



MTA
SZTAKI

Hungarian Academy of Sciences
Computer and Automation Research Institute

Research Laboratory on Engineering & Management Intelligence Research Group of Operations Research and Decision System

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Operations research is the theory and methodology of scientific approaches used for examining and solving problems arising in the analysis and development of the structure of complex systems, as well as in course of the organization and management of above systems. It is an interdisciplinary field where the frontiers of different branches of science are connected, mainly via mathematical models, to different theories and methodologies of mathematics, algorithms for problem solving, and to computer science. Operations research is applied science. One of its typical applications, in different fields of real life, comprises supporting the process of managerial decision making, and improving the operation of organizational systems. The management and decision problems arising in various relations are approached by modelling, analyzing and optimizing them.

Main R&D topics

In operations research our main fields of research are global, linear and quadratic, and smooth optimization, while in decision systems, multiattribute group decision making problems are in the focus of our research.

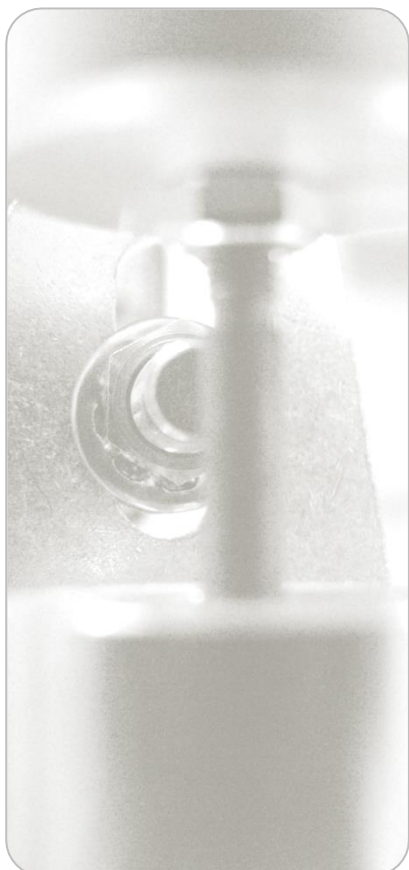
The group participated autonomously in numerous projects, where the members could exploit their knowledge in optimization and decision support. Besides, they are involved in some projects of Research Laboratory on Engineering & Management Intelligence.

International scientific partnerships

We take part in the editorial boards of international journals Global Optimization, Optimization Letters, and International Abstracts of Operations Research.

Industrial solutions

- The “Optimal Power Flow” (OPF) problems aim to minimize the operational costs of a static power system on which different types of generators and consumers are connected together through a network, satisfying the rules of electricity and fulfilling the functional specifications. The number of nodes in large-scale real power networks may reach



Main domestic references

- Prímagáz Hungária Inc.
- MAVIR Magyar Villamosenergia-ipari Rendszerirányító Inc.
- GraphIT Ltd.
- MÉLYÉPTERV Kultúrmérnöki Ltd.
- Közutas Ltd.
- Local government of Szeged City

Main international references

- Siemens Corporate Research
- Scala ECE (Overseas) Ltd.

hundred thousand. In a project for Siemens Corporate Research, our goal was to develop an efficient solver engine to solve the continuous relaxations of the nonlinear discrete OPF models. We implemented an interior point method which applies algebraical reductions and exploits the special structure of these problems.

- For GraphIT Ltd., we developed an ActiveX DLL for searching the shortest path in road-networks, taking the weight and size limitations into consideration. It is callable from Visual Basic and Active Server Pages programs.
- For Prímagáz Hungária Inc., we performed modelling and computing to elaborate some variants of the optimal production and transportation plans.
- Our group participated in building the models of multi-attribute decision problems is tram and trolley bus tenders of Szeged and the establishment of a new intermodal center in Kecskemét. Our tasks were to coordinate the process of weighting the criteria, to construct rating rules and to provide sensitivity analysis of the results.

Tools developed by us:

- WINGDSS - Group Decision Support Software
- QOPT - Quadratic Optimization Library

Most important projects

- Közutas Ltd.: Consultancy in the multi-attribute decision model of the decision preparatory study of a new intermodal center in Kecskemét - 2011
- Siemens Corporate Research: Developing a special interior point method-based optimization engine for an industrial application – 2010
- Local government of Szeged City: Consultancy in the multi-attribute decision model in the public procurement procedure of tram and trolley-bus tenders – 2008-2009
- MÉLYÉPTERV Kultúrmérnöki Ltd.: Comparative analysis of the alternatives of the Metro 4 lines - first section – 2002, second section - 2006-2008
- GraphIT Ltd.: Searching the shortest path in road-networks, taking the weight- and size limitations into consideration - 2007
- Prímagáz Hungária Inc.: Modelling of annual operation of plants - 2002, 2003, 2005, 2007
- MAVIR Hungarian Power System Operator Company: Consultancy in tender evaluation – 2002-2004
- BME-MOKK: Modelling of decision problems in a web-neighbourhood – 2002-2003
- Scala Business Solutions N.V.: Master planning - 2002-2003

Educational activities

Participation in the education at Central European University, Corvinus University of Budapest and Óbuda University in optimization, operations research and decision theory.

Staff

Sándor Bozóki, János Fülöp, Csaba Mészáros, Mária Prill

