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Review of *The Handbook of Groundwater Engineering*, Third Edition

John H. Cushman, Daniel M. Tartakovsky, editors. CRC Press, Boca Raton, FL, USA. 2017. 1074 pp. ISBN 978-1-4987-0304-8. £159.00, US$249.95

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Since the first edition in 1998, *The Handbook of Groundwater Engineering* has been a reference book and constant companion for many people interested in groundwater engineering. Meixner (2008) recommended in his review of the second edition of this book: "This detailed and meticulous volume should be on the shelf of any consultant, researcher, or professor who has need of a reference book on the ins and outs of groundwater." Fostered by Jacques W. Delleur for the first two editions, *The Handbook of Groundwater Engineering* is now available in a third edition.

The third edition of the Handbook of Groundwater Engineering is edited by John H. Cushman and Daniel M. Tartakovsky and includes contributions from 104 authors. The book has 1073 pages and is organized in three sections, including 38 chapters and 581 black and white illustrations. This new edition is significantly revised, including 17 new chapters. It is an excellent state-of-the-art reference book for both scientists and professionals in groundwater engineering.

Section I: Fundamentals of Groundwater Hydrology covers the basic concepts and processes in subsurface hydrology. With more than 300 pages, this section provides insights into the history of groundwater hydrology, occurrence of groundwater, physical processes connected to groundwater flow and transport, and groundwater contaminants. This section also covers the physical processes occurring at transitions between or within adjacent compartments, such as the unsaturated zone, sea water, and surface water. This section contains mainly chapters resumed from the second edition, though the new chapter on groundwater–surface water interactions is a very good addition as it completes the interaction of groundwater with its adjacent compartments.

Section II: Models of Subsurface Flow and Transport,covers state-of-the-art modeling concepts and techniques. This section, more than 400 pages long, gives insights into the rapidly evolving field of models and modeling in groundwater engineering. It contains many newly added and some revised chapters from the second edition. It brings together, compares and discusses the different concepts, theories, applications, and limitations of a tremendous range of models that have emerged in the last decades in subsurface hydrology. Moreover, this section highlights concepts and procedures to validate models, quantify uncertainties, and assess the risk of damage to groundwater systems. By adding this section to the third edition, the editors did a great job in bridging the gap between established and emerging models, and bridging basic principles presented in the first section to the field methods presented in the third section.

Section III: Data Acquisition and Analysis with Application to Remediation covers state-of-the-art concepts and techniques for aquifer characterization, groundwater monitoring, and remediation. This section contains new chapters and partly revised chapters from the second edition. With more than 300 pages, this chapter provides insights into field methods in groundwater engineering, including well construction, aquifer tests, groundwater sampling, geophysical methods, hydraulic tomography, and tracer tests. Moreover, this section includes methods and tools for structural analysis and modeling of field data, including inversion

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techniques, geostatistics, and geographical information systems. Finally, this section also introduces strategies and methods for landfill management and biochemical and physical remediation of contaminated groundwater.

All chapters are well written by experts in their field and are organized consistently throughout the book, including elaborate reference lists. Many chapters additionally provide a glossary and recommendations for further reading. The book also provides a comprehensive index, which covers keywords from all chapters.

To conclude, the third edition of *The Handbook of Groundwater Engineering* is not a substite for the many textbooks with focus on specific disciplines in groundwater engineering, but it is an excellent and comprehensive reference book that brings together theories, models, and experiments from many disciplines relevant to groundwater engineering. The book bridges gaps between practitioners and theoreticians, field experts and modelers, and applied and fundamental researchers. As stated at the very beginning of this review, I can recommend this book to everyone interested in groundwater engineering and I hope that *The Handbook of Groundwater Engineering* will be fostered with timely and worthwhile updates in the future. More information about this book can be found in the review articles by Fiori (2017) and Ferguson (2017).

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