

1. Record Nr.	UNINA9910137630003321
Titolo	Biohybrid systems [[electronic resource]] : nerves, interfaces, and machines / / edited by Ranu Jung
Pubbl/distr/stampa	Weinheim, : Wiley-VCH, c2011
ISBN	3-527-63937-3 1-283-64417-7 3-527-63938-1 3-527-63936-5
Descrizione fisica	1 online resource (231 p.)
Altri autori (Persone)	JungRanu
Disciplina	612.81
Soggetti	Neurobiology Medical physics
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 and index.
Nota di contenuto	Biohybrid Systems: Nerves, Interfaces, and Machines; Contents; Preface; List of Contributors; 1 Merging Technology with Biology; 1.1 Introduction; 1.2 NeuroDesign; 1.3 The NeuroDesign Approach; 1.4 Neuromorphic Control of a Powered Orthosis for Crutch-Free Walking; 1.5 Frontiers of Biohybrid Systems; 1.6 Chapter Organization; References; 2 Principles of Computational Neuroscience; 2.1 Introduction; 2.2 Some Physiology of Neurons; 2.2.1 Membrane Potential; 2.2.2 Membrane Equivalent Circuit; 2.2.3 Action Potential: Generation and Propagation; 2.3 General Formalisms in Neuronal Modeling 2.3.1 Conductance-Based Hodgkin-Huxley Model for Action Potential Generation 2.3.2 Chemical and Electrical Synaptic Inputs; 2.3.3 Cable Theory of Neuronal Conduction and Compartmental Modeling; 2.3.4 Calcium and Calcium-Dependent Potassium Currents; 2.3.5 Simplified Neuronal Models; 2.4 Synaptic Coupling and Plasticity; 2.4.1 Modeling Synaptic Plasticity; 2.5 Computational Models of Neuronal Systems for Biohybrid Applications; 2.6 Resources; References; 3 Neuromorphic Electronic Design; 3.1 Choices for Neuromorphic Circuits: Digital versus Analogue; 3.2 The Breadth of Neuromorphic Systems

3.3 The Fundamental Processing Unit: The Neuron 3.3.1 Conductance-Based Modeling; 3.3.2 Compartmental Modeling; 3.3.2.1 The Dendritic Compartment: Home to the Synapses; 3.3.2.2 The Somatic Compartment: Spike-Based Processing and the Integrate-and-Fire Model; 3.3.2.3 The Axonal Compartment: Address-Event Representation; 3.4 Sensing the Environment; 3.4.1 Vision; 3.4.2 The Silicon Retina; 3.4.3 Audition; 3.4.3.1 Silicon Cochlea Modeling; 3.5 Conclusions; 3.6 Resources; References; 4 Principles of Neural Signal Processing; 4.1 Introduction; 4.2 Point Process Theory 4.2.1 Definition of a Point Process 4.2.2 Examples of Point Processes; 4.2.2.1 The Poisson Process; 4.2.2.2 Renewal Processes; 4.2.2.3 Markov Point Processes; 4.2.2.4 Non-Markovian Point Processes; 4.2.3 Multiple Point Processes; 4.3 Analyzing a Point Process; 4.3.1 The Interval Histogram and Hazard Function; 4.3.2 The PST Histogram; 4.3.3 Characterizing Multiple Point Processes; 4.4 Dynamic Neural Processing; 4.5 Information Theory and Neural Signal Processing; 4.5.1 Data Processing Theorem; 4.5.2 Channel Capacity; 4.5.3 Rate Distortion Theory; 4.5.4 Application to Biohybrid Systems 4.6 Summary References; 5 Dynamic Clamp in Biomimetic and Biohybrid Living-Hardware Systems; 5.1 What is a Dynamic Clamp?; 5.1.1 The Digital Dynamic Clamp; 5.2 Dynamic Clamp Performance and Limitations; 5.3 Experimental Applications of Dynamic Clamp; 5.3.1 Example Application 1: Neuronal Gain Control; 5.3.1.1 Synaptic Background Noise Mechanism; 5.3.1.2 Synaptic Depression Mechanism; 5.3.2 Example Application 2: Constructing Artificial Neuronal Circuits; 5.4 Dynamic Clamp System Implementations and Future; 5.4.1 Fundamental Considerations; 5.4.2 Recent and Future Implementations; 5.5 Resources References

Sommario/riassunto

The discipline of neurodesign is a highly interdisciplinary one, while at the same time in the process of maturing towards real-life applications. The breakthrough about to be achieved is to close the loop in communication between neural systems and electronic and mechatronic systems and actually let the nervous system adapt to the feedback from the man-made systems. To master this loop, scientists need a sound understanding of neurology, from the cellular to the systems scale, of man-made systems and how to connect the two. These scientists comprise medical scientists, neurologists and physio