efficient solutions of DMOLP are generated step by step through an auxiliary problem, and the preferred solution is found in an interactive procedure. As a result of the decomposition of the decision space and the objective space of DMOLP at the same time, the required computer memory is greatly reduced and the procedure for decision analysis is simplified. The application of the ISTDM to the production planning of an oil refinery is illustrated in the last two sections.

1. Introduction

Multiobjective optimization problems frequently exist in large scale social, economic and industrial systems. Recently, more attention has been paid to the solution of these problems. Tarvainen and Haimes, for instance, explored the coordination theory and methodology of hierarchical multiobjective systems [1]. Masatoshi Sakawa and Fumi Seo have proposed an interactive decision method for solving multiobjective nonlinear programming with the coupled block-diagonal structure, which was used to solve the multiobjective decision problems in environmental systems [2]. Those papers, however, which deal with large scale multiobjective linear programming, are rather seldom. In this paper, a new interactive step trade-off decomposition method for solving DMOLP is proposed. In contrast with other interactive methods, our method possesses some important advantages. All efficient solutions of the DMOLP can be found by using this method and the final preferred solution is also an efficient one. In addition, the interactive procedure proposed here is also practical, clear and easy to understand

Multiobjective decision making methods have already been applied to environmental systems [2], energy systems [3], and other social and economic systems. For large scale industrial systems, however, papers dealing with the applications of multiobjective decision methods are very seldom seen in I published periodicals. One reason is that the production procedures of large scale industrial enterprises are very complicated, which causes the dimension of the optimization models to be rather high and hence makes it not easy to carry out optimization computation on microcomputers required in multiobjective decision analysis. Another reason is that the existing methods do not meet the requirements for large scale multiobjective decision analysis. The ISTDM proposed here suggests one method for making decision analysis on microcomputers. With the improvement of the computational efficiency of the decomposition algorithm [4, 5] and the utilization of the ISTDM, the authors have

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successfully made multiobjective decision analysis of the multiobjective production planning for a large scale oil refinery on microcomputers. In this paper the general principles, the methodology, and the conditions for the applications of the ISTDM are propounded.

2. Multiobjective decomposition models

2.1. Multiobjective decomposition models