Newsletter of the European Working Group
"Multicriteria Aid for Decisions"

Bulletin du Groupe de Travail Européen
"Aide Multicritère à la Décision"

Groupe de Travail Européen "Aide Multicritère à la Décision"
Série 3, nº10 automne 2004.

European Working Group "Multiple Criteria Decision Aiding"
Series 3, nº 10 Fall, 2004.

## Opinion Makers Section

### Multicriteria decision aid in Classification problems

**Constantin Zopounidis** and **Michael Doumpos**
*Technical University of Crete, Dept. of Production Engineering and Management, Financial Engineering Laboratory, University Campus, 73100 Chania, Greece*

#### 1. Introduction

Classification problems refer to the assignment of some alternatives into predefined classes (groups, categories). Such problems often arise in several application fields. For instance, in assessing credit card applications the loan officer must evaluate the characteristics of each applicant and decide whether an application should be accepted or rejected. Similar situations are very common in fields such as finance and economics, production management (fault diagnosis), medicine, customer satisfaction measurement, data base management and retrieval, etc.

Addressing a classification problem requires the development of a classification model that aggregates the characteristics of the alternatives to provide recommendations on the assignment of the alternatives to the predefined classes. The significance of classification problems has motivated the development of a plethora of techniques for constructing classification models. Statistical techniques have been dominating the field for many years, but during the last two decades other approaches have become popular mainly from the field of machine learning.

The contributions of MCDA are mainly focused on the study of multicriteria classification problems (MCPs). MCPs can be distinguished form traditional classification problems studied within the statistical and machine learning framework in two aspects (Zopounidis and Doumpos, 2002). The first aspect involves the nature of the characteristics describing the alternatives, which are assumed to have the form of decision criteria providing not only a description of the alternatives but also some additional preferential information. The second aspect involves the nature of the predefined classification which is defined in ordinal rather than nominal terms. Classification models developed through statistical and machine learning techniques often fail to address this issues focusing solely on the accuracy of the results obtained from the model.

The next two sections describe some important issues on the use and implementation of MCDA classification methods mainly regarding the existing criteria aggregation forms, as well as model development and evaluation issues.

#### 2. Criteria aggregation models

Within the MCDA several criteria aggregation forms have been proposed for developing decision models. These include relational forms, value functions, and rule-based models.

Relational models are based on the construction of an outranking relation that is used to compare the alternatives with some reference profiles characterizing each class. The reference profiles are either typical examples (alternatives) of each class or examples that define the upper/lower bounds of the classes. Some typical examples of this approach include methods such as ELECTRE TRI (Roy and Bouyssou, 1993), PROAFTN (Belacel, 2000), PAIRCLAS (Doumpos and Zopounidis, 2004), and PROMETHEE TRI (Figueira et al., 2004). The main advantage of this approach is that it enables the decision maker (DM) to take into account the non-compensatory character of the decision process and to identify alternatives with special characteristics through the incorporation of the incomparability relation in the analysis. On other hand, the construction of the outranking relation requires the specification of a considerable amount of information which is not always easy to obtain.

Value functions have also been quite popular as a criteria aggregation model in classification problems. This approach provides a straightforward methodology to perform the classification of the alternatives. Each alternative is evaluated according to the constructed value function and its global evaluation is compared to some value cut-off points in order to perform the assignment to one of the predefined classes. Due to their simplicity linear or additive value functions are usually considered (Jacquet-Lagrèze, 1995; Zopounidis and Doumpos, 1999, 2000). These provide a simple evaluation mechanism which is generally easy to understand and implement. However, there has been criticism on the assumptions underlying the use of such simple models and their ability to capture the interactions between the criteria.

Rule-based models provide a completely different point of view compared to the previous two approaches. Rule-based models are function-free and they are usually expressed in symbolic forms, such as "if … then …"

decision rules. Recently, in this framework a complete and well-axiomatized methodology has been proposed for constructing decision rule preference models from decision examples, based on the rough sets theory (Greco et al., 1999, 2001). Each "if … then …" decision rule is composed from a condition part specifying a partial profile on a subset of criteria to which an alternative is compared using the dominance relation, and a decision part suggesting an assignment of the alternative to "at least" or "at most" a given class. The main advantage of rule-based models involves their natural and easy interpretation. On the other hand, however, such models do not provide some form of performance index that will enable the DM to assess the relative performance of the alternatives. Such information is often needed as a complement to the classification of the alternatives for further decision support.

Obviously, there are different available specifications for the general form of a multicriteria classification model and there are also several variations of the general schemes described above. Each approach has advantages and disadvantages, but it would be impossible to provide a clear recommendation for the most appropriate form. This depends solely on the requirements of each decision situation and the nature of the classification problem that is considered.

## 3. Model development and validation

The development and evaluation of a model is a crucial point in addressing a classification problem. Model development involves the specification of the parameters of the model, whereas model evaluation refers to the analysis of the characteristics of the final model regarding its interpretability and performance.

Within the traditional MCDA paradigm it is assumed that the model is developed through the co-operation between the decision analyst and the DM. In this case the DM specifies all the preferential information that is required to structure and implement the model. For problems of limited size (small number of alternatives and criteria) as well as in problems of non-repetitive character this could be a feasible process. However, in many cases, implementing such an approach is cumbersome with regard to the cognitive effort required by the DM and the time required to elicit preferential information.

Preference disaggregation techniques (Jacquet-Lagrèze and Siskos, 2001) have been successfully applied to address these issues in classification problems. Within this context the DM is asked to provide some representative decision examples (reference alternatives). These examples involve alternatives that are evaluated by the DM and are classified into the predefined classes. Thus, each example and its classification provide a representation of the DM's judgment policy and preferential system. Given that a sufficient number of examples is available, it is possible to perform a disaggregation analysis in order to identify the parameters of the model, such that the model's results is as consistent as possible with the DM's classification of the reference alternatives.

In adopting this kind of approach there are two issues that should be carefully considered. The first involves the measures used to assess the consistency of the model's results, whereas the second involves the way that the disaggergation is implemented to optimize consistency.

The consistency measure that is most widely used in this optimization process involves the classification error rate representing the proportion of the reference alternatives for which there is a disagreement between the model's outputs and the DM's classification. A number of alternative measures have also been proposed (e.g., the receiver operating characteristic curve). Actually this is an active research topic in the classification research (Schiavo and Hand, 2000).

Given a selected consistency measure, mathematical programming techniques (linear and non-linear) have become popular over the past few years as an efficient approach to model development. These involve the solution of appropriate optimization problems to identify the optimal parameters of the models that maximize the selected consistency measure. Several linear and non-linear programming formulations have been proposed within this context to develop MCDA classification models that are expressed in relational or functional form (Dias et al., 2002, Mousseau and Slowinski, 1998, Zopounidis and Doumpos, 1999, 2000). Rule induction algorithms have also been proposed for rule-based models (Greco et al., 1999, 2001).

Of course, it should be emphasized that the definition and optimization of a consistency measure for the development of multicriteria classification models in a preference disaggregation context is not a straightforward process. This means that one should not consider the development of a multicriteria classification model as a simple process where some input data are introduced to an optimization procedure to obtain the optimal model. Careful analysis of the estimated model's parameters is required to ensure that they are in accordance with the DM's preferential system. This is a crucial point since it is often observed that a model can be highly consistent with the classification of the reference alternatives, yet its parameters are difficult to interpret from the DM's point of view. A classification model that fails this kind of validation is highly likely to be useless in practice, either because the DM does not feel confident on the structure of the model or because the model's results are incorrect. Additional model validation and verification of the model's performance is also often necessary using new decision examples, other than reference alternatives used during model development.

A final important issue that needs to be stretched involves scalability and computational efficiency. As the volume of data increases the tools and procedures used for developing classification models should be able to accommodate the need of handling large data sets in an efficiency way. The significance of this issue is

highlighted by the fact that the development of a classification model is performed through an iterative and interactive process. Therefore, the implementation of such a process in real time for large data sets can only be achieved if the techniques used for model development are computationally efficient.

### 4. Conclusions and perspectives

The research on classification problems has evolved rapidly over the past two decades. The MCDA paradigm has contributed positively in addressing classification problems with a multicriteria character. However, there are still several interesting topics that need further investigation. Up to now, most MCDA studies have focused on the development of new MCDA classification methods and new techniques for model development. Future research should consider issues such as the validation of the new methods and techniques that are developed, the analysis of their parameters, their extensions to large data sets, the connectives between MCDA research and other disciplines that are related to classification problems, as well as analysis and reconsideration of the consistency measures used for the development of multicriteria classification models. Other issues also include the robustness of the models to changes in the problem data or the parameters of the methods, the modeling of classification problems in dynamic decision environments, as well as the development of methods to assess the quality that each criterion provide in a classification context.

### References

Belacel, N. (2000), "Multicriteria assignment method PROAFTN: Methodology and medical applications", *European Journal of Operational Research*, 125, 175-183.

Dias, L., Mousseau, V., Figueira, J., Climaco, J. (2002), "An aggregation/ disaggregation approach to obtain robust conclusions with ELECTRE TRI", *European Journal of Operational Research*, 138(2), 332-348.

Doumpos M. and Zopounidis C. (2004), "A multicriteria classification approach based on pairwise comparisons", *European Journal of Operational Research*, 158, 378-389.

Figueira, J., De Smet, Y. and Brans, J.P. (2004), "MCDA methods for sorting and clustering problems: Promethee TRI and Promethee CLUSTER", Université Libre de Bruxelles, Service de Mathématiques de la Gestion, Working Paper 2004/02 (http://www.ulb.ac.be/polytech/smg/indexpublications.htm).

Greco, S., Matarazzo, B. and Slowinski, R. (1999), "The use of rough sets and fuzzy sets in MCDM", in: T. Gal, T. Hanne and T. Stewart (eds.), *Advances in Multiple Criteria Decision Making*, Kluwer Academic Publishers, Dordrecht, 14.1-14.59.

Greco, S., Matarazzo, B. and Slowinski, R. (2001), "Rough sets theory for multicriteria decision analysis", *European Journal of Operational Research*, 129, 1-47.

Jacquet-Lagrèze, E. (1995), "An application of the UTA discriminant model for the evaluation of R & D projects", in: P.M. Pardalos, Y. Siskos, C. Zopounidis (eds.), *Advances in Multicriteria Analysis*, Kluwer Academic Publishers, Dordrecht, 203-211.

Jacquet-Lagrèze, E. and Siskos, J. (2001). Preference disaggregation: Twenty years of MCDA experience, *European Journal of Operational Research*, 130, 233-245.

Mousseau, V. and Slowinski, R. (1998), "Inferring an ELECTRE-TRI model from assignment examples", *Journal of Global Optimization*, 12/2, 157-174.

Roy, B., and Bouyssou, D. (1993), *Aide Multicritère à la Décision: Méthodes et Cas*, Economica, Paris.

Schiavo, R.A. and Hand, D.J. (2000), "Ten more years of error rate research", *Journal of Statistical Science*, 63(3), 295-310.

Zopounidis, C. and Doumpos, M. (1999), "A multicriteria decision aid methodology for sorting decision problems: The case of financial distress", *Computational Economics*, 14(3), 197-218.

Zopounidis, C. and Doumpos, M. (2000), "Building additive utilities for multi-group hierarchical discrimination: The MHDIS method", *Optimization Methods and Software*, 14(3), 219-240.

Zopounidis, C. and Doumpos, M. (2002). "Multicriteria Classification and Sorting Methods: A Literature Review," *European Journal of Operational Research* 138(2), 229-246.

# Forum

## Robustness Analysis: Optimisation

**Marc Sevaux [a] and Kenneth Sörensen [b]**
[a] *University of Valenciennes, France*
[b] *University of Antwerp, Belgium*

### Introduction

The discussion developed in this forum is an excellent opportunity to present a different point of view of what we consider to be robustness analysis.

In many real-life combinatorial optimisation problems, robustness is just an important issue as is optimality. However, this aspect of optimisation has long been neglected by researchers. For our purposes, robustness refers to the insensitivity of a solution with

respect to the input data. In our opinion, researchers and especially those involved in optimisation should be able to provide solution methods that can find robust solutions.

**Definitions**

Changing data, uncertainty, and dynamic modifications of data lead current optimisation methods to poor solution. One way to deal with stochastic problem data is to find solutions that are *robust*. We distinguish two types of robustness. *Quality robustness* is a property of a solution whose quality, measured by the objective function value, does not deviate much from optimality when small changes in the problem data occur.

The second type of robustness is called *solution robustness* and can be described as robustness in the solution space. When changes in the problem data occur, the decision maker might be forced to re-optimise the problem. In this case, the quality of the solution is guaranteed by the optimisation procedure. In some situations however a solution is preferred that is "close" (in the solution space, not the objective function space) to the solution currently used. For example, many manufacturers operate with a production schedule that repeats itself on a regular basis (e.g. daily or weekly). When e.g. a new job needs to be scheduled, the problem is re-optimised, but the new production schedule should be as similar as possible to the one currently used.

This type of robustness stresses the importance of solution stability. The two types of robustness are not entirely equivalent in the sense that quality robustness is a property of a solution that is insensitive to changes in the problem data *before* these changes occur, whereas solution robustness refers to the stability of a solution *after* changes have occurred.

**A simple framework for robust optimisation**

Consider an optimisation problem for which the data are uncertain or stochastic. If we want to find an optimal solution, we need to adapt a search procedure to be able to take into account the stochastic nature of our problem.

Based on our experiments, we argue that meta-heuristics can very easily be adapted to the requirements of a stochastic problem formulation. That there is a need for robust meta-heuristic optimisation is recognised in the influential book "Robust discrete optimisation" [KOU97], when the authors say on p. 354: "*We believe that considerable more effort should be spent in systematic development of [...] metaheuristic frameworks, which with minimal adjustment effort can be applied to a large class of robust optimisation problems [...]* ".

In metaheuristics, the search towards an optimal (or near-optimal) solution is guided by successive evaluation of solution in a sequential mode (simulated annealing, tabu search, …) or in a parallel way (genetic algorithm, ant colony optimisation, …). If we are able to take into account the stochastic nature of the problem at this step, we should be able to guide the search towards a robust solution. Hence, one way to do it is to modify the evaluation function and evaluate the robustness of the solution at this step. This is done by replacing the evaluation function by a so-called robust evaluation function.

**Quality robustness**

Let $x$ be a solution of an optimisation problem. The quality of $x$ is computed by an evaluation function $f(x)$. When we want to indicate that $f$ has parameters, we write $f(x,P)$, where $P$ is the set of problem data. To allow the robust algorithm (RA) to find robust solutions, the evaluation function $f(x)$ is replaced by a *robust evaluation function* $f^*(x)$. The robust evaluation function for quality robust solutions adheres to the following principles [SOR01,SOR03]:

*Principle 1:* Each solution is implemented on a modified set of characteristics $S_i(P)$. $S$ is a *sampling function*, that takes a random sample from the stochastic elements of $P$. $S_i(P)$ is the $i$-th set of sampled parameters of $P$. We call the implementation of a solution on a modified set of characteristics a *derived solution*.

*Principle 2:* Several evaluations of a solution $x$ on a sample of $P$ are combined into a new evaluation function. An evaluation of a derived solution is called a *derived evaluation*. This new function is the *robust evaluation function* $f^*(x)$.

A possible form of a robust evaluation function is a weighted average of $m$ derived evaluations:

$$f^*(x) = \frac{1}{m}\sum_{i=1}^{m} c_i \; f(x,S_i(P))$$

where $c_i$ is a weight associated to this derived evaluation according to its importance and $m$ is the number of derived solutions to evaluate.

A more conservative robust evaluation function may examine the worst-case performance of a solution across all derived evaluations:

$$f^*(x) = Max(i=1\Lambda\, m,\; f(x,S_i(P)))$$

if $f$ has to be minimised.

**Solution robustness**

Solution robustness is a property of a solution that is similar to a given baseline solution, $x_0$ *i.e.* for which the *distance* to the baseline solution (as measured by some distance function) is small. Of course, solution robustness cannot be used as the only objective, since solution quality or quality robustness should always be taken into account. The need for solution robustness therefore automatically transforms the problem into a multi-objective one and a solution should be found that simultaneously has a high quality (robustness) and a small distance to the baseline solution.

In our framework, solution robustness is obtained by measuring the distance between the baseline solution and each solution generated by the metaheuristic along the search. It is assumed that the metaheuristic visits a sufficiently diverse set of solutions, so that at least a fraction of them will be solution robust. A solution is then chosen using a multi-objective decision making process, taking into account the decision maker's preferences for solution robustness and quality (robustness).

A sensible distance measure should accurately reflect the "similarity" between two solutions. The meaning of this concept is highly dependent on the specific situation. For problem where the representation of a solution can be undertaken by a permutation, [SOR03a] provides a set of distance measures based on the *edit* distance (also called distance of Levenstein).

**Risk preference**

The function $f^*(x)$ estimates the average performance or the worst case performance of a solution, given that some of the parameters of the problem are stochastic. Clearly, the worst case performance measure will lead to solutions that are more conservative. Solutions found using this form of the robust evaluation function will hedge only against the worst possible incidence, independent of the probability that this scenario will occur. This type of robust evaluation function can be used by extremely risk-averse decision makers.

A more subtle manner to incorporate the risk preference of the decision maker, is to include into the robust evaluation function an estimate of the probability that the quality of a solution will deviate from its expected value. A possible measure is the standard deviation of the quality of a given solution over all samples: This could be done easily along the search and keep as a second attribute of the solution.

The two measures (the robust evaluation and the standard deviation computed) can be integrated in a multi-objective decision making approach. A possible way is to find the solution that minimises $f^*(x) + \bullet . \bullet \ ^*(x)$, where $\bullet$ is a parameter indicating the risk-averseness of the decision maker. A more advanced way is to retain all efficient solutions and choose one according to a multi-objective decision making method.

**Application in scheduling and routing problems**

To demonstrate the efficiency of such type of approach, we tackle two types of problem. The first one considers the optimisation under uncertainty of a one-machine scheduling problem presented in [SEV04]. The metaheuristic developed for this problem is a genetic algorithm. The second type of application is dedicated to the robust and flexible vehicle routing problem presented in [SOR04]. For this latter application, the metaheuristic is a memetic algorithm in which the population is carefully managed. This technique is called MA/PM memetic algorithm with population management.

**Conclusion**

To conclude, we can summarize our approach as follow. Based on an existing metaheuristic, the stochastic nature of the problem can be taken into account through a robust evaluation function that replaces the standard evaluation function and guides the search towards a robust solution. This approach has been applied successfully to two types of applications, routing and scheduling that can be considered as two major categories of combinatorial optimisation problems.

## References

[KOU97] P. Kouvelis and G. Yu, 1997. *Robust discrete optimisation and its applications.* Kluwer academic publishers, Dordrecht.

[SEV04]M. Sevaux and K. Sörensen, 2004. A genetic algorithm for robust schedules in a one-machine environment with ready times and due dates. *4OR* 2(2), pp 129-147.

[SOR01] K. Sörensen, 2001. Tabu searching for robust solutions. In *proceedings of the 4th metaheuristics international conference.* Porto, Portugal, pp 707-712.

[SOR03] K. Sörensen, 2003. *A framework for robust and flexible optimisation using metaheuristics with applications in supply chain design.* PhD. Thesis. University of Antwerp, Belgium.

[SOR03a] K. Sörensen, 2003. Distance measures based on edit distances for permutation-type representations. In A. Barry, editor, *Proceeding of the workshop on analysis and design representations and operators, GECCO conference.* Chicago, USA.

[SOR04] K. Sörensen and M. Sevaux, 2004. Robust and flexible vehicle routing in practical situations. In *proceedings of the 5th triennial symposium on transportation analysis. Le Gosier, Guadeloupe (French West Indies), France.*

# MCDA Research Groups

## Laboratory of Operations Research, Decision and Control of Processes


Fouad Ben Abdelaziz
*Institut Supérieur de Gestion de Tunis*
*41 rue de la liberté, Cité Bouchoucha, 2000 Le Bardo, Tunisia*
*Phone.: (+216) 71 560 313, Fax: (+216) 71 568 767*
*fabdelaz@isg.rnu.tn*

LARODEC is a scientific educational laboratory at the Higher Institute of Management of Tunis, Tunisia (Institut Supérieur de Gestion, ISG, Tunis), University of Tunis. The main interest of the LARODEC is multicriteria optimization, decision theory, statistics and probability.

The LARODEC currently includes 27 Faculty and permanent researchers, 32 Graduate students.The main objective of the laboratory is to contribute to the national and international research activity by supervising graduate students.

### Research Program

Following is the list of decision aid problems considered in our research program:

- Multicriteria decision aid.
- Interactive decision systems
- Multiobjective optimization
- Quality control of products and processes.
- Data mining
- Optimization of the allocation and the management of water ressources.
- Transportation networks and telecommunication.
- Choice problem in an uncertain universe
- Reliability and production systems

## Relevant LARODEC Publications

- Ben Abdelaziz F., Enneifar L. and Martel J.M. A Multiobjective Fuzzy Stochastic Program for Water Resources Optimization: the Case of Lake Management, accepted for publication in INFOR.
- Ben Abdelaziz F., Krichen S. An Interactive Method for the optimal Selection Problem with Two Decision Makers, to appear in European Journal of Operational Research.
- Ben Abdelaziz F., Masri H. Stochastic Programming with linear Partial Information on Probability Distribution, to appear in European Journal of Operational Research.
- Ben Abdelaziz F., Mamoghli Ch., and Aouni L. A bivariate risk aversion measure, To appear in Finance India.
- Ben Abdelaziz F., J M Martel, A Mselmi. IMGD: an interactive method for multiobjective group decision aid, The Journal of the Operational Research Society. Oxford: May 2004. Vol. 55, Iss. 5; p. 464
- Elouadi Z., Mellouli K., and Smets P. Assessing sensor reliability for multisensor data fusion with the transferable belief model. IEEE Transactions on System Man and Cybernatics. Part B, february 2004.
- Zouaoui H. and Limam M. Interval estimation for gauge R&R studies with four factors : A case study. Journal of Quality Technology To appear (2004).
- Ben Amor N., Benferhat S., Dubois D., Mellouli K., and Prade, H. A theoretical framework for possibilistic independence in a weakly ordered setting. To appear in International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems .
- Hajlaoui, M. and Limam, M.M.T.(2003), Economical Quality Control with Measurement Error, Communications in Statistics: Theory and Methods, 32, 11, 2259-2273.
- Ben Yaghlane B. Smets Ph. And Mellouli K. Belief function independence : I. the conditional case. International Journal of Approximate Reasoning 31/1-2 (2002), 31-75.

- Ben Yaghlane B. Smets Ph. And Mellouli K.. Belief function independence : I. The marginal case. International Journal of Approximate Reasoning 29/1 (2002), 47-70.

- El- Aroui M.A. and Diebolot J. On the use of the peaks over thresholds method for estimating out-of-sample quantiles. Computational Statistics and Data Analysis 39, 4 (2002), 453-475.

- Ben Abdelaziz F., Lang P and Nadeau R., Dominance and Efficiency in Multicriteria Decision under Uncertainty, Theory and Decision. Dordrecht: Dec 1999. Vol. 47, Iss. 3; p. 191

## Cooperation

The LARODEC laboratory collaborates with many international research teams. Below are some coperation projects :

1. Project PICS : cooperation project between LARODEC and the LIP6 laboratory of the university of « Pierre et Marie Curie » of Paris. The project of cooperation entitled « Qualitative decision model and management of the environment in an uncertain universe » concerns the development and the application of non-probabilistic models of uncertainty in a real decisional context.

2. Luso-Tunisian cooperation project (GRICES): Institut Supérieur de Gestion and Faculdade de Economia da Universidade de Coimbra : "Preference modelling in electoral systems and multi-criteria analysis". January 2004 - December 2005.

3. Actions of exchanges DGRST-CNRS : between the LARODEC and the laboratory HEUDIASYC of the technological university of Compiègne. The project is entitled « Aid to the classification in an uncertain context ». Its main objective is to develop methods of classification in an uncertain context.

4. Actions of exchanges DGRST-CNRS : between the LARODEC and the laboratory IRIT of Toulouse. The project is entitled « Decision aid through theories of uncertainty ». The two teams (LARODEC and IRIT) work together from more than four years with the help of the research group FUSION (Fusion of Uncertain Data for Sensors, Information Systems and Expert Opinions) that allowed many research meetings.

5. Frensh-Tunisian cooperation project CMCU : between the LARODEC and the laboratory HEUDIASYC of the technological university of Compiègne. The project is entitled « Representation and management of the uncertainty in the decision problem : Evidential, possibilistic and probabilistic approaches.

## Events

## The Larodec organized the following conferences

- MOPGP'04, Hammamet from 11 to 14 April, 2004. MOPGP is a series of international conferences dedicated to multiobjective programming and goal programming (MOP/GP)
- ROC04: Second meeting of operations research and control of processes and third scientific day of LARODEC, Mahdia, April 2004.
- ROC03: First meeting of operations research and control of processes, and second scientific day of LARODEC. This day has been organized in the month of January 2003 in Hammamet and many members of the laboratory and invited researches have presented their works
- Co organizer of the international conference IEEE/SMC (Science, Men and Cybernetics - IEEE SMC-2002 in Hammamet.
- International Total Quality Management TQM'02, june 2002 in Tunis, the number of participants is about one hundred (researchers and industrial ingeneers).
- International seminar "Total Quality Management TQM'01" March 2001 in Tunis. The number of participants is about one hundred (researchers and industrial ingeneers).
- EMAD'99: Multicriteria meeting for decision aid, April 1999 in Gammarth, Tunisia

# Software

## VIP Analysis

**Methodology by: Luis Dias and João Clímaco**

**Software design and development by: Luis Dias**

**Contact information:**
*INESC Coimbra, Rua Antero de Quental, 199, 3000-033 Coimbra, Portugal, or*
*Faculdade de Economia da Universidade de Coimbra, Av. Dias da Silva 165, 3004-512 Coimbra, Portugal.*
*e-mail : LMCDias@fe.uc.pt*

**Web site:**
http://www4.fe.uc.pt/lmcdias/english/vipa.htm

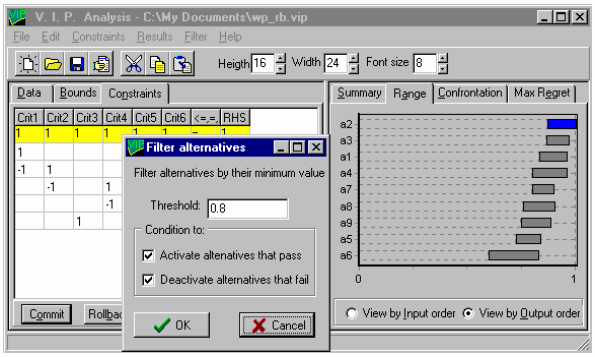
The VIP (Variable Interdependent Parameters) Analysis software has been built to support the selection of the most preferred alternative among a list, considering the impacts of each alternative on multiple evaluation criteria. It is based on an additive aggregation model (value function), accepting imprecise information on the value of the scaling coefficients (a.k.a. scaling constants, which indirectly reflect the weight of the each evaluation function).

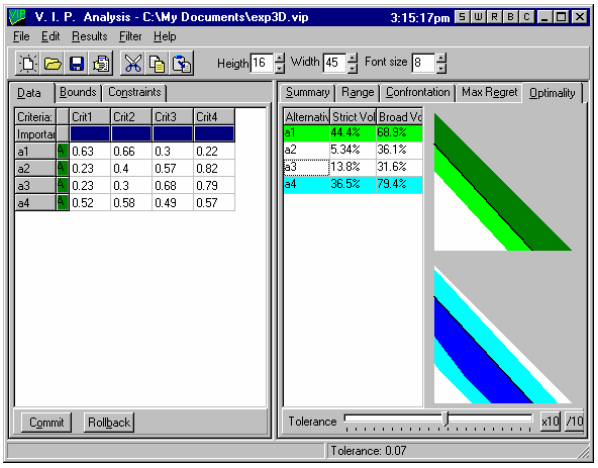
Rather than precise values, the scaling coefficients are considered Variable Interdependent Parameters subject to a set of constraints (e.g. bounds, order relations, or any linear constraints). This type of problems are often referred to as "partial information", "poor information", "imprecise information" or "preference programming" ones. VIP Analysis considers multiple acceptable combinations of values for these parameters, which is particularly relevant despite the simplicity of the model.

Indeed, fixing precise values for the scaling constants is often difficult because these values reflect the judgment of the decision makers, which may evolve through time and may be hard to elicit in a precise way. The number of arbitrary options in the process of building the criteria, plus the possibility of divergence among several decision makers may further hinder the requirement of precise numerical figures.

The VIP Analysis software offers its users user-friendly tool to analyze a choice problem by using multiple approaches at several levels of detail, when imprecise information is accepted. Namely, it computes:

- the best and worst overall value that each alternative may attain (given the multiple acceptable inputs);
- the pairwise confrontation table (maximum differences of global value between pairs of alternatives), which allows to discover alternatives that are "dominated" in the sense that there is another one that has always the same or better overall value (again, given the multiple acceptable inputs);
- the maximum loss of opportunity associated with choosing each alternative ("maximum regret");
- the graphical representation in the parameter space of the domain where each alternative has the best value (where it is "optimal") in problems with 2 degrees of freedom (number of criteria minus numeber of equality constraints, e.g. precise trade-offs).




A distinctive feature of VIP Analysis is the possibility of controlling interactively a tolerance parameter to know which alternatives are quasi-optimal or quasi-dominated. Another of its characteristics is that it accepts any kind of linear constraint on the parameters. Plans for the continuation of this project include offering the use of "wizards" for the insertion of constraints, volume computation tools, and the development of a Group Decision Support System (see 2nd reference below).

VIP Analysis is distributed for free to anyone interested who contacts the authors. In four years (since 2000), VIP Analysis has been requested by almost one hundred users (academics and others) from several countries, besides Portugal: Argentina

(4), Australia (3), Brazil (28), Canada, China & Taiwan (3), Colombia, Cuba, Czech Republic, Egypt, Ecuador, Finland, France, Greece (2), Italy (7), Japan, Malaysia, Maroc, The Netherlands, New Zealand, Poland, Russia, Slovenia, Spain, Switzerland, UK (4), USA (3), Venezuela and Vietnam.

**References**

Dias, L.C., J.N. Clímaco, "Additive Aggregation with Variable Interdependent Parameters: the VIP Analysis Software", *Journal of the Operational Research Society*, Vol. 51, No. 9, 1070-1082, 2000.

Dias, L.C., J.N. Clímaco, "Dealing with imprecise information in group multicriteria decisions: A methodology and a GDSS architecture", *European Journal of Operational Research*, 160, 291-307, 2005.

## Persons and Facts

Operations Research in Africa. As you may be aware, since 2001, EURO has decided to invest in the promotion of Operational Research in Africa, trying to organise, support and improve the presence of our discipline in this continent so near to us and so far at the same time. (For more details about this project, please see the attached letter)

## About the 60th Meeting

**Bartel Van de Walle**

The 60th meeting of the MCDA Euro Working group was held in Tilburg (the Netherlands) from October 14 to 16, 2004. The theme of the meeting was "MCDA in electronic auctions, markets and negotiations", though as usual also general presentations on multi-criteria decision aid were invited. In total, about 30 people attended the meeting, of which about half presented their current research activities at the meeting.

It was unfortunate that the Dutch public transportation decided to go on national strike at the first day of the meeting, causing some members of the group to cancel their trip to the Netherlands or missing the first day of the meeting. Despite (or perhaps thanks to) this relatively low attendance, the meeting was characterised by a very friendly atmosphere and very lively discussions throughout the meeting!

At the first day, the general theme of the meeting was introduced to us by Professor Martin Bichler of the Technical University of Munich (Germany). Martin spoke eloquently about 'Markets, Computation and Decisions', and exposed us to the current computational-theoretical research and internet based experimentation in this domain – a very nice opening talk of the meeting. Two subsequent sessions elaborated on this topic, with presentations on theory and experiments in electronic markets, auctions and negotiations. The last session was followed by a welcome reception offered by the Information Systems department of Tilburg University, after which we left for the impressive and cosy restaurant 'The Four Seasons' located in the center of the city, where we enjoyed a very nice dinner.

The second day consisted of four sessions on new developments in methodology and new applications, with lots of discussion and interaction among all participants. I believe we will remember for some time the first session in the afternoon, in which the thought-provoking talk by Alexis Tsoukias "*From decision theory to decision aiding methodology*" set the stage for a lively discussion… for the duration of the entire session! Special attention was also given to the younger PhD students of our group: PhD work was presented by Yves De Smet and Iryna Yevseyeva on Thursday, and Catrinel Turkanu, Benjamin Rousval and Tommi Tervonen on Friday. The final day of the scientific program was concluded by a 'farewell' reception, which provided for a nice closing of the meeting.

The social program on Saturday consisted of a visit to an abbey near Tilburg, where we enjoyed the only non-Belgian trappist beer in the world, brewed by the monks. We learned a lot about the trappist, but it certainly was not an easy task to experimentally validate the theory and try all different types of 'La Trappe'! Fortunately, we were offered a light lunch before we left the abbey, but nevertheless most of us felt a little 'lightheaded' when we headed for the bus and left for 's Hertogenbosch (or, in French, Bois-le-Duc). At this wonderful old town, we first enjoyed the typical chocolate cake – and a strong cup of coffee – in a cozy café. We were then ready to enjoy a boot trip on the canals of the town, which surprisingly took us through old, narrow and sometimes very dark tunnels running under the houses and city center: a really unique perspective on the medieval town! We departed at about 5 pm from Den Bosch to arrive in Tilburg one hour later, tired but happy!

**PROGRAM**
**Thursday, October 14 2004**

***Location: Room EZ4, Building 'E' or also called TIAS Building. (TIAS is the Business School of the University)***

***Map at: http://www.tilburguniversity.nl/university/route/uvtmap.html***

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|---|---|
| MORNING | **REGISTRATION (from 10:30 am)** |

1:30 **LUNCH**

| | | |
|---|---|---|
| 1:30 - 2:30 pm | **PLENARY TALK** | Prof. Dr. Martin Bichler<br><br>Markets, Computation and Decision Modeling |

| | | |
|---|---|---|
| | **Session 1 Markets - auctions - negotiations** | |
| 2:30-3:30 pm | *2:30* | Yves De Smet, ULB, Belgium<br><br>Multicriteria Auctions (20 min) |
| *Chair: Tervonen* | *3:00* | Bartel Van de Walle, Tilburg University<br><br>Information Market Games in the classroom (20 min) |
| | *3:30* | Iryna Yevseyeva<br><br>Diagnostics of Behaviour using MCDA (20 min) |
| | *Paper submitted for discussion:* | K. Zimmermann et al., Centre de Jouy en Josas, France<br><br>Alignment of Exchange Rates (EUR, USD, JPY) Time Series (20 min) |

4:00 - 4:30 pm **COFFEE BREAK**

| | | |
|---|---|---|
| | **Session 2 Markets - auctions - negotiations** | |
| 4:30 - 6:00 pm | *4:30* | Willem Brauers, Univ. Antwerp, Belgium<br><br>Multiple Objectives and negotiations between stakeholders (40 min) |
| *Chair: De Smet* | *5:30* | Trzaskalik and Wachowicz, Karol Adamiecki University of Economics, Poland<br><br>Application of Multi-attribute stochastic dominance to selection of negotiation strategies in e-negotiations (20 min) |
| | *Paper submitted for discussion:* | Donatas Bakshys and Leonidas Sakalauskas, Vilnius<br><br>Study on e-commerce environment in Lithuania |

6:00 - 6:45 pm **Welcome Reception Offered by the Department of Information Systems and Management**

7:00 PM **CONFERENCE DINNER in "The Four Seasons", Tilburg**

**Friday, October 15 2004**

***Location: Room YZ3, Building 'Y' or also called Law Building.***

***Map at: http://www.tilburguniversity.nl/university/route/uvtmap.html***

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|---|---|---|
| 9 - 10:30 am *Chair: Norese* | **APPLICATIONS I** | |
| | *9:00* | Catrinel Turcanu et al., SCK-CEN, Belgium<br><br>Evaluation of agricultural countermeasures in nuclear emergency management by means of outranking decision-aid methods (20 min) |
| | *9:30* | Jean-Philippe Waaub et al., UQAM, Canada<br><br>Planification territoriale et savoirs autochtones: une suggestion pour developer un processus d'aide multicritere a la concertation en support a l'evaluation environmentale strategique (20 min) |
| | *10:00* | Matos et al.<br><br>Deciding about wind power penetration levels: a case study (20 min) |
| | *Papers submitted for discussion:* | Ben Brahim et al.,<br><br>L'aide a la decision pour la promotion de la reutilisation Agricole des Eaux usees traitees en Tunisie<br><br>Romeo-Mihai Ciobanu et al., IASI, Romania<br><br>MCDA system for e-procurement in administration of Romanian universities |

10:30 - 11 am **COFFEE BREAK**

| | | |
|---|---|---|
| 11 - 12:00 *Chair: Bisdorff* | **APPLICATIONS II** | |
| | *11:00* | Sven-Olov Larsson, Uppsala, Sweden<br><br>MCDA and Public Transport (20 min) |
| | *11:30* | Maria-Franca Norese et al., Politecnico di Torini, Italy<br><br>On-line services and MC approach in the context of computer and network security (20 min) |
| | *Papers submitted for discussion* | Joao Climaco et al., Portugal<br><br>A multicriteria approach for the choice of remote load control strategies<br><br>Rogers<br><br>Decision modeling in the risk assessment procedure within road safety auditing<br><br>Dzhaleva-Chonkova et al., Univ. of Transport, Sofia, Bulgaria<br><br>Application of MADMML Approach to creating a virtual museum of transport |

**Friday, October 15 2004** **(Cont.)**

12 - 1 pm **LUNCH**

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|---|---|
| 1 - 1:30 pm | **Working Group Business**<br>News on the Working Group and Next Meetings<br>Introductions |

| | | |
|---|---|---|
| 1:30 - 3 pm | **METHODOLOGY** | |
| *Chair: Cadier* | *1:30* | Alexis Tsoukias, LAMSADE, Paris, France<br>From decision theory to decision aiding methodology (40 min) |
| | *2:30* | Raymond Bisdorff et al., Luxembourg<br>Determiner le meilleur choix a partir d'une relation de surclassement value (20 min) |
| | *Papers submitted for discussion:* | |
| | | Bana e Costa and Lourenco<br>**PROBE**: Preference robustness evaluation in hierarchical additive models |
| | | Gonzales-Pachon et al., Madrid, Spain<br>A dimension theory for non-transitive binary relations |
| | | Greco et al.,<br>Rough set approach to decision with a plurality of decision makers |
| | | Renaud et al.,<br>Incidence des poids dans un classement multicritere obtenu par la methode OWA |

3 - 3:30 pm **COFFEE BREAK**

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|---|---|---|
| 3:30 - 5:30 pm | **METHODOLOGY - APPLICATIONS** | |
| *Chair: Tsoukias* | *3:30* | Suciu et al.,<br>Dynamique de la decision distribuee (20 min) |
| | *4:00* | Rousval and Bouyssou<br>Structuration des objectifs: une application a l'environment et les transports (20 min) |
| | *4:30* | Tervonen et al.,<br>A method for preference information aggregation in SMAA using DS/AHP (20 min) |
| | *Papers submitted for discussion* | Figueira et al., Building additive utility functions representing intensities of preferences |
| | | Tontchev<br>MCDM approach to solving problems of improving materials in electronics |

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| 5:30 | **Closing Reception Offered by the Department of Information Systems and Management** |

**Saturday, October 16 2004**

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|---|---|---|---|
| 9:30 AM | Bus leaves at Tilburg University | | 20 min |
| 10:00 AM | Visit at Trappist Cloister | With guided tour and tasting of the famous 'trappist' beer. Lunch on site. | 3 hours |
| about 12:30 | Bus leaves to Den Bosh | | 1 hour |
| 2:00 PM | Trip on Canals in Den Bosh | Boat trip on the canals of Den Bosh with guides | 1:30 hour |
| 3:30 PM | Visit of City Center | With special degustation of Den Bosh 'bollekes' | 2 hours |
| 5:00 PM | Bus leaves to Tilburg University | | 1 hour |

## 15th Mini-EURO Conference

### "Managing Uncertainty in Decision Support Models"

**Carlos Henggeler Antunes and Luís Dias**

The 15th Mini-EURO Conference "Managing Uncertainty in Decision Support Models", was held in Coimbra, from 22 to 24 September 2004. The scientific programme included two plenary presentations, "Decision Support and e-Democracy: How do we represent Uncertainty for all Stakeholders?", by Prof. Simon French (University of Manchester, UK) and "Managing Uncertainty through Preference Programming", by Prof. Ahti Salo (Helsinki University of Technology, Finland). The programme also included 20 parallel sessions where 63 papers were presented. There was a high participation of the delegates in the plenary and parallel sessions, which demonstrates the interest that this event received. As a matter of fact, 78 researchers from 24 countries were present: Portugal (20), UK (10), Spain (7), Finland (6), Norway (4), Japan (4), France (3), Canada (2), Denmark (2), Greece (2), Belgium (2), Austria (2), Estonia (2), Ukraine (2), Germany (1),

Israel (1), South Africa (1), Australia (1), Switzerland (1), Poland (1), Bolivia (1), Turkey (1), Lithuania (1) and China (1). This set of participants shows well the international character of this event, which attracted many researchers from outside Europe.
The proceedings were published as a CD-ROM, with ISBN. The volume includes the full versions of the papers submitted to the conference, which underwent a refereeing process beforehand.
The authors were invited to submit their papers to international journals from Elsevier that will publish special issues dedicated to this conference: Decision Support Systems and European Journal of Operational Research.

The CD-ROM Proceedings of MUDSM 2004 are available from INESC Coimbra (Rua Antero de Quental, 199; 3000-033 Coimbra; Portugal; mudsm2004@inescc.pt) for the price of 25 euros (including VAT and postage costs).

Contents (full papers):

Ahuja H, Utility Estimation and Preference Aggregation under Uncertainty by Maximum Entropy Inference. Aköz O, D Petrovic, A new fuzzy goal programming model with uncertain goal hierarchy. Alonso JA, MT Lamata, Relative criterion of consistency in the Analytic Hierarchy Process. Amor SB, K Jabeur, JM Martel, Multiple criteria aggregation procedure for mixed evaluations. Andreeva G, Ansell J, JN Crook, Combining default and purchase propensity in credit scoring. Balbo AR, EC Baptista, MN Arenales, An adaptation and application of the Dual-Affine Interior Points Method to the Flatness Problem. Brynielsson J, Game-Theoretic Reasoning in Command and Control. Contreras I, AM Marmol, A consensus method for multiple criteria group decision problems with imprecise information. Costa JP, Computing Weight Indifference Regions in MOLFP. Craveirinha J, L Martins, J Clímaco, Dealing with complexity in a multiobjective dynamic routing model for multiservice networks – a heuristic approach. Damart S, LC Dias, V Mousseau, On sorting with aggregation/disaggregation approaches in contexts with multiple decision-makers. Diakoulaki D, S Grafakos, Treatment of uncertainty in weights elicitation through the disclosure of the hidden monetary values assigned to sustainability criteria. Entani T, K Sugihara, H Tanaka, Interval Priority Weights in AHP by Three Different Models. Ferreira P, M Araújo, Including non-financial aspects in project evaluation. Flaten O, G Lien, M Ebbesvik, M Koesling, PS Valle, Stochastic utility-efficient programming of organic dairy farms. García-Bernabeu AM, CP Sarasa, Selecting funds on the Portuguese Exchange: The prospective phase. Gomes da Silva C, J Figueira, J Clímaco, On the imperfect knowledge about criteria coefficients and its effects on the non-dominated frontier: a particular case of the bi-criteria {0,1}-knapsack problem Gouveia MC, LC Dias, CH Antunes, DEA and multiple criteria decision analysis with imprecise information for efficiency evaluation. Greben JM, Prediction and confidence intervals for models fit to data when the errors are mainly non-statistical. Hyde KM, HR Maier, Distance Based Uncertainty Analysis for Multi-Criteria Decision Analysis in Excel using Visual Basic for Applications (VBA). Iglesias O, RA Ribeiro, JR Fonseca, A Bidding Model using Fuzzy Multi-Criteria for Transportation. Inuiguchi M, J Suzuki, T. Miyajima ,Toward Rule Extraction from Multiple Decision Tables Based on Rough Set Theory. Ishizaka A, Advantages of clusters and pivots in AHP. Jesús PMO, MT Ponce de Leão, Optimal Power Flow Analysis using Fuzzy Supply and Fuzzy Demand Functions. Jiménez A, LC Rodríguez, A Mateos, Sixto Ríos-Insua, A DSS for Contracting of Cleaning Services in a European Public Underground Transportation Company. Jones D. F. , S. Mardle, Multiple Objective Decision Trees: Theory and Use in Strategy Formulation. Józefczyk J, Robust algorithm for task scheduling on moving executors with uncertain processing times. Kavran Z, I Cavar, AHP Model of Selecting Mobile Phones in the Republic of Croatia. Koshlai L, M Mikhalevich, Two-stage stochastic model of export-import activity. Kunsch PL, A Ruttiens, A Chevalier, A methodology using option pricing to determine a suitable discount rate in environmental management. Kunsch PL, Ph. Fortemps, Evaluation of multicriteria valued preferences using fuzzy inference. Leleur S, KB Salling, AV Jensen, Modelling Decision Support and Uncertainty for Large Transport Infrastructure Projects: The CLG-DSS Model of the Øresund Fixed Link. Lien G, S Størdal, JB Hardaker, LJ Asheim,Optimal rotation of a forest and risk aversion: A stochastic efficiency approach. Lourenço R, JP Costa, Incorporating citizens' views in local policy decision making processes. Matos MA, Decision under risk as a multicriteria problem. Mavrotas G, D Diakoulaki, A combined MCDA-MOMILP approach to assist in project selection under policy constraints and uncertainty in the criteria weights. Melo P, JP Costa, sing Differences for Group Decision - description of a prototype system. Mikhalevich M, L Koshlai, Estimates of tolerance to decision maker's errors for stochastic interactive procedures. Oliveira C, CH Antunes,. An overview of interval programming in MOLP models with focus on the optimizing approach. Ozturk M, A Tsoukiàs, Modelling continuous positive and negative reasons in decision aiding. Pearson M, Decision-Making in Supply Chain Networks. Petrovic D, A Duenas. S Petrovic, A multi-objective job shop scheduling problem with linguistically quantified decision functions. Petrovic S, C Fayad, A Fuzzy Shifting Bottleneck Hybridised with Genetic Algorithm for Real-world Job Shop Scheduling . Pla-Santamaria D, C Stummer, M Guenther, E Ballestero, Compromise-utility approach to portfolio selection: A case from an opportunity set on three European Exchanges. Põldaru R, J Roots, Estimating Uncertainty in Simple Nonlinear Stochastic Model (a Case Study). Raa B, E-H Aghezzaf, The Cyclical Inventory Routing

Problem with Uncertain Demands and Travel Times. Sanchez LR, Integrating soft criteria in development project appraisal. Sanchis A, M. J. Segovia, J. A. Gil, A. Heras, J. L. Vilar, Rough Sets and the prediction of financial instability (macroeconomic problem) and the prediction of insolvency in insurance sector (microeconomic problem). Saraiva JT, N Fonseca, MA Matos, Fuzzy Tools for Power System Analysis – Fuzzy Power Flow and Fuzzy Optimal Power Flow. Sarasa CP, AM García-Bernabeu, Applying the compromise-utility method to select funds on the Portuguese Exchange. Sato Y, Empirical evaluation of scales employed in a pair-wise comparison. Schauer MB, R&D Project Selection considering Risk and Uncertainty. Silva RT, MJ Alves, J Clímaco, A discussion on a forest management case study based on an interactive analysis of a multiobjective integer model. Valishevsky A, Granular-Information-Based Decision Aid Methodology. Viana N, A Pereira, RA Ribeiro, A Donati, Handling missing values in solar array performance degradation forecasting. Yang J-B, D-L Xu, Making Decisions under Uncertainties using the Evidential Reasoning Approach. Yang S. L. , X. B. Liu, Y. Fang, The satisfying consistency of weighted geometric mean interval number judgement matrix in AHP.

## Forthcoming Meetings

(This section is prepared by Luís Dias and Carlos Henggeler Antunes)

**Forthcoming EWG Meettings/Prochaines réunions du Groupe**

**Note:**

- It should be remarked again that this is a bilingual group; all the papers should be presented in both official languages of the group (i.e. French with English slides, and *vice-versa*).
- Ceci en un groupe bilingue ; tous les papiers doivent être présentés dans les deux langues officielles du groupe (i.e. en français avec les transparents en anglais et *vice-versa*).

**March 10-11, 2005. 61st Meeting of the European Working Group on MCDA. Organisateurs: Raymond Bisdorff, Jean-Luc Marichal, Patrick Meyer. Thème: Preference Modelling. Lieu: Université du Luxembourg, Campus Limpertsberg, 162a, avenue de la Faïencerie, L-1511 LUXEMBOURG.**
**Page web: http://www.uni.lu/mcda61/.**
**E-mails: {raymond.bisdorff, jean-luc.marichal, patrick.meyer}@uni.lu**

**September 22-23, 2005. 62nd Meeting of the European Working Group on MCDA. Organisers: S-O Larsson, J-E Nilsson, A Grummas. Topic: Infrastructure, transport and Multicriteria Decision Aiding. Place: The Swedish National Road and Transport Research Institute (Borlänge, Sweden). The host organisation of the reunion MCDA 62 is: Institute (http://www.vti.se).**
**Web site of the Meeting: http://www.vti.se/mcda62. However, it will not open until March 2005.**
**E-mail: larsson.018129984@telia.com and agneta.grummas@vti.se.**

**Other Meetings**

20-22 October 2004. International Symposium TICE 2004 – UTC, France. Anne.claire-prevost@utc.fr, karine.sliwak@utc.fr

20-22 October 2004. IV-International Conference of Entreprise Science. Faculty of Entreprises Sciences, Central University Marta Abreu of Las Villas, Santa Clara, Cuba. www.universitur.uclv.edu.cu

24-27 October 2004. INFORMS Annual Meeting Denver 2004. Denver, Colorado, USA.

November 2004. FIFTH ALIO/EURO WORKSHOP ON APPLIED COMBINATORIAL OPTIMIZATION Paris, FRANCE. Organisers: Olivier Hudry and Irene Charon. E-mail: hudry@infres.enst.fr.

19-21 December 2004. 2nd International Industrial Engineering Conference. Riyadh, Saudi Arabia. [http://www.iiec2004.ksu.edu.sa/]

January 31 – February 4, 2005 AIRO Winter 2005. Cortina d'Ampezzo, Dolomites, Italy.
[http://www.iasi.cn.it/aw05.html]

February 14 – February 16, 2005. ROADEF 2005. Tours, France. [http://www.ocea.li.univ-tours.fr/roadef05/]

20 - March 23, 2005. INOC. International Network Optimization Conference, Lisbon, Portugal. March [http://www.inoc2005.fc.ul.pt/].

March 9-11, 2005. Third International Conference on Evolutionary Multi-Criterion Optimization (EMO 2005). Centro de Investigacion en Matematicas, A.C. , Mexico http://www.cimat.mx/emo2005/. Further information at: emo2005@cimat.mx

March 9-11, 2005. Third International Conference on Evolutionary Multi-Criterion Optimization (EMO 2005). Centro de Investigacion en Matematicas, A.C. , Mexico http://www.cimat.mx/emo2005/. Further information at: emo2005@cimat.mx

March 30 - April 1, 2005. 5th European Conference on EVOLUTIONARY COMPUTATION IN COMBINATORIAL OPTIMIZATION, Lausanne, Switzerland.
[http://evonet.lri.fr//eurogp2005/?page=evocop]

April 18-20 2005. ISCRAM2005, the second International Conference on Information Systems for Crisis Response and Management, Brussels. The full CFP and additional information can be found at the ISCRAM Community website: http://www.sckcen.be/iscram

April 17 - April 19, 2005 . INFORMS Conference on OR/MS Practice: Applying Science to the Art of Business; Palm Springs, CA, USA.
[http://www.informs.org/Conf/Practice05]

May 15 - May 18, 2005. Eighth SIAM Conference on Optimization Stockholm, Sweden.
[http://www.siam.org/meetings/op05/]

May 23 - May 25, 2005. OPTI 2005 Ninth International Conference on Computer Aided Optimum Design in Engineering Skiathos, Greece.
[http://www.wessex.ac.uk/conferences/2005/op2005/2.html]

May 23 – May 26, 2005. CIRO'05: 4ème Conférence Internationale en Recherche Opérationnelle Marrakech, Morocco. [http://www.ucam.ac.ma/fssm/ciro05/]

May 26 – May 28, 2005. EWG ECCOXVIII, 18th annual meeting of the EWG European Chapter on Combinatorial Optimization. Meeting theme: Combinatorics for Modern Manufacturing, Logistics and Supply Chains. Belarusian State University, Minsk, Belarus.
[http://www.prism.uvsq.fr/~vdc/ECCO/]

June 5 – June 7, 2005. EWG Graz-2005 - Joint-Workshop on Decision Support Systems, Experimental Economics & e-Participation. Graz, Austria. [http://www.uni-graz.at/soowww/eCube]

June 6 - June 10, 2005. Seventh Workshop on Models and Algorithms for Planning and Scheduling Problems (MAPSP2005) Siena, Italy. [http://mapsp2005.dii.unisi.it/]

June 8 - June 10, 2005. Eleventh Conference on Integer Programming and Combinatorial Optimization (IPCO XI) Berlin, Germany. [http://www.math.tu-berlin.de/ipco05]

July 3 - July 8, 2005. The 16th IFAC World Congress Prague, Czech Republic.
[http://ifacplaza.certicon.cz/index.php]

July 10 - July 12, 2005. The First Euro Conference on Mobile Government (The EURO, mGOV 2005) Sussex University, Brighton, The United Kingdom. [http://www.icmg.mgovernment.org/europeanmg.htm]

July 10-13, 2005. 9th World Multi-Conference on Systemics, Cybernetics and Informatics (http://www.iiisci.org/sci2005), which will take place in Orlando, Florida, USA. You can get the conferences Call for papers in
[http://www.iiisci.org/sci2005/website/callforpapers.asp]

July 11 - July 15, 2005. SIAM Annual Meeting New Orleans, LA, USA.
[http://www.siam.org/meetings/an05/index.htm]

July 11 - July 15, 2005. 17th Triennial Conference of the International Federation of Operational Research Societies 2005 Honolulu, Hawaii..
[http://www.informs.org/Conf/IFORS2005/]

July 11 - July 15, 2005. The 17th IMACS World Congress Paris, France. [http://imacs2005.ec-lille.fr/]

July 21 - July 26, 2005. CINC 2005 7th International Conference on Computational Intelligence and Natural Computing, 2005 Salt Lake City, UT, USA. [http://www.jcis.org/pages/subconference/cinc/cinc.aspx]

July 28 - July 31, 2005. INFORMS Annual Teaching of Management Science Workshop Lake Bluff, Illinois, USA.
[http://www.informs.org/Edu/TMSWorkshop/TMS05/index.htm]

August 22 - August 26, 2005. 6th Metaheuristics International Conference (MIC2005) Vienna, Austria. [http://www.mic2005.org/]

September 1-3, 2005. The Tenth International Conference on Rough Sets, Fuzzy Sets, Data Mining and Granular Computing RSFDGrC2005. University of Regina, Canada Website: www.cs.uregina.ca/~rsfdgrc. Email: rsfdgrc@uregina.ca

September 7 - September 9, 2005. Operations Research 2005 (OR 2005) International Conference on Operations Research Bremen, Germany. [http://www.or2005.uni-bremen.de]

October 26 - October 28, 2005. 7th International Conference on Artificial Evolution (EA'05) Lille, France; [http://www.lifl.fr/~jourdan/ea2005/]

November 13 - November 16, 2005. INFORMS Annual Meeting, New Orleans 2005 New Orleans, Louisiana, USA. [http://www.informs.org/Conf/NO2005/]

July 2 - July 5, 2006. EURO XXI, 21st European Conference on Operational Research 2006 Reykjavik, Iceland. [http://www.euro2006.org]

November 5 - November 8, 2006. INFORMS Annual Meeting 2006 Pittsburgh, PA, USA.

## Call for Papers

**Web site for Call for Papers:**
www.inescc.fe.uc.pt/~ewgmcda/CallforPapers.html

## Books

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### Multiobjective Optimization: Principles and Case Studies

**Yann Collette & Patrick Siarry**

From whatever domain they come, engineers are faced daily with optimization problems that require conflicting objectives to be met. This monograph systematically presents several multiobjective optimization methods accompanied by many analytical examples. Each method or definition is clarified, when possible, by an illustration. Multiobjective Optimization treats not only engineering problems, e.g in mechanics, but also problems arising in operations research and management. It explains how to choose the most suitable method to solve a given problem and uses three primary application examples: optimization of the numerical simulation of an industrial process; sizing of a telecommunication network; and decision-aid tools for the sorting of bids. This book is intended for engineering students, and those in applied mathematics, algorithmics, economics (operational research), production management, and computer scientists.

Keywords: Multicriteria, Multiobjective, Metaheuristics, Pareto domination, Decision aid

Contents: Introduction: Multiobjective Optimization and Domination.- Scalar Methods.- Interactive Methods.- Fuzzy Methods.- Methods which use a Metaheuristic.- Decision Aid Methods.- Performances Measurement.- Test Functions of Multiobjective Optimization Methods.- Attempt to Classify Multiobjective Optimization Methods.- Case Study No.1: Qualification of Scientific Software.- Case Study No.2: Study of the Extension of a Telecommunication Network.- Case Study No.3: Multicriteria Decision Tools to Deal with Bids.- Conclusion.- References.- Index.

SPRINGER
ISBN 3-540-40182-2. June 2004. Series: Decision Engineering. 1st ed. 2003. Corr 2nd printing, 2004, X. 293 p., 153 illus. Hardcover. Recommended Retail Price: EUR 69.95. http://www.springer.de/

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### Evolutionary Algorithms for Solving Multi-Objective Problems

**Coello Coello**, Carlos A., **Van Veldhuizen**, David A., **Lamont**, Gary B.

ABOUT THE BOOK: The solving of multi-objective problems (MOPs) has been a continuing effort by humans in many diverse areas, including computer science, engineering, economics, finance, industry, physics, chemistry, and ecology, among others. Many powerful and deterministic and stochastic techniques for solving these large dimensional optimization problems have risen out of operations research, decision science, engineering, computer science and other related disciplines. The explosion in computing power continues to arouse extraordinary interest in stochastic search algorithms that require high computational speed and very large memories. A generic stochastic approach is that of evolutionary algorithms (EA). Such algorithms have been demonstrated to be very powerful and generally applicable for solving different single objective problems. Their fundamental algorithmic structures can also be applied to solving many multi-objective problems. In this book, the various features of multi-objective evolutionary algorithms (MOEAs) are presented in an innovative and unique fashion, with detailed customized forms suggested for a variety of applications. Also, extensive MOEA discussion questions and possible research directions are presented at the end of each chapter. For additional information and supplementary teaching materials, please

visit the authors' website at http://www.cs.cinvestav.mx/~EVOCINV/bookinfo.html

Contents: List of Figures. List of Tables. Preface. Foreword. 1. Basic Concepts. 2. Evolutionary Algorithm MOP Approaches. 3. MOEA Test Suites. 4. MOEA Testing and Analysis. 5. MOEA Theory and Issues. 3. MOEA Theoretical Issues. 6. Applications. 7. MOEA Parallelization. 8. Multi-Criteria Decision Making. 9. Special Topics. 10. Epilog. Appendix A: MOEA Classification and Technique Analysis. Appendix B: MOPs in the Literature. Appendix C: Ptrue & PFtrue for Selected Numeric MOPs. Appendix D: Ptrue & PFtrue for Side-Constrained MOPs. Appendix E: MOEA Software Availability. Appendix F: MOEA-Related Information. Index. References.

Kluwer Academic Publishers. Series : Genetic Algorithms and Evolutionary Computation , Vol. 5. 2002, 610 p., Hardcover. ISBN: 0-306-46762-3

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## Multiple Criteria Decision Analysis: State of the Art Surveys

**Figueira, Jose; Greco, Salvatore; Ehrgott, Matthias (Eds.)**

About the Book: Multiple Criteria Decision Analysis: State of the Art Surveys provides survey articles and references of the seminal or state-of-the-art research on MCDA. The material covered ranges from the foundations of MCDA, over various MCDA methodologies (outranking methods, multiattribute utility and value theories, non-classical approaches) to multiobjective mathematical programming, MCDA applications, and software. This vast amount of material is organized in 8 parts, with a total of 24 chapters. More than 2000 references are listed.

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## Goal Programming Techniques for Bank Asset Liability Management

**Kyriaki Kosmidou, Constantin Zopounidis**

*Technical University of Crete*
*Department of Production Engineering and Management*
*Financial Engineering Laboratory*
*University Campus, Chania, Greece*

Contents: Preface. Chapter 1. Introduction. Chapter 2: Review of the asset liability management techniques. Chapter 3: Bank asset liability management methodology. Chapter 4: Application. Chapter 5: Conclusions and future perspectives, References, Subject Index.

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Abdelaziz, F. B., J. M. Martel and A. Mselmi. IMGD: an interactive method for multiobjective group decision aid. Journal of the Operational Research Society, vol. 55, no 5, 464-474, 2004.

Adán, M. and V. Novo. Proper Efficiency in Vector Optimization on Real Linear Spaces. . Journal of Optimization Theory and Applications, vol. 121, no 3, 515-540, 2004.

Agrell, Per J., Antonie Stam and Günther W. Fischer Interactive multiobjective agro-ecological land use planning: The Bungoma region in Kenya. European Journal of Operational Research, vol. 157, no 3, 194-217, 2004.

Ahsan, M.K. and J. Bartlema. Monitoring healthcare performance by analytic hierarchy process: a developing-country perspective International Transactions in Operational Research, vol. 11, no 4, 465-478, 2004.

Alberto, I. and P. M. Mateo. Representation and management of MOEA populations based on graphs. European Journal of Operational Research, vol. 159, no 1, 52-65, 2004.

Angilella, Silvia, Salvatore Greco, Fabio Lamantia and Benedetto Matarazzo. Assessing non-additive utility for multicriteria decision aid. European Journal of Operational Research, vol. 158, no 3, 734-744, 2004.

Arroyo, J. E. C. and V. A. Armentano. A partial enumeration heuristic for multi-objective flowshop scheduling problems. Journal of the Operational Research Society, vol. 55, no 9, 1000-1007, 2004.

Azaiez, M. N. and S. S. Al Sharif. A 0-1 goal programming model for nurse scheduling. Computers and Operations Research, vol. 32, no 3, 491-507, 2005.

Bichler, Martin and Jayant Kalagnanam. Configurable offers and winner determination in multi-attribute auctions. European Journal of Operational Research, vol. 160, no 2, 380-394, 2005.

Bollinger, Dominique and Jacques Pictet. Potential use of e -democracy in MCDA processes. Analysis on the basis of a Swiss case. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 65-76, 2003.

Brugha, C. M. Structure of multi-criteria decision-making. Journal of the Operational Research Society, vol. 55, no 11, 1156-1169, 2004.

Brugha, Cathal M. Phased multicriteria preference finding. European Journal of Operational Research, vol. 158, no 2, 308-316, 2004.

Caballero, Rafael, Emilio Cerdá, María del Mar Muñoz and Lourdes Rey. Stochastic approach versus multiobjective approach for obtaining efficient solutions in stochastic multiobjective programming problems. European Journal of Operational Research, vol. 158, no 3, 633-648, 2004.

Chen, Ling-Show and Ching-Hsue Cheng. Selecting IS personnel use fuzzy GDSS based on metric distance method. European Journal of Operational Research, vol. 160, no 3, 803-820, 2005.

Chen, Yan-Kwang and Hung-Chang Liao. Multi-criteria design of an $\overline{X}$ control chart. Computers and Industrial Engineering, vol. 46, no 4, 877-891, 2004.

Cochran, Jeffery K. and Hung-Nan Chen. Fuzzy multi-criteria selection of object-oriented simulation software for production system analysis. Computers and Operations Research, vol. 32, no 1, 153-168, 2005.

Collette, Y. and P. Siarry. Three new metrics to measure the convergence of metaheuristics towards the Pareto frontier and the aesthetic of a set of solutions in biobjective optimization. Computers and Operations Research, vol. 32, no 4, 773-792, 2005.

Daskalaki, S. and T. Birbas. Efficient solutions for a university timetabling problem through integer programming. European Journal of Operational Research, vol. 160, no 1, 106-120, 2005.

De Smet, Yves and Linett Montano Guzmán. Towards multicriteria clustering: An extension of the k-means algorithm. European Journal of Operational Research, vol. 158, no 2, , 390-398 2004.

Dias, Luis C. and João N. Clímaco. Dealing with imprecise information in group multicriteria decisions: a methodology and a GDSS architecture. European Journal of Operational Research, vol. 160, no 2, 291-307, 2005.

Doerner, Karl, Walter J. Gutjahr, Richard F. Hartl, Christine Strauss and Christian Stummer. Pareto Ant Colony Optimization: A Metaheuristic Approach to Multiobjective Portfolio Selection. Annals of Operations Research, Special Issue: Meta-Heuristics - Theory, Applications and Software(Guest Editors: Prof. Dr. Ulrich Derigs and Prof. Dr. Stefan Voß), vol. 131, 79-99, 2004.

Dombi, József and Ákos Zsiros Learning multicriteria classification models from examples: Decision rules in continuous space. European Journal of Operational Research, vol. 160, no 3, 663-675, 2005.

Doumpos, Michael and Constantin Zopounidis. A multicriteria classification approach based on pairwise comparisons. European Journal of Operational Research, vol. 158, no 2, 378-389, 2004.

Fan, Zhi-Ping, Guo-Fen Hu and Si-Han Xiao. A method for multiple attribute decision-making with the fuzzy preference relation on alternatives. Computers and Industrial Engineering, vol. 46, no 2, 321-327, 2004.

Fan, Zhi-Ping, Si-Han Xiao and Guo-Fen Hu. An optimization method for integrating two kinds of preference information in group decision-making. Computers and Industrial Engineering, vol. 46, no 2, 329-335, 2004.

Fernández, Francisco R., Miguel A. Hinojosa and Justo Puerto. Multi-criteria minimum cost spanning tree games. European Journal of Operational Research, vol. 158, no 2, 399-408, 2004.

French, Simon. The challenges in extending the MCDA paradigm to e-democracy. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 63-64, 2003.

Fu, Yan and Urmila M. Diwekar. An Efficient Sampling Approach to Multiobjective Optimization. Annals of Operations Research, vol. 132, 109-134, 2004.

Geldermann, Jutta and Otto Rentz. Environmental decisions and electronic democracy. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 77-92, 2003.

Gelman, Irit Askira. Addressing time-scale differences among decision-makers through model abstractions. European Journal of Operational Research, vol. 160, no 2, 325-335, 2005.

González-Pachón, Jacinto and Carlos Romero. A method for dealing with inconsistencies in pairwise comparisons. European Journal of Operational Research, vol. 158, no 2, 351-361, 2004.

Greco, Salvatore, Benedetto Matarazzo and Roman Sl owinski. Axiomatic characterization of a general utility function and its particular cases in terms of conjoint measurement and rough-set decision. European Journal of Operational Research, vol. 158, no 2, 271-292, 2004.

Grönlund, Åke. *e*-democracy: in search of tools and methods for effective participation. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 93-100, 2003.

Hämäläinen, Raimo P. Decisionarium - aiding decisions, negotiating and collecting opinions on the web. Journal of

Multi-Criteria Decision Analysis, vol. 12, no 2-3, 101-110, 2003.

Hinloopen, Edwin, Peter Nijkamp and Piet Rietveld. Integration of ordinal and cardinal information in multi-criteria ranking with imperfect compensation. European Journal of Operational Research, vol. 158, no 2, 317-338, 2004.

Hodgkin, Julie, Valerie Belton and Anastasia Koulouri. Supporting the intelligent MCDA user: A case study in multi-person multi-criteria decision support. European Journal of Operational Research, vol. 160, no 1, 172-189, 2005.

Horowitz, Ira. Aggregating Expert Ratings Using Preference-Neutral Weights: The Case of the College Football Polls. Interfaces, vol. 34, no 4, 314-320, 2004.

Hwang, Heung-Suk. Web-based multi-attribute analysis model for engineering project evaluation. Computers and Industrial Engineering, vol. 46, no 4, 669-678, 2004.

Ida, Masaaki. Efficient solution generation for multiple objective linear programming based on extreme ray generation method. European Journal of Operational Research, vol. 160, no 1, 242-251, 2005.

Insua, David Rios, Julio Holgado and Raul Moreno. Multicriteria e-negotiation systems for e-democracy. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 213-218, 2003.

Jaszkiewicz, Andrzej. A Comparative Study of Multiple-Objective Metaheuristics on the Bi-Objective Set Covering Problem and the Pareto Memetic Algorithm. Annals of Operations Research, Special Issue: Meta-Heuristics - Theory, Applications and Software(Guest Editors: Prof. Dr. Ulrich Derigs and Prof. Dr. Stefan Voß), vol. 131, 135-158, 2004.

Jaszkiewicz, Andrzej. On the computational efficiency of multiple objective metaheuristics. The knapsack problem case study. European Journal of Operational Research, vol. 158, no 2, 418-433, 2004.

Junker, Ulrich. Preference-Based Search and Multi-Criteria Optimization. Annals of Operations Research, Special Issue: Hybrid Optimization Techniques (Editors: Narendra Jussien and François Laburthe), vol 130, 75-115, 2004.

Kaliszewski, Ignacy. Out of the mist—towards decision-maker-friendly multiple criteria decision making support. European Journal of Operational Research, vol. 158, no 2, 293-307, 2004.

Kárný, Miroslav and Jan Kracík. A normative probabilistic design of a fair government decision strategy. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 111-125, 2003.

Karsak, E. Ertugrul. Fuzzy multiple objective programming framework to prioritize design requirements in quality function deployment. Computers and Industrial Engineering, vol. 47, no 2-3, 149-163, 2004.

Kengpol, Athakorn. Design of a decision support system to evaluate the investment in a new distribution centre. International Journal of Production Economics, vol. 90, no 1, 59-70, 2004.

Kersten, Gregory E. *e*-democracy and participatory decision processes: lessons from *e*-negotiation. experiments. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 127-143, 2003.

Kostreva, M. M. and X. Q. Yang. Unified approaches for solvable and unsolvable linear complementarity problems. European Journal of Operational Research, vol. 158, no 2, 409-417, 2004.

Kostreva, Michael M., Wodzimierz Ogryczak and Adam Wierzbicki. Equitable aggregations and multiple criteria analysis. European Journal of Operational Research, vol. 158, no 2, 362-377, 2004.

Leskinen, Pekka, Annika S. Kangas and Jyrki Kangas. Rank-based modelling of preferences in multi-criteria decision making. European Journal of Operational Research, vol. 158, no 3, 721-733, 2004.

Levin, Asaf. Strongly polynomial-time approximation for a class of bicriteria problems. Operations Research Letters, vol. 32, no 6, 530-534, 2004.

Li, Dengfeng and Chuntian Cheng. Stability on multiobjective dynamic programming problems with fuzzy parameters in the objective functions and in the constraints. European Journal of Operational Research, vol. 158, no 3, 678-696, 2004.

Lins, M. P. Estellita, L. Angulo-Meza and A. C. Moreira da Silva. A multi-objective approach to determine alternative targets in data envelopment analysis. Journal of the Operational Research Society, vol. 55, no 10, 1090-1101, 2004.

Liu, Dingfei and Theodor J. Stewart. Integrated object-oriented framework for MCDM and DSS modelling. Decision Support Systems, vol. 38, no 3, 421-434, 2004.

Lotov, Alexander V. Internet tools for supporting of lay stakeholders in the framework of the democratic paradigm of environmental decision making. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 145-162, 2003.

Loukil, T., J. Teghem and D. Tuyttens. Solving multi-objective production scheduling problems using metaheuristics. European Journal of Operational Research, vol. 161, no 1, 42-61, 2005.

Maeda, T. Second-Order Conditions for Efficiency in Nonsmooth Multiobjective Optimization Problems. Journal of Optimization Theory and Applications, vol. 122, no 3, 521-538, 2004.

Marichal, Jean-Luc, Patrick Meyer and Marc Roubens. Sorting multi-attribute alternatives: The TOMASO

method. Computers and Operations Research, vol. 32, no 4, 861-877, 2005.

Mateos, Alfonso, Antonio Jiménez and Sixto Ríos-Insua. Modelling individual and global comparisons for multi-attribute preferences. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 177-190, 2003.

Mishra, S. K., S. Y. Wang and K. K. Lai. Nondifferentiable multiobjective programming under generalized d-univexity. European Journal of Operational Research, vol. 160, no 1, 218-226, 2005.

Moreno-Jiménez, José María and Wolfgang Polasek. *e*-democracy and knowledge. A multicriteria framework for the new democratic era. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 163-176, 2003.

Munda, Giuseppe. Social multi-criteria evaluation: Methodological foundations and operational consequences. European Journal of Operational Research, vol. 158, no 3, 662-677, 2004.

Niculae, Carmen and Simon French. Bringing understanding in societal decision making: explaining and communicating analyses? Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 191-202, 2003.

Nowak, Maciej. Preference and veto thresholds in multicriteria analysis based on stochastic dominance. European Journal of Operational Research, vol. 158, no 2, 339-350, 2004.

Ogryczak, W. and Rudolf Vetschera. Methodological foundations of multi-criteria decision making European Journal of Operational Research, vol. 158, no 2, 267-270, 2004.

Omero, Marta, Lorenzo D'Ambrosio, Raffaele Pesenti and Walter Ukovich. Multiple-attribute decision support system based on fuzzy logic for performance assessment. European Journal of Operational Research, vol. 160, no 3, 710-725, 2005.

Ozdemir, Mujgan S. and Rafail N. Gasimov. The analytic hierarchy process and multiobjective 0–1 faculty course assignment. European Journal of Operational Research, vol. 157, no 2, 398-408, 2004.

Papamichail, K. N. and I. Robertson. Supporting societal decision making: a process perspective. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 203-212, 2003.

Phelps, Selcen (Pamuk) and Murat Köksalan. An Interactive Evolutionary Metaheuristic for Multiobjective Combinatorial Optimization. Management Science, vol. 49, no 12, 1726-1738,2003.

Piunovskiy, A. B. Multicriteria impulsive control of jump Markov processes. Mathematical Methods of Operations Research, vol. 60, no 1, 125-144, 2004.

Raciti, F. Bicriterion Weight Varying Spatial Price Networks. . Journal of Optimization Theory and Applications, vol. 122, no 2, 387-403, 2004.

Riera-Ledesma, Jorge and Juan José Salazar-González. The biobjective travelling purchaser problem. European Journal of Operational Research, vol. 160, no 3, 599-613, 2005.

Rosqvist, Tony. Stakeholder compensation model based on decision analysis. Journal of Multi-Criteria Decision Analysis, vol. 12, no 2-3, 219-223, 2003.

Ruiz-Torres, Alex J. and Francisco J. López. Using the FDH formulation of DEA to evaluate a multi-criteria problem in parallel machine scheduling. Computers and Industrial Engineering, vol. 47, no 2-3, 107-121, 2004.

Sakawa, Masatoshi, Kosuke Kato and Hideki Katagiri. An interactive fuzzy satisficing method for multiobjective linear programming problems with random variable coefficients through a probability maximization model. Fuzzy Sets and Systems, vol. 146, no 2, 205-220, 2004.

San Pedro, Jocelyn, Frada Burstein and Alan Sharp. A case-based fuzzy multicriteria decision support model for tropical cyclone forecasting. European Journal of Operational Research, vol. 160, no 2, 308-324, 2005.

Stewart, Theodor J., Ron Janssen and Marjan van Herwijnen. A genetic algorithm approach to multiobjective land use planning. Computers and Operations Research, vol. 31, no 14, 2293-2313, 2004.

Sugihara, Kazutomi, Hiroaki Ishii and Hideo Tanaka Interval priorities in AHP by interval regression analysis. European Journal of Operational Research, vol. 158, no 3, 745-754, 2004.

Sundarraj, R. P.. A Web-based AHP approach to standardize the process of managing service-contracts. Decision Support Systems, vol. 37, no 3, 343-365, 2004.

Sylva, John and Alejandro Crema. A method for finding the set of non-dominated vectors for multiple objective integer linear programs. European Journal of Operational Research, vol. 157, no 3, 46-55, 2004.

Tangian, Andranik. A model for ordinally constructing additive objective functions. European Journal of Operational Research, vol. 159, no 2, 476-512, 2004.

Toktas, Berkin , Meral Azizolu and Suna Kondakcı Köksalan Two-machine flow shop scheduling with two criteria: Maximum earliness and makespan. European Journal of Operational Research, vol. 157, no 2, 286-295, 2004.

Wang, Ge, Samuel H. Huang and John P. Dismukes. Product-driven supply chain selection using integrated multi-criteria decision-making methodology International. Journal of Production Economics, vol. 91, no 1, 1-15, 2004.

Wang, Yiqiang, Richard C.M. Yam and Ming J. Zuo. A multi-criterion evaluation approach to selection of the best statistical distribution. Computers and Industrial Engineering, vol. 47, no 2-3, 165-180, 2004.

Wu, H. C. A Solution Concept for Fuzzy Multiobjective Programming Problems Based on Convex Cones. Journal of Optimization Theory and Applications, vol. 121, no 2, 397-417, 2004.

Xu, Wei-Xuan and Yi-Ming Wei. Multiple objective-integrated methodology of global optimum decision-making on mineral resources exploitation. Computers and Industrial Engineering, vol. 46, no 2, 363-372, 2004.

Yeh, Wei-Chang and Ali Allahverdi. A branch-and-bound algorithm for the three-machine flowshop scheduling problem with bicriteria of makespan andtotal flowtime. International Transactions in Operational Research, vol. 11, no 3, 323-339, 2004.

Yun, Y. B., H. Nakayama and M. Arakawa. Multiple criteria decision making with generalized DEA and an aspiration level method. European Journal of Operational Research, vol. 158, no 3, 697-706, 2004.

Zaras, Kazimierz. Rough approximation of a preference relation by a multi-attribute dominance for deterministic, stochastic and fuzzy decision problems. European Journal of Operational Research, vol. 159, no 1, 196-206, 2004.

Zhang, Cai Wen and Hoon Liong Ong. Solving the biobjective zero–one knapsack problem by an efficient LP-based heuristic. European Journal of Operational Research, vol. 159, no 3, 545-557, 2004.

Zhang, Quan, Jason C. H. Chen and P. Pete Chong. Decision consolidation: criteria weight determination using multiple preference formats. Decision Support Systems, vol. 38, no 2, 247-258, 2004.

## Séminaires du LAMSADE

“MODÉLISATION DES PRÉFÉRENCES ET AIDE MULTICRITÈRE À LA DÉCISION”

Responsables: Bernard ROY et
Daniel VANDERPOOTEN
(le mardi, de 14:00 à 17:00, en salle P510)

| | |
|---|---|
| **9 nov 2004** | Discussion des travaux de Salem Chakhar (LAMSADE) : Aide multicritère à la décision spatio-temporelle : Application aux problèmes d'aménagement des infrastructures linéaires. |
| **30 nov 2004** | Conférence de Marc Pirlot (Faculté Polytechnique de Mons, Belgique) : Mesurage conjoint et axiomatique de la concordance. |
| **14 déc 2004** | Conférence de Alexis Tsoukiàs (LAMSADE) : De la théorie de la décision à l'aide à la decision. |
| **11 janv 2005** | Discussion des travaux de Hassene Aissi (LAMSADE) : Elaboration de conclusions robustes pour les problèmes d'association de données. |

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# Dissertations

JOSEFOWIEZ, Nicolas. « Modélisation et résolution approchée de problèmes de tournées multi-objectif ». Thèse de Doctorat. LIFL, Université de Lille I. Soutenance : décembre 2004. Jury : José Figueira (Université de Coimbra, Portugal) ; Christian Prins (Université de Troyes, France) ; Max Dauchet (Université de Lille, France) ; El-Ghazali Talbi (Université de Lille, France) ; Frédéric Semet (Université de Valenciennes, France) ; Xavier Gandibleux, Universite de Nantes, France

RESUME : Les problèmes de tournées forment une des grandes familles de problèmes de la recherche opérationnelle. En effet, ils ont non seulement un intérêt académique mais possèdent aussi de nombreuses applications pratiques notamment en logistique et en distribution. Il existe de nombreux problèmes dans cette famille, mais dans ces travaux nous nous intéressons à la définition de problèmes de tournées multi-objectif ainsi qu'à leur résolution par des méthodes qui prennent en compte l'aspect multi-objectif.

L'état de l'art effectué dans le cadre de cette thèse montre que si le nombre de travaux portant sur les problèmes de tournées multi-objectif est encore faible, la plupart des études sont récentes. Il apparaît alors que l'optimisation multi-objectif est utilisée dans trois buts. Le premier but concerne la modélisation de cas réels pour lesquels plusieurs objectifs sont définis par le décideur. La seconde utilisation de l'optimisation multi-objectif a pour but d'étendre des problèmes classiques en leur ajoutant de nouveaux objectifs sans pour autant délaisser l'objectif traditionnel. Enfin, l'optimisation multi-objectif a aussi pour but de généraliser des problèmes en remplaçant certains paramètres et les contraintes associées par des objectifs supplémentaires.

Les deux problèmes bi-objectif étudiés dans cette thèse illustrent ces différentes approches. Ainsi, le problème d'élaboration de tournées de véhicules avec équilibrage des tournées est une extension du problème d'élaboration de tournées de véhicules avec contrainte de capacité. Dans le problème bi-objectif, on cherche à générer des ensembles de tournées qui soient toutes de longueur équivalente sans pour autant abandonner l'objectif classique de minimisation de la longueur totale parcourue. Le second problème, le problème de la tournée couvrante bi-objectif, est une généralisation du problème de la tournée couvrante. La généralisation consiste en la suppression d'un paramètre lié à la couverture et à son remplacement par un second objectif. Nous avons aussi

étudié le problème de la tournée couvrante bi-objectif dans le cadre de la gestion d'une unité de soins mobile au Ghana.

Pour résoudre ces problèmes, nous avons utilisé une approche coopérative en deux phases. La première phase cherche à générer une première approximation qui soit de bonne qualité du point de vue de la diversification. Elle est effectuée par des algorithmes génétiques multi-objectif. Dans ce cadre, nous avons défini un nouveau mécanisme favorisant la diversité des solutions : la diversification élitiste. Nous avons aussi exploré l'utilisation du parallélisme au travers de la définition de modèles en îles. La seconde phase cherche à améliorer les résultats obtenus lors de la première phase du point de vue de la diversification. Pour cela, nous avons défini plusieurs stratégies dont le rôle est de guider des méthodes de voisinage dans le cadre multi-objectif. De plus, pour la résolution du problème de la tournée couvrante, nous avons aussi défini des schémas de coopération où la seconde phase est réalisée par un algorithme de séparations et coupes pour le problème de la tournée couvrante. Les différents mécanismes proposés ont été implémentés dans le cadre de méthodes pour la résolution des deux problèmes et leur intérêt a été évalué sur des jeux de données. D'autre part, pour le problème de la tournée couvrante bi-objectif, les ensembles de solutions optimaux étaient connus grâce à une méthode exacte que nous avons définie en utilisant un algorithme de séparations et coupes pour le problème de la tournée couvrante au sein d'une méthode e-contrainte.

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**Announcement:**

The "Useful links" section of the group's homepage

(http://www.inescc.pt/~ewgmcda)

is being enlarged. Contributions of URL links to societies, research groups and other links of interest are welcome.

A membership directory of the European Working Group on "Multiple Criteria Decision Aiding" is available at the same site. If you would like to be listed in this directory please send us your data (see examples already in the directory).

Contact: José Figueira (figueira@fe.uc.pt) and Luís Dias (ldias@inescc.pt)

## Web site for the EURO Working Group "Multiple Criteria Decisions Aiding"

A World Wide Web site for the EURO Working Group on "Multicriteria Aid for Decisions" is already available at the URL:

http://www.inescc.pt/~ewgmcda

This WWW site is aimed not just at making available the most relevant information contained in the Newsletter sections, but it also intends to become an online discussion forum, where other information and opinion articles could appear in order to create a more lively atmosphere within the group.

All information as well as links to other Web sites of interest can be sent to Luís Dias by the e-mail:

ldias@inescc.pt

**Groupe de Travail Européen "Aide Multicritère à la Décision" /**
**European Working Group "Multiple Criteria Decision Aiding"**

*President of the EURO Working Group:*
Bernard Roy

*Newsletter editor:*
José Figueira

*Permanent Collaborators:*
Maria João Alves, Carlos Henggeler Antunes, João Clímaco, Luís Dias

*Contributions should be sent to:*
José Figueira (Room 317)
School of Economics, Univ. Coimbra, Av. Dias da Silva, 165
3004-512 Coimbra, PORTUGAL
E-mail: figueira@fe.uc.pt

*or by fax to:*
+351 239 403511

*or by electronic mail to*:
ewg-mcda.newsletter@inescc.pt

*URL:*
http://www.inescc.pt/~ewgmcda

This newsletter is published twice a year by the "E-WG on MCDA", in November/December and April/May , with financial support of the Association of European Operational Research Societies, and the logistics support of INESC-Coimbra and the Faculty of Economics of the University of Coimbra. Reproduction and distribution guaranteed by B. Roy LAMSADE, Université Paris-Dauphine, Place du Maréchal De Lattre de Tassigny, F-75775 Paris Cedex 16.


To the members of the
Operational Research
Societies within EURO

Brussels, 2/7/2004

Dear colleague

As you may be aware, since 2001, EURO has decided to invest in the promotion of Operational Research in Africa, trying to organise, support and improve the presence of our discipline in this continent so near to us and so far at the same time. When we began our efforts towards the promotion of OR in Africa, there was only one OR society in the continent, namely the well-established and efficiently run Operations Research Society of South Africa. To date, five more OR societies have been established including one in Algeria, in East Africa (federating Kenya, Tanzania and Uganda), in Morocco, in Tunisia, and in West and Central Africa (federating Benin, Burkina Faso, Cameroon, Congo (both), Mali, Niger, Nigeria, Senegal, Tchad and Togo). A number of conferences and workshops have also been held / or scheduled to take place in the near future, with an increasing participation and impact to the local societies. Our small investment has yielded great results and we are proud of our colleagues in Africa who have been able to do so much with so little.
You can see more at http://www.euro-online.org/africanOR.

However, today we NEED you. The EURO's AFRICA project has opened the way to an institutional presence of our discipline over the continent, but the real

Alexis Tsoukiàs, CNRS-LAMSADE, Université Paris Dauphine, 75775 Paris Cedex 16, France
Tel : +33 1 44054401, fax : +33 1 44054091, e-mail : tsoukias@lamsade.dauphine.fr ,
URL: http://www.lamsade.dauphine.fr/~tsoukias

problem for our colleagues is the dramatic need for resources for the purpose of studying, training and doing research. Our discipline is a key subject for the development of the whole continent, as it has been the case in other parts of the world. The establishment of the NEPAD (see http://www.nepad.org) explicitly calls for contributing towards a new era for the African continent and Operational Research can play a leading role in this direction as explicitly mentioned in their documents. However, there is a striking difference between the expectations and the everyday reality. This is why our colleagues in Africa and EURO need you. What can you do? What will you do?

EURO, in collaboration with IFORS, has established the African OR fund (see http://www.euro-online.org/africanOR). We collect donations of money, books, journals' collections, training support materials etc. We have a bank account (IBAN: CH78 0026 0260 GS10 5363 3) and an address: africa@euro-online.org. Any contribution is welcome. A 500€ out of your very recent research program is perhaps a marginal expense, but it can make the difference in Africa where a whole year's tuition fee, including accommodation, for a Masters student in OR costs 2000€.

You can see more on the African OR initiative, and more specifically, on the African OR fund at our web site. If you have any questions please do not hesitate to contact me at the address africa@euro-online.org.

Thanking you for your attention.

Yours sincerely,

Alexis Tsoukiàs
President Elect of EURO

Alexis Tsoukiàs, CNRS-LAMSADE, Université Paris Dauphine, 75775 Paris Cedex 16, France
Tel : +33 1 44054401, fax : +33 1 44054091, e-mail : tsoukias@lamsade.dauphine.fr ,
URL: http://www.lamsade.dauphine.fr/~tsoukias

# ANNALS OF OPERATIONS RESEARCH

## Volume on "Managerial Decisions with Multiple Criteria"

***Guest Editors:***

Prof. Constantin Zopounidis, Dr. Michael Doumpos

*Technical University of Crete, Dept. of Production Engineering and Management*
*Financial Engineering Laboratory, University Campus, 73100 Chania, Greece*

The rapid advances in the technological and business environment have complicated the nature of the managerial decision making process. The complexity of real-world managerial decision making problems, constitutes a major challenge and motivation for any operations research (OR) researcher/practitioner. Addressing this complexity often requires the development of new methodologies, thus motivating new theoretical developments. Furthermore, the application and testing of OR models in complex managerial decision problems, helps in gaining insight to the models themselves which is necessary for their successful implementation and further improvement.

Traditionally, OR models have been based on profit (cost) maximization (minimization) criteria. However, such an approach is often not really applicable for addressing the increasing complexity of managerial decision making problems, because other factors have also evolved as highly relevant. Typical examples include environmental criteria, socio-economic impacts, technological factors, quality and customer satisfaction issues, etc. Within this context it is clearly necessary to extend the traditional OR optimization principles to a multidimensional case.

Multiple criteria decision aid (MCDA) has evolved over the past decades as a significant field of OR dealing with such kind of problems. Both the theory and practice of MCDA have evolved significantly focusing on issues such as: (1) the resolution of the conflicting nature of the criteria, (2) the modeling of the decision makers' preferences, (3) the identification of compromise solutions, the analysis of the consequences of multicriteria solutions, and (4) the development of decision making models.

Given the existing outgrowth of the MCDA research, the objective of this volume is to highlight the contributions of this field in managerial decision making. This will enable the analysis of the applicability of the recent theoretical advances made in MCDA, as well as the development and implementation of new MCDA tools and methodologies required to address the complexity of the managerial decision making process. Typical managerial decision making fields that are of interest include among others: (1) Financial and accounting decisions, (2) Marketing decisions, (3) Organizational aspects and performance analysis, (4) Public management, (5) Production management and planning, (6) Human resources management.

Issues that are of major interest in addressing such problems include the resolution of the conflicting nature of the criteria, the analysis and modeling of the decision makers' preferences, the representation and incorporation of the decision makers' experience into decision models, the development of knowledge and value systems, as well as the structuring and supporting of the decision process. MCDA provides an arsenal of methodological tools which are applicable within this context, such as multiobjective mathematical programming, multiattribute utility theory, outranking relations, preference disaggregation analysis.

Within this framework, submitted papers might describe new methodological developments, experimental results, development of decision support systems or real-world case studies in the aforementioned managerial decision making fields, but should seek to present innovative work and results, explore themes of interest to managerial decision making, and demonstrate academic and theoretical rigor.

All papers will undergo through a vigorous reviewing process. The submitted papers should follow the Journal's typewriting instructions and must include original, unpublished research which is not submitted for publication elsewhere. Manuscripts should be submitted **in four copies by December 31st, 2004** to Prof. Constantin Zopounidis, Guest Editor. For any additional information, please contact the Guest Editor at:

Professor Constantin Zopounidis
Technical University of Crete
Financial Engineering Laboratory
University Campus, 73100, Chania, Greece
E-mail: kostas@dpem.tuc.gr

# *Omega Journal*

# *Special Issue on*

# *"Multiple Criteria Decision Making for Engineering"*

## *Guest Editors:*

Margaret M. Wiecek, Clemson University
Matthias Ehrgott, The University of Auckland
Georges Fadel, Clemson University
José Figueira, The University of Coimbra

## *Call for Pappers*

Rapid technological and economic growth over the last fifty years has changed human lives and made modern society face complex decision making problems. In the present world, people have to deal with urbanization and industrialization, increase of water and energy demands, environmental pollution, shortage of natural resources and food, and many other challenges. These problems necessitate the development of a multidisciplinary approach for analyzing diverse mechanisms and consequences of modern civilization. Multiple criteria decision making (MCDM), as a subfield of systems engineering and science, has become a modeling and methodological tool for dealing with complex engineering problems. The development of MCDM models and methods has been motivated not only by a variety of real-life problems requiring the consideration of multiple criteria, but also by the scientists' and engineers' desire to propose enhanced decision making techniques using recent advancements in mathematical optimization, scientific computing, and computer technology.

This special issue will bring together scientists and engineers working in the area of MCDM and will address the impact that the MCDM paradigm makes on science and engineering. We welcome articles presenting real-life applications and case studies that will report on new methods developed for and within engineering disciplines including mechanical engineering, electrical engineering, environmental engineering, chemical engineering, civil engineering, industrial engineering, bioengineering and others. We encourage submissions not only by engineers applying MCDM within their disciplines but also by researchers from other academic areas who are eager to demonstrate potential of MCDM for use in engineering. Although the proposed techniques may use advanced mathematical models or procedures, the papers will target readers without rigorous background in engineering mathematics and will emphasize the applicability and relevance of those methods rather than their derivation and origination.

Topics include but are not limited to:

- Applications of MCDM in the areas of energy and environment, transportation, production and materials, communication, and sustainability
- Web-based applications
- Managing performance and affordability
- Managing risk and uncertainty
- MCDM with multiple scenarios
- MCDM with black-box functions
- Modeling preferences
- Imperfect knowledge: sensitivity and robustness analysis
- Complexity issues

## *Submission Information*

Manuscripts should be electronically submitted directly to the guest editors (acknowledgement will be sent upon receipt).
Margaret M. Wiecek, **wmalgor@clemson.edu**
Matthias Ehrgott, **m.ehrgott@auckland.ac.nz**
Georges Fadel, **fgeorge@clemson.edu**
José Figueira, **figueira@fe.uc.pt**

Submit one copy in pdf format with author names, affiliation and contact information. Submitted papers should not have been previously published nor be currently under consideration for publication elsewhere. Refereeing and the selection of papers for publication will be carried out according to the standards of OMEGA-The International Journal of Management Science. Authors should consult the instructions for authors section at: **http://www.omegajournal.org/authors.html**.

The submission deadline is January 31, 2005.
The special issue is scheduled for publication early in 2006.

FIRST CALL FOR PAPERS

**The Tenth International Conference on Rough Sets, Fuzzy Sets, Data Mining, and Granular Computing (RSFDGrC 2005), September 1-3, 2005, Regina, Canada.**

http://rsfdgrc.cs.uregina.ca/

Introduction

Rough set theory, proposed by Zdzislaw Pawlak in 1982, is a model of approximate reasoning. The main idea is based on the indiscernibility relation that describes indistinguishability of objects. Concepts are represented by lower and upper approximations. In applications, rough set methodology focuses on approximate representation of knowledge derivable from data. It leads to significant results in many areas including, for example, data mining, machine learning, finance, industry, multimedia, medicine, and most recently bioinformatics.

Conference History

RSFDGrC 2005 is a continuation of international conferences and workshops devoted to the subject of rough sets, held alternatively in Canada, China, Japan, Poland, Sweden, and the USA. RSFDGrC achieved the status of bi-annual international conference, starting from the year of 2003, in Chongqing, China.

Aim and Scope

RSFDGrC 2005 encompasses rough sets and fuzzy sets, granular computing, as well as knowledge discovery and data mining. We also welcome submissions addressing the connections of the main conference scopes to the following areas:

- Approximate reasoning and reasoning under uncertainty
- Computational intelligence and machine intelligence
- Decision support systems and expert systems
- Evolutionary computing and adaptive systems
- Human-computer interaction and multimedia
- Information retrieval and data warehouses
- Intelligent agent and web technologies
- Knowledge representation and visualization
- Layered learning and hierarchical learning
- Machine learning and statistical analysis
- Monitoring, security, and rescue techniques
- Multi-agent systems and distributed systems
- Multi-criteria and group decision-making
- Non-standard logics and relational systems
- Pattern recognition and image processing
- Petri nets and concurrency
- Signal processing and speech recognition
- Spatial reasoning and temporal reasoning

We plan special sessions on applications to bioinformatics, medicine, industry, and environmental problems. We welcome any other proposals for special sessions as well.

Chairs and Committees To be announced later

Honorary Chairs: Zdzislaw Pawlak (Poland), Lotfi A. Zadeh (USA)

Conference Chairs: Wojciech Ziarko (Canada), Yiyu Yao (Canada),Xiaohua (Tony) Hu (USA)

Program Chair: Dominik Slezak (Canada)

Program Co-Chairs: Ivo Duentsch (Canada), James F. Peters (Canada),Guoyin Wang (China)

Advisory Board:

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Bo Zhang (China),
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Program Committee: To be announced later
Workshop Chair: JingTao Yao (Canada)
Tutorial Chair: Marcin Szczuka (Poland)
Publicity Chair: Cory Butz (Canada)
Local Organizing Chair: Brien Maguire (Canada)
Conference Secretary: Lois Adams (Canada)

## Publication

All accepted papers will be published in the conference proceedings by Springer-Verlag in the series of Lecture Notes in Computer Science / Lecture Notes in Artificial Intelligence (LNCS/LNAI).

A selected number of accepted papers will be expanded and additionally revised for inclusion in the journal Transactions on Rough Sets (Springer-Verlag, LNCS journal subline). Depending on the number of high quality papers, possibilities of preparing special issues in other journals are open.

## Paper Submission

Both research and application papers are solicited. All submitted papers will be reviewed on the basis of technical quality, relevance, significance, and clarity. Please send a PDF version of your paper and an ASCII version of the cover page by February 14, 2005, using email address rsfdgrc@cs.uregina.ca or the conference website http://rsfdgrc.cs.uregina.ca/.

The ASCII version of a cover page must include author(s) full address, e-mail, paper title and a 200 word abstract, and up to five (5) keywords. Your draft paper should have no more than ten (10) pages in the LNCS style, including all figures, tables, and references. Please read the Information for Authors and use the style files for Proceedings and Other Multi-Author Volumes supplied by Springer-Verlag regarding LNCS.

## Tutorials and Workshops

On August 31, 2005, we plan student poster sessions, as well as lectures by representatives of the local research centres. We also welcome proposals for tutorials and workshops. All the materials concerning the August 31 activities will be attached to the main conference proceedings on CDs.

## Registration

It is intended that the early full registration will not exceed $450 CAD. The late full registration will equal to the early one + $100 CAD. The student early/late registration will equal to 50% ($225 CAD / $275 CAD) of the full early/late registration.

The early registration is required to print the paper(s) in the Springer-Verlag proceedings. The late registration entitles to including the paper(s) in the CD materials, but not in the Springer-Verlag proceedings.

One registration entitles to include two papers in the conference materials. Every additional paper can be included on the extra cost of 50% of the early registration fee.

Please note that the registration forms are needed earlier to prepare the invoices for appropriate registration fees. This is outlined in the "Important Dates" section.

Trip to Moose Jaw

After the conference, on September 3-4, we will organize an optional trip to Moose Jaw - the city with a famous mineral spa, underground tunnels, and the Western Development Museum. Details will depend on a number of interested participants.

Important Dates:

| | |
|---|---|
| Full paper submission by | February 13, 2005 |
| Acceptance notices | April 3, 2005 |
| Camera-ready papers and early registration forms by | May 1, 2005 |
| Copyright forms and early Registration fee due by | May 16, 2005 |
| Late registration forms due by | July 17, 2005 |
| Late registration fee due by | August 1,2005 |
| Tutorials and workshops | August 31,2005 |
| Conference | September 1-3,2005 |
| Trip to Moose Jaw | September 3-4,2005 |