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Beltrami, Edward
Mathematical models for society and biology. 2nd ed.
Amsterdam: Elsevier/Academic Press (ISBN 978-0-12-404624-5/hbk). xiii, 266 p. (2013).

This is the second edition of a very nice text featuring fascinating modeling problems arising in social and life sciences. The wide range of topics covers questions from biochemistry, molecular biology, epidemiology, ecology, embryology, medicine, criminal justice, finance, municipal services, social mobility, sports. The book is designed for readers already equipped with a basic knowledge of calculus, linear algebra, probability, differential equations and interested in discovering a variety of unusual and interesting applications of mathematics. "This volume is definitely not a text, nor is it suitable to train biologists or sociologists, since the math employed is generally beyond what these students learn in their usual coursework. Instead, it is a reference for mathematically prepared students (undergraduate) consisting of interesting and unusual applications to the biological and social sciences, a resource for self-study." The author maintains his point of view at modeling emphasizing once again that "the model should be simple, transparent, and verifiable. ... In short, there should be a balance between sufficient complexity to mimic the essential dynamics of the underlying process and a respect for simplicity in order to avoid getting tangled in extraneous and irrelevant details." As in the first edition, all chapters present different modeling situations and are shaped as virtually independent essays, even though one occasionally comes across some ideas and techniques from earlier chapters later in the text. Each essay begins with the description of the sociological or biological context followed by the discussion regarding formulation of an appropriate mathematical model that may shed the light onto specific questions introduced in relation with the problem. Some material from the first edition that became less relevant during the last decade has been eliminated from the book, some material has been updated, and some rearranged. Quite a lot of new material has been added during the revision; this resulted in expansion of the text from the original nine chapters into the current twelve. A short description of new chapters follows. Essays in Chapter 5 titled "A Bayesian take on colorectal screening, baseball, fund management, and a murder" demonstrate how Bayes' theorem can be successfully used for the analysis of different problems regarding colorectal screening, criminalistics, fund management and sports. Chapter 6, "What are odds of that?" addresses problems of amazing coincidences we observe on times; these may apparently be not so unusual and can be logically explained. Properties and applications of probability distributions known as power laws are explored in Chapter 7, "It's normal not to be normal." The role of diffusion in pattern formation is discussed in Chapter 11 titled "Spatial patterns: the cat's tail and spreading slime." Sections with exercises and suggestions for further reading from the first edition transformed into "Concluding thoughts" in the end of each chapter in a new edition. There are no doubts that the second revised edition of this nice text will be warmly welcomed by the mathematical community; the first edition has already proved to be a useful resource for students and researchers interested in applications of mathematics to life and social sciences.

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