

Chi-Bin Cheng
Department of Information Management
Tamkang University
New Taipei City, Taiwan

Hsu-Shih Shih
Department of Management Sciences
Tamkang University
New Taipei City, Taiwan

E. Stanley Lee
Department of Industrial
and Manufacturing Systems
Engineering
Kansas State University
Manhattan, KS, USA

Preface

Decision making under a hierarchical structure is commonly found in the real world, yet the optimization of such decisions is typically difficult due to the highly inter-dependent nature among the decisions by the decision-makers at different levels of the hierarchical organization. Problems in such a domain are referred to as multi-level decision making. The basic concept of multi-level decision making is that an upper-level decision-maker sets his or her goal and/or decision and then asks each subordinate level of the organization for their decisions. The decisions of the lower levels are then submitted and modified by the upper level with consideration of the overall benefits of the organization. This mutually interactive process is continued until reaching a solution, which is satisfactory to all the decision-makers. Apparently, the degree of interaction and the degree of satisfaction depend on the management style of the upper level. This decision-making process is extremely useful to the hierarchy decentralized organizations that are pervasive in various industries.

To solve the multi-level decision making, the problems are typically modeled by multi-level programming, which contains a set of nested optimization problems over a single feasible region and the control of the decision variables is partitioned among the levels where one decision variable may impact the objective of several levels. There have been many traditional approaches proposed for solving the multi-level programming problems, such as the decomposition principle, goal programming, multi-objective programming, and game theory. However, almost all of these traditional approaches cannot meet the common features, the interactive nature in particular, of the decision process of a multi-level decentralized organization. By contrast, soft computing approaches use a collection of algorithms to find inexact solutions to computationally difficult tasks for which conventional methods do not yet provide low cost and time-feasible solutions. Approaches in this category such as fuzzy logic can facilitate the implementation of interactive decision making among levels.

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