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Book Review

Numerical Modeling in Open Channel Hydraulics, by R. Szymkiewicz. Water Science and Technology Library, Vol 83, Springer, 2010, ISBN: 978-90-481-3673-5 (hardback); e-ISBN: 978-90-481-3674-2

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Numerical Modeling in Open Channel Hydraulics is mainly addressed to students, scientists and engineers involved in modeling techniques of flow or pollutant transport in rivers. The main goal of this useful and interesting book is to present and explain all important issues connected with one-dimensional numerical modeling in open channel hydraulics, including basic definitions, derivation of fundamental equations, numerical methods, examples of solutions and sources of possible errors, both numerical and resulting from physical processes. Although it is not the first book on the subject, Szymkiewicz's concept is to systematize knowledge in terms of writing the numerical models, correct understanding of the relation between the numerical models and physical processes, and drawing proper conclusions from the modeling results. The systematic and detailed description of the problems covered by the book is invaluable for all people involved professionally, or wishing to be, in open channel hydraulics. It is especially important at a time when free or toll user friendly computer packages are becoming outstandingly popular and are not always used with proper knowledge about the physical background and numerical solutions applied.

Numerical Modeling in Open Channel Hydraulics comprises nine coherent and well written chapters, preface and index. Unfortunately for the reader, the Index seems over-simplified; it does not include either some well known notions, like Hessian or Jacobian, or less frequently used ones, Kortweg–de Veries equation are examples. Chapter 1 is dedicated to the overview and derivation of the fundamental channel flow equations. From Chap. 2 one may learn how to solve algebraic equations. Methods of numerical solutions of ordinary differential equations are introduced in Chap. 3. Chapter 4 is devoted to cases with steady gradually varied flow in open channels. In Chap. 5 an introduction to numerical methods for solving partial differential equations is presented, including finite difference and finite element methods. The following two Chapters (numbered 6 and 7) are devoted to the detailed description of numerical solutions of advection and advection–diffusion equations, respectively. They include both discussion of various numerical schemes as well as very informative examples. Chapter 8 is probably the most technical in the whole book, as it covers the detailed description of methods which allow numerical integration of Saint–Venant equations. One must admire the comments on various connected topics, including formal requirements for application, initial and boundary conditions, and details on accuracy and stability analysis. The final Chap. 9 covers the simplified methods of modeling of unsteady flow in open channel, including among others kinematic and diffusive wave equations and lumped flood routing models. A number of problems which should be well understood prior to numerical modeling, including partial differential equations classification, stability and accuracy analysis, numerical errors, numerical schemes, and appropriate initial and boundary conditions were addressed, in detail, in Chaps. 5–8. Also, a number of more difficult issues are well illustrated graphically. Each chapter is concluded with a reference list, which, unfortunately, is usually too short and does not

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include more recent publications in the subject. The fact that the reader frequently finds one or two references to the chapter published in the present millennium may arouse some concern. Also, the first historical works in the subject were usually omitted.

Although a few books are free from errors, one must note that in such a detailed and technical book some clear mistakes are unfortunately present, especially in equations (see the description of the Ridders method (page 66) to find an example of a crucial error, and the Runge–Kutta method (page 94) for a minor one). These errors may affect the understanding of the problem and require special care when writing own models based on Szymkiewicz's book. However, this should not prevent anyone from equipping their own technical library with *Numerical Modeling of Open Channel Hydraulics*.

This book should be recommended for all scientists and engineers involved in numerical modeling of open channel flow as one of the fundamental methodological references. It will also be acknowledged by students in the field as a clearly written, technically detailed and comprehensive help in their studies allowing mastering of computer writing skills.