



Mathematics for Neuroscientists

Fabrizio Gabbiani, Steven James Cox

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Virtually all scientific problems in neuroscience require mathematical analysis, and all neuroscientists are increasingly required to have a significant understanding of mathematical methods. There is currently no comprehensive, integrated introductory book on the use of mathematics in neuroscience; existing books either concentrate solely on theoretical modeling or discuss mathematical concepts for the treatment of very specific problems. This book fills this need by systematically introducing mathematical and computational tools in precisely the contexts that first established their importance for neuroscience. All mathematical concepts will be introduced from the simple to complex using the most widely used computing environment, Matlab. All code will be available via a companion website, which will be continuously updated with additional code and updates necessitated by software releases.

This book will provide a grounded introduction to the fundamental concepts of mathematics, neuroscience and their combined use, thus providing the reader with a springboard to cutting-edge research topics and fostering a tighter integration of mathematics and neuroscience for future generations of students.

- A very didactic and systematic introduction to mathematical concepts of importance for the analysis of data and the formulation of concepts based on experimental data in neuroscience
- Provides introductions to linear algebra, ordinary and partial differential equations, Fourier transforms, probabilities and stochastic processes
- Introduces numerical methods used to implement algorithms related to each mathematical concept
- Illustrates numerical methods by applying them to specific topics in neuroscience, including Hodgkin-Huxley equations, probabilities to describe stochastic release, stochastic processes to describe noise in neurons, Fourier transforms to describe the receptive fields of visual neurons
- Provides implementation examples in MATLAB code, also included for download on the accompanying support website (which will be updated with additional code and in line with major MATLAB releases)
- Allows the mathematical novice to analyze their results in more sophisticated ways, and consider them in a broader theoretical framework

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