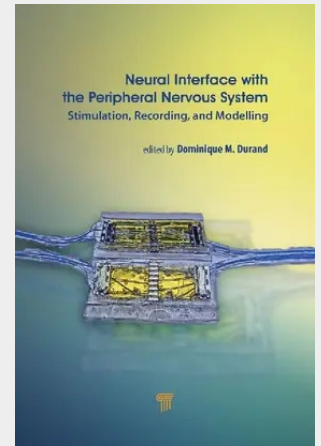


Neural Interface with the Peripheral Nervous System

Stimulation, Recording, and Modelling

Neural interfacing represents a riveting journey of scientific curiosity, innovation, and the relentless pursuit of solutions to some of the most complex challenges in neurology and bioengineering. Over the past two decades, pioneering studies have significantly propelled the field forward, particularly in the realm of peripheral nerves. These groundbreaking works have transformed our understanding of how to connect with the nervous system, allowing researchers and clinicians to uncover new therapeutic possibilities. Exploring peripheral nerve recording selectivity alongside multiple-contact nerve electrodes has brought unprecedented precision, enabling targeted treatments that minimize side effects and hold immense potential for both therapeutic interventions and diagnostics. The efforts continue to refine these technologies with the aim to reduce the mechanical and biological footprint of electrodes within the nervous system, and the ultimate vision is to develop neural interfaces that seamlessly integrate with both peripheral and central nervous systems for several years, enhancing the quality of life for individuals affected by neurological conditions. This book highlights the remarkable progress in neural interfacing, from theoretical models to intricate designs of long-term implantable electrodes. It provides foundational knowledge and cutting-edge solutions for future breakthroughs in neuroprosthetics, neuromodulation, and the treatment of neurological disorders. It discusses pioneering research that laid the groundwork for predicting nerve fiber responses to electrical stimuli. It reviews the early models that forecast axonal excitation that simplified the complex, computational process, making neural interface design more practical and scalable. It analyzes innovations such as slowly penetrating interfascicular electrodes and spiral nerve cuff electrodes that significantly enhance precision and stability in neural recordings, minimizing tissue damage and expanding applications in prosthetics and sensory restoration. The book also covers key advancements in chronic neural interfaces and functional electrical stimulation that allow for fine-tuned muscle activation and novel neuromodulation treatments and analyzes closed-loop stimulation systems that utilize spontaneous nerve activity as feedback. It explores peripheral nerve recording selectivity that further boosts targeted therapeutic interventions and diagnostics, offering promising solutions for future neuroprosthetic devices. The book is a comprehensive resource that traces the evolution of nerve stimulation and recording technologies and is a testament to the collaboration, ingenuity, and perseverance of scientists, engineers, and clinicians dedicated to pushing the boundaries of what is possible.



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