Mathematical Neuroscience

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Mathematical Neuroscience is a book for mathematical biologists seeking to discover the complexities of brain dynamics in an integrative way. It is the first research monograph devoted exclusively to the theory and methods of nonlinear analysis of infinite systems based on functional analysis techniques arising in modern mathematics.

Neural models that describe the spatio-temporal evolution of coarse-grained variables—such as synaptic or firing rate activity in populations of neurons —and often take the form of integro-differential equations would not normally reflect an integrative approach. This book examines the solvability of infinite systems of reaction diffusion type equations in partially ordered abstract spaces. It considers various methods and techniques of nonlinear analysis, including comparison theorems, monotone iterative techniques, a truncation method, and topological fixed point methods. Infinite systems of such equations play a crucial role in the integrative aspects of neuroscience modeling.

- The first focused introduction to the use of nonlinear analysis with an infinite dimensional approach to theoretical neuroscience
- Combines functional analysis techniques with nonlinear dynamical systems applied to the study of the brain
- Introduces powerful mathematical techniques to manage the dynamics and challenges of infinite systems of equations applied to neuroscience modeling

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