Abstract

In most of the real-life decision-making problems, the decision-maker needs to take decisions under some uncertain environment. These uncertainties are addressed by using probability distribution or fuzzy numbers or intervals. Stochastic programming (SP) is concerned with the decision-making problems in which some or all parameters are treated as random variables. The main idea of the present work is to establish the solution procedures for some Mathematical Programming (MP) problems involving random variables or uncertain parameters. Chance-constrained programming (CCP) and Two-Stage Stochastic programming (TSSP) are two popular approaches used for solving SP problems. We consider some CCP problems and TSSP problems where right-hand side parameters of the constraints are random variables following some continuous distributions. Using appropriate techniques, we transform the problems to their corresponding deterministic models, and then standard mathematical programming techniques are applied to solve these deterministic models.

In some mathematical programming problems, the decision-maker has to set a multiple numbers of values for a parameter. One suitable value to be chosen from these multiple values in order to optimize the problem. This technique is called Multi-Choice Programming (MCP) problem. If some parameters present in the MCP problem follow some probabilistic distributions, then it is known as Multi-Choice Stochastic Programming (MCSP) problem. To solve MCSP problem, first CCP technique or TSSP technique is used to transform the problem to a MCP problem, then interpolating polynomial approach is used to tackle multi-choice parameters.

To solve MCP problem, generally, some transformation techniques are used to tackle the presence of multi-choice parameters in the problem. These transformation techniques create extra variables and additional constraints during the solution procedure, which makes the process more computational expensive. To avoid this problem, we have proposed Genetic algorithms (GAs) for MCP problem which can solve MCP problem directly, and without involving extra variables or additional constraints unlike other approaches.

In certain mathematical programming problems, the parameters are uncertain with the data varying in the uncertainty set. These types of problems can be solved by Robust optimization (RO) techniques. We have a considered problem where some parameters are multi-choice types and some parameters are uncertain with the data varying in the uncertainty set. To solve this problem, First we find the transformed model for robust counterpart of uncertain multi-choice programming problem, then interpolating polynomial is used to handle multi-choice parameters of the problem. Finally, suitable numerical examples are presented to illustrate the solution procedures and methodologies.

Keywords: Stochastic Programming, Chance-constrained Programming, Two-stage stochastic Programming, Fuzzy Programming, Multi-objective Programming, Multi-choice Programming, Genetic Algorithm, Robust Optimization