ABSTRACT

In linear fractional programming a ratio of two functions is to be maximized or minimized. In other applications the objective involves more than one such ratio. Ratio optimization is commonly called fractional programming.

Multi Objective optimization methods are of great importance in practice, particularly in engineering design, scientific experiments and business decision making. A solution that is extreme with respect to one objective requires a compromise in other objectives.

In this research work, new computer oriented methods have been proposed to solve sum of ratios linear fractional programming problems and multi objective linear programming problems. A new method is developed to solve sum of ratios linear fractional programming problems containing arbitrary number of ratios in its objective function. A new method is developed to solve multi objective linear programming problem with arbitrary number of objectives. A genetic algorithm based method is developed to solve multiobjective linear programming problem with arbitrary number of objectives.

Sum of ratios linear fractional programming algorithm solves problems with sum of any number of ratios. Promising variables are identified and ordered using $\theta$ matrix and their contribution to sum of ratios in the given problem. The promising variables are allowed to enter into basis only if they improve the ratio value obtained in the previous iteration. In this way, unnecessary popping in and out of variables to and from the basis are avoided. The iterations are also reduced.

The Multi Objective Linear Fractional Programming Algorithm approaches the multi objective linear programming problems in a new pattern. A new type of
transformation is performed on objective functions. Multi objective linear programming problem is transformed to sum of ratios linear fractional programming problem. The sum of ratios of given objective functions determines the selection of promising variables. Different orderings (permutations) of given objective functions are enumerated and the problem is solved for each ordering. Optimal solution is the one that produces the best value for the ratio formed with the objective functions.

Proposed new genetic algorithm solves multi objective linear programming problems. Different orderings (permutations) of given objective functions are enumerated and the problem is solved for each ordering. Decision variables are selected from theta matrix based on their maximum contribution to the sum of ratios of objective function. Lower and upper bounds of decision variables are fixed using theta matrix. Random numbers (chromosomes) are generated within the bounds of each decision variable selected from theta matrix. Fixed number of parents containing chromosomes are generated. Sum of ratios of objective fractions is used as fitness function to select parents. Linear cross over operator is applied between parents to produce off springs. The process is repeated for chosen number of generations. The problem is solved for each ordering of objective fraction. The values of decision variables that produces the best ratio value is reported as the optimal solution for the given problem.

Computer coding is written in C language and Visual C++ to implement the proposed algorithms. Large Scale problems with sum of ratios of linear fractional functions are solved using the Sum of Ratios Linear Fractional Programming algorithm. Large scale multi objective linear programming problems are solved using the multi objective linear fractional programming algorithm. Large scale multi objective linear programming problems are also solved using the genetic algorithm.
The results are tabulated and plotted. The proposed algorithms are analyzed in terms of multiply / divide operations and computational efficiency is established.