

1. Record Nr.	UNINA9910791474803321
Autore	Gabbiani Fabrizio
Titolo	Mathematics for neuroscientists [[electronic resource] /] / Fabrizio Gabbiani, Steven J. Cox
Pubbl/distr/stampa	Amsterdam ; ; Boston, : Elsevier, 2010
ISBN	1-282-76902-2 9786612769023 0-08-089049-0
Edizione	[1st ed.]
Descrizione fisica	1 online resource (505 p.)
Collana	Elsevier science & technology books
Altri autori (Persone)	CoxSteven J
Disciplina	612.8 612.80151
Soggetti	Medicine - Mathematics Neurosciences
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references (p. 473-482) and index.
Nota di contenuto	Front cover; Mathematics for Neuroscientists; Copyright page; Full Contents; Preface; Chapter 1. Introduction; 1.1. How to Use This Book; 1.2. Brain Facts Brief; 1.3. Mathematical Preliminaries; 1.4. Units; 1.5. Sources; Chapter 2. The Passive Isopotential Cell; 2.1. Introduction; 2.2. The Nernst Potential; 2.3. Membrane Conductance; 2.4. Membrane Capacitance and Current Balance; 2.5. Synaptic Conductance; 2.6. Summary and Sources; 2.7. Exercises; Chapter 3. Differential Equations; 3.1. Exact Solution; 3.2. Moment Methods*; 3.3. The Laplace Transform*; 3.4. Numerical Methods 3.5. Synaptic Input 3.6. Summary and Sources; 3.7. Exercises; Chapter 4. The Active Isopotential Cell; 4.1. The Delayed Rectifier Potassium Channel; 4.2. The Sodium Channel; 4.3. The Hodgkin-Huxley Equations; 4.4. The Transient Potassium Channel*; 4.5. Summary and Sources; 4.6. Exercises; Chapter 5. The Quasi-Active Isopotential Cell; 5.1. The Quasi-Active Model; 5.2. Numerical Methods; 5.3. Exact Solution via Eigenvector Expansion; 5.4. A Persistent Sodium Current*; 5.5. A Nonspecific Cation Current that is Activated by Hyperpolarization*; 5.6. Summary and Sources; 5.7. Exercises Chapter 6. The Passive Cable 6.1. The Discrete Passive Cable Equation;

6.2. Exact Solution Via Eigenvector Expansion; 6.3. Numerical Methods; 6.4. The Passive Cable Equation; 6.5. Synaptic Input; 6.6. Summary and Sources; 6.7. Exercises; Chapter 7. Fourier Series and Transforms; 7.1. Fourier Series; 7.2. The Discrete Fourier Transform; 7.3. The Continuous Fourier Transform; 7.4. Reconciling the Discrete and Continuous Fourier Transforms; 7.5. Summary and Sources; 7.6. Exercises; Chapter 8. The Passive Dendritic Tree; 8.1. The Discrete Passive Tree; 8.2. Eigenvector Expansion; 8.3. Numerical Methods; 8.4. The Passive Dendrite Equation; 8.5. The Equivalent Cylinder*; 8.6. Branched Eigenfunctions*; 8.7. Summary and Sources; 8.8. Exercises; Chapter 9. The Active Dendritic Tree; 9.1. The Active Uniform Cable; 9.2. On the Interaction of Active Uniform Cables*; 9.3. The Active Nonuniform Cable; 9.4. The Quasi-Active Cable*; 9.5. The Active Dendritic Tree; 9.6. Summary and Sources; 9.7. Exercises; Chapter 10. Reduced Single Neuron Models; 10.1. The Leaky Integrate-and-Fire Neuron; 10.2. Bursting Neurons; 10.3. Simplified Models of Bursting Neurons; 10.4. Summary and Sources; 10.5. Exercises; Chapter 11. Probability and Random Variables; 11.1. Events and Random Variables; 11.2. Binomial Random Variables; 11.3. Poisson Random Variables; 11.4. Gaussian Random Variables; 11.5. Cumulative Distribution Functions; 11.6. Conditional Probabilities*; 11.7. Sum of Independent Random Variables*; 11.8. Transformation of Random Variables*; 11.9. Random Vectors*; 11.10. Exponential and Gamma Distributed Random Variables; 11.11. The Homogeneous Poisson Process; 11.12. Summary and Sources; 11.13. Exercises; Chapter 12. Synaptic Transmission and Quantal Release; 12.1. Basic Synaptic Structure and Physiology

Sommario/riassunto

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 important
