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1 Research interests

Research interests focus on model-based support for solving complex problems, which incorporates three interlinked areas. First, integration of interdisciplinary knowledge and its representation by mathematical models. Second, creation of knowledge by comprehensive model analysis, including multicriteria methods. Third, tailoring the modeling process to meet the needs of decision-making processes.

Thus the research interests cover a cluster of areas relevant to the adaptation (whenever possible) or development (when needed) of methodology, algorithms, and software for model-based decision-making support. This includes more specific topics of Operations Research (OR): multicriteria problem analysis, large scale optimization, optimization of badly conditioned problems, use of database management systems for complex models, decision analysis and support, user interfaces in decision support systems, effective treatment of uncertainty and risk.

The current focus is on methods and tools for web-based applications supporting collaborative research of interdisciplinary teams working in distant locations [16]. Collaboration with the IIASA Energy Program resulted in the IIASA Energy Multicriteria Analysis (ENE-MCA) Policy tool [13] which provides an interactive analysis of the various synergies and trade-offs involved in attaching priorities to four of the main energy sustainability objectives: climate change, energy security, air pollution and health, and affordability. The new multicriteria methods implemented on the Web has been used for public participation in the multicriteria analysis of future energy technologies [25], and had been later extended to a general-purpose Web-site available for research and educational purposes [22]. This application also illustrates efficiency of modern ICT technology applied to model-based policy-making support [34]. Web-based application supporting cost-efficient and envirnmentally safe carbon emission trading [14, 15] has been developed for supporting analysis of various types of emission trading markets. Structured Modeling Technology (SMT) is being developed [51] to meet IIASA's growing needs for tailored modeling support for problems characterized by complex relations, huge amounts of data, and the demand for integrated model analysis, as well as on new methods for multicriteria analysis and the corresponding Web-based tools aimed at supporting open access to such analysis by stakeholders, including those with limited analytical skills. SMT aims at supporting interdisciplinary teams working at dispersed locations on model specification, collection and verification of data, definition of various model instances, and applying diversified methods of model analysis. Thus SMT is based on the Web and uses DBMSs for a consistent management of all persistent elements of the whole modeling process.

Recent contributions to effective methods in coping with uncertainties are presented in [9, 10, 12, 14, 15].

2 Experience

2.1 Model-based problem solving support

Development of model-based support for diversified types of complex decision problems:

- Web-enabled environments for collaborative multidisciplinary research [4, 16].
- Web-based multicriteria analysis [22, 23, 24, 39]
- Public participation in multicriteria analysis of future energy technologies [25, 33, 34, 46, 47].
- Cost effective and environmentally safe carbon emission trading [14, 15].
- Effective methods for robust decisions under uncertainties [9, 10, 11].
- Cost effective measures for improving European air quality (long-term collaboration with the team developing the RAINS models) [51, 72, 73, 83, 93, 94, 95].
- River basin water quality management [81, 98].
- Land use planning [82, 90, 96].
- Planning and controlling agricultural production with a decentralized management structure [119].
- Planning formation and utilization of water resources in an agriculture region [124].
- Planning national energy system [121].
- Regional air quality management [125, 126, 127].

2.2 Methodology

Contributions to various topics related to model-based support for solving complex problems:
- Modeling problems and methods [18, 21, 26, 40, 41, 42, 43, 44, 45, 51, 62, 64, 66, 67, 70, 71, 72, 85, 87, 97, 107, 109, 113, 122].
- Multicriteria analysis [1, 2, 5, 6, 7, 21, 22, 23, 24, 39, 57, 69, 76, 86, 102, 105, 108, 110, 114, 117].
- Modeling knowledge [50, 54, 55, 58, 59, 63, 67, 68, 74, 75].
- Coping with uncertainty and risk [3, 8, 19, 26, 27, 28, 29, 30, 31, 32, 35, 36, 37, 38, 48, 49, 53, 56, 65].
- Selected software issues [77, 78, 79, 80, 84, 89, 99, 101, 103, 104, 106, 108, 111, 112, 115, 118].

2.3 Computing

Experience includes organization of team work for software development, consulting in modeling and in programming (C++, Fortran), UNIX and administrating a subnet composed of Sun workstations, as well as experiences with different computers (CDC Cyber 73-16, Univac 1100, Vax, Sun, and PCs) and operating systems. Author or co-author of many computer programs, including:
- Implementation of the Structured Modeling Technology [51].
- Software for decision support systems, e.g., [72, 81, 82, 91, 92, 119, 124, 127].
- Modular solvers, e.g., [85, 100, 108, 113, 115, 116, 120].
- C++ libraries and modular tools, e.g., [80, 84, 86, 97, 104, 106, 105, 123].

3 Education

Born in 1946, raised and educated in Warsaw, Poland, finished primary school in 1960 and high school in 1964. Academic education started in 1964 at the Faculty of Electronics of the Warsaw of Technology. In 1966-1969 also studied applied mathematics at the Faculty of Mathematics and Mechanics, Warsaw University. Graduated in 1970, with an Engineer and Master of Sciences degree in the fields of control engineering and computer science.

In 1970, joined the Systems Research Institute of the Polish Academy of Sciences where Ph.D. was received in 1976 for a thesis on optimization of environmental models.

4 Professional activities

4.1 At IIASA

2014 Senior Research Scholar in the Energy Program.

2011-2013 Senior Research Scholar in the Advanced System Analysis Program, which was created by merging the Integrated Modeling Environment and System Dynamics Programs.

2006-2010 leader of the Integrated Modeling Environment Project. The current focus is on Structured Modeling Technology (SMT), which is being developed to meet IIASA's growing needs for tailored modeling support for problems characterized by complex relations, huge amounts of data, and the demand for integrated model analysis.

1997-2005 senior research scholar with the Risk, Modeling and Society Project, which amalgamated the activities of the Methodology of Decision Analysis (MDA) Project with those of the Risk, Uncertainty and Complexity Project. Continuation of work on methods and software tools for model-based problem solving. This work is driven by the needs of complex models developed at IIASA, thus it combines novel methodologies with their applications.

1989-1997 with the MDA Project (for two years as Acting Leader of the project); collaboration with several of IIASA's projects and a number of research institutions, especially in Japan and Poland. Main research topics: decision support type applications, development of optimization solvers and software for multiple-criteria model analysis.

1987-1989 joined the Computer Services Department at IIASA as Math Application Programmer developing applications and providing consultations on modeling, numerical methods, programming languages, and software development.

Also:
- co-ordinated clusters of activities within two projects (NEEDS and EnRiMa) funded by the European Framework Program;
- co-ordinated several of IIASA's collaborative studies with Japanese and Polish institutes;
- supervised over 40 participants of the YSSP;
- regular reviewer of several journals, including: Advances in Water Resources, Energy Policy, European Journal of Operational Research, International Journal of Information Technology and Decision Making, IEEE Transactions of Fuzzy Systems, International Transactions in Operational Research;
- member of the editorial board of International Journal of Knowledge and System Sciences;
- Guest Editor of two Feature Issues on *Advanced Modeling* in the European Journal of Operational Research [52, 88], and is a regular reviewer of this journal, and other journals, including Decision Support Systems, Environmental Modeling & Software; is also a member of the Editorial Board of International Journal of Knowledge and Systems Sciences;
- organized over 25 workshops;
- chaired two IIASA's advisory computing committees, and IIASA's YSSP (Young Scientists Summer Program) Task Force; and
- has been leading a Work-package of the EU 6th Framework Project NEEDS.

4.2 Before 1987

Since 1970 until coming to IIASA in 1987, was with the Systems Research Institute of the Polish Academy of Sciences, from 1976 as a leader of *Environmental Systems Modeling* laboratory and assistant professor. Leader of, or participant in, various projects aimed at application of mathematical programming methods for supporting decision-making. Several of these projects were done in cooperation between IIASA and the Polish Academy of Sciences. The research activities in this period include:

1977-1987 leader of various projects on application of computerized models to planning and management of water resources. Works on the application of the mathematical programming methods for the Noteć Region in Poland awarded in 1982 by the Prize of the Minister of Agriculture.

1980-1987 cooperation with IIASA's Systems and Decision Sciences Program on development of software and methodology for decision support systems.

1983-1987 manager of a group of scientific and organizational projects aimed at applications of decision support methods for water management in the Noteć region; this activity had a yearly budget of about 30 man-years and involved several institutions (both scientific and local authorities).

1979-1982 theoretical work and software for the Model of Polish Agriculture developed for the Food and Agriculture Program at IIASA and for the State Planning Committee in Poland.

1977-1981 collaboration with IIASA's Integrated Regional Development Project on the Noteć/Silistra Project.

1972-1976 participation in the development of model and software for improving air quality in the Silesia region.

5 Non-professional activities

Over twenty years experience in various activities related to sailing. In 1979 received Ocean-going Master License (valid for being a captain of any non-commercial sailing or motor yacht). Experience includes dozens of high-sea cruises (also as captain during a transatlantic race), teaching sailing at all levels (also training sailing instructors), and diversified organizational duties. The latter includes: a commander of the Warsaw Academic Sailing Club, deputy chairman of the Polish Academic Sailing Board, and deputy president of the Education Board of the Polish Yachting Association (the Board organizes and supervises sailing education in Poland).

Over 50 years addiction to skiing but still on a level of a skill that is not proportional to the overall skiing time. Experience in climbing, which has been reduced to mountain hiking due to being out of shape. Tennis, swimming, and biking augment leisure sport activities.

Semi-professional interests include investment markets, financial mathematics, efficient treatment of uncertainty and risks, the latter not only in the context of investments, but also for a more robust use of knowledge about the past, to be better prepared for the future.

6 Selected publications

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Note: The above list of selected publications contains most of items published after 1990, and a proportionally smaller selection of earlier publications. All items are sorted in the reversed chronological order.