2 - Compromise Solutions in Problems with Contradictory Criteria: PSI Method and MOVI Software System within CENETIX to support MIO Experiments

Alexander Bordetsky, Information Sciences, NPS Monterey, abordets@nps.edu, *Stefan Pickl*

Real-life optimization problems such as design, identification, design of controlled systems, decomposition and aggregation of large-scale systems, predicting from observational data, finite element models and so on are essentially multicriteria. Numerous attempts to reduce these problems to single-criterion problems have proved to be fruitless. Application of conventional optimization methods implies that an expert can state an optimization problem correctly and thus determine the feasible solution set (i.e., the constraints imposed on the parameters, functional relationships, and criteria). Unfortunately, this is not always the case, especially when dealing with contradictory criteria. As a result, an expert ends up solving ill-posed problems. Definition of the feasible solution set represents significant, sometimes insurmountable difficulties and existing optimization methods are not helpful in this situation. Taking into account difficulties of determining constraints, the feasible solution set can be poor or even empty. Therefore it is very important to help the expert to determine the constraints correctly. The authors present the PSI method and the MOVI software system; furthermore they formulate and solve new examples which occur in the context of the MIO experiments.

3 - Optimal Usage of Satellites based on an Intelligent Distributed Anchor Network, Explained by a Real-World Example called SAR-Lupe

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This paper shows a framework to optimally distribute anchor stations around the globe in order to maximise response times / contact times of LEO satellites. Especially LEOs on a polar flight path offer an opportunity to use anchor stations close to the poles. This clearly increases the time to communicate with the LEO. At the end the paper compares the results of German reconnaissance satellite network with the current setting and a possibly different setting to show the value of optimally distributing anchor stations.

■ FC-05

Friday, 11:30-13:00
1131

Advances in OR, Learning and Data Mining Tools in Life Sciences and Education

Chair: *Vadim Strijov*, Computing Center of the Russian Academy of Sciences, strijov@ccas.ru
Chair: *Alexander Vasin*, Operations Research, Moscow State University, vasin@cs.msu.su

1 - An Interactive Learning Software for Modern Operations Research Education and Training

Victor Izhutkin, Applied Mathematik and Informatik, Mary State University, izhutkin@yandex.ru, *Stefan Pickl*

In this contribution we present a new interactive learning concept for modern Operations Research education and training methods. We will focus on specific topics like linear, nonlinear, discrete optimization, multiple criteria decision making, especially game-theory and crisis management. The electronic platform offers the possibility to distinguish between theoretical presentations, examples, exercises, so-called "test-exercises with planned errors" and comfortable comparative analysis techniques [1]. Realization of training elements is carried out by means of special mathematical applets (written in Java) which give the chance to document the learning process of the students.

How do they get a solution? How will the decision process be developed and characterized? Key element is the combination of analytical expressions and geometrical images. Such an attempt increases the speed of an information transfer within lecturer and student. Furthermore it raises the level of the underlying understanding processes. The software contains a lot of instruments of actual knowledge management techniques related to Operations Research Methods. Main focus is the individual use and the integration of distance/ blended learning elements. The interactive elements are worked-out examples and interactive personalized exercises. The presented approaches avoid routine calculations and solves a visualization problem with a high amount of creative activity at the expense of prevalence cognitive approaches of the representation of knowledge. References: 1. Izhutkin V.,Toktarova V.. Principles of construction and realization of training systems on numerical methods // Educational Technology & Society 9(1) 2006, ISSN 1436-4522, P. 397-410.

2 - Trim Loss Concentration Modeling in One-Dimensional Cutting Stock Problem by Defining a Virtual Cost "Trim Loss-Oriented Model"

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Nowadays, One-Dimensional Cutting Stock Problem (1D-CSP) is used in many industrial processes and recently has been considered as one of the most important research topics. In this paper, an optimization model is represented to minimize the trim loss and also to focus the trim loss on minimum number of large objects in CSP. In this Trim loss-Oriented model, the remaining large objects will be appeared on the minimum number of beams with the largest possible length, so they can be used easier in the future cutting orders. This model minimizes a cost function which is created by assigning a virtual cost to the trim loss of each stock.

3 - Evolutionary Games, Utility Functions and Human Reproduction

Alexander Vasin, Operations Research, Moscow State University, vasin@cs.msu.su

The standard assumptions on utility functions in economic models are questionable in many cases. The present paper studies whether it is possible to endogenize determination of payoff functions and what are the mechanisms of their changing. The main conclusion of this investigation is that "natural" payoff functions concern reproduction of individuals. We confirm this conclusion by the known results on the Replicator Dynamics and by a model of evolutionary mechanisms' natural selection. Another model shows that altruistic or cooperative behavior among relatives is evolutionary stable if it maximizes the total fitness of the family. Finally, we discuss why the mentioned models do not work for social populations, what mechanisms provide a possibility to influence individual behavior and who or what changes individual utility function.In this context we consider demographic dynamics in Europe.

4 - Evidence of Successively Generated Models

Vadim Strijov, Computing Center of the Russian Academy of Sciences, strijov@ccas.ru

Let us investigate an algorithm of regression model construction. The constructed model will be used to solve problems of the Financial Sector: it might be a scoring model, an energy price forecasting model or a European option volatility smile model. We suppose that given historical data are not sufficient to discover hidden dependencies in an investigated problem. So we propose the following approach to the model construction. Together with historical data we use expert-given set of primitive functions. It is recommended to collect functions, which already widely used to model the investigated problem. Then we assign a generating function, which will be used to generate the set of the competitive models. We estimate evidence of the models using coherent Bayesian inference and select a model of the best structure. Since generating functions make a countable set of models, we organize an iterative generation-selection procedure. Each cycle of the procedure include the following steps.