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Book reviews

Modeling tools for environmental engineers and scientists
N. Nirmalakhandan (Ed.), CRC Press, Boca Raton, FL, 2002, 323 pp., US$ 89.95, ISBN:
1-56676-995-7

The combination of environmental modeling with powerful computers has tremendously advanced the field of environmental analysis and control. This well-written book will enable students and practicing engineers to avail themselves of this rapidly developing tool.

The author notes that his book is not a treatise on environmental modeling. Rather, his goal was to "bridge the gap between the science of environmental modeling and working models of environmental systems."

In the first of his eight chapters, entitled "Introduction to Modeling," the author defines modeling as "the process of application of fundamental knowledge or experience to simulate or describe the performance of a real system to achieve certain goals." These goals can be either research- or management-oriented, i.e. "to interpret the system; to analyze its behavior; to manage, operate, or control it to achieve desired outcomes; to design methods to improve or modify it; to test hypotheses about the system; or to forecast its response under varying conditions."

Nirmalakhandan's objective was to "introduce several types of computer software packages that subject matter experts with minimal computer skills can use to develop their own models." He begins this process in Chapter 2, entitled "Fundamentals of Mathematical Modeling," which he follows by a chapter entitled "Primer on Mathematics" and a chapter entitled "Fundamentals of Environmental Processes." The author continues his development of the subject in Chapter 5, entitled "Fundamentals of Engineered Environmental Systems." In this chapter, he discusses "Applications of the fundamentals of transport processes and reactions in developing material balance equations for engineered environmental systems."

In Chapter 6, "Fundamentals of Natural Environmental Systems," the author "outlines fluid flow and material balance equations for modeling the fate and transport of contaminants in unsaturated soils, lakes, rivers, and groundwater, and presents solutions for selected cases."

Software development is the topic of Chapter 7. The author notes that there "are three distinct types of commercially available software packages for model development ...: spreadsheet-based, equation solver-based, and dynamic simulation-based packages." He states his objective of this chapter is "to provide an overview of the available software and their capabilities so that readers can make their own choices appropriate to their modeling

goals." In this chapter, he groups the models in the following manner:

- spreadsheet-based software;
- equation solver-based software: Mathcad, Mathematica, MATLAB, and TK Solver;
- dynamic simulation-based software: extend, ithink, and simulink.

The final two chapters describe the use of selected environmental models. In Chapter 8, entitled "Modeling of Engineered Environmental Systems," 12 examples of the application of these models to engineering systems are discussed: "The selected examples include steady and unsteady state analyses using algebraic and differential equations, solved by analytical, trial and error, and numerical methods." The modeling examples are by title:

- transients in sequencing batch reactors;
- CMFRs in series for toxicity management;
- municipal wastewater treatment;
- chemical oxidation;
- analysis of catalytic bed reactor;
- waste management;
- activated carbon treatment;
- bioregeneration of activated carbon;
- pipe flow analysis;
- oxygen/nitrogen transfer in packed columns;
- groundwater flow management;
- diffusion through porous media.

The last chapter (Chapter 9) contains 12 examples of modeling of natural environmental systems. The topics range from modeling of lakes in series to modeling of well placement and water quality management.

In my opinion, this book will be of great use both to environmental engineering students as well as to practicing engineers in the field.

Gary F. Bennett

Introduction to Environmental Analysis
Roger Reeve, John Wiley & Sons, Inc., New York, MY, 2002, US$ 115.00, 323 pp., ISBN: 0-471-49294-9

This book is the third in a series of "open learning" texts published by Wiley on analytical methods in the sciences. The series is designed for students who cannot pursue full-time traditional courses. The text material is supplemented with "learning objectives" which are found at the beginning of each chapter. There are also frequent inclusions of short discussion questions followed immediately by the author's response. There are also more comprehensive self-assessment questions posed throughout the text with the answers given at the end of the book.