

Preface

Drinking water utilities in urban areas are facing new challenges in their real-time operation because of limited water resources, intensive energy requirements, a growing population, a costly and ageing infrastructure, increasingly stringent regulations and increased attention towards the environmental impact of water use. Such challenges force water managers to monitor and control not only water supply and distribution, but also consumer demand. This book presents a set of approaches for the real-time monitoring and control of drinking water networks based on advanced ICT technologies of automation and telecommunications for largely improving their efficiency in terms of water use, energy consumption, water loss minimization and water quality guarantees.

The proposed approaches and tools presented in this book cover:

- decision support for real-time optimal control of the water transport network, operating the main flow and pressure actuators (pumping stations and pressure regulation valves) and intermediate storage tanks to meet demand using the most sustainable sources and minimizing electricity costs, thanks to the use of stochastic model predictive control algorithms that explicitly take into account the uncertainty associated with energy prices and actual demand;
- decision support for monitoring water balance and quality of the distribution network in real time via fault detection and diagnosis techniques, using information from hundreds of flow, pressure and water quality sensors, and hydraulic and quality-parameter evolution models, to detect and locate leaks in the network, possible breach in water quality, and sensor/actuator failures; consumer demand prediction, based on smart metering techniques, producing a detailed analysis and forecasting of consumption patterns and providing a service of communication to consumers, together with economic measures to promote a more efficient use of water at the household level.

All methods' approaches presented in the book are applied and illustrated using a real-life pilot demonstration based on the Barcelona drinking water network and Catalonia regional network (Spain). The results presented in the book are the results of the long collaboration of the Research Center "Supervision, Safety and Automatic

Control” (CS²AC-UPC) at Technical University of Catalonia (UPC) and Consejo Superior de Investigaciones Científicas (CSIC) at the Institut de Robòtica i Informàtica Industrial (IRI) with the Barcelona water company (AGBAR) and its technical centre (CETAQUA) in several Spanish and European research projects and private contracts as well as with *ATLL Concessionària de la Generalitat de Catalunya* in several private contracts.

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