

# Preface

The idea of writing this book originated several years ago; however, due to certain factors it got delayed, and we have now finally been able to realise it. The objective of this book is to explain the computational methods that deal with the complex problem of water quality modelling in rivers and streams. The book provides in-depth coverage of computational open channel hydraulics as well as water quality issues and describes scientifically sound synthesised procedures that are relatively simple to use and fundamental for simulation purposes so that practical results can be achieved.

It was not our intention to replace any of the comprehensive books on numerical open channel hydraulics and water quality. The knowledge gathered in these two scientific areas over the last 50 years is so vast that it is impossible to review it comprehensively in a volume of this type.

On the contrary, the objective of the book is to address some fundamental problems of water quality in rivers and streams by integrating methods and procedures from these scientific fields. Our intention is thus to describe modelling fundamentals that will assist potential developers and users in devising the new generation of models, which will serve specific requirements in keeping with new legislation in many areas of the world, the Water Framework Directive in Europe being the principal reference.

Readers who would like to acquire deeper knowledge of the methods presented briefly in this book are recommended to refer to the following scientific literature on computational hydraulics: *Practical Aspects of Computational River Hydraulics*, by J. Cunge, F. Holly and A. Verwey; *Computational Hydraulics – Elements of the Theory of Free Surface Flow*, by M.B. Abbott; *Computational Techniques for Fluid Dynamics*, by C.A. Fletcher; and the recently published *Numerical Modelling in Open Channel Hydraulics*, by R. Szymkiewicz.

Readers can also refer to the following books on water quality science: *Aquatic Chemistry*, by W. Stumm and J. Morgan; *Surface Water-Quality Modeling*, by S.C. Chapra; *Hydrodynamics and Water Quality: Modelling Rivers, Lakes and Estuaries*, by J. Zhen-Gang; and *Quality Assurance for Water Analysis*, by P. Quevauviller.

Since this book is didactic, readers can consult even the more fundamental texts in river hydraulics, such as *Open Channel Hydraulics*, by V.T. Chow, and *Open Channel Flow*, by F.M. Henderson, which were the first introductory books on the subject published several years ago.

In view of the continuous advance in numerical techniques and computing facilities, there is an increasing production and circulation of ready-made software packages, which young engineers tend to use extensively. In light of this, it is also the aim of this book to explain the theoretical background for the simulation of the physical processes described, as well as the principles and limitations of these models, so that they can be applied effectively and safely to a variety of practical water quality problems.

It should be borne in mind that no model can offer useful results if it is not extensively calibrated and validated. Further, it should be remembered that successful model users are those who have the so-called engineering judgement.

The book is organised in 21 chapters and an appendix.

The first four chapters present introductory material related to the state of the art, the basics of pollution transport and the fundamental hydrodynamic processes.

Chapters 5, 6, 7, and 8 explain biochemical pollution and describe the most frequent pollutants in a river system.

Chapters 9, 10, 11, 12, 13, 14, and 15 are devoted to analytical and numerical methods, which can be used for simulating the pollution transport in rivers and streams.

Chapter 16 addresses thermal pollution and its simulation.

Chapters 17, 18, 19, and 20 are concerned with optimisation problems and the general processes of calibration and validation. They also deal with data acquisition and retrieval as well as with model reliability and measurement uncertainty.

Chapter 21 covers future trends and perspectives.

Last but not least, the appendix provides a short description of some widely used commercial ready-made packages.

We would like to express our gratitude to a number of people who assisted us in improving the content and the presentation of this book, in particular Prof. Mario Rosati of the University “La Sapienza” of Rome for his valuable suggestions and remarks in fundamental and applied mathematics. We would also like to thank Dr. D. Alexakis of the National Technical University of Athens for his assistance on quality issues and PhD candidate V. Bellos of the same university for running the numerical models with significant examples.

We would like to acknowledge the encouragement provided by members of the Permanent Working Group on “Water Quality” of the European Water Resources Association during the preparation of the book.

We would like to express our thanks to Ms. P. Van Steenberg from Springer and to Prof. V.P. Singh, editor-in-chief of the series in which this book is included, for their suggestions during the finalisation of our work. We are also grateful to Ms. H. Vloemans, who helped us in preparing the text.

Finally, we would like to thank Prof. G. Viggiani of the University of Palermo and Prof. V.A. Tsihrintzis of the Democritus University of Thrace for their critical review of the manuscript and the encouraging appreciation of our work.

We hope that the reader will find the book practical, easy to follow and useful in professional life.

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Water Quality Modelling for Rivers and Streams

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2013, XVIII, 288 p. 94 illus., 10 illus. in color., Hardcover

ISBN: 978-94-007-5508-6