



## Opinion Makers Section

**Discours sur l'agrégation des préférences prononcé par Ph. VINCKE à l'Université Paris-Dauphine, le 12 mai 2009, à l'occasion de sa nomination comme Docteur Honoris Causa de cette université.**

Mesdames, Messieurs, Chers Collègues,

Intuitivement, l'agrégation des préférences est présente dans toute activité humaine qui implique une prise de décision.

- Un individu qui doit choisir un plat dans un restaurant va devoir gérer ses propres préférences sur les différents éléments qui interviennent dans sa décision : viande ou poisson, léger ou consistant, quel accompagnement, quel prix,...sa décision finale résultera de la synthèse, de l'agrégation de toute une série de petits choix, de toute une série de petites comparaisons basées sur ses préférences.
- Un conseil d'administration qui doit choisir une politique d'investissement aura pour tâche d'agréger les préférences de ses membres, préférences qui peuvent être contradictoires, en opposition les unes avec les autres, ambiguës, incertaines, variables dans le temps...

Je crois donc pouvoir affirmer que l'agrégation des préférences est présente, parfois sous des dénominations différentes et souvent implicitement, dans les activités qui relèvent de l'économie ou de la finance (les domaines des deux collègues avec qui j'ai le plaisir de partager l'honneur qui nous est fait aujourd'hui), mais aussi de la psychologie, de la sociologie, des sciences politiques, de la gestion, de la recherche opérationnelle et de l'aide à la décision, qui a été mon domaine d'activités.

Il est sans doute important de faire remarquer que l'expression "agrégation des préférences" n'est pas nécessairement utilisée telle quelle par les économistes, les financiers, les psychologues, les sociologues ou les gestionnaires. Beaucoup d'entre eux font, je crois, de l'agrégation de préférences implicite, comme M. Jourdain faisait de la prose. Néanmoins, si vous voulez développer un outil d'aide à la décision, vous devez obligatoirement prendre en compte cette dimension d'agrégation des préférences.

Il est important également de définir précisément les mots qu'on utilise pour éviter les discours trop vagues ou les malentendus, surtout si ces mots sont utilisés dans des domaines de la connaissance très différents et qui communiquent relativement peu entre eux.

Je suis persuadé que s'il y a dans cette salle des économistes, des financiers, des psychologues, des sociologues, des gestionnaires et des chercheurs opérationnels, tous donnent au mot "préférence", et à l'expression "agrégation des préférences", des contenus opérationnels différents par rapport à leurs disciplines respectives.

Je vais donc essayer de vous expliquer, en 10 minutes, ce que "préférence" et "agrégation des préférences" signifient dans mon domaine de recherche, quelles questions on se pose sur ces concepts, quels résultats et quels outils on en déduit et en quoi ces recherches peuvent intéresser les économistes, les financiers, les psychologues, les sociologues et les gestionnaires. Bien entendu, vu sa durée, mon exposé sera nécessairement superficiel et je vous prie de m'en excuser.

Etant donné deux objets ou deux décisions possibles A et B, nous considérons généralement que leur comparaison peut conduire à trois situations de base :

- Préférence (de A sur B ou de B sur A),
- Indifférence entre A et B,
- Incomparabilité de A avec B.

L'avis d'un individu sur un ensemble de décisions possibles se traduit donc par trois relations binaires dans l'ensemble des décisions possibles : une relation de préférence, une relation d'indifférence et une relation d'incomparabilité,

auxquelles on attribue des propriétés minimalement réalistes comme par exemple le fait que l'indifférence est une relation symétrique et la préférence une relation asymétrique.

Bien entendu, des modèles plus sophistiqués sont également envisagés pour traduire, par exemple

- le fait que, dans certains cas, l'individu peut hésiter entre indifférence et préférence,
- le fait qu'une préférence peut être plus ou moins forte (degré de préférence),
- le fait que l'on peut comparer des écarts de préférence,
- le fait que l'on veut représenter une préférence collective qui est le résultat d'un sondage (A est préféré à B pour 60 % des personnes interrogées).

Très vite se pose alors la question de la représentation de ces préférences au moyen d'outils les plus maniables possibles.

Ainsi, si l'ensemble des objets ou des décisions que l'on compare est fini et pas trop grand, on peut représenter une relation de préférence par un graphe et utiliser les concepts et les algorithmes de la théorie des graphes pour exploiter la relation et faire ainsi de l'aide à la décision. C'est B. Roy qui, il y a 40 ans maintenant, a suggéré, dans la fameuse méthode ELECTRE, d'utiliser la notion de noyau d'un graphe pour identifier, dans un ensemble de décisions, un sous-ensemble minimal de décisions tel que toute décision en dehors de ce sous-ensemble est moins bonne qu'au moins une décision de ce sous-ensemble, ce qui permet de simplifier le problème initial en restreignant les choix possibles.

L'outil de représentation des préférences le plus fréquemment utilisé, notamment en économie et en finances, est ce qu'on appelle la fonction de valeur ou la fonction d'utilité, qui consiste à attribuer une valeur numérique à chaque décision de telle manière que si la valeur de la décision A est supérieure à la valeur de décision B, cela traduit le fait que A est meilleure que B. Rechercher la meilleure décision revient alors à maximiser la fonction d'utilité dans l'espace des décisions considérées.

Ce que l'on oublie parfois, c'est que la représentation des préférences d'un individu par une fonction de valeur ou une fonction d'utilité suppose que les préférences de l'individu ont une structure spécifique, ou ont des propriétés particulières qui peuvent, dans certains cas, ne pas être satisfaites. Autrement dit, il n'est pas vrai que, dans la réalité, les préférences d'un individu (et a fortiori d'un groupe) peuvent toujours être représentées par une fonction de valeur ou une fonction d'utilité.

L'exemple le plus frappant avait déjà été donné il y a plus de cinquante ans par D. LUCE. Un individu peut ne pas

avoir de préférence entre A et B, mais les considérer comme indifférentes, même si elles ne sont pas identiques (mais ce qui les distingue n'est pas suffisant pour justifier une préférence). Il peut aussi être indifférent entre B et C pour les mêmes raisons. Mais il peut ne pas être indifférent entre A et C parce que ce qui les distingue peut justifier une préférence. Un modèle basé sur une fonction d'utilité conduirait à attribuer la même valeur à A et B et la même valeur à B et C, sans attribuer la même valeur à A et C ce qui est mathématiquement impossible.

Les choses se compliquent encore si on veut que la fonction d'utilité représente aussi l'information dont on dispose sur les écarts de préférence.

Comme indiqué au début de mon exposé, la plupart des problèmes de décisions sont des problèmes d'agrégation de préférences, préférences d'un même individu sur différents aspects des décisions envisagées ou préférences d'individus différents qui doivent prendre collectivement une décision.

Si les préférences ont été représentées par des fonctions d'utilité, la tendance naturelle est d'agrèger les préférences en combinant les fonctions d'utilité entre elles par des opérations d'addition ou de multiplication, souvent précédées ou combinées à des opérations de normalisation de manière à ramener toutes les fonctions d'utilité sur une même échelle. Ces opérations de normalisation, d'addition, de multiplication posent évidemment de très nombreuses questions sur les hypothèses que l'on doit faire sur les préférences du décideur (ou du comité) pour que ces opérations soient justifiées.

Un problème crucial, et pas toujours très bien traité, est de savoir comment traduire, dans cette agrégation, les importances relatives (les « poids » relatifs) des différentes préférences que l'on veut agréger. De nombreux modèles existent, mais peu d'utilisateurs de ces modèles sont conscients des limites de ceux-ci et surtout des hypothèses restrictives sur lesquelles ces modèles reposent implicitement.

Je voudrais ici attirer l'attention sur le travail de pionnier qu'a été celui de l'université Dauphine, à travers le LAMSADE, et sous la direction du professeur B. Roy, dans le développement d'une autre approche, appelée l'approche du surclassement, qui a conduit à de nouvelles méthodes d'agrégation de préférences.

Les méthodes de surclassement qui, sur le plan des fondements théoriques, ont des liens avec la théorie du choix social, les procédures du vote et des résultats comme le théorème d'Arrow, ont donné lieu à une véritable Ecole, aujourd'hui largement internationale, avec ses livres de référence, ses revues, ses workshops, ses publications, mais aussi ses logiciels commerciaux, ses bureaux d'études et ses applications concrètes dans tous

les domaines de l'activité humaine, en particulier en finance ou en économie.

Je terminerai en disant que j'ai été très heureux et fier de faire partie de cette école.



## MCDA Research Groups

Research group in Industrial Optimization  
Department of Mathematical Information  
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<http://www.mit.jyu.fi/optgroup/>

**Kaisa Miettinen, Petri Eskelinen, Jussi Hakanen**

### Group Description

The Industrial Optimization Group of the University of Jyväskylä, Finland, is a part of the Department of Mathematical Information Technology and is headed by Prof. Kaisa Miettinen (since 1998). The research interests of the group are focused on MCDM and in particular on developing theory, methods and software for solving real-world optimization problems, especially when multiple nonlinear objectives are involved. Overall, the work is inspired by real-life applications.

In the group name industrial optimization is indicating that in general theoretical and methodological development, the focus is typically on methods which are suitable and applicable in the case of industrial level applications. Even though the methods applied are typically based on strong mathematical foundations, in practice, the applications may typically lack nice mathematical structures (they can be e.g. black box models and computationally expensive) and these practical characteristics must be taken into account when developing methods. Another characteristic of the methods developed is application-independence. In other words, behind the application-specific user-interface, the optimization method can be the same for designing paper machines or planning radiotherapy treatment.

Among others, the industrial applications considered deal with improvement of product properties, making production processes and their controls more efficient, or finding the best shape or structure etc.

### Research Profile

Real-life industrial problems typically need to be considered from very different perspectives. This leads to the need of optimizing several conflicting objectives simultaneously. In the light of this, it is quite natural that one of the main driving forces behind the research of the group is multiobjective optimization.

In multiobjective settings with continuous variables, there typically are infinitely many Pareto optimal solutions and the ultimate task of the decision maker is to determine the best, that is, the most preferred Pareto optimal solution which is to be implemented and tested in practice. However, it is very important that before the actual decision about the final solution takes place the decision maker should gain a good understanding about the trade-offs between the solution alternatives. The final decision should be firmly grounded.

Benefits of multiobjective optimization include that the conflicting objectives are taken into account simultaneously leading to an overall insight of the problem. Therefore, multiobjective optimization can bring about a significant competitive advantage when compared to widely used simplistic approaches where e.g. only some primary objective is optimized and other, although important, objectives are left without a special attention. In different fields of industry, there is a lot of need for multiobjective treatment but not yet enough awareness about it and, thus, the group also faces the challenge of disseminating information about the potential of multiobjective optimization.

One of the main research interests in the group is interactive multiobjective optimization. It supports the decision maker actively in finding the 'best' Pareto optimal solution by continuously involving him/her and his/her preferences in the solution process to guide the search. The continuous involvement enables the decision maker to learn about one's preferences and the problem/phenomenon considered as well as interdependencies between the objectives.

In addition to MCDM and especially interactive multiobjective optimization, evolutionary multiobjective optimization, and different hybrid methods (incorporating benefits of different types of approaches), our group shares also interest in general mathematical programming, global optimization (e.g. evolutionary algorithms and memetic approaches) and optimization software development including, in particular, usability issues. Actually, the group is one of the few groups actively

working with implementations of interactive multiobjective optimization methods.

### Some Current Research Directions

The most well-known interactive method developed in the group is NIMBUS. NIMBUS is a classification-based method where the decision maker classifies objective functions to indicate the kind of changes that are desired in the current Pareto optimal solution to make it better. Several variants of the method have been published during the years and the synchronous version is currently in use.

Among more recently developed interactive methods we can mention Pareto Navigator which has been directed for computationally expensive problems. The idea is to create an approximation of the Pareto optimal set and enable the decision maker to navigate on it. On the approximation, changes of trade-offs can be seen in real-time and then any interesting solution can be projected to the real Pareto optimal set. Without the approximation, the navigation would be too slow because calculating new Pareto optimal solutions would take too much time. On the other hand, the interactive Nautilus method questions the idea of considering only Pareto optimal solutions throughout the solution process. Instead, the method starts from the nadir point and allows finding the most preferred solution without anchoring and the need of giving up in some objectives. This can be useful also for group decision making situations.

Because many methods developed in the group are motivated by practical applications, it is important that this work is also brought close to people that in real-life face the actual problems and apply the methods. Therefore, the group has developed and is developing several different interactive tools for multiobjective optimization.

One can say that the most widely available interactive multiobjective optimization software is WWW-NIMBUS (available at <http://nimbus.it.jyu.fi/>), an implementation of the NIMBUS method. WWW-NIMBUS is a web-based software freely available for academic teaching and research use around the world (the first version was published as early as in 1995). Based on the WWW-NIMBUS software, the group has also developed a commercial optimization tool IND-NIMBUS, which is a desktop application operating on Linux and Windows platforms. IND-NIMBUS has been lately used for most industrial applications considered. It is available for industrial partners and a demo-version is available for interested parties (<http://ind-nimbus.it.jyu.fi/>).

After testing with demo versions, the implementation of the new interactive methods Pareto Navigator and Nautilus has been started so that they can become more widely applicable. In method and related software development, the group is paying special attention to

intuitive human-computer interaction. Because interactive methods are supposed to support learning, the way preference information is acquired from and new insight into the problem is presented to the decision maker plays a very important role in the success of the solution process. This research contains user interface and interaction design, usability research, information visualization and visual analytic environments.

The group has been active in building bridges between the MCDM and evolutionary multiobjective optimization (EMO) communities. Examples of hybrid method development include approaches for estimating the nadir point utilizing EMO and achievement scalarizing functions. In addition, the efficiency and accuracy of EMO methods have been improved by hybridizing scalarizing functions and local search in them. Preference information has been also incorporated in EMO methods in the form of a reference point improving efficiency and enabling concentration on interesting Pareto optimal solutions.

Alongside the general theoretical and methodological development, recently, the development of so-called approximation methods has been considered in the group. These methods aim, in a way or another at building or utilizing an approximation of the objective functions or the Pareto optimal set (e.g. meta models, polyhedral and tangent plane approximations). An approximation of the Pareto optimal set is especially useful in the case of industrial applications because problem related models are typically computationally very time-consuming to operate.

Another research direction is related how to tackle with uncertainty in multiobjective optimization problems, that is, how to compare solution alternatives under uncertainty and in changing environments. This research contains studies related to uncertainties in process parameters, optimization of the production plant concepts under different production tasks and production plant design through bilevel multiobjective problem formulation.

### Research Projects and Industrial Applications

Currently, our group is involved in a couple of industrial research projects.

In one project, for instance, the research is focused on developing a basis for the modeling and simulation of the unit processes of a biorefinery. The sensitivity of such models to uncertainties in process parameters, optimization of the production plant concepts and finally for life-cycle analysis of the biorefinery products are considered. This is a joint project with Helsinki University of Technology and the Technical Research Centre of Finland (VTT) and funded by Tekes, the Finnish Funding Agency for Technology and Innovation as well as several companies.

In another project, a new model-based and optimizing design concept for material and information flows in production systems is being developed. The overall aim is to increase flexibility in process design and reduce the amount of capital invested in production lines. The main application area is pulp and paper industry. This is a joint project with Tampere University of Technology, VTT, Helsinki University of Technology and University of Kuopio and it is funded by Forest Cluster Ltd (a company owned by several universities, research institutes and firms in the forest and pulp and paper sector) and Tekes.

The group is also involved in a University Alliance project (with Tampere University of Technology and University of Jyväskylä) called Measurements, Data Analysis and Multiobjective Optimization. In addition, the Academy of Finland funds a long-term project Strategic Development of Multiobjective Optimization: Theory and Software and the University of Jyväskylä supports the work of several researchers of the group.

Examples of some applications from previous projects include continuous casting of steel (optimal control of secondary cooling), headbox design for paper machines, paper machine design (paper quality), ultrasonic transducer design, chemical process design (various processes in paper production), optimization of simulated moving bed processes (separation of fructose and glucose), optimal shape design of exhaust pipe (in two-stroke engines), intensity modulated radiotherapy treatment planning and brachytherapy planning as well as wastewater treatment plant design.

#### **Current Members**

The Industrial Optimization Group is headed by Prof. Kaisa Miettinen, who is a professor in industrial optimization at the Dept. of Mathematical Information Technology, University of Jyväskylä. Currently, the group has ten active members including three PhDs (Timo Aittokoski, Petri Eskelinen and Jussi Hakanen) and six doctoral students (Tomi Haanpää, Markus Hartikainen, Vesa Ojalehto, Sauli Ruuska, Karthik Sindhya and Suvi Tarkkanen). In addition, Prof. Margaret Wiecek (Clemson University, USA) is visiting the group for the current academic year (August 2009 – June 2010). Furthermore, some members of the group are currently affiliated abroad. In addition, the radiotherapy optimization thesis by Henri Ruotsalainen at the University of Kuopio is supervised by Prof. Miettinen.

#### **International and National Collaboration**

The Industrial Optimization Group takes actively part in international conferences and publishes its results in refereed publications. The group is also represented in the editorial boards of several journals. The group members are active e.g. in the International Society on Multiple Criteria Decision Making (Kaisa Miettinen is the

President-Elect of the Society), EUROPT, the EURO Working Group on Continuous Optimization (Kaisa Miettinen is the Vice-Chair of the Working Group), Finnish Operations Research Society and Finnish Society on Computational Sciences. Among others, the group has taken part in organizing the 67<sup>th</sup> Meeting of the European Working Group "Multiple Criteria Decision Aiding" in Rovaniemi, Finland in April 2008 and the IFAC Workshop on Control Applications of Optimization in May 2009 in Jyväskylä and is heavily involved in organizing the 21<sup>st</sup> International Conference on Multiple Criteria Decision Making. This conference will be organized on June 13-17, 2011 in Jyväskylä (<http://www.jyu.fi/mcdm2011/>). Organizing and active participation in the Dagstuhl seminars on Practical Approaches to Multiobjective Optimization and Hybrid and Robust Approaches to Multiobjective Optimization and preparation for the next Dagstuhl seminar are also in the close interests of the group.

The group works in close collaboration with many researchers in Finland and abroad and is a part of many networks including the modeling and simulation technology program of Tekes. In particular, many of the research topics mentioned above have been studied and methods developed in close national and international collaboration. Some of the collaborators are:

Prof. Lorenz T. Biegler (Carnegie Mellon University, USA)  
Dr. Jurgen Branke (University of Warwick, UK)  
Prof. Kalyanmoy Deb (IIT Kanpur, India)  
Drs. Leoneed Kirilov and Mariana Vassileva (Bulgarian Academy of Sciences)  
Prof. Kathrin Klamroth (University of Wuppertal, Germany)  
Prof. Pekka Korhonen and Jyrki Wallenius (Helsinki School of Economics, Finland)  
Prof. Alexander Lotov (Russian Academy of Sciences)  
Prof. Marko M. Mäkelä (University of Turku, Finland)  
Prof. Risto Ritala (Tampere University of Technology, Finland)  
Prof. Francisco Ruiz and Drs. Mariano Luque and Julian Molina (University of Malaga, Spain)  
Prof. Roman Slowinski (Poznan University of Technology, Poland)  
Prof. Ralph E. Steuer (University of Georgia, USA)  
Prof. Lothar Thiele and Eckart Zitzler (ETH, Switzerland)  
Prof. Margaret Wiecek (Clemson University, USA)

The group has also been involved in researcher exchange. For example, Kerstin Dächert, a doctoral student from the University of Wuppertal, Germany, was recently visiting the group (in August - September 2009).

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For more publications, see <http://www.mit.jyu.fi/miettinen/publ.html>.

#### Some topics for ongoing PhD thesis work

- Adaptive user interface concept for analysis and optimization of industrial processes including multiple objectives
- Formulation and numerical solution of real-life optimization problems in consideration of multiple objectives and uncertainty
- Approximating the Pareto optimal set with meta models
- On some practical problems of multiobjective optimization: computational expense and uncertainty
- Implementation challenges of interactive multiobjective optimization
- Guaranteed convergence and distribution in evolutionary multiobjective algorithms via achievement scalarizing functions

More information is available at <http://www.mit.jyu.fi/optgroup/> (see e.g. <http://www.mit.jyu.fi/optgroup/posters.html> containing posters of research interests of the group) and <http://www.mit.jyu.fi/miettinen/engl.html>.

## Forum

(two articles)

### Common and distinctive features of robustness analysis and multicriteria decision aid.

Yves De Smet

CoDE-SMG, Engineering Faculty, Université Libre de Bruxelles  
Boulevard du Triomphe CP-210-01, 1050 Bruxelles, Belgium

From 2000 to 2005, two main research directions were actively represented at the SMG laboratory: Multicriteria Decision Aid (MCDA) and Robustness Analysis (RA). The director of the unit, Professor Philippe Vincke, was encouraging every PhD student to think about the robustness features of his own works. Regularly, young researchers had to present their progress during seminars. A number of discussions followed and participants soon realized that they were sharing common research interests. Naturally, a question arose: "What are the common and distinctive features of Multicriteria Decision Aid and Robustness Analysis?" Romina Hites, Nathalie Risse, Martha Salazar-Neumann, Philippe Vincke and I decided to deepen this question. A paper summarizing these considerations appeared in the European Journal of Operational Research in 2006 [4]. In what follows, I will present the main ideas proposed in the paper.

Since the works of Gupta and Rosenhead [1] about the notion of robustness in sequential planning problems, a number of authors have investigated this idea in various fields. In statistics for instance, Hampel [2] states that "*Robust statistics is the stability theory of statistical procedures. It systematically investigates the effect of deviations from modeling assumptions on known procedures and, if necessary, develops new, better procedures*". More specifically, many authors focus their research on the detection and the influence of outliers in statistical analysis. In the discrete optimization field, Kouvelis and Yu [5] have analyzed different criteria in order to characterize feasible solutions that are evaluated according to different scenarios. More recently, in the decision aid community, Roy and Vincke have promoted the idea of robustness. This concept is not only applied to solutions but also to conclusions, recommendations, assertions, methods ... [7,9,10]

At this point, it is worth noting that the notion of robustness can be interpreted in two different ways. The first meaning is related to the notion of stability: A solution will be judged to be robust if it does not vary too much from one scenario to the other. A second meaning is related to the quality of the solution: a solution will be judged to be robust if it is not too far from the optimality in every scenario.

In this article we address the "Robustness Analysis" problem in a very restrictive sense. We focus on unicriterion optimization problems for which the set of feasible solutions can be evaluated according to a set of possible scenarios. No assumptions (probability, possibility, ...) are made according to the likelihood of these scenarios. Moreover, we suppose that these scenarios are given as inputs. In other words, we do not consider for instance the problem of selecting (or creating) these scenarios. Of course, the reader must understand that the Robustness Analysis research field is much wider than the problem studied here. Nevertheless, we will use the term "Robustness Analysis" to refer to optimization problems with one criterion and several scenarios.

If the cardinality of the set of feasible solutions is limited, this problem can be described by a table for which each column represents a given scenario and each row represents a given feasible solution evaluated on the different scenarios. Put in this way, it is comparable to multicriteria problems where each column represents one criterion and each row represents an alternative evaluated according to the different criteria. In both domains, a solution (or an alternative) is rarely simultaneously optimal for all the scenarios (or criteria). A number of methods have been developed in MCDA in order to identify a good compromise solution (or a set of good compromise solutions). The starting point of our reflection was to investigate if it could make sense to apply MCDA methods to robustness analysis problems in order to highlight "robust" solutions. This attempt is of course oversimplified. Nevertheless, it allows to point out the similarities and differences between the two disciplines.

Let us start with arguments in favor of this idea. The two fields share a number of issues. First of all, let us stress the "**plural nature of the problem**". In most real problems, solutions are rarely evaluated according to a unique imposed criterion. On the contrary, most of the time, different conflicting criteria are simultaneously considered. On the other hand, the data characterizing the decision problem are rarely known with certainty. A direct consequence of this observation is the "**inadequacy of the concept of optimality**". In multicriteria decision aid, researchers are attached to the notion of good compromise solution. Indeed, there is no universally objective way to select a given solution from a Pareto optimal frontier. As already stressed, a number of criteria can be considered to select a solution in robustness analysis. As in MCDA, none of them is universally and objectively accepted. This leads us to the next common feature: "**the central role played by the decision maker**". In both fields, the proposed approaches are subjective in the sense that the decision maker has to provide additional information about his preferences (in MCDA) or his risk nature (in RA). As a consequence, both fields lead to subjective approaches. Another common point is the "**natural dominance relation**". If there is a solution  $a$  that is at



least as good as another solution  $b$  in all the scenarios and better than  $b$  in a least one scenario,  $b$  can be considered as a dominated solution. Like in MCDA, attention is focused on efficient solutions.

In the field of multicriteria decision analysis, one usually distinguishes three main approaches: multi-attribute utility theory, interactive methods and outranking approaches [8]. The latter are based on pair-wise comparisons. A key question here is to build binary relations between the alternatives that will reflect as best as possible the decision maker's preferences. Saying that an alternative  $a$  outranks another alternative  $b$  ( $a S b$ ) means that  $a$  is globally at least as good as  $b$  without being much worse on any criterion. In 2004, Hites [3] proposed a similar notion applied to robustness problems: "*a robust solution is one that is satisfactory to the decision maker in as many scenarios as possible without being too unsatisfactory to the decision maker in any single scenario*". Similarly, one could consider a binary relation  $R$  such that  $a R b$  means that solution  $a$  is at least as robust as solution  $b$ . This proposition shows that in both fields the **role of aggregated binary relations is fundamental**.

The previous arguments have put forward the similarities between multicriteria decision aid and robustness analysis. Nevertheless a number of distinctive features also exist between the two domains. First we have to stress that the **evaluation of a solution** is different. In multicriteria problems, two particular alternatives are always comparable with respect to a given criterion. For instance, when considering the purchase of a new car, one can always say that an alternative  $a$  is cheaper, has the same price or is more expensive than an alternative  $b$ . In other words,  $a$  is preferred, indifferent or being preferred by alternative  $b$  (for that particular criterion). As already mentioned, the main problem in MCDA is to aggregate the local preferences obtained for each criterion into a global preference degree or a global outranking relation. In robustness analysis, such an aggregated relation could also be useful in order to state that a solution  $a$  is at least as robust as another solution  $b$ . Nevertheless, the notion of robustness is meaningless considering a single scenario. It only makes sense when several scenarios are simultaneously taken in to account. While the notion of preference is both meaningful at criterion and global level, the notion of robustness is only meaningful at global level. Another difference is related to the **definition of the family of criteria as opposed to the set of scenarios**. In multicriteria decision aid, the selection of the considered criteria has to respect formal conditions. Roy [6] defines a coherent family of criteria as satisfying the properties of exhaustivity, cohesion and non-redundancy. Intuitively, the property of exhaustivity means that if two alternatives  $a$  and  $b$  are identical with respect to all considered criteria, then the global preference between  $a$  and a third alternative  $c$  should be the same as between  $b$  and  $c$ . If it is not the case, additional criteria have to be considered.

Such a property can be easily interpreted in terms of robustness analysis.

The property of cohesion means that improving an alternative  $a$  (on a given criterion) and worsening an alternative  $b$  (on a given criterion) should reinforce the existing global preference between  $a$  and  $b$  (we assume that  $a$  is at least as good as  $b$ ). This property ensures that some cohesion exists between the unicriterion and the global preferences. Since the notion of robustness cannot be defined at criterion level, this property cannot be directly reformulated in terms of robustness analysis.

**The units** of criteria and scenarios also constitute a major difference. In robustness analysis the evaluation of the solution according to different scenarios have the same unit. In multicriteria problems, alternatives are, most of the time, evaluated according to criteria expressed in different units. The **number** of scenarios in robustness analysis can be limited, finite or even infinite (for instance when the data is expressed in interval form) while the **number** of criteria in MCDA is usually limited.

The **relative importance** of each individual criterion plays a crucial role in MCDA. However, the importance of scenarios in RA is less obvious. Let us remind the critics of Kouvelis and Yu [5] about the use of probability in such a context.

Finally, let us point out that while the **number of alternatives** is usually the same for every criterion, it is not the case in robustness analysis where the **number of solutions** may naturally vary from one scenario to the other (due to the satisfaction of specific constraints).

These differences clearly show that we cannot just apply a multicriteria method to a robustness problem. There are intrinsic differences between the two fields. Even if we could expect such a kind of conclusion the previous considerations have helped us to highlight a number of open questions.

First of all, the definition of a coherent family of criteria is a crucial question in MCDA. On the contrary, in RA, one often assumes that the scenarios are given. According to us, a lot of work has still to be done regarding the construction of the set of scenarios and the fact that they represent the "reality". Questions related to the independence of scenarios have still to be addressed (such questions related to preferential independence are common in multicriteria decision aid).

Another issue is related to the **compensation**. While it is often acceptable in MCDA that compensations might exist between several criteria, we should ask ourselves if it makes sense in robustness analysis. Finally, as it is done in MCDA, we could possibly identify different robustness problematics (choice, ranking, sorting, description,...)

To conclude this article, we can mention the **multicriteria evaluation of robustness**. With respect to the previous arguments, we can state that MCDA methods cannot simply be applied to robustness analysis in order to identify robust solutions. Nevertheless, authors have proposed different criteria to solve robustness problems: absolute robustness, deviation robustness, relative robustness, stability, ... None of them is fully satisfying and we do think that an interesting research direction would be the simultaneous use of several robustness criteria to manage these problems. As a consequence, the selection of robust solutions could be seen as a particular multicriteria problem.

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### Portfolio Decision Analysis Theory and Practice: Have we got the balance right?

Alec Morton

*London School of Economics and Political Science*

As part of the Multi Criteria Decision Analysis stream at the EURO XXIII Conference in Bonn, a group of us (Ahti Salo, Jeff Keisler and myself) organised a panel discussion on the topic "Portfolio Decision Analysis: Bridging Theory and Practice", as part of a co-ordinated group of sessions on the subject of Portfolio Decision Analysis (PDA). The text which we invited panelists to respond to was as follows:

*An indicator of the liveliness of any area of OR is a healthy interaction between practice and theory. In an applied discipline, practice provides the ultimate motivation for theoretic questions, but an excessive reverence for practice can block learning and hinder interdisciplinary innovation. Theory underpins the development of methods and tools, but theoretic inquiry can lose sight of application and become an end in itself. As an emerging subfield of Decision Analysis, has Portfolio Decision Analysis got the balance right, and, if not, what should we do about it?*

In response, **Jeff Keisler** (University of Massachusetts at Boston), as a practitioner turned academic, asked us to consider the state of knowledge of how well PDA works for the people who need it. He contrasted the role of research in a field like Decision Analysis, where there is a strong focus on the use of the normative theory to design tools, with the role of research in a field such as Information Systems, where researchers attempt to build and test social science theory. Keisler commented on the lack of testable hypotheses in PDA (and in Decision Analysis more generally) and argued that researchers have neglected to study the relationships between what is done and the outcomes of a PDA intervention, and why some things work in some places and not in others. He also argued that there is a role for theory in codifying the technologies used by practitioners.

**Don Kleinmuntz** (Strata Decision Technology), as an academic turned practitioner, offered a different response, arguing that it is both the case the "practice lags academia" and "academia lags practice". Practice lags academia in the sense that, to the extent that we have well-developed technology it is not used: Kleinmuntz observed that practitioners sometimes make fundamental theoretic mistakes, combining probability and value additively rather than multiplicatively, confusing incremental and absolute benefit prioritisation, and using benefit/ cost ratio prioritisation in settings where optimisation is appropriate and necessary (such as when facing multiple resource constraints). At the same time, academia lags practice in the sense that although PDA is among the most common forms of decision analysis used in practice, there is little in

the textbooks. Further, there is a lack of new theory addressing the distinctive issues facing the Portfolio Decision Analyst: for example, how to deal with multiple stakeholders, or how to decide on a suitable level of complexity of modelling. Echoing Keisler, he also highlighted that one-off academic case studies tell us little about persistence: an organisation may have a good experience with a method introduced by Professor X, but does it continue to use the method after Professor X and his students have departed?

**Alexis Tsoukiàs** (University of Paris-Dauphine) drew attention to three issues driven by and closely relating to practical questions. Firstly he drew attention to recommender systems which have been developed outside of decision analysis in other disciplines such as Artificial Intelligence, arguing that what is done in these systems is essentially PDA but it is not labelled or recognised as such. Secondly he drew attention to the question of *what is a decision* arguing that this is a larger theoretical problem, in which the question of *what is a portfolio decision* can be located. Specifically, Tsoukiàs argued, a decision in general can be conceptualised as some sort of partitioning of a set into subsets having some desired properties. In the case of PDA these subsets may relate to capacity or may have some desired inclusion properties. The third point to which Tsoukiàs drew attention is that construction of the set of alternatives. The construction of alternatives, Tsoukiàs argued, should be seen as an act of PDA in which alternatives are built for the decision maker out of constituent sub-alternatives.

**José Figueira** (Instituto Superior Técnico, Technical University of Lisbon) stressed that many multicriteria approaches to PDA aggregate together benefit criteria, ignoring the difficulties which decision makers may face in performing such an aggregation, and the theoretical and mathematical issues involved in weighted sum combinations. He argued that there is a missing link between Multi-Objective Optimisation and Multi-Criteria Decision Analysis. This gap can be bridged by the development of interactive methods, such as his GRIP method, developed with Roman Slowinski and Salvatore Greco, although such a method would have to be adapted to the PDA setting as the options are implicitly defined. Figueira also highlighted the importance of robustness, and the need to use computational methods such as metaheuristics in large-scale problems where classical optimisation methods may be inadequate.

**Ahti Salo** (Helsinki University of Technology) talked of the large span between theory and practice and the hurdles that may impede the uptake of theoretical methodologies. He spoke of his conviction that challenging practical problems can be very instructive from a theoretical point of view, despite the many drawbacks of working in an environment that may be characterized by challenges such as inadequate data or organisational politics, among

others. He also stressed the importance of clarity and simplicity, and suggested that overly complex methods may be counterproductive ("doomed to failure" – Kleinmuntz). Following Kleinmuntz, he concluded by stressing the importance of training practitioners to use the next generation of PDA methods.

Finally, **Larry Phillips** (London School of Economics) was unable to attend the meeting but his presentation was delivered by the author. Phillips gave a resounding "no" to the question of whether the field has got the balance between theory and practice right. He argued that PDA academics give too much attention to abstruse and useless mathematics, and too little attention to what their clients need and how they think. Theory-based tools can be as simple as the representation of the value and cost of a project as the sides of the a right-angle triangle, with the slope representing the value for money. This representation is based on a theoretic insight, but at the same time is so simple that even a CEO can understand it. Another important aspect of relating to a client is to demonstrate how the analysis relates to the structure of the organisation: the Equity software achieves this grouping projects according to the organisational area or budget category in which they fall. Finally the trading in and out features of the Equity software were illustrated, indicating how decision analysis forces the reconciliation of holistic and disaggregate judgement.

There was also a short discussion, with questions from the floor. Although no conclusion was reached, the exchange was extremely lively and enjoyable. The overall impression that the author was left with was a field which faces numerous challenges, both practical, and theoretic (and indeed, theoretico-practical and practico-theoretic), and that these challenges are being faced down with energy, creativity and enthusiasm.

## Consultancy Companies

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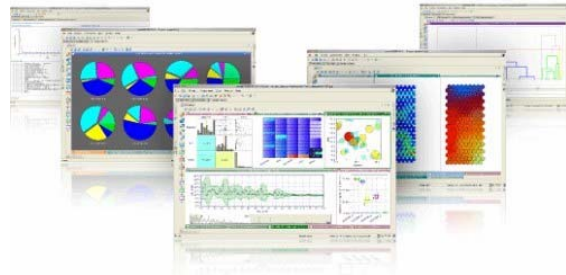
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EnginSoft's core software in Europe is modeFRONTIER®, developed by ESTECO srl EnginSoft Technologie per l'Ottimizzazione, Trieste. EnginSoft distributes the software in Italy and Europe and provides a wide range of consultancy services to its customers.



*modeFRONTIER 4.1 screenshot*

modeFRONTIER is a multi-objective design environment software, a state-of-the-art PIDO tool which allows easy coupling to almost any computer-aided-engineering (CAE) tool. modeFRONTIER can handle data sets containing up to 1 million design configurations and provides enhanced post-processing capabilities:

- Statistical Analysis tools embedded in the system
- Data Mining tools to extract design features
- Wizard to make creation of meta-models easier
- New Look and Feel to enhance navigation between different tools

In addition, modeFRONTIER contains a wide range of data-mining tools which help users to understand complex data.

modeFRONTIER's latest version 4.1.2 also features an enhanced set of statistical tools to analyze and exchange data. A Statistic Summary, ANOVA, Significance Analysis, and Distribution Fitting have been added to the extensive list of state-of-the-art tools already available in previous releases.

Last but not least, when it comes to Design Optimization Algorithms, the software developers have added many new features in recent months which make life easier for users when looking for optimal solutions:

- Optimization Wizard, to assist in the selection of the best optimization strategy
- New Multi-Objective Optimizers, including Multi-Objective Particle Swarm (MOPSO)
- Reliability Methods for Robust Design and DFSS
- New automatic work-flow creation: modeFRONTIER now features even more seamless integration to third-party CAD/CAE tools.
- Matrix, Vector, and String Variables, to deal with systems of complex data

- New Calculator Node allows advanced post-processing, using built-in functions, to be performed directly in the workflow.

To provide the widest possible range of expertise to its customers and partners in Europe, EnginSoft has established an Optimization Consulting team in its Padua Office which solely focuses on all areas of process integration and design optimization.

The team offers support and technical advice in all areas of multiobjective design optimization and multi-criteria decision making. Its experts assist customers in delineating the logic of the optimization problem and hence the optimization sequence and scheduling. Moreover, the group can create customized solutions for specific optimization problems and/or supply multiobjective and multi-disciplinary optimization libraries.

For more information, please contact Silvia Poles: [s.poles@enginsoft.it](mailto:s.poles@enginsoft.it)  
EnginSoft S.p.A. Optimization Consulting, Padua – Italy

## Software

### JSMAA: an open-source software for SMAA decision analysis

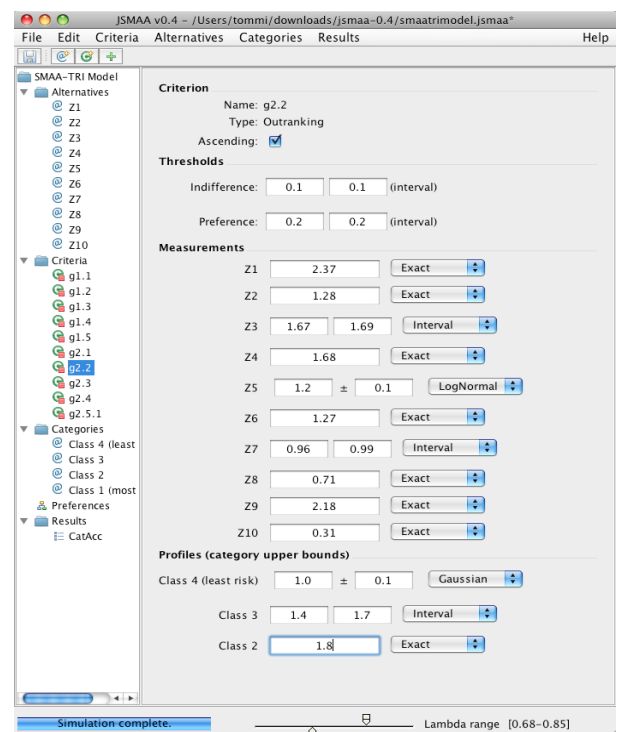
Stochastic Multicriteria Acceptability Analysis (SMAA) is a family of multi-criteria decision aiding methods that allow to handle problems with partial or missing information about model parameter values (i.e. weights, criteria measurements and technical parameters). Different SMAA methods support all MCDA problem statements. Instead of giving an exact answer to the decision problem under consideration, the SMAA methods provide various indices to support the decision. For example, instead of a ranking, SMAA-2 provides rank acceptability indices that take into account uncertainty and missing parameter values.

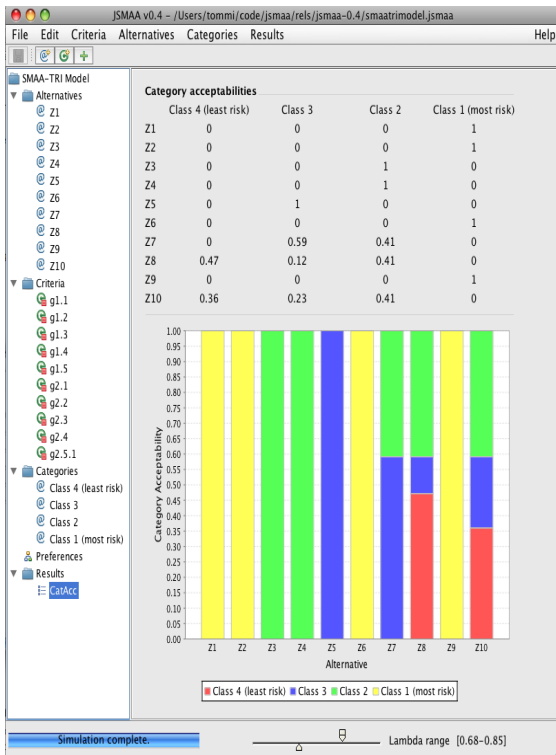
The lack of usable software has hindered practical application of SMAA methods outside their core developers. The various SMAA indices cannot be calculated by hand but must be estimated through Monte Carlo simulation – and in practice a dedicated computer program is needed for this. To overcome this limitation, I have released JSMAA that aims to implement all SMAA methods in a unified software. Currently (as of v0.4) it implements SMAA-2 for utility-theory based choosing/ranking and SMAA-TRI for sorting with a stochastic ELECTRE TRI model.

JSMAA minimizes the user interaction required for SMAA analyses. For example, with SMAA-2, no utility functions need to be specified, but instead linear ones with ranges derived from criteria measurements are used. In case of uncertain measurements, the range of a single criterion is constructed to include possible ranges of measurements of all alternatives. With SMAA-TRI, a feasible lambda range is also provided by default. With both methods, the default option is to run the analysis with missing preference information. When a model is modified, the Monte Carlo simulation used for computing the indices is re-started. This minimizes the waiting time required for obtaining results. In practice the simulation overhead is unnoticeable to the user.

JSMAA is free also for commercial purposes and licensed under GPL open-source license. The main site for information and distribution is [www.smaa.fi](http://www.smaa.fi). JSMAA is developed openly, and a link to a live github code repository can be found at the website. For development purposes, the computational functionality of JSMAA is separated into a library that can be used for integrating SMAA functionality with the rest of existing ICT infrastructure.

I believe that only through provenly working free software developed in an open manner can MCDA methods come to enjoy more widespread use. I encourage JSMAA users to submit requests for features and possible bugs and annoyances found in the software. Although each build is automatically tested through a large set of unit tests, no software is perfect. In order to achieve open, usable, and free software, input from users (you!) is needed.





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## Persons and Facts

Dear all,

The members of the International Society on MCDM have elected the following persons as the members of the Exetive Committee (term 2009-2013):

Jim Dyer  
Matthias Ehrgott  
José Rui Figueira  
Roman Slowinski

Congratulations!

It is time to warmly thank the old executive committee and the members who are now stepping down (Kathrin, Salvatore, Daniel, and Luis)!

With best regards, Kaisa

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Dear friends and colleagues,

it is with great pleasure that I am sending you the link to the new issues of the MCDM E-Newsletter:  
[http://mcdmsociety.org/MCDMNews/MCDMeNews\\_2009\\_2.pdf](http://mcdmsociety.org/MCDMNews/MCDMeNews_2009_2.pdf)

With the best wishes,  
Martin J. Geiger



## About the 70<sup>th</sup> Meeting

**70<sup>th</sup> MEETING OF THE EURO WORKING GROUP  
MULTIPLE CRITERIA DECISION AIDING  
Moncton, Canada, September 24-26, 2009.**

**70<sup>th</sup> MEETING OF THE EURO WORKING  
GROUP MULTIPLE CRITERIA DECISION  
AIDING, Moncton, New Brunswick, September  
24-26, 2009.**

The 70th meeting of the European Working Group "Multiple Criteria Decision Aiding" was co-organized by Nabil Belacel and Georges Corriveau of the Institute for Information Technology, National Research Council Canada with the support of Serge Leger, web developer and master of [www.mcda70.org](http://www.mcda70.org), Sophie Leblanc, the Administrative Assistant and Cedric Martin a computer support.

The meeting took place at the Delta Hotel in downtown Moncton. Among the 65 registered participants over 45 representing 20 different countries actively took part to the meeting. The financial support was given by the four different Departments of the Government of New Brunswick including Departments of Health, Energy, Environment and Intergovernmental Affairs and from the City of Moncton. EURO supported the participation of some PhD students. The main topic of this meeting was: "MCDA in Health, Energy and Environment".

Among the keynote speakers we had Professor Slobodan P. Simonovic from the University of Western Ontario; his talk was on the water resources management and on the application of systems approach to management of complex water and environmental systems. The second keynote speaker was Dr Aljandra Duenas from Health Economics and decision science of University of Sheffield. Her talk was around the question "Is multicriteria decision analysis applicable to public health decision making? She described how the National Institute for Health and Clinical Excellence's public health intervention guidance process works. The last key note speaker was Professor Jonathan Barzilai from Dalhousie University presenting the challenging problems on decisions theory with some fundamental errors at the foundations of these theories.

Out of the 32 submitted papers, 18 were scheduled for presentation in 5 sessions during the two days. During these sessions, 10 papers were presented on the application of MCDA to environment, energy and health and the remaining papers were presented on the theory and methodology with other interesting applications of MCDA.

The social program included a Saturday visit to the Hopewell Rocks where the participants had the opportunity to walk on the ocean floor. The Bay of Fundy has the world's highest tides with over 100 billion tones of water flowing in and out of the bay every 12 hours. This volume of water has created some interesting flowerpot-shaped rock formations. Participants appreciated the guided tour by the Hopewell Rocks Provincial Park knowledgeable interpreters where they had a chance to see these flowerpot-shaped rocks. Interpretive tour, multimedia exhibit, viewing deck and the lunch were also well appreciated.

More information about the meeting can be found at [www.mcda70.org](http://www.mcda70.org).  
Nabil Belacel ([nabil.belacel@nrc.gc.ca](mailto:nabil.belacel@nrc.gc.ca))  
Georges Corriveau ([Georges.Corriveau@nrc.gc.ca](mailto:Georges.Corriveau@nrc.gc.ca))



## FINAL PROGRAM

### Jeudi 24 Septembre – Thursday, September 24

**10.00-11.00** Accueil et enregistrement – Welcome and Registration

**11.00-11.30** Allocutions de bienvenue – Welcoming addresses

- Merrill Henderson, Ville de Moncton, Moncton City

- Christian Couturier, Director General, National Research Council, NRC-Institute for Information Technology

- Chris Collin, Province du NB- former City Council representing Moncton

**11.30-12.30** **Intervenant principal – Keynote speaker I**

**Président – Chair:** Roman Slowinski

- **S.P. Simonovic (Canada):** Water Resources Management: A Systems view

**12.30-13.30** *Déjeuner – Lunch*

**13.30-15.00** **Session 1: MCDA in Environment I**  
**Président – Chair:** Maria Franca

Norese

- **F. Macary, X. Dumas, O. Laviale (France) :** Analyse de la robustesse et de la sensibilité de résultats obtenus par la méthode ELECTRE III dans le cadre d'une problématique agroenvironnementale
- **D. E. Lane, S. E. Nichols (Canada) :** MCDM in the Coastal Zone: Decision making alternatives for managing adaptation to environmental change
- **J-P. Waaub (Canada) :** La sélection d'un système d'indicateurs de suivi de la dégradation des terres et des eaux pour le Bassin du fleuve Niger: une approche multicritère

**15.00-15.30** *Pause Café – Coffee Break*

**15.30-17.00** **Session 2: MCDA in Environment II**  
**Président – Chair:** Jean-Philippe

Waaub

- **R. Lavoie, M. Boisvert, P. Dufour, J-C. Roy (Canada) :** Développement de la villégiature dans la MRC des Appalaches : Une application d'Electre Tri

- **K. Lidouh, Y. De Smet, E. Zimányi (Belgium)** : Representation of Preferences between Geographical Entities by Means of Spatial Deformations
- **M. Franca Norese, E. Liguigli (Italy)** : The Conceptual Design of a new Land Monitoring System

**Papiers soumis à discussion – Papers submitted for discussion**

- **S. Hajkowicz (Australia)** : Using Multiple Criteria analysis in Australia - Reflecting on major applications over the past decade
- **F. G. Libengue, B. Some, B. Ulungu (Belgium)** : Analyse multicritère pour la gestion de l'agriculture: structuration d'un processus de choix d'une variété de riz en République Centrafricaine

**19.00** *Dîner – Dinner*

**Vendredi 25 Septembre – Friday, September 25**

**08.30-09.30** **Session 3: MCDA in Energy I**  
**Président – Chair:** Slobodan P. Simonovic

- **A. Marzi (Canada)** : A Bees Inspired Multi-Objective Optimization Algorithm applied to the Environmental/Economic Dispatch Problem
- **M. de L. Vazquez (Canada)** : Analyse Spatiale et Approche D'Aide Multicritère et Multiacteurs à la Négociation Pour Évaluer Des Scénario D'Implantation Des Parcs Éoliens

**Papiers soumis à discussion – Papers submitted for discussion**

- A. Malamakis, **A. Karagiannidis, G. Perkoulidis (Greece)** : Simulation and Assessment of Alternative PAY-AS-YOU-THROW Scenarios Aiming At Maximizing Municipal Waste Diversion by The Resulting Direct Promotion of Minimization and Recovery Schemes
- **A. Karagiannidis, G. Perkoulidis (Greece)** : A Multicriteria Ranking of Different Technologies for anaerobic Digestion for Energy Recovery of the organic Fraction of municipal solid wastes
- **F. Cavallaro (Italy)** : Use of Multicriteria analysis to select Thermal energy storage in concentrated solar power (CSP) systems
- **A. Benallou, A. Menou (Morocco)** : Approches neuronales pour l'optimisation et la gestion du

mix énergétique alimentant les aéroports du Maroc

**09.30-10.00** *Pause café – Coffee break*

**10.00-11.00** **Intervenant principal – Keynote speaker II**  
**Président – Chair:** Jonathan Barzilai

- **A. Duena (UK)**: Is multicriteria decision analysis applicable to public health decision making?

**Papiers soumis à discussion – Papers submitted for discussion**

- S. Vlah, **J. R. Figueira (Portugal)** : Multi-Objective Scheduling and a Resource Allocation Problem in Hospitals
- **N. Belacel, M. Cuperlovic-Culf (Canada)** : Tumors Classification Using Microarray Gene Expression Data and PROAFTN Methodology
- **N. Belacel, S. Léger, H. Fournier, D. Cormier, S. Robichaud (Canada)** : Web Integration of Clinical Decision Support System for Screening and Assessment of Suicide Risk

**11.00-12.00** **Intervenant principal – Keynote speaker III**  
**Président – Chair:** Jose Rui Figueira

- **J. Barzilai (Canada)** Correcting the foundations of decision theory

**12.00-13.30** *Déjeuner – Lunch*

**13.30-14.00** B. Roy, **R. Slowinski, J. R. Figueira** : prochaine réunion et organisation – Next Meeting and organization

**14.00-16.00** **Session 4: Theory and Methodology I**  
**Président – Chair:** Kazimierz Zaras

- S. Greco, M. Kadzinski, **R. Slowinski (Poland)** : Identifying the most representative value function in robust multiple criteria sorting
- **S. Ben Amor, J. M. Martel (Canada)** : Multiple Criteria Aggregation Procedure for mixed evaluations including the weak preference relation: A new measure of distance
- V. Buchenkov, **M. Fernandes (Portugal)** : An algorithm for constructing the Pareto frontier of Multicriteria Integer Problems
- **W. Habenicht (Germany)** : An Interactive approach to integer linear vector optimization problems



16.00-16.30 *Pause café – Coffee break*

16.30-18.00 **Session 5: MCDA Applications I**  
**Président – Chair:** Sarah Ben Amor

- N. Kajiji, **Gordon H. Dash**, Elliot Krieger (USA) : Integration of Artificial Intelligence and Rough Set Methodology to Engineer a Predictive School Classification System
- **K. Zaras (Canada)** : Modélisation des préférences à l'aide des ensembles approximatifs sur l'exemple de la prédiction de faillite des PME Manufacturières de la MRC ROUYN-NORANDA
- **Q. Hayez, Y. De Smet, B. Mareschal (Belgium)** : D-Sight: a new multicriteria decision aid software

**Papiers soumis à discussion – Papers submitted for discussion**

- **G. Samaras (Greece)** : A Knowledge-Based DSS for a Global Stock Evaluation Application in Athens Stock Exchange
- **C. E. Escobar Toledo, Hector A. Martinez Berumen (Mexico)** : Technological Aspects of an R & D Centre using the Systems Approach: A Multicriteria decision making aid
- **R-M. Ciobanu, G. Condurache (Romania)** : Decision-Making in the Romanian Organizations: A Critical Process Between Art and Science
- **F. Al-Obeidat, N. Belacel (Canada)** : New Automatic Approach Based GA for Learning and Optimizing The MCDA Method PROAFTN



## Forthcoming Meetings

(This section is prepared by Carlos Henggeler Antunes)

### Forthcoming EWG Meetings/ 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*).

The 71th meeting of the European Working Group "Multiple Criteria Decision Aiding" will be held in **Torino, Italy. Date: 25-27 March 2010. Organizer: Maria Franca Norese (mariafranca.norese@polito.it). Web site: www.mcda71.polito.it E-mail: mcda@lep.polito.it.**

The 72th of the European Working Group "Multiple Criteria Decision Aiding" will be held in **Paris, France. Possible dates: September 30 to 2 October or October 7-9, 2010 or October. Topic: MCDA put into practice / Preference Elicitation. Organizer: Vincent Mousseau (vincent.mousseau@ecp.fr).**

### Other Meetings

Algorithmic Decision Theory, Venice, Italy, October 21-23, 2009, <http://www.adt2009.org>

V Latin-American Algorithms, Graphs and Optimization Symposium (LAGOS'09), Gramado (Rio Grande do Sul), Brazil, November 3-7, 2009, <http://www.inf.ufrgs.br/lagos09/>

IV Encuentro de la Red Iberoamericana de Evaluación y Decisión Multicriterio, Zapopan, México, November 10-13, 2009, <http://redmulticriterio09.cucea.udg.mx/>

Operational Research Society of New Zealand Annual Conference (ORSNZ09) Christchurch, New Zealand, December 3-4, 2009, <http://conference.orsnz.org.nz>

Association of Operational Research Societies in Asia Pacific Region - APORS2009, Jaipur, India, December 6-9, 2009, <http://www.apors2009.com>

Workshop on Transportation and Logistics, Chile, December 6-12, 2009, <http://www.sistemasdeingenieria.cl>

2009 IEEE International Conference on Industrial Engineering and Engineering Management, Hong Kong, China, December 8-11, 2009, <http://www.ieem2009.org>

3rd International Conference on Operations and Supply Chain Management, Malaysia, December 9-11, 2009, <http://www.oscm-forum.org/oscm2009>

2009 IEEE International Conference on Industrial Engineering and Engineering Management, Hong Kong, China, December 8-11, 2009, <http://www.ieem2009.org>

3rd International Conference on Operations and Supply Chain Management, Malaysia, December 9-11, 2009, <http://www.oscm-forum.org/oscm2009>

HICSS Minitrack on Intelligent Decision Support for Logistics and Supply Chain Management, Kauai, Hawaii, U.S.A., January 5-8, 2010, <http://www1.uni-hamburg.de/IWI/hicss/>

3rd Global Conference on Power Control & Optimization, Courtyard Surfers Paradise Resort, Gold Coast, Australia, February 2-4, 2010, <http://www.engedu2.net>

71st Meeting of the EWG on MCDA, Theme: "MCDA in the public and private organizations: today and in the future", Torino, Italy, March 25-27. Contact: Maria Franca Norese ([mariafranca.norese@polito.it](mailto:mariafranca.norese@polito.it)).

The Second Int. Conf. on Engineering Systems Management and its Applications, March 30 – April 1, 2010, American University of Sharjah, United Arab Emirates, <http://www.aus.edu/conferences/icesma2010/index.php>

25<sup>th</sup> Mini-EURO Conference Uncertainty and Robustness in Planning and Decision Making, Coimbra, Portugal, April 17-19, 2010, <http://www.inescc.pt/urpdm2010>

INFORMS 2010 Practice Conference: Applying Science to the Art of Business, Hilton Bonnet Creek Resort, Orlando, Florida, U.S.A., April 18-20, 2010, <http://meetings.informs.org/>

INFORMS 2010 Practice Conference: Applying Science to the Art of Business, Orlando, Florida, USA, April 18-20, 2010, <http://meetings.informs.org/>

Tenth INFORMS Telecommunications Conference 2010, Concordia University Montreal, Quebec, Canada, May 5-7, 2010, <http://meetings.informs.org/>

CIAC 2010 - 7th International Conference on Algorithms and Complexity, Rome, Italy, May 26-28, 2010, <http://ciac.di.uniroma1.it/>

ECCO XXIII - CO 2010 Joint conference of ECCO and the British CO group, Malaga, Spain, May 27-29, 2010, <http://www.g-scop.eu/ECCO>

17th International Annual EurOMA Conference – Managing Operations in Service Economies, Porto, Portugal, 6-9 June 2010, <http://www.euroma2010.org/>

ALIO/INFORMS International 2010, Buenos Aires, Argentina, June 6-9, 2010, <http://meetings.informs.org/>

Seventh Triennial Symposium on Transportation Analysis - TRISTAN VII, Tromsø, Norway, June 20-25, 2010, <http://www.tristan7.org>

12th International Conference on Stochastic Programming Halifax, Nova Scotia, Canada, August 16-20, 2010, <http://ispc12.dal.ca>

EURO XXIV – 24<sup>th</sup> European Conference on Operational Research, Lisbon, Portugal, July 11-14, 2010, <http://www.euro2010lisbon.org/>

2nd International Conference on Applied Operational Research (ICAOR'10), Turku, Finland, August 25-27, 2010, <http://www.tadbirstm.org.ir>

MCPL 2010 – Management and Control of Production Logistics, Coimbra, Portugal, September 8-10, 2010, <http://mcpl2010.uc.pt/>

INFORMS Annual Meeting 2010, Austin, Texas, USA, November 7-10, 2010, <http://meetings.informs.org/>

The 21st International Conference on Multiple Criteria Decision Making – MCDM 2011, University of Jyväskylä, Finland, June 13-17, 2011, <https://www.jyu.fi/en/congress/mcdm2011>

2011 IFORS Conference on World OR : Global Economy and Sustainable Environment, Melbourne, Australia, July 10-15, 2011, <http://www.ifors2011.org/>

OR 2011 - International Conference on Operations Research Zurich, Switzerland, August 30 - September 2, 2011

INFORMS Annual Meeting 2011, Charlotte, North Carolina, U.S.A., November 13-16, 2011, <http://meetings.informs.org/>

## Announcements

### Cost IC0602 International Doctoral School

#### Algorithmic Decision Theory: Computational Social Choice

Session 2010 : April 9-14, 2010, Estoril, Lisbon, Portugal

Organizing and scientific committee: José Rui Figueira (CEG-IST, Instituto Superior Técnico, Lisbon, Portugal), António Carvalho Fernandes (CEG-IST, Instituto Superior Técnico, Lisbon, Portugal), Alexis Tsoukiàs (CNRS-LAMSADE, Paris, France), Jérôme Lang (CNRS-LAMSADE, Paris, France), Carlos Henggeler-Antunes (INESC-Coimbra).

This programme is an activity of the COST Action IC0602 "Algorithmic Decision Theory" ([www.algodec.org](http://www.algodec.org)). It is also supported by the Centre for Management Studies (CEG-IST) at Instituto Superior Técnico (IST) and Tagus Park Campus of IST. It is the fourth doctoral school organised by the COST Action IC0602 (the first took place in Han sur Lesse, Belgium, in September 2007, the second one in Troina, Sicily, Italy, April 2008, the third one at Cork, Ireland, April 2009; see more in [www.algodec.org](http://www.algodec.org)).

#### Goals:

- Promote recent research results obtained in the field of Computational Social Choice and Algorithmic Decision Theory
- Develop contacts and collaboration among young researchers in this field.

Target participants: doctoral students engaged in decision theory or decision support, understood in a broad sense (i.e. computational social choice theory, multiple criteria decision analysis including multi-objective optimization, decision under risk and uncertainty, algorithmic decision theory, welfare economics, etc.)

Organisation: during their stay, up to 30 selected doctoral students will receive intensive training in three selected topics dispensed by three well-known scholars in the field of computational social choice; the participants will be given an opportunity to present their own work and receive a feedback. Additional senior researchers will stay for one or two days and give a talk. All presentations and discussions will be in English.

Practical issues: the participants will be accommodated at the Eden Hotel located in Estoril (<http://www.portugalvirtual.pt/lodging/costadelisboa/estoril/estoril.eden/index.html>), a small city around 25 kilometres far from Lisbon. The working sessions will take place in the hotel, as well as the meals. From the airport, the hotel can be reached by bus-subway-train, bus-

train, or taxi (more information will be provided in the site of the hotel).

Sketch of the programme: a typical day will consist of two lectures of two hours. Confirmed talks by:

- Christian Klamer (Institute of Public Economics at Graz University). Url: <http://www.uni-graz.at/fwiwww/home-eng/staff/klamler.html>)
- Ulle Endriss (ILLC, University of Amsterdam). Url: <http://www.ilic.uva.nl/~ulle/>
- Jérôme Lang (CNRS-LAMSADE, Paris). URL: <http://www.irit.fr/recherches/RPDMP/persos/Jerome.html>

About three hours will be devoted to presentation and discussion of their research by the participants. Five senior researchers will visit the School and deliver short lectures.

Fee: The School is supported by the COST Action IC0602 "Algorithmic Decision Theory". Other sponsors are CEG-IST and IST-Taguspark. The fee for students is 225 € for the entire stay (full pension). Travel expenses are not covered by the organizers.

Application: doctoral students, especially those in early stages of their research, are invited to apply for participation to the School by sending a short CV that mention their background and their research interests and/or achievements. Applications must be sent by the end of January, 2010

to José Rui Figueira ([figueira@ist.utl.pt](mailto:figueira@ist.utl.pt)). The scientific committee will select the participants on the basis of their research interests and records. Priority will be given to students from countries involved in the COST Action. Students who already participated to the previous schools can apply again although priority will be given to new applications. Applicants will be informed of the decision of the committee by February 20, 2010.

For further information send an e-mail to: [figueira@ist.utl.pt](mailto:figueira@ist.utl.pt).

For further details look at: [www.algodec.org](http://www.algodec.org).

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**The 10<sup>th</sup> MCDA Summer School, Ecole Centrale Paris, June 27th - July 9th, 2010.**

<http://www.qi.ecp.fr/mcda-ss>

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Dear Colleagues

Please find below three web-links to announcements for three PhD research positions at Eawag. I would greatly appreciate if you could spread the information at your institutions and among relevant candidates:  
[http://www.eawag.ch/jobs/doktorate/phd\\_sww\\_environ\\_eng](http://www.eawag.ch/jobs/doktorate/phd_sww_environ_eng)

[http://www.eawag.ch/jobs/doktorate/phd\\_siam\\_environ\\_eng](http://www.eawag.ch/jobs/doktorate/phd_siam_environ_eng)

[http://www.eawag.ch/jobs/doktorate/phd\\_siam\\_decision\\_analysis](http://www.eawag.ch/jobs/doktorate/phd_siam_decision_analysis)

The positions are part of the transdisciplinary project "Sustainable Water Infrastructure Planning" funded by the Swiss National Science Foundation. The successful candidate will be part of a team of 3 PhD students that will develop a novel integrated, participatory planning procedure for municipal water infrastructures. The project focuses on dealing with limited data, the uncertainty of future developments, and ensuring high acceptance of the decision-making process by stakeholders.

Thank you in advance.

Max Maurer,  
max.maurer@eawag.ch  
<http://www.eawag.ch>

Info about my person:

<http://www.eawag.ch/~maurer/>

## Call for Papers

### Web site for Call for Papers:

[www.inescc.fe.uc.pt/~ewgmcda/CallforPapers.html](http://www.inescc.fe.uc.pt/~ewgmcda/CallforPapers.html)



## Books

### Encyclopedia of Operations Research and Management Science

Centennial Edition

Gass, Saul I.; Fu, Michael C. (Eds.)

Version: **eReference** (online access)

3rd ed., 2012

ISBN: 978-1-4419-1153-7

#### About this encyclopedia

The Encyclopedia aims to provide decision-makers in the OR field with a comprehensive overview of the range of ideas and forces that combine in the fields of operations research and management science.

Among the topics treated in the 2<sup>nd</sup> edition that will be revisited in the 3<sup>rd</sup> edition are:

analytic network process, call centers, certainty equivalence, comb. optimization by simulated ce, computational organization, constraint programming, data mining, degeneracy graphs, economic order q extensions, educational issues in b-schools, electronic commerce, financial markets, global climate change, hidden markov models, history of early british or, implementation for public sector, info tech benefits, interactive multi-objective math. programming, knapsacks with nonlinearities, little's law in distribution form, military ops other than war, multivariate quality control, perturbation analysis, simulation metamodeling, simulation optimization, supply chain management, theory of constraints, timetabling.

New entry topics for the 3<sup>rd</sup> edition, include the following, yield management, flexible queuing systems, service mangement, local search, tolerance sensitivity analysis, influence diagrams, knowledge management, strategy and policy making, school districting, computational biology, lagrangian relaxation, closed-loop supply chain, sensitivity analysis, bioinformatics, rendezvous search, ant search algorithms, agriculture and forestry resources, and many others...

#### Written for:

Professional decision-makers with varying educational and skill backgrounds (from undergraduate students to PhDs), all research libraries in OR/MS

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## Recent Advances in Decision Making

Springer, 2009  
Volume Edited

### Preface

It is not only the vast amount of data but knowledge extraction and processing play an important role in the design of the decision support systems. Sensible decision support systems are required in virtually every field including business, healthcare, defence and so on [1]. The design of decision support systems is also dependent on factors such as changing sets of circumstances, uncertainty, incomplete set of data. Intelligent paradigms such as knowledge-based systems, artificial neural networks, fuzzy systems, evolutionary computing paradigms, intelligent agents have contributed immensely in the decision making process. Knowledge-based systems [2] can mimic the performance of a human expert in a limited sense by transferring his/her knowledge to the computer in a specific domain. Artificial neural networks are modeled after the human brain for fusing human like intelligence in machines. Fuzzy systems are designed to incorporate human like reasoning capability in machines. Evolutionary systems use principles inspired by natural population genetics and are applied in many problems including optimization. Intelligent agents can aid and automate complex problem solving in many areas and help in effective decisions [3]. The combination of intelligent systems and decision support systems provides new powerful tools for decision makers [4][5]. The book is a collection of selected contributions from some of the world class researchers in the field of intelligent tools and decision making. This sample is to demonstrate that the intelligent tools can enhance the decision making process. We sincerely thank the contributors and reviewers for their excellent contribution. We acknowledge the excellent support of Springer-Verlag and SCI Data Processing

Team.

Elisabeth Rakus-Andersson, Sweden  
Ronald R. Yager, USA  
Nikhil Ichalkaraje, Australia  
Lakhmi C. Jain, Australia

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## SWARM INTELLIGENCE FOR MULTI-OBJECTIVE PROBLEMS IN DATA MINING

Edited by: Carlos A. Coello Coello, Satchidananda Dehuri and Susmita Ghosh

Published by: Springer (Studies in Computational Intelligence, Series Vol. 242), ISBN: 978-3-642-03624-8  
Hardcover, 288 pages, 82 illustrations

<http://www.springer.com/engineering/book/978-3-642-03624-8>

### About this book:

The purpose of this book was to collect contributions that are at the intersection of multi-objective optimization, swarm intelligence (specifically, particle swarm optimization and ant colony optimization) and data mining. Such a collection intends to illustrate the potential of multi-objective swarm intelligence techniques in data mining, with the aim of motivating more researchers in evolutionary computation and machine learning to do research in this field.

This volume consists of eleven chapters, including an introduction that provides the basic concepts of swarm intelligence techniques and a discussion of their use in data mining. Some of the research challenges that must be faced when using swarm intelligence techniques in data mining are also addressed. The rest of the chapters were contributed by leading researchers, and were organized according to the steps normally followed in Knowledge Discovery in Databases (KDD) (i.e., data preprocessing, data mining, and post processing).

We hope that this book becomes a valuable reference for those wishing to do research on the use of multi-objective swarm intelligence techniques in data mining and knowledge discovery in databases.

### Written for:

Researchers, engineers, graduate students in computational intelligence, computer science, swarm intelligence

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## Decision Behaviour, Analysis and Support

Simon French

*University of Manchester*

John Maule

*University of Leeds*

Nadia Papamichail

*University of Manchester*

**Paperback**

(ISBN-13: 9780521709781)

Behavioural studies have shown that while humans may be the best decision makers on the planet, we are not quite as good as we think we are. We are regularly subject to biases, inconsistencies and irrationalities in our decision making. Decision Behaviour, Analysis and Support explores perspectives from many different disciplines to show how we can help decision makers to deliberate and make better decisions. It considers both the use of

computers and databases to support decisions as well as human aids to building analyses and some fast and frugal tricks to aid more consistent decision making. In its exploration of decision support it draws together results and observations from decision theory, behavioural and psychological studies, artificial intelligence and information systems, philosophy, operational research and organisational studies. This provides a valuable resource for managers with decision-making responsibilities and students from a range of disciplines, including management, engineering and information systems.

- Explains effective decision-making for practitioners and students from a range of disciplines, including management, engineering and information systems
- Covers the use of computer technology in decision-making
- Features real-world examples and scenarios to give practical insight

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### **Herramientas Operativas para el Análisis Multicriterio del Desarrollo Económico Local**

Juan Carlos Leyva López  
Ezequiel Avilés Ochoa  
José Jaime Zepeda Rodríguez  
(editores)

Aquel proceso reactivador y dinamizador de la economía local, que mediante el aprovechamiento eficiente de los recursos endógenos existentes de una determinada zona, es capaz de estimular el crecimiento económico, crear empleo y mejorar la calidad de vida se le conoce como **Desarrollo Económico Local**. Durante las últimas décadas el desarrollo económico local ha resultado un campo de la mayor importancia para el desarrollo sustentable de una región. Ello se debe principalmente a la creciente complejidad de los ambientes sociales, económicos, demográficos, entre otros. Estas nuevas condiciones junto con la complejidad en los problemas de toma de decisiones públicas han motivado a investigadores de diversos campos de investigación a desarrollar metodologías eficientes para toma de decisiones de desarrollo económico local. **Herramientas Operativas para el Análisis Multicriterio del Desarrollo Económico Local** presenta un conjunto de herramientas operacionales provenientes del análisis multicriterio, sistemas de apoyo a la decisión, análisis estadístico e inteligencia artificial para el estudio de algunos problemas de desarrollo económico local. La presentación de estas herramientas y su aplicación a problemas del mundo real ofrece una nueva perspectiva de

solución a problemas complejos de decisión en el amplio campo de las Ciencias Sociales.

Audiencia:

**Herramientas Operativas para el Análisis Multicriterio del Desarrollo Económico Local** es ideal para todos aquellos investigadores, profesionales y estudiantes graduados que desean seguir el proceso de solución de problemas complejos de decisión por medio de técnicas del análisis multicriterio para la toma de decisiones.

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### **Trends in Multicriteria Decision Analysis**

M. Ehrgott, J.R. Figueira, and S. Greco (Editors)

Forthcoming, 2010 (for more details see the next issue of the Newsletter)



### **Articles Harvest**

(This section is prepared by Juscelino ALMEIDA DIAS)

Adra S. F., T. J. Dodd, I. A. Griffin, and P. J. Fleming (2009). Convergence Acceleration Operator for Multiobjective Optimization. *IEEE Transactions on Evolutionary Computation* 13(4), 825-847.

Alfares H. K. and S. O. Duffuaa (2008). Assigning cardinal weights in multi-criteria decision making based on ordinal ranking. *Journal of Multi-Criteria Decision Analysis* 15(5-6), 125-133.

Amid A., S. H. Ghodsypour, and Ch. O'Brien (2009). A weighted additive fuzzy multiobjective model for the supplier selection problem under price breaks in a supply Chain. *International Journal of Production Economics* 121(2), 323-332.

Angilella S., S. Greco, and B. Matarazzo (2010). Non-additive robust ordinal regression: A multiple criteria decision model based on the Choquet integral. *European Journal of Operational Research* 201(2), 277-288.

Arana-Jiménez M., G. Ruiz-Garzón, A. Rufián-Lizana, and R. Osuna-Gómez (2010). A necessary and sufficient condition for duality in multiobjective variational problems. *European Journal of Operational Research* 201(3), 672-681.

- Arıkan F. and Z. Güngör (2009). Modeling of a manufacturing cell design problem with fuzzy multi-objective parametric programming. *Mathematical and Computer Modelling* 50(3-4), 407-420.
- Baky I. A. (2009). Fuzzy goal programming algorithm for solving decentralized bi-level multi-objective programming problems. *Fuzzy Sets and Systems* 160(18), 2701-2713.
- Behzadian M., R. B. Kazemzadeh, A. Albadvi, and M. Aghdasi (2010). PROMETHEE: A comprehensive literature review on methodologies and applications. *European Journal of Operational Research* 200(1), 198-215.
- Ben Abdelaziz F. and H. Masri (2010). A compromise solution for the multiobjective stochastic linear programming under partial uncertainty. *European Journal of Operational Research* 202(1), 55-59.
- Brito A. J., A. Teixeira de Almeida, and C. M.M. Mota (2010). A multicriteria model for risk sorting of natural gas pipelines based on ELECTRE TRI integrating Utility Theory. *European Journal of Operational Research* 200(3), 812-821.
- Brothers A. J., S. V. Mattigod, D. M. Strachan, G. H. Beeman, P. K. Kearns, A. Papa, and C. Monti (2009). Resource-Limited Multiattribute Value Analysis of Alternatives for Immobilizing Radioactive Liquid Process Waste Stored in Saluggia, Italy. *Decision Analysis* 6(2), 98-114.
- Cao N. V., E. Fragnière, J.-A. Gauthier, M. Sapin, and E. D. Widmer (2010). Optimizing the marriage market: An application of the linear assignment model. *European Journal of Operational Research* 202(2), 547-553.
- Carrizosa E. (2010). Unequal probability sampling from a finite population: A multicriteria approach. *European Journal of Operational Research* 201(2), 500-504.
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## Seminars

### SÉMINAIRE «MODÉLISATION DES PRÉFÉRENCES ET AIDE MULTICRITÈRE À LA DÉCISION»

**Responsables :** Bernard ROY,

Daniel VANDERPOOTEN

(le mardi, à 14.00)

20 octobre 2009

Conférence de **Tristan Cazenave** (LAMSADE) :  
*Recherche Monte-Carlo Emboîtée pour la régulation de lignes de bus.*  
(salle à préciser)

10 novembre 2009

Conférence de **Yannis Siskos** (University of Piraeus, Grèce) :  
*Mesures de robustesse dans les méthodes de désagrégation multicritère.*  
(salle à préciser)

- 24 novembre 2009      Conférence de **Florent Joerin** (Université Laval, Canada) :  
*Aide à la décision territoriale : est-ce si différent ?*  
(salle à préciser)
- 15 décembre 2009      Conférence de **Meltem Oztürk** (LAMSADE) :  
*Agrégation des ordres d'intervalle par une optimisation propositionnelle.*  
(salle à préciser)
- 12 janvier 2010      Conférence de **Jérôme Lang** (LAMSADE) :  
*Apprentissage de préférences séparables sur des domaines combinatoires.*  
(salle à préciser)
- 2 février 2010      Conférence de **Denis Bouyssou** (LAMSADE) et **Thierry Marchant** (Université de Gand, Belgique) :  
*Mesurage conjoint additif sur la base de partitions ordonnées.*  
(salle à préciser)

## DISSERTATIONS

EUSÉBIO, Augusto: Network Flow Problems with Multiple Objectives [In Portuguese], PhD Thesis, November 2009, University of Coimbra. Jury: Prof. José Reis, Margarida Vaz Pato, Carlos Ferreira, João Lisboa, Maria João Alves, and José Rui Figueira (supervisor)

ABSTRACT: The work presented in this Thesis is devoted to the field of multi-objective network flows problems. It begins with a survey of all known exact and approximate algorithms for continuous network flow problems as well as integer network flow problems. We began by doing a survey of all the algorithms known for solving the multiple objective flow problems, for both the continuous and integer case exact and approximation algorithms. We observed that the large majority of the algorithms were designed for taking into account only two objectives and there were several algorithms incorrect. We presented some examples showing that the most used method to find all the supported non-dominated solutions for the integer bi-objective network flow problem was wrong. A set of original algorithms were proposed: a primal-dual algorithm that finds all the extreme non-dominated solutions for the bi-objective network flow problem, a primal-dual algorithm for the minimum flow problem, a cost zero cycle algorithm that finds all the supported efficient/non-dominated solutions for the integer multi-objective network flow problem (this algorithm is based on the proof of the connectedness of the supported non-dominated solutions that was presented also in this Thesis), an improved  $\epsilon$ -constraint algorithm that finds all efficient/non-dominated solutions for the integer bi-objective network flow problem and a trapezium algorithm that finds representations of the set of all non-dominated solutions for the integer bi-objective network flow problem. All the algorithms have been implemented by using the C programming language and the results and analysis were reported in this document too.

**Announcement:**

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

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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 Rui Figueira ([figueira@ist.utl.pt](mailto:figueira@ist.utl.pt)) and Luís Dias ([ldias@inescc.pt](mailto:ldias@inescc.pt))

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

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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.

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## Call for Papers

# 25<sup>th</sup> Mini-EURO Conference

## Uncertainty and Robustness in Planning and Decision Making (URPDM 2010)

Coimbra - Portugal

15-17 April 2010



Institute of Systems  
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### Scope and objectives

Uncertainty and risk are pervasive issues in planning and decision making tasks. With a wide range of causes and types of uncertainty, there are correspondingly many approaches to their treatment in decision analysis and optimization models. Some are tackled through discussion and creativity techniques to help decision makers set the boundaries of their problem; others are tackled through modelling techniques, e.g. probability, to reflect the randomness in the external world; yet others are approached through the use of sensitivity and robustness studies to explore the possible consequences of lack of precision in data estimates and judgments.

Different research communities address uncertainty issues in planning and decision making using different approaches, which often present similarities although being developed under distinct perspectives. There is a clear need for more work in the interfaces between these approaches for dealing creatively and effectively with different types of uncertainty in different contexts, also having in mind real-world applications.

This Conference is aimed at bringing together the specific expertise in aspects of handling uncertainty within decision support models to build a more comprehensive overview and integrated methodologies to tackle the various sources and types of uncertainties at stake in optimization and decision problems. The Conference will provide a forum in which researchers coming from different scientific disciplines and areas can discuss and share their experience regarding methodological approaches to tackle uncertainty for obtaining robust conclusions in decision support models with application to several areas.

Contributions from decision theory, Bayesian analysis, fuzzy sets, rough sets, risk analysis, stochastic programming, sensitivity analysis, robustness analysis, interval programming, inexact programming, constraint programming, evolutionary algorithms and meta-heuristics, multi-criteria analysis and multi-objective optimization, among others, are expected both from methodological and application perspectives, thus paving the way for a cross-fertilization between distinct ways to incorporate the treatment of uncertainty in optimization and decision support models.

This event follows up the successful conference on "Managing Uncertainty in Decision Support Models" that was held in 2004.

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### Submissions and publication

Contributions must be submitted under the form of short papers (4-6 pages) in the template provided at the Conference web site. Two types of submissions are welcome:

- Proposal for a session of three papers dedicated to a given topic. After acceptance, the promoter will be responsible for his/her session and will chair it.
- Free submission of short papers (4-6 A4 pages).

The accepted papers will be published in a CD-ROM Conference Proceedings.

Full versions of the papers presented at the Conference may be later submitted for publication in the following journals, subject to a thorough peer-review process: International Journal of Systems Science, Journal of Mathematical Modelling and Algorithms, International Journal of Intelligent Decision Technologies.

### Venue

The conference will be hosted by the University of Coimbra. Dating from 1290, the University of Coimbra is one of the oldest in Europe and the oldest in Portugal.

Coimbra is located in the central region of Portugal, easily accessible by car, bus or train from Lisbon (200 Km) or Porto (130 Km) international airports.

### Registration fee

Type of registration	Until March 1, 2010	After March 1, 2010
Normal <sup>(1)</sup>	250 €	300 €
Student <sup>(2)</sup>	150 €	200 €

<sup>(1)</sup> Includes Proceedings volume and conference documentation, two lunches, coffee breaks, social program, and taxes.

<sup>(2)</sup> Includes all of the above, except the banquet comprised in the social program. To qualify as a student, the delegate must present a student card.

### Important dates

November 30, 2009 – Proposals for sessions and submission of short papers (4-6 pages)

February 1, 2010 - Notification to authors

March 1, 2010 - Final paper due (final version may be expanded up to 8 pages, 2MB pdf file max) and early registration deadline

March 22, 2010 - Registration deadline (to guarantee inclusion in the final program and proceedings volume)

April 15-16-17, 2010 – Conference

A deadline will be announced for submission of full papers to the refereed special issues of journals.

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**META'10**  
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# International Conference on Metaheuristics and Nature Inspired Computing

October 28th-30th 2010  
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The 3<sup>rd</sup> International Conference on Metaheuristics and Nature Inspired Computing, META'10, will held at Djerba Island in Tunisia on the October-28<sup>th</sup>-30<sup>th</sup> 2010.

The Conference will be an exchange space thanks to the sessions of the research works presentations and also will integrate tutorials and a vocational training of metaheuristics and nature inspired computing.

The scope of the META'2010 conference includes, but is not limited to:

- Local search, tabu search, simulated annealing, VNS, ILS, ...
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## Submission papers

- Submission of papers should be in shape of an abstract of two pages sent before the **15<sup>st</sup> May 2010** via the website.

- Selected papers will be published in **international journals**.

- Predefined styles are available on the website <http://www.lifl.fr/META10> that we invite you to visit regularly and which evolves when the organization progresses.

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### Welcome to PCO 2010 in Gold Coast!

It is our great pleasure to announce the third Global Conference on Power Control and Optimization PCO 2010, which will be held in Courtyard Surfers Paradise Resort, Gold Coast, Australia from 2 to 4 February 2010. The Conference is technically sponsored by AIP, WSEAS and Springerlink, and organized by School of Engineering, Curtin University, Malaysia, and the Middle East Technical University, the Institute of Applied Mathematics (IAM). Scope of the conference is contemporary and original research and educational development in the area of electrical power engineering, control systems and methods of optimization. The scope of the conference includes, but not limited to, the following topics:

- Hybrid renewable energy and energy saving
- Power systems, protection and reliability
- Controllers, drives and machine design
- Smart system and dynamic robust system
- Mechatronics and nano physics
- NEMS and MEMS
- Simulators and software engineering
- Soft computing and computational intelligent
- Fuzzy and hybrid optimization
- Bioinformatics and body sensors
- Inventory, queuing & game theory
- Artificial immune systems
- Evolutionary algorithms
- Ant colony, genetic and swarm optimization
- Probabilistic & possibilistic optimization
- Production design and rough set
- Line, pattern searches and decision making
- Micro transportation
- Network communication and wireless sensor
- Scheduling and assignment problems
- Condition monitoring and instruments
- Graf theory & supply chain management

Prospective authors from universities or institutes and industries are invited to submit the full paper by email before the deadline. Paper should be submitted electronically, formatted in MS-Word, as per PCO guideline.

All papers will be peer reviewed by independent specialists as per IEEE guide. PCO-10 proceeding will be published online by AIP. Selected papers will be published in Elsevier, Springer, Inderscience, Professional Engineering, and other Journals.

Proposal for holding special sessions, tutorial and workshop are invited from prospective authors, industrial bodies and academicians, and should be addressed to the Chair. The program committee is currently looking for speakers and financial sponsors from industry, academics, and professional bodies.

### Important Dates

Submission of Full Papers	01/10/09
Notification with Peer Review	01/11/09
<b>Camera-ready Paper</b>	<b>15/12/09</b>
<b>Registration with Full Payment</b>	<b>15/12/09</b>

### Registration

Registration fee covers three day sessions, program booklet, CD proceeding, lunches, tea breaks, and banquet dinner. The fee is unique and identical for all delegates. The registration form must be submitted by email before the deadline to: [icpco.20@gmail.com](mailto:icpco.20@gmail.com)

Each accepted paper must be presented by one of the authors after paying the necessary fee of 300.00 EURO. This fee is applied for all delegates, accompanies and students. No discount or waving will be given.

### Contact

All correspondence should be addressed to the conference secretariat:

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Cvetko Andreeski, Macedonia  
Andrew Kusiak, USA  
Wei Xu, UK  
Cvetko Andreeski, Macedonia

### International Program Committee

Terry Williams, UK  
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Didier Dubois, France  
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John Mellor, UK  
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Praveen Jain, Canada  
Frede Blaabjerg, Denmark  
Christoph Meyer, Germany  
Nicola Femia, Italy  
Nikhil Ranjan Pal, Taiwan  
Henry Nuttle, USA  
Gerhard Wilhelm Weber, Turkey  
Fernando Gomide, Brazil  
Moti Henig, Israel  
Sergey Kryzhevich, Russia  
Gianfranco Rizzo, Italy

## Streams on the behalf of the EWG-MCDA

### 1. MCDA I: New approaches and applications

Bernard Roy ([roy@lamsade.dauphine.fr](mailto:roy@lamsade.dauphine.fr))

Salvatore Greco ([salgreco@unict.it](mailto:salgreco@unict.it))

#### People to invite for organizing sessions:

- Sebastien Damart ([damart@mlab.ens-cachan.fr](mailto:damart@mlab.ens-cachan.fr))
  1. *MCDA I: Processes: Social and Organizational highlights*
- Sarah Ben Amor ([BenAmor@telfer.uottawa.ca](mailto:BenAmor@telfer.uottawa.ca))
  1. *MCDA I: Uncertainty*
- Antonio Boggia ([boggia@unipg.it](mailto:boggia@unipg.it))
  1. *MCDA I: Applications in Agricultural and Environmental Management*
- Maria Franca Norese ([mariafranca.norese@polito.it](mailto:mariafranca.norese@polito.it))
  1. *MCDA I: Public Administration*
- Florent Joerin  
([florent.joerin@esad.ulaval.ca](mailto:florent.joerin@esad.ulaval.ca), [Florent.Joerin@crad.ulaval.ca](mailto:Florent.Joerin@crad.ulaval.ca),  
[Florent.Joerin@epfl.ch](mailto:Florent.Joerin@epfl.ch))
  1. *MCDA I: Territorial Decision Making*
- Constantin Zopounidis ([kostas@dpem.tuc.gr](mailto:kostas@dpem.tuc.gr))
  1. *MCDA I : Methods Applied to Finance*

### 2. MCDA II: Axiomatic basis, meaningfulness, and other issues

Denis Bouyssou ([bouyssou@lamsade.dauphine.fr](mailto:bouyssou@lamsade.dauphine.fr))

José Rui Figueira ([figueira@ist.utl.pt](mailto:figueira@ist.utl.pt))

#### People to invite for organizing sessions (9):

- Alec Morton ([a.morton@lse.ac.uk](mailto:a.morton@lse.ac.uk))
  1. *MCDA II: Portfolio Analyses I*
  2. *MCDA II: Health*
  3. *MCDA II: Environment*
- Marc Pirlot ([marc.pirlot@fpms.ac.be](mailto:marc.pirlot@fpms.ac.be))
  1. *MCDA II: Theoretical contributions*
  2. *MCDA II: Applications and other issues*
- Kostas Zopounidis ([kostas@dpem.tuc.gr](mailto:kostas@dpem.tuc.gr))
  1. *MCDA II: Sorting Models, theoretical aspects and other issues.*
- Yannis Siskos ([ysiskos@unipi.gr](mailto:ysiskos@unipi.gr)) and Vangelis Grigoroudis  
([vangelis@ergasya.tuc.gr](mailto:vangelis@ergasya.tuc.gr))
  1. *MCDA II: New issues in aggregation-disaggregation philosophies*
- Jean-Philippe Waaub ([waaub.jean-philippe@uqam.ca](mailto:waaub.jean-philippe@uqam.ca); [jean-philippe.waaub@gerad.ca](mailto:jean-philippe.waaub@gerad.ca))



- 1. *MCDA II: Environment and natural resources management.*
- Juan Carlos Leyva Lopez ([jleyva@culiacan.udo.mx](mailto:jleyva@culiacan.udo.mx))
  - 1. *MCDA II: Group Decision*

### 3. MCDA III: Preference Learning

Roman Slowinski ([roman.slowinski@cs.put.poznan.pl](mailto:roman.slowinski@cs.put.poznan.pl))  
 Alexis Tsoukias ([tsoukias@lamsade.dauphine.fr](mailto:tsoukias@lamsade.dauphine.fr))

#### People to invite for organizing sessions (2):

- Roman Slowinski ([roman.slowinski@cs.put.poznan.pl](mailto:roman.slowinski@cs.put.poznan.pl))
  - 1. *MCDA III: Preference Learning I*
- Alexis Tsoukias ([tsoukias@lamsade.dauphine.fr](mailto:tsoukias@lamsade.dauphine.fr))
  - 1. *MCDA III: Preference Learning II*

### 4. Multi-Objective Optimization (MOO):

Kathrin Klamroth ([kathrin.klamroth@math.uni-wuppertal.de](mailto:kathrin.klamroth@math.uni-wuppertal.de))  
 Jacques Teghem ([Jacques.Teghem@umons.ac.be](mailto:Jacques.Teghem@umons.ac.be))  
 José Rui Figueira ([figueira@ist.utl.pt](mailto:figueira@ist.utl.pt))

#### People to invite for organizing sessions (19):

- Jacques Teghem ([Jacques.Teghem@umons.ac.be](mailto:Jacques.Teghem@umons.ac.be))
  - 1. *MOO: Metaheuristics for Multi-Objective Optimization. II*
  - 2. *MOO: Scheduling Problems I*
- José Rui Figueira ([figueira@ist.utl.pt](mailto:figueira@ist.utl.pt))
  - 1. *MOO: Network Territorial Partition Problems.*
- Luís Paquete ([paquete@dei.uc.pt](mailto:paquete@dei.uc.pt))
  - 1. *MOO: Algorithms for Multi-Objective Combinatorial Optimization I*
- José Luís Santos ([zeluis@mat.uc.pt](mailto:zeluis@mat.uc.pt))
  - 1. *MOO: Algorithms for Multi-Objective Combinatorial Optimization II*
- Marta Pascoal ([marta@mat.uc.pt](mailto:marta@mat.uc.pt))
  - 1. *MOO: Network Optimization and Transportation.*
- El-Ghazali Talbi ([El-ghazali.Talbi@lifl.fr](mailto:El-ghazali.Talbi@lifl.fr))
  - 1. *MOO: Metaheuristics for Multi-Objective Optimization. II*
- Fouad Ben Abdelaziz ([fabdelaziz@aus.edu](mailto:fabdelaziz@aus.edu))
  - 1. *MOO: Theory and Practice I*
- Matthias Ehrgott ([m.ehrgott@auckland.ac.nz](mailto:m.ehrgott@auckland.ac.nz))
  - 1. *MOO: Multi-Objective Combinatorial Optimization*
- Kaisa Miettinen ([Kaisa.miettinen@jyu.fi](mailto:Kaisa.miettinen@jyu.fi)) and Jacques Teghem ([Jacques.Teghem@umons.ac.be](mailto:Jacques.Teghem@umons.ac.be))
  - 1. *MOO: Nonlinear Multi-Objective Optimization Techniques in Action*
- Justo Puerto ([puerto@us.es](mailto:puerto@us.es))
  - 1. *MOO: Complexity Issues in MOCO*
- Christiane Tammer ([christiane.tammer@mathematik.uni-halle.de](mailto:christiane.tammer@mathematik.uni-halle.de))
  - 1. *MOO: Multiple Criteria Approaches in Mathematical Finance*
  - 2. *MOO: Optimality Conditions in Multi-Objective Optimization*
- Margarida Vaz Pato ([mpato@iseg.utl.pt](mailto:mpato@iseg.utl.pt))

- 1. *MOO: Scheduling Problems II*
- George Mavrotas ([mavrotas@chemeng.ntua.gr](mailto:mavrotas@chemeng.ntua.gr)) and Danae Diakoulaki ([diak@chemeng.ntua.gr](mailto:diak@chemeng.ntua.gr))
  - 1. *MOO: Energy Systems*
  - 2. *MOO: Project Selection*
- Carlos Ferreira ([carlosf@ua.pt](mailto:carlosf@ua.pt))
  - 1. *MOO: Facility Location Problems*
- Rafael Caballero ([r\\_caballero@uma.es](mailto:r_caballero@uma.es)) and Julia Molina ([julian.molina@uma.es](mailto:julian.molina@uma.es))
  - 1. *MOO: Trends in Metaheuristics Multio-Objective*
- Vladimir Bushenkov ([bushen@uevora.pt](mailto:bushen@uevora.pt))
  - 1. *MOO: Integer Programming*

## **PhD Research Position in applying Decision Analysis in Environmental Engineering**

Eawag is the Swiss Federal Institute of Aquatic Science and Technology, a Swiss-based and internationally active research institute within the ETH Domain, committed to an ecological, economical, and socially responsible management of water.

The Department of 'System Analysis, Integrated Assessment and Modelling' has a vacancy for a

### **PhD Research Position in applying Decision Analysis in Environmental Engineering**

The doctoral thesis is part of the transdisciplinary project "Sustainable Water Infrastructure Planning" of the National Research Program "Sustainable Water Management" (NRP 61). The successful candidate will be part of a team of 3 PhD students that will develop a novel integrated, participatory planning procedure for municipal water infrastructures. The project focuses on dealing with limited data, the uncertainty of future developments, and ensuring high acceptance of the decision-making process by stakeholders.

The project combines engineering with decision sciences. The focus of this specific doctoral thesis is on stakeholder participation and Multi-Criteria Decision Analysis (MCDA) to support wastewater infrastructure planning under uncertain future scenarios. MCDA is a well-structured process combining cost-benefit calculations with subjective stakeholder preferences. Special attention is given to understanding stakeholder values, and integrating diverging interests of different stakeholders. The approach will be applied to running real world planning processes in Switzerland.

The candidate for this position is expected to hold either a MS degree in Environmental Engineering, Environmental Sciences, or similar with a strong interest in the science-society interface, or a MS in economy or psychology with an interest to apply his or her knowledge to support wastewater infrastructure decisions. He or she should have the capability and interest to closely collaborate with stakeholders from Swiss municipalities and water utilities. For the interviews and workshops, fluency in German is required. Additionally, we require the skills and willingness to work in an interdisciplinary team.

The position starts as soon as possible for a project duration of three years. PhD enrolment will be at ETH Zürich. For further information, please consult [www.eawag.ch](http://www.eawag.ch), [www.nfp61.ch](http://www.nfp61.ch), or contact Dr. Judit Lienert, Phone: +41 44 823 5574, Email [judit.lienert@eawag.ch](mailto:judit.lienert@eawag.ch).

Please submit your application including application letter describing your personal motivation, CV, copies of your academic qualifications, and names and contact information of three references in electronic form to Jadranka Vögelin, Human Resources Department: [recruiting@eawag.ch](mailto:recruiting@eawag.ch), indicating reference number 094602. Deadline for application is 5<sup>th</sup> December 2009.

## **PhD Research Position in Environmental Engineering and Decision Analysis**

Eawag is the Swiss Federal Institute of Aquatic Science and Technology, a Swiss-based and internationally active research institute within the ETH Domain, committed to an ecological, economical, and socially responsible management of water.

The Departments of 'Urban Water Management' and 'System Analysis, Integrated Assessment and Modelling' have a vacancy for a

### **PhD Research Position in Environmental Engineering and Decision Analysis**

The doctoral thesis is part of the transdisciplinary project "Sustainable Water Infrastructure Planning" of the National Research Program "Sustainable Water Management" (NRP 61). The successful candidate will be part of a team of 3 PhD students that will develop a novel integrated, participatory planning procedure for municipal water infrastructures. The project focuses on dealing with limited data, the uncertainty of future developments, and ensuring high acceptance of the decision-making process by stakeholders.

The project combines engineering with decision sciences. The focus of this specific doctoral thesis is to combine quantitative models of water supply infrastructure with Multi-Criteria Decision Analysis (MCDA) to support the long term planning process. MCDA is a well-structured procedure combining cost-benefit calculations with subjective stakeholder preferences. Special attention is given to uncertainty: imperfect data, uncertain future scenarios, and the decision makers' own uncertainty concerning his or her preferences. The developed concepts and approaches will be applied to running real world planning processes in Switzerland.

The candidate for this position is expected to hold a MS degree in Environmental Engineering, Environmental Sciences, or similar. He or she should have skills in mathematical modelling as well as the capability and interest to bridge the science-society interface in particular concerning the application of decision sciences and elicitation of stakeholder values. For this collaboration with municipalities and utilities in Switzerland, fluency in German is required. Additionally, we require the skills and willingness to work in an interdisciplinary team.

The position starts as soon as possible for a project duration of three years. PhD enrolment will be at ETH Zürich. For further information, please consult [www.eawag.ch](http://www.eawag.ch), [www.nfp61.ch](http://www.nfp61.ch), or contact Dr. Judit Lienert, Phone: +41 44 823 5574, Email [judit.lienert@eawag.ch](mailto:judit.lienert@eawag.ch).

Please submit your application including application letter describing your personal motivation, CV, copies of your academic qualifications, and names and contact information of three references in electronic form to Jadranka Vögelin, Human Resources Department: [recruiting@eawag.ch](mailto:recruiting@eawag.ch), indicating reference number 094603. Deadline for application is 5<sup>th</sup> December 2009.

## **PhD Research Position in Environmental Engineering**

Eawag is the Swiss Federal Institute of Aquatic Science and Technology, a Swiss-based and internationally active research institute within the ETH Domain, committed to an ecological, economical, and socially responsible management of water.

The Department of Urban Water Management has a vacancy for a

### **PhD Research Position in Environmental Engineering**

The doctoral thesis is part of the transdisciplinary project "Sustainable Water Infrastructure Planning" funded by the Swiss National Science Foundation. The successful candidate will be part of a team of 3 PhD students that will develop a novel integrated, participatory planning procedure for municipal water infrastructures. The project focuses on dealing with limited data, the uncertainty of future developments, and ensuring high acceptance of the decision-making process by stakeholders.

The project combines engineering with decision sciences. The focus of this specific doctoral thesis is to develop quantitative models to predict the long term development of condition and performance of the wastewater infrastructure. Special attention is given to the prevailing imperfection of data in practice and to the consequences of an uncertain future. The models will be applied to running real world planning processes in Switzerland and will be used as a base for the decision making process.

The candidate for this position is expected to hold a MS degree in Environmental Engineering, Environmental Sciences, or similar. He or she should have some experience or a pronounced interest in modelling and mathematical applications. Fluency in German is an important asset, as an essential part of the project implicates collaboration with municipalities and utilities in Switzerland. Additionally, we require the skills and willingness to work in an interdisciplinary team.

The position starts as soon as possible for a project duration of three years. PhD enrolment will be at ETH Zürich. For further information, please consult [www.eawag.ch](http://www.eawag.ch), [www.nfp61.ch](http://www.nfp61.ch), or contact Dr. Max Maurer, Phone: +41 44 823 5386, Email [max.maurer@eawag.ch](mailto:max.maurer@eawag.ch).

Please submit your application including application letter describing your personal motivation, CV, copies of your academic qualifications, and names and contact information of three references in electronic form to Jadranka Vögelin, Human Resources Department: [recruiting@eawag.ch](mailto:recruiting@eawag.ch), indicating reference number 096101. Deadline for applications is 5<sup>th</sup> December 2009.