Editorial

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Biographical notes: Neima Brauner is a Professor of Mechanical Engineering at Tel-Aviv University. She received her BSc and MSc in Chemical Engineering from the Technion in Haifa (1976), and a PhD in Mechanical Engineering from Tel-Aviv University (1983). She is an Editor of Reviews in Chemical Engineering, Associate Editor of Heat Transfer Engineering and on the Editorial Board of Multiphase Science and Technology. She served as the President of the Israel Institute of Chemical Engineers (IIChE), and was awarded an honorary fellow of the IIChE. She is a co-author of more than 150 publications in the fields of transport phenomena in multiphase systems and data analysis.

Eugene Levner is Professor of Computer Science and Operations Research at Holon Institute of Technology, Holon, Israel. He received his Master's in Computational Mathematics in 1968 from the Moscow State Lomonosov University (USSR) and PhD in Computer and System Science in 1972 from the Soviet Academy of Sciences, Moscow, USSR. His main scientific interests are mathematical modelling, computer algorithms, risk analysis and applications in industry and environmental protection. He is the author/editor of seven books and the author/co-author of more than 100 papers.

David Moalem Maron is presently on sabbatical, after finishing his term of office as President of Holon Institute of Technology since 1991. He received his BSc (1966), MSc (1988) and DSc (1972) in Chemical Engineering from the Technion, Haifa, Israel. For his outstanding contribution to higher education in Israel and his achievements in the field of engineering science, he received an

award from the Association for the Promotion of Research, Literature and Art in 2004, and the Israel Rotary prize in 2006. His main scientific interests are two-phase flows and transport phenomena, and he is a co-author of over 100 research articles and chapters in books.

This Special Issue of *International Journal of Water*, entitled 'Integrated Water Resources Management in Arid and Semi-Arid Areas', covers recent research and developments in the above area and addresses various venues in theory building, computer modelling, design of methodologies and their testing, reviews of case studies and experience from different countries.

In an increasing number of countries in arid and semi-arid areas, water scarcity and deteriorating quality of natural water sources have become critical factors limiting national economic development, expansion of food production and/or provision of basic health and hygiene services to the population. There is an increasing urgency to develop new scientific means for sustainable management of water resources, and to offer solutions for improving living and working conditions for present and future generations. Sustainable integrated water resources management is a concept that emphasises the need for a multi-disciplinary study of changing demands in the exploited water ecosystems, which considers the development without their degradation in a long-term perspective as well as at the present.

The main purpose of this special issue is to better understand the key aspects of the sustainable management of water resources in arid and semi-arid area, to construct new mathematical, computer and physical models using modern instruments of the system engineering, management science, and information technologies, and to attempt to determine what is needed to improve effective water resources management in arid and semi-arid areas. The special issue consists of nine articles presented by researchers from Australia, Germany, Greece, Egypt, India, Israel, Jordan, Tunisia, and USA.

A mix of theory building, modelling and empirical case study papers that have strong relevance to practical problems of integrated water management in arid and semi-arid areas is presented. The following subjects are discussed:

- principles and theory of sustainable integrated water resources management in arid and semi-arid areas
- integration of mathematical, physical and chemical methods for sustainable water resources analysis and management
- decision making and decision support systems in integrated water resources management in arid and semi-arid areas on regional scales
- integrated risk analysis and risk management in exploited water ecosystems in arid and semi-arid areas
- advanced technological concepts and new technologies related to integrated management of water resources and assessment of water quality
- integration of physical models of water flow phenomena and economic-mathematical regional development models

- elaboration of hydrodynamic models with regard to the prevention of groundwater and surface water pollution from agriculture and wastewaters
- integrated water resources management in developing and rapidly developing countries
- international co-operation, exchange of experience and know-how in integrated research programmes on water resources management.

Noah Goldstein, Robin Newmark, Camilla Dunham Whitehead, Elizabeth Burton, James McMahon, Girish Ghattkar and Deborah May in their paper 'The Energy-Water Nexus and information exchange: challenges and opportunities' consider the problems and constraints on energy availability that the USA will be facing in the near future, owing to the heightened demand for both energy and water, especially during droughts and summers. Increasing stress on the inextricably linked resource availability of both water and energy can be mitigated with integrated planning. Exchanging data is an important component to current and future mitigation approaches within the Energy-Water Nexus (EWN). The authors describe the types of relationship that are formed in the US EWN, and address the data-sharing obstacles within. Approaches to removing the obstacles of data sharing are presented, based on case studies.

The paper 'A model for integrated water resources management in water-scarce regions: irrigation with wastewater combined with desalination processes', by Nava Haruvy, Sarit Shalhevet and Yehuda Bachmat, develops a model for planning water supply from diverse sources in Israel, including groundwater, the National Water Carrier, wastewater and seawater. The model integrates hydrological, technological and economic considerations, and estimates the economic and environmental impacts of alternative water management policies. A unique hydrological database is constructed and a hydrological model is developed for planning water resources use and forecasting the chloride concentration in aquifers. The results include recommendations for the water treatment level and for desalination of different water sources, as well as forecasts for the implementation costs.

Thomas Kluge and Petra M. Moser-Nørgaard, in their paper 'Innovative water supply and disposal technologies as integral part of integrated Water Resources Management: an example from Namibia', describe a new eight-year integrated water resources management (IWRM) project for central northern Namibia, which links IWRM concept development to the implementation of demand-oriented and regionally adapted innovative water technologies. These technologies include rainwater harvesting, solar-coupled groundwater desalination and artificial groundwater recharge for water supply, and a semi-decentralised urban infrastructure system that includes rainwater utilisation, as well as wastewater collection and treatment. Special attention is devoted to stakeholder participation.

Amgad Elmahdi, Assem Afify and Alaa Abdin, in their paper 'Development of a GIS-based decision support tool and assessment of Nile River water quality', describe a monitoring programme for the Nile river water quality that has been established by the Nile Research Institute since 1976. The objective of their paper is to develop and present a GIS-based decision support tool capable of management, visualisation, and analysis for the most recent water quality data. An initial assessment of the current status of the Nile River water quality has been obtained.

Ekin Birol, Phoebe Koundouri and Yiannis Kountouris, in their paper 'Evaluating farmers' preferences for wastewater: quantity and quality aspects', note that arid and semi-arid countries, such as Cyprus, face severe threats regarding the sufficiency of water resources for agricultural, domestic and industrial purposes. In Cyprus, the decreasing trend of precipitation rates during the last decade has resulted in the overexploitation of groundwater resources for irrigation. The Akrotiri aquifer has been severely disaffected by excessive pumping and is now recognised to be under threat of depletion and seawater intrusion. To respond to this, the authorities proposed recharging the aquifer with treated wastewater from the surrounding cities and villages. This paper contributes to the evaluation of this policy regarding the understanding of farmers' attitudes towards it.

Krishna Reddy Kakumanu and Siegfried Bauer in their paper 'Conjunctive use of water: valuing of groundwater under irrigation tanks in semiarid region of India', estimate the impact of subsidised electricity policy for pumping groundwater in the agricultural sector in India. The impact is estimated by fitting a water response function to measure the marginal productivity and value of marginal productivity of water for 2003–2004 and 2004–2005 cropping seasons. By using regression functions and paired sample t-tests the authors found that the surface water usage is decreasing by increasing the groundwater use and ultimately leading to the decrease in water productivity. Increased groundwater use influences not only the water productivity, but also the value of groundwater (VG) and stabilisation value of groundwater (SVG). VG and SVG are increasing with the decrease in electricity prices and surface water availability.

The next three papers are devoted to important case studies at the nationwide level in Jordan, Tunisia and India, respectively. Mohammed Matouq analyses the prospect of reusing treated municipal wastewater for irrigation in the Hashimite Kingdom of Jordan. Makram Anane, Hamadi Kallali, Salah Jellali and Mohamed Ouessar describe in detail the ranking of suitable sites for soil aquifer treatment in Jerba Island (Tunisia) using remote sensing, GIS and AHP-multicriteria decision analysis. Amit Masih, Renuka Saini and Ajay Taneja consider the contamination and exposure profiles of priority polycyclic aromatic hydrocarbons in groundwater at a semi-arid region in India.

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