1. Record Nr. UNINA9910462011603321

Autore	Schiff Steven J
Titolo	Neural control engineering : the emerging intersection between control theory and neuroscience / / Steven J. Schiff
Pubbl/distr/stampa	Cambridge, MA, : MIT Press, c2012
ISBN	1-283-83468-5 0-262-31208-5
Descrizione fisica	1 online resource (403 p.)
Collana	Computational neuroscience series
Disciplina	612.8
Soggetti	Computational neuroscience Nonlinear control theory Neural Networks (Computer) Electronic books.
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. [337]-356) and index.
Nota di contenuto	Contents; Series Foreword; Preface; Chapter 1. Introduction; 1.1 Overview; 1.2 A Motivational Example; 1.3 Least Squares; 1.4 Expectation and Covariance; 1.5 Recursive Least Squares; 1.6 It's a Bayesian World; Exercises; Chapter 2. Kalman Filtering; 2.1 Linear Kalman Filtering; 2.2 Nonlinear Kalman Filtering; 2.3 Why Not Neuroscience?; Exercises; Chapter 3. The Hodgkin-Huxley Equations; 3.1 Pre-Hodgkin and Huxley; 3.2 Hodgkin and Huxley and Colleagues; 3.3 Hodgkin and Huxley; Exercises; Chapter 4. Simplified Neuronal Models; 4.1 The Van der Pol Equations; 4.2 Frequency Demultiplication 4.3 Bonhoeffer and the Passivation of Iron 4.4 Fitzhugh and Neural Dynamics; 4.5 Nagumo's Electrical Circuit; 4.6 Rinzel's Reduction; 4.7 Simplified Models and Control; Exercises; Chapter 5. Bridging from Kalman to Neuron; 5.1 Introduction; 5.2 Variables and Parameters; 5.3 Tracking the Lorenz System; 5.4 Parameter Tracking; 5.5 The Fitzhugh-Nagumo Equations; Exercises; Chapter 6. Spatiotemporal Cortical Dynamics-The Wilson Cowan Equations; 6.1 Before Wilson and Cowan; 6.2 Wilson and Cowan before 1973; 6.3 Wilson and Cowan during 1973; 6.4 Wilson and Cowan after 1973 6.5 Spirals, Rings, and Chaotic Waves in Brain 6.6 Wilson-Cowan in a

Sommario/riassunto

How powerful new methods in nonlinear control engineering can be applied to neuroscience, from fundamental model formulation to advanced medical applications. Over the past sixty years, powerful methods of model-based control engineering have been responsible for such dramatic advances in engineering systems as autolanding aircraft, autonomous vehicles, and even weather forecasting. Over those same decades, our models of the nervous system have evolved from single-cell membranes to neuronal networks to large-scale models of the human brain. Yet until recently control theory was completely inapplicable to the types of nonlinear models being developed in neuroscience. The revolution in nonlinear control engineering in the late 1990's has made the intersection of control theory and neuroscience possible. In Neural Control Engineering, Steven Schiff seeks to bridge the two fields, examining the application of new methods in nonlinear control engineering to neuroscience. After presenting extensive material on formulating computational neuroscience models in a control environment--including some fundamentals of the algorithms helpful in crossing the divide from intuition to effective application--Schiff examines a range of applications, including brain-machine interfaces and neural stimulation. He reports on research that he and his colleagues have undertaken showing that nonlinear control theory methods can be applied to models of single cells, small neuronal networks, and large-scale networks in disease states of Parkinson's disease and epilepsy. With Neural Control Engineering the reader acquires a working knowledge of the fundamentals of control theory and computational neuroscience sufficient not only to understand the literature in this trandisciplinary area but also to begin working to advance the field. The book will serve as an essential guide for scientists in either biology or engineering and for physicians who wish to gain expertise in these areas.