

Preface

This book is devoted to the modelling and control of sewage systems within the framework of model predictive control (MPC). It also proposes several MPC controller designs for sewer networks, taking into account some of their inherently complex dynamics, the multiple nature of their control objectives, and the performance of the closed-loop scheme when real rain episodes are considered as system disturbances. The incorporation of the closed-loop scheme within a fault-tolerant architecture is studied, and faults in the system actuators (valves and pumping stations) are also considered. The sewage system used as the case study for the book consists of a representative portion of the sewer network of Barcelona (Spain). This portion includes the main phenomena and the most common characteristics and issues that appear in the entire sewer network. Measurements of real rain events and other real data associated with the behaviour of this particular sewer network are available, and the calibrated and validated model of the networked system that follows the corresponding methodology is also included and explained. Results obtained from the simulations associated with this case study highlight the difficulties involved in managing such complex systems.

The book proposes and explores novel research lines in the framework of the real-time control of complex networks related to the urban water cycle. Thus far, several researchers and communities have focused on water management and the dynamical modelling and predictive control of these complex systems as a tool for designing policies aimed at improving the behaviour of water networks, preventing undesirable phenomena caused by different features associated with such networked systems (*e.g.*, weather, topology design, drinking water consumption demands, *etc.*). Additionally, while considering faults in some elements increases the complexity of the problem, detailed research focusing on such adverse system conditions is justified.

Due to the very applied nature of the topics addressed in this book, and the way that different concepts, techniques and methodologies relating to

modelling, simulation and control are merged within it, the potential audience of the book consists of academic researchers working in the fields of large-scale networked systems, model predictive control, hybrid systems and fault-tolerant control, researchers associated with water management companies who wish to improve their control algorithms, specialists in sewer network management, people interested in working at the interface between control theory and the real-time implementation of control strategies for complex systems, and postgraduate students interested in research into sewer network modelling, control and fault tolerance.

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