



Pumps, Electromechanical Devices and Systems Applied to Urban Water Management

Edited by

Enrique Cabrera

Institute for Water Technology, Universidad Politécnica de Valencia, Spain

Enrique Cabrera Jr.

Institute for Water Technology, Universidad Politécnica de Valencia, Spain

VOLUME 2

The book consists of two volumes. Volume 1 contains 20 chapters, while Volume 2 contains 12 chapters. Both volumes are intended for professionals and students in the field of water management, particularly those involved in the design, construction, and operation of urban water systems. The book is divided into two main parts: Volume 1 covers basic concepts and methods, while Volume 2 focuses on specific applications and case studies. The book is intended to provide a comprehensive overview of the latest developments in the field of urban water management, and to serve as a valuable reference for both practitioners and researchers.



A.A. BALKEMA PUBLISHERS LISSE / ABINGDON / EXTON (PA) / TOKYO

Table of contents

Foreword	XIII
Acknowledgements	XV
Sponsors	XVII
<i>Volume 1</i>	
<i>Systems management</i>	
Energetic optimization by rehabilitation of oversized water distribution networks <i>L. Ainola, T. Koppel & N. Kändler</i>	3
The use of performance indicators to support water network rehabilitation planning <i>H. Alegre, J.M. Baptista, S.T. Coelho & P. Praça</i>	11
Performance evaluation for water companies. A practical case <i>V.J. Bourguett O., R. Sandoval, M. Serra M., L. Ochoa-A., J. Montoya, J.A. Ruiz-A., C. Mariano & V.H. Mireles</i>	19
Multiple objectives and water quality in water distribution networks <i>C. Bragalli, D. Savic, E. Keedwell & S. Artina</i>	27
Benchmarking in the water industry. Basic principles, applicability and methodology <i>E. Cabrera Jr., R. Cobacho J. & M. Herrero Á.</i>	37
Research of the flow procedures in a pressure sewer system <i>C. Dohse & H. Eckstädt</i>	45
About the two IWA performance indicators systems for urban water management <i>P. Duarte, H. Alegre & R. Matos</i>	53
Countermeasures against water hammer phenomena in Japan <i>F. Etoh</i>	61

A new approach to assess performance indicators' data quality <i>M. Herrero, E. Cabrera Jr. & F.J. Valero</i>	69
Breaking of activated sludge flocs using pumps and mixers <i>P. Hlavínek</i>	79
Integrated management of urban water supply systems – A general vision potential risks <i>E. Koelle</i>	87
Rehabilitation of water networks: Data collection and data acquisition at Compagnie Générale des Eaux, Lyon <i>D. Poinard, F. Texier & P. Le Gauffre</i>	97
Condition monitoring of water distribution pipelines as a rehabilitation aid <i>M. Poulton</i>	105
Application of the PI system for water network rehabilitation in Norway – Possibilities and pitfalls <i>F. Sjøvold, J. Røstum, M. Volta, I. Selseth & S. Sægrov</i>	113
Hai Phong water supply company, the example of effective renovation of water system management in developing Vietnam <i>N. Viet Anh</i>	121
 <i>Network analysis and modeling</i>	
Invited lecture: Future challenges in the design and modelling of water distribution systems <i>B.W. Karney</i>	129
Design of water distribution networks under uncertain demand <i>A. Babayan, D. Savic & G. Walters</i>	137
Turbulent velocity profiles in pressurized pipes by UDV <i>A. Berni, B. Brunone & M. Ferrante</i>	145
GESTAR and EPANET hydraulic modelling of control valves in non-looped branches <i>C. González C., C. Estrada C. & R. Aliod S.</i>	153
Inverse problems in hydraulic network modelling <i>C. Di Cristo & A. Leopardi</i>	163
Water distribution system design: Pathology of simplified loading conditions <i>Y.R. Filion, B.J. Adams & B.W. Karney</i>	173
Optimal sampling design for calibration of transient network models using multi-objective GAs <i>Z.S. Kapelan, D.A. Savic & G.A. Walters</i>	181
Inverse problems in hydraulic network modelling: Parameter identification in a real case study <i>G. de Marinis, R. Gargano & A. Leopardi</i>	189
Complex systems hydraulic design considering unsteady flow <i>L.B. Ramos & J.M. Abreu</i>	197
Numerical modelling of storage-settling basins <i>F. Schmitt, V. Milisic & G. Chebbo</i>	207

Planning and decision support systems

The repair and maintenance costs curve: Ways to calculate it for a medium size utility <i>R. Cobacho, E. Cabrera, E. Cabrera Jr., F. Arregui & M. Dubois</i>	219
Leaks, energy costs, and storage operations <i>A.F. Colombo & B.W. Karney</i>	229
The labyrinth of water distribution systems: Demand, energy and climate change <i>A.F. Colombo & B.W. Karney</i>	239
Multi-objective optimization of water systems: A comparative study <i>R. Farmani, D.A. Savic & G.A. Walters</i>	247
A case study on oversizing the pipeline diameters of a urban water distribution system <i>J.C. Lauria</i>	257
Decision support for the prioritisation of water network rehabilitation projects – Data needs and data availability <i>P. Le Gauffre, R. Baur, K. Laffréchine, M. Schiatti & L. Tuhovčák</i>	263
A system for the integrated planning of distribution network in the Canal de Isabel II <i>R. Miguel P.</i>	273
Computer aided rehabilitation of water networks <i>S. Sægrov, J.M. Baptista, P. Conroy, P. Eisenbeis, V. de Federico, R. Herz, P. Le Gauffre, S. Mazzacane, J. Røstum, W. Schilling & L. Tuhovčák</i>	279
A decision support system for the control and replacement of water meters in the city of Athens <i>A.D. Tzamtzis & M. Paralika</i>	289
Evaluation of investment projects with national and international bidders in water sector. Learning from experiences in last decade of transition period in Vietnam <i>N. Viet Anh</i>	297
Failures analysis for water distribution networks long-term rehabilitation planning <i>P. Vrbková & L. Tuhovčák</i>	307
Prediction of river water level by using system identification method <i>N. Yoshizawa, O. Yamanaka, A. Nagaiwa, S. Iwasaki, T. Nakayama & M. Saito</i>	315

Water losses

Evaluation of leakage by means of night flow measurements and analytical discrimination. A comparative study <i>J. Almundoz, E. Cabrera, J. Gil & I. Pellejero</i>	327
Evaluating domestic water meter accuracy. A case study <i>F.J. Arregui, C.V. Palau, L. Gascón & O. Peris</i>	343

The state of deterioration of the pipe in Saltillo, Mexico <i>V.J. Bourguett O., J.A. Ruiz-A., L.H. Ochoa-A. & C.E. Mariano</i>	353
New method to estimate leakage rates in drinking water distribution systems <i>G.S. Buchberger & G. Nadimpalli</i>	363
Frequency response coding for the location of leaks in single pipeline systems <i>P.J. Lee, J.P. Vítkovský, M.F. Lambert, A.R. Simpson & J.A. Liggett</i>	371
A study of geophysical methods for water leak location <i>A. Lockwood, T. Murray, G. Stuart & L. Scudder</i>	379
Do customers' meters register correctly? <i>F. Mendaza M. & C. Verdú S.</i>	387
Detecting leaks from water pipes at a test facility using ground-penetrating radar <i>E. O'Brien, T. Murray & A. McDonald</i>	395
Computational fluid dynamic approach to the design of a single-jet water-meter <i>G. Sánchez & A. Rivas</i>	405
Leakage detection repair management and optimisation of water supply network performance in the city of Athens <i>A.D. Tzamtzis & M. Paralika</i>	415
Leak and blockage detection in pipelines via an impulse response method <i>J.P. Vítkovský, P.J. Lee, M.L. Stephens, M.F. Lambert, A.R. Simpson & J.A. Liggett</i>	423
Author index	431
Volume 2	
<i>Pumping stations – planning and design</i>	
Invited lecture: Real-time design of centrifugal pump impellers on a PC-cluster <i>R. Schilling, Th. Lepach, S. Krämer & N. Müller</i>	435
Vertical mixed flow pump with screw type impeller <i>S. Andou, T. Yoshida & T. Ono</i>	445
A pumping station refurbishment – Case study <i>M. Ceausescu & S. Perju</i>	453
Design of a pumping station with underground storage for drainage of a low-lying area in Hong Kong <i>M.T. Chow, K.W. Yan, C.W. Li, O.W.H. Wai & Y.S. Li</i>	461
Reconstruction of well-draw of sewer system in big waterworks <i>A. Gajić, M. Cvjetković, Z. Pušica & Đ. Čantrak</i>	469
An experience on planning large pumping systems in a critical situation <i>K. Gotoh</i>	477
Submerged vortices simulations in pump sump models <i>T.S. Lee</i>	485

Reorganization of CERN's water distribution networks <i>G.F. Luyet & H. Köster</i>	491
Pumps life cycle cost – A practical methodology for evaluation and pump selection <i>R.P.F. Went</i>	499
<i>Pumping stations – operation and maintenance</i>	
An algorithm for estimation of pumping station performances <i>A. Anton</i>	509
Optimum operation scenarios for water supply pumping stations <i>A. Anton & D. Cioc</i>	517
Identification of cavitation NPSH in centrifugal pumps <i>G. Ciaravino</i>	525
Coupling between well hydraulics and pump operation to determine unsteady flowrates <i>V.B. Espert, G. López, P.A. López & F.J. Martínez</i>	533
Rainwater pump facilities for urban sewerage system <i>K. Fujino</i>	543
Pressure pulsation problems in a self-evacuating, variable speed centrifugal pump for wastewater conveyance <i>L. Jönsson</i>	551
Is there any optimal configuration of a local pumping station? Case study <i>W. Koral</i>	559
Pumping in a non-potable water network <i>J.P. Nicolau</i>	567
Effects of distribution method on water mixtures: Study carried out on pilot unit <i>A. Miallet, E. Delahaye, B. Nguyen & B. Welté</i>	575
Advantages of variable frequency drives in urban water pumping stations <i>S. Muppana, F. Withoos & S. Pichayajittipong</i>	583
Experimental study on the performances prediction methodologies of pumps and their systems <i>Z. Rentian</i>	593
Optimization of water supply operation: Pump power rate reduction using genetic algorithm <i>Y. Sakamoto, F. Kurokawa, K. Yamazaki & T. Ashiki</i>	603
<i>Valves</i>	
Invited lecture: Valve selection and application <i>J.P. Tullis</i>	613
Air valve dynamic behaviour <i>F.J. Arregui, J. García-Serra, A.C.H. Kruisbrink, E. Cabrera, V.S. Fuertes, C.V. Palau & L. Gascón</i>	623

Reviewing air valves selection	633
<i>E. Cabrera, V.S. Fuertes, J. García-Serra, F. Arregui, L. Gascón & V. Palau</i>	
Pressure surges in water systems caused by air venting	641
<i>G. De Martino, N. Fontana & M. Giugni</i>	
Experimental investigation on the flow characteristics of piston valves	651
<i>J.C. Lauria & M. Solera Rodrigues Da Silva</i>	
Hydraulic of membrane valves as regulator of head and transient processes in hydraulics	661
<i>M. Maradjieva</i>	
 <i>Transients</i>	
Invited lecture: Potential causes of high pressure transients in urban water systems and their solutions	671
<i>A. Anderson</i>	
Transient analysis software for pumping stations	685
<i>C. Bragalli, B. Brunone, F. Calabresi & M. Ferrante</i>	
An investigation on unsteady-state friction in laminar flow	695
<i>B. Brunone, M. Cacciamani, F. Calabresi & M. Ferrante</i>	
A cautionary note on the operation of pumping mains without appropriate surge control and the potentially detrimental impact of small air pockets	703
<i>R. Burrows</i>	
Dissipation of pressure surges in water pipeline systems	711
<i>D. Covas, I. Stoianov, H. Ramos, N. Graham & C. Maksimovic</i>	
Fluid oscillator in the wastewater treatment	721
<i>P. Hlavínek, C. Alföldi & B. Řeháková</i>	
Study on column separation protection using air-inlet-and-outlet valves in pumping system of urban water supply	731
<i>J. Jing, W. Xiaohong, F. Xiangqian & Z. Weiling</i>	
Energy dissipation mechanisms in water distribution systems	739
<i>B.W. Karney & Y.R. Filion</i>	
Fluid transients in complex pumping systems with gas release and absorption	749
<i>T.S. Lee</i>	
A modified formulation for estimating the dissipative effect of 1-D transient pipe flow	755
<i>D. Loureiro & H. Ramos</i>	
Case studies on the control of check-valve slam in pump-rising main systems	765
<i>P.J. Purcell</i>	
Frequency-domain transient pipe flow solution including unsteady friction	773
<i>J. Vítkovský, A. Bergant, M. Lambert & A. Simpson</i>	
Unsteady friction weighting function determination from transient responses	781
<i>J. Vítkovský, A. Bergant, M. Lambert & A. Simpson</i>	
Simulation of transients in a looped laboratory pipe network	791
<i>X.-J. Wang, A.R. Simpson, M.F. Lambert, J.P. Vítkovský & J.A. Liggett</i>	

Application of genetic algorithm to the optimization of the closing of liquid control slow closing butterfly valve in a pumping station <i>F. Xiangqian, L. Guang-lin, J. Jing & Z. Weiling</i>	799
<i>Monitoring, control and regulation</i>	
Invited lecture: Real-time control of urban water systems <i>M. Schütze, A. Campisano, H. Colas, P. Vanrolleghem & W. Schilling</i>	807
Evaluation of the cost and benefits of automatic control in the Pasakoy wastewater collection basin <i>M. Cakmakci</i>	825
Optimisation of a full-scale activated sludge aeration process <i>P. Cañizares, L. Rodríguez, M.A. Rodrigo, J. Villaseñor & F.J. Fernández</i>	835
On-line scheduling in water distribution networks <i>M. Damas, J. Ortega, M. Salmerón & G. Olivares</i>	843
SCADA system for pumping stations and treatment plants <i>M. Garcia</i>	853
WAMODAT – An alternative system for remote monitoring <i>J. Kretek & J. Fiedler</i>	861
Application of SCADA system for monitoring booster station <i>Z. Liyou & S. Shiquan</i>	867
Controlled pressure regulation within the water piping (Examples of the application in the Czech Republic) <i>R. Mára & V. Kadeřábek</i>	873
Application of linear-quadratic regulators to sewer network control <i>M. Marinaki & M. Papageorgiou</i>	879
Advanced pumping station control for RTC of sewer systems <i>M. Schütze & J. Alex</i>	887
Experience of Barcelona with electromechanical devices applied to the management of the urban drainage <i>E. Segura & A. Villanueva</i>	895
Prognosis control of drinking water production <i>H.J. Tinge</i>	903
Hybrid modeling of potable water treatment plant <i>J.L. Villa, M. Duque, A. Gauthier & N. Rakoto-Ravalontsalama</i>	909
Author index	919