Modeling and Simulation in Ecotoxicology with Applications in MATLAB and Simulink

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Exploring roles critical to environmental toxicology, **Modeling and Simulation in Ecotoxicology with Applications in MATLAB® and Simulink®** covers the steps in modeling and simulation from problem conception to validation and simulation analysis. Using the MATLAB and Simulink programming languages, the book presents examples of mathematical functions and simulations, with special emphasis on how to develop mathematical models and run computer simulations of ecotoxicological processes.

Designed for students and professionals with little or no experience in modeling, the book includes:

- General principles of modeling and simulation and an introduction to MATLAB and Simulink
- Stochastic modeling where variability and uncertainty are acknowledged by making parameters random variables
- Toxicological processes from the level of the individual organism, with worked examples of process models in either MATLAB or Simulink
- Toxicological processes at the level of populations, communities, and ecosystems
- Parameter estimation using least squares regression methods
- The design of simulation experiments similar to the experimental design applied to laboratory or field experiments
- Methods of postsimulation analysis, including stability analysis and sensitivity analysis
- Different levels of model validation and how they are related to the modeling purpose

The book also provides three individual case studies. The first involves a model developed to assess the relative risk of mortality following exposure to insecticides in different avian species. The second explores the role of diving behavior on the inhalation and distribution of oil spill naphthalene in bottlenose dolphins. The final case study looks at the dynamics of mercury in Daphnia that are exposed to simulated thermal plumes from a hypothetical power plant cooling system.

Presented in a rigorous yet accessible style, the methodology is versatile enough to be readily applicable not only to environmental toxicology but a range of other biological fields.

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