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Numerical Solution of Portfolio Selecting Semi-Infinite Problem

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Abstract : SIP problems are part of non-classical optimization. There are problems in which the number of variables is finite, and the number of constraints is infinite. These are semi-infinite programming problems. Most algorithms for semi-infinite programming problems reduce the semi-infinite problem to a finite one and solve it by classical methods of linear or nonlinear programming. Typically, any of the constraints or the objective function is nonlinear, so the problem often involves nonlinear programming. An investment portfolio is a set of instruments used to reach the specific purposes of investors. The risk of the entire portfolio may be less than the risks of individual investment of portfolio. For example, we could make an investment of M euros in N shares for a specified period. Let yi> 0, the return on money invested in stock i for each dollar since the end of the period (i = 1, ..., N). The logical goal here is to determine the amount xi to be invested in stock i, i = 1, ..., N, such that we maximize the period at the end of ytx value, where x = (x1, ..., xn) and y = (y1, ..., yn). For us the optimal portfolio means the best portfolio in the ratio "risk-return" to the investor portfolio that meets your goals and risk ways. Therefore, investment goals and risk appetite are the factors that influence the choice of appropriate portfolio of assets. The investment returns are uncertain. Thus we have a semi-infinite programming problem. We solve a semi-infinite optimization problem of portfolio selection using the outer approximations methods. This approach can be considered as a developed Eaves-Zangwill method applying the multi-start technique in all of the iterations for the search of relevant constraints' parameters. The stochastic outer approximations method, successfully applied previously for robotics problems, Chebyshev approximation problems, air pollution and others, is based on the optimal criteria of quasi-optimal functions. As a result we obtain mathematical model and the optimal investment portfolio when yields are not clear from the beginning. Finally, we apply this algorithm to a specific case of a Colombian bank.

Keywords : outer approximation methods, portfolio problem, semi-infinite programming, numerial solution
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