BOOK REVIEW

OPTIMIZATION METHODS FOR A STAKEHOLDER SOCIETY

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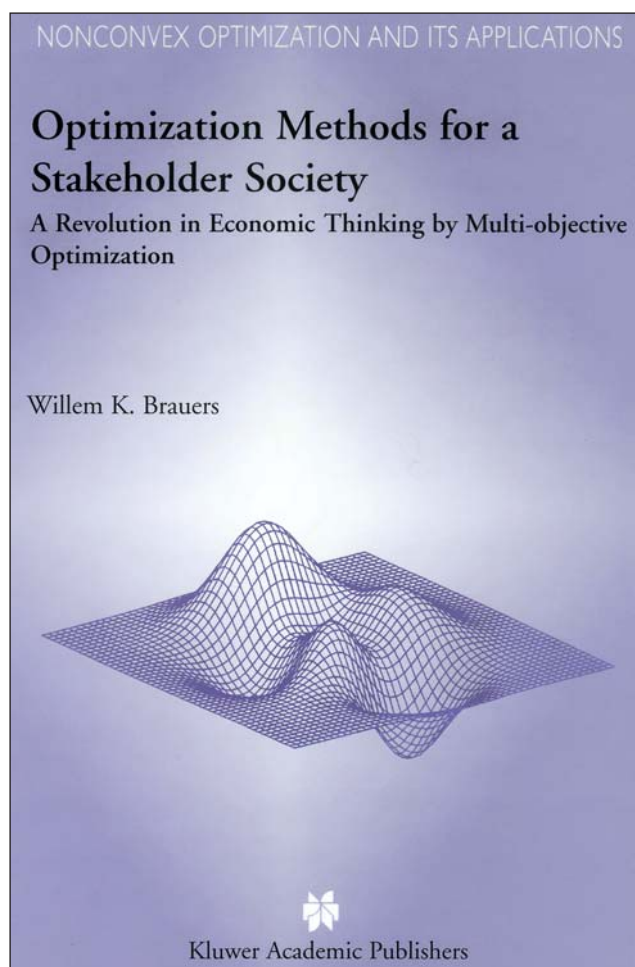|	
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NONCONVEX OPTIMIZATION AND ITS APPLICATIONS

Optimization Methods for a Stakeholder Society

A Revolution in Economic Thinking by Multi-objective Optimization

Willem K. Brauers

Kluwer Academic Publishers

1. Introduction

The purpose of this book is to optimize problems with different objectives, expressed in different units. Consequently, multi-optimization is applied in a multitude of diverse fields such as: privatization or non-privatization in the public sector, regional versus national economic policy, different locations of a seaport, different forms of arms procurement and of industrialization of a developing country, updating or replacement of old industry, pre- and post-evaluation of projects, performance management, marketing and distribution. Traditional methods such as Cost-Benefit are passed as they translate all these objectives into monetary costs, a materialistic approach. On the contrary, objectives have rather to stick to their own units. In addition, the author stands up for the use of nonlinear methods in multi-objective optimization. Therefore, several nonlinear approaches are proposed, illustrated with many applications.

Finally, the book is intended for both public and private managers and for researchers in the areas of applied mathematics, engineering, economics, operation research, decision and management sciences. It is meant for professionals as well as for practitioners in the field of multi-objective optimization.

2. The content of the book

The book is divided into six parts. In the first part the link is made with traditional economics. General economic interdependence will help to diminish the number of objectives. With the rise of mathematics in economics, the significance of econometric models is underlined not without forgetting the shortcomings such as the understatement of uncertainty and the influence of all kinds of external data.

In the second part the author sees the advent of new economics due to more creative and prospective thinking, assisted by nominal methods such as Delphi, Nominal Group Technique and Cross-Impact, paving the way for simulations and scenario writing.

The third part brings the new economics for a stakeholder society with, as much as possible, an optimization of the fulfillment of the aspirations of the individual and of all the stakeholders. Stakeholders mean everybody interested in a certain issue. However, despite statistical interdependence, hierarchy, filtering, measurement of quality, indifference and dominance, objectives could remain incomparable, forming the core of the problem to be studied. As a solution, some traditional methods are not welcome, such as cost-benefit, the weighting concept and binary comparisons.

The multiple objectives are met by different alternative solutions or projects of a discrete or a continuous origin. The discrete case faces a set of a limited number of alternatives, whereas the continuous one concerns alternatives, generated out of a set of continuous and numerous alternatives.

In order to solve all these problems, the fourth part of the book proposes Reference Point Theory. In Reference Point Theory, distances are considered to a reference point. With the Maximal Objective Reference Point the coordinates are realized in one of the candidate alternatives. The author proves that only the Min-Max Metric has sense as Reference Point method and not famous metrics such as the Rectangular Distance Metric or the Euclidean Distance Metric, certainly when consumer sovereignty has to be concerned. As TOPSIS uses the Euclidean Distance Metric, also TOPSIS is excluded.

The fifth part presents another nonlinear approach, namely Multiplicative Representation. A n-power form represents the Multiplicative Representation, whereas normalization is not necessary. Consequently, in the full-multiplicative form, an objective of the size: 10, 10^2, 10^3, 10^6, 10^9, etc. can be replaced by the unit size without changing the relationship between the utilities of the alternatives. An exponent gives importance to an objective, whereas the use of one digit in the objective is sufficient. Another possibility is to add an additive parameter to each factor. When objectives move in a different direction the objectives to be minimized are put as denominators.

The sixth part posits the question, if still another approach, namely Ratio Analysis, represents a control mechanism on the previous approaches, or can be considered as an additional nonlinear theory. In the ratio system each response of an alternative on an objective is compared to a denominator, which is representative for all alternatives concerning that objective. For this denominator the square root of the sum of squares of each alternative per objective is proposed. A mechanical method for normalization producing endogenous results is preferred. Ratio Analysis responds to this condition.

Each nonlinear theory is illustrated with many examples and applications.

3. Discussion

The reader, who is especially interested in nonlinear methods for optimization with different independent objectives, could immediately start with:

Part IV: Reference Point Theory,
Part V: Multiplicative Representation and
Part VI: Ratio Analysis for Multi-objective Utility Theory with feedback for clarification by the preceding parts.

The author is not in favour of an additive linear method with weights (geometrically, in the case of two objectives, the method represents a line, which gave the name to the method). We agree for the following reasons: 1) Weights have a double function: a function of normalization and a function of importance. It would be better if these two functions are separated. 2) Adding the weights gives the impression that one super-objective is created as the sum of the weights equals one. 3) The method advances mostly extreme solutions. 4) For consumer sovereignty it is feared that the solutions are located in a not allowed non-convex zone. Given these remarks the author prefers rather the following nonlinear methods: reference point theory, multiplicative theory and ratio analysis.

In the first part of the book the link is made with traditional economics. Uncertainty in the actual world forms a weak point to grasp at, for instance, by econometric models. Correlation and regression are too much results of the past. If they could be combined with cross-section data, which show a picture of today and with the consideration of alternative futures, they could help to decrease the number of numerous objectives for each problem. A limitation of the number of objectives per problem is welcome and consequently objectives are obtained being independent or at least quasi-independent.

The author devotes much attention to consumer sovereignty as measured by indifference curves. Considering the highest possible indifference curve given the budgetary restrictions, a reference point will tend to pull the co-ordinates of the alternatives into the non-convex zone of the indifference curve, as the corresponding distances have to be minimized. However, the Min-Max Metric will limit the damage.

In all multi-objective theories subjectivity remains a weak point. Being not the main theme of the book, subjectivity can still be present in the choice of the objectives and of the alternatives. First, dominance can lead to a non-subjective choice, either more or less disputable from above in centralization or federalism or from bottom up after the substitution principle or by confederation. However, what is meant by non-subjectivity? In physical sciences, a natural law dictates non-subjectivity without deviations. In human sciences, for instance in economics, an economic law will state the attitude of men in general but exceptionally with individual deviations. Outside these human laws unanimity or at least a certain form of convergence in opinion between all stakeholders concerned will lead to non-subjectivity. The convergence of opinions of the stakeholders has to be brought not by face-to-face methods but rather by nominal methods such as the Nominal Group Technique. On its turn, the nominal method of Delphi supports convergence of the importance of the objectives. Delphi also solves conflicts between the different stakeholders.

Alternatives can be well defined such as the European Union and the European Monetary Union. More uncertain, if alternatives concern Projects the whole theory on Project Analysis enters into the picture.

In the sixth part of the book the question is posited, if still another approach, namely Ratio Analysis, represents a control mechanism on the previous approaches, or can be considered as an additional nonlinear theory. Ratio System results in dimensionless numbers in the interval *(0; 1),* solving the problem of normalization. At the same time, in all the other methods, the danger of subjectivity in normalization exists. It is the case for methods with weights, but also for scores in a reference point method. Therefore, a mechanical method for normalization producing endogenous results is preferred. A ratio system responds to this condition. In this way a ratio system would rather become the main method with the Min-Max Metric of Reference Point Theory as a controlling method.

Importance to an objective in the Ratio System and in the Min-Max Metric is given by dividing an important objective into different sub-objectives.

For every method numerous practical examples are brought. Consequently, the book is not only valuable for experts in multiple objectives but also for all decision makers or stakeholders. The author extends the application to each possible optimization process. Costs-Benefits are contrasted to overall social needs, a welfare economy to a wellbeing economy and even to sustainable development. Therefore, the author speaks of "a revolution in economic thinking". In this way the book is recommendable to a wide audience.

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