The concepts represented in this textbook are explored for the first time in assistive and rehabilitation robotics, which is the combination of physical, cognitive, and social human-robot interaction to empower gait rehabilitation and assist human mobility. The aim is to consolidate the methodologies, modules, and technologies implemented in lower-limb exoskeletons, smart walkers, and social robots when human gait assistance and rehabilitation are the primary targets. This book presents recent advances in emerging technologies for gait assistance, open source, automatic learning, and motion planning. From the clinical perspective, case studies are presented for testing and evaluating how those robots interact with humans, analyzing acceptance, perception, biomechanics factors, and physiological mechanisms of recovery during the robotic assistance or therapy. Interfacing Humans and Robots for Gait Assistance and Rehabilitation will enable undergraduate and graduate students of biomechanical engineering, rehabilitation engineering, robotics, and health sciences to understand the clinical, technological, and scientific advances of human-robot interaction behind robotic devices for assistive and rehabilitation robotics.

This book provides state-of-the-art scientific and engineering research findings and developments in the area of service robotics and associated support technologies around the theme of human-centric robotics. The book contains peer reviewed articles presented at the CLAWAR 2017 conference. The book contains a strong stream of papers on robotic locomotion strategies and wearable robotics for assistance and rehabilitation. There is also a strong collection of papers on non-destructive inspection, underwater and UAV robots to meet the growing emerging needs in various sectors of the society. Robot designs based on biological inspirations are also strongly featured.

Current ROM (range of motion) rehabilitation is done by a therapist helping each patient individually, which can be done more effectively and efficiently by robotic devices. The goal of this work is to design and develop a robotic finger exoskeleton system as a CPM device for ROM rehabilitation. The research introduces a novel mechanism for finger exoskeleton design. The main concepts of the proposed design are having no interference and no translational forces on phalanges during flexion/extension. The design consists of an actuated IP joint for each finger. The joint system contains a mechanism of three revolute joints to accommodate all the configurations. The requirement based evaluation and the subjective test show that the device can move a subject's finger with quite natural and unimpeded motion along the predefined path. The device is successfully tested with 14 healthy subjects.

Practical and authoritative, this new edition delivers easy access to the latest advances in the diagnosis and management of musculoskeletal disorders and other common conditions requiring rehabilitation. Each topic is presented in a concise, focused, and well-illustrated two-color format featuring a description of the condition, discussion of symptoms, examination findings, functional limitations, and diagnostic testing. The treatment section is extensive and covers initial therapies, rehabilitation interventions, procedures, and surgery. From sore shoulders in cancer patients to spinal cord injuries, Essentials of Physical Medicine and Rehabilitation, 2nd Edition provides you with the knowledge you need to face every challenge. The fully updated, clinically relevant material for the diagnosis and treatment of musculoskeletal conditions. Discusses physical agents and therapeutic exercise for the prevention, diagnosis, treatment and rehabilitation of disorders that produce pain, impairment, and disability. Presents a consistent chapter organization that delivers all the content you need in a logical, practical manner. Presents a new co-editor, Thomas D. Rizzo, Jr., MD, and a pool of talented contributors who bring you fresh approaches to physical medicine and rehabilitation. Offers current evidence and expert guidance to help you make more accurate diagnoses and choose the best treatment option for each patient. Features an entirely new section on pain management so you can help your patients reach their full recovery potential. Incorporates redrawn artwork that makes every concept and technique easier to grasp. Includes updated ICD-9 codes giving you complete information for each disorder.

This useful resource is directed to healthcare professionals with specific information about the diverse area of assistive technology. It covers the variety of technology available and explains the adaptations of the technology, as well as how different devices work together. The first section provides the fundamentals of assistive technology, discussing issues such as life span considerations, environmental context, and funding and public policy. The next section delves into topics especially relevant for patient care, including computer access and alternative communication. Sections on manipulation, ambulation, and locomotion technologies are discussed next, concentrating on devices that assist with upper and lower body function. This text ends with a discussion of technologies for environments in the real world. Diversity of technology areas - covers all major areas and facets of assistive technology, including how the various technologies can be used in conjunction to improve the ease of activities of daily living for the user Organization by topic - by grouping assistive technology into four major areas, the book is able to easily lead the reader to the both the general area and the specific information they need. Also contains a list of resources and contact people that are useful for both the consumer and the professionals that support them. It is an excellent resource for anyone who is seeking to improve their knowledge in the area of assistive technology. The organizations and individuals that are represented in this book are listed at the end of each section. Section editors and contributors representing the country's major programs and each area of assistive technology - provides accurate, up-to-date information for the reader.

Rehabilitation interventions for individuals with activities of daily living for individuals with upper extremity disabilities. Conventional therapies for rehabilitation have not shown significant improvement in hand function. Robotic exoskeletons have been developed to assist in therapy and there is initial evidence that such devices with force-control based strategies can help in effective rehabilitation of human limbs. However, to the best of our knowledge, none of the existing hand exoskeletons allow for accurate force or torque control. In this dissertation, we design and prototype a novel hand exoskeleton that has the following unique features: (i) Bowden-cable-based series elastic actuation allowing for bidirectional torque control of each joint individually; (ii) an underlying kinematic mechanism that is optimized to achieve large range of motion and (iii) a thumb module that allows for independent actuation of the four thumb joints. To control the developed hand exoskeleton for efficacious rehabilitation after a neuromuscular impairment such as stroke, we present two types of subject-specific assist-as-needed controllers. Learned force-field control is a novel control technique in which a neural-network-based model of the required torques given the joint angles for a specific subject is learned and then used to build a force field to assist the joint motion of the subject to follow a trajectory designed in the joint-angle space. Adaptive control, on the other hand, is based on the other two error signals to provide a subject-specific adaptation for improved trajectory tracking. Experiments with healthy human subjects showed that each controller has its own trade-offs and is suitable for a specific type of impairment. Finally, to promote and optimize motor (re-)learning, we present a framework for robot-assisted motor (re-)learning that provides subject-specific training by allowing for simultaneous adaptation of task, assistance and feedback based on the performance of the subject on the task. To train the subjects for dexterous manipulation, we present a torque-based task that requires dexterous manipulation and feedback to the subjects.
This revised, updated second edition provides an accessible, practical overview of major areas of technical development and clinical application in the field of neurorehabilitation movement therapy. The initial section provides a rationale for technology application in movement therapy by summarizing recent findings in neuroplasticity and motor learning. The following section then explains the state of the art in human-machine interaction requirements for clinical rehabilitation practice. Subsequent sections describe the ongoing revolution in robotic therapy for upper extremity movement and for walking, and then describe other emerging technologies including electrical stimulation, virtual reality, wearable sensors, and brain-computer interfaces. The promises and limitations of these technologies in neurorehabilitation are discussed. Throughout the book the chapters provide detailed practical information on state-of-the-art clinical applications of these devices following stroke, spinal cord injury, and other neurologic disorders. It serves to clarify ambiguous for the reader. Neurorehabilitation Technology. Second Edition is a valuable resource for neurologists, biomedical engineers, roboticists, rehabilitation specialists, physiotherapists, occupational therapists and those training in these fields.

Wearable Robotics: Systems and Applications provides a comprehensive overview of the entire field, with both engineering and medical perspectives. Helps readers quickly and efficiently design and develop wearable robotics for healthcare applications.

The new technological advances opened widely the robotic field of robots. Robots are moving from the classical application scenario with structured industrial environments and tedious repetitive tasks to new application environments that require more interaction with the humans. It is in this context that the concept of Wearable Robots (WbR) has emerged. One of the most exciting and challenging aspects in the design of biomechatronics wearable robots is that the human takes a place in the design, this fact imposes several restrictions and requirements in the design of this sort of devices. The key distinctive aspect in wearable robots is their intrinsic dual cognitive and physical interaction with humans. The key role of a robot in a physical human–robot interaction (pHRI) is to make the human aware of the possibilities of the robot while allowing them to maintain control of the robot at all times. This book gives a general overview of the robotics exoskeletons and introduces the reader to this robotic field. Moreover, it describes the development of an upper limb exoskeleton for tremor suppression in order to illustrate the influence of a specific application in the designs decisions.

The coupling of several areas of the medical field with recent advances in robotics systems has seen a paradigm shift in our approach to selected sectors of medical care, especially over the last decade. Rehabilitation medicine is one such area. The use of advanced robotics technology has ushered in an exponential number of times and experiments aimed at optimising restoration of quality of life to those who are physically debilitated. Despite these developments, there remains a paucity in the presentation of these advances in the form of a comprehensive tool. This book was written to present the most recent advances in rehabilitation robotics known to date from the perspective of some of the leading experts in the field and presents an interesting array of developments put into 33 comprehensive chapters. The chapters are presented in a way that the reader will get a seamless impression of the current concepts of optimal modes of both experimental and applicable roles of robotic devices.

Gait disorder is a commonly lasting side-effect for stroke and spinal cord injury survivors. Conventional gait rehabilitation training provided by therapists are largely dependent on their experience. Such trainings are often challenging for therapists due to their physically intensive nature. Hence, consistent optimal results cannot always be achieved. Robotic technologies were thus introduced to automate the gait rehabilitation training, in order to emancipate therapists from physically intensive work as well as making rehabilitation training more accessible to patients. Research have shown that task specific repetitive training and patients’ active participation can lead to more effective gait rehabilitation. However, conventional mGait rehabilitation could be less effective compared to the stroke rehabilitation robot. A study with 12 patients showed the use of a robotic-aided stroke rehabilitation device could decrease the leg fatigability of stroke patients, and increased the walking speed. Eventually, it is important to ensure that the robotic gait rehabilitation training is more analogous to actual human walking and maximize the training subject’s active participation. The goal of this thesis is the development of a new robotic GAIT Rehabilitation EXoskeleton (GAREX) that is compliant with the current neurorehabilitation theories in order to achieve optimised robotic gait rehabilitation. Such goal is tackled systematically in terms of both robotic design and control algorithm research. GAREX was designed to provide safe, task specific, and patient-centered training that can be used for outpatient, inpatient, and home-based training. For example, the exoskeleton can be used to support patients in gait training. Therapists can specify the tasks and the training programme to be performed. Especially, the intrinsic compliance can create a wide range of dynamic environment for control strategy development. However, the negative correlation between PM’s force output and contracting length means a trade-off between torque and range of motion specifications of the actuation system. The design of GAREX comprehensively addressed torque and joint range of motion requirements imposed by task-specific gait rehabilitation training. Control strategies are the key to implement the training theory. In order to support tasks, the robot needs to enable gait assistance a patient needs to complete treadmill based gait training. To implement assist-as-needed (AAN) control, the robot should also be able to assess the extent of active participation and change the assistance provided accordingly. The intrinsic compliance of GAREX’s PM actuation system could be utilized to change the level of guidance. A new multi-input multi-output (MIMO) sliding model (SM) controller was developed to adjust assistance while guiding training subjects to walk in predefined gait trajectories. Technical experimental validation indicated that controller was able to adapt assistance and trajectory to improve gait. A strong correlation between gait space average anteroposterior PM measures. The proposed MIMO SM controller is able to vary the compliance of the exoskeleton To online assess the training subject’s active participation, a fuzzy logic compliance adaptation (FLCA) controller is proposed. The FLCA algorithm utilizes the robotic kinematics and human- exoskeleton interaction torque to assess the extent of patient’s active participation. The patient’s active level can be automatically adjusted with higher compliance for more active participation and vice versa. Nevertheless, the FLCA algorithm does not require models of the exoskeleton and biomechanics of the training subject, which means less preparation work and easier implementation. Performance of the FLCA control system was validated with three healthy subjects who simulated different extents of participation. The FLCA control system could successfully adapt the joint actuation compliance accordingly in all the scenarios.

This book contains the proceedings of the 1st Latin American Congress on Automation and Robotics held at Panama City, Panama in February 2017. It gathers research work from researchers, scientists, and engineers from academia and private industry, and presents current and exciting research applications and future challenges in Latin America. The scope of this book covers a wide range of themes associated with advances in automation and robotics research encountered in engineering and scientific research and practice. These topics are related to control algorithms, systems automation, perception, mobile robotics, computer vision, educational robotics, robotics modeling and simulation, and robotics and mechanism design. LACAR 2017 has been sponsored by SENACYT (Secretaria Nacional de Ciencia, Tecnologias e Inovacion de Panama).

A wearable robot is a mechatronic system that is designed around the shape and function of the human body, with segments and joints corresponding to those of the person it is externally coupled with. Teleoperation and power amplification were the first technological advances that range of applications with fields has widened. Increasing recognition from the scientific community means that this technology is now employed in telemanipulation, non- amplification, neuromotor control research and rehabilitation, and to assist with impaired human function of the body. Logical in structure and original in its global orientation, this volume gives a full overview of wearable robotics, providing the reader with complete understanding of the key applications and technologies suitable for development. The main topics are presented through two detailed case studies. The main topics are presented through two detailed case studies. The main topics are presented through two detailed case studies. The main topics are presented through two detailed case studies.
rehabilitation process, robot assisted gait rehabilitation has gained much interest over the past years. There have been many prototypes and commercial products for the robot assisted rehabilitation, but many had limitations. One of which is being limited to stroke patients which could improve the quality of life for stroke patients. Improper attachment and configuration could result in injury in the long term use. Another limitation is the lack of mechanical compliance which is the key to improve the safety of the robotic system for the patient. In order to address the limitations identified, a new robot orthosis, Human-inspired Robotic Exoskeleton (HuREx) was developed. HuREx utilizes a compact exoskeleton parts custom fit for each individual patient manufactured using a rapid prototyping technique. Pneumatic Muscle Actuators (PMAs) were used as they exhibit natural compliance and configuration antagonistically. The design of the orthosis and the actuation mechanism made the system highly nonlinear. Therefore, an advanced model-based controller was designed and implemented to achieve the accuracy of performance. Many experiments were carried out to observe the performance and verify the proof of concept. The contributions of this research are the development of the new robotic exoskeleton device designed to be light weight, comfortable and safe to use for gait rehabilitation for stroke patients, which were lacking in the existing devices. Another contribution is the establishment of new manufacturing technique that allow custom exoskeleton component for each individual patient. Finally the development of advanced model-based FF controller that achieves fast and accurate tracking performance. The potential of robotic systems to aid in the rehabilitation of patients with cerebral palsy is a burgeoning area of research. It is able to provide more repeatable and enjoyable physiotherapy regimes, in addition to lessening the burden on physiotherapists and their role to work on a supervisory manner. In this research, the main focus of this study will be on the development of a new wearable robotic system for the rehabilitation of the upper limb. The exoskeleton contains a novel actuation joint, presented as the Bio-Sensor & Joint (BSJ) and this is used to apply torques to the elbow joint. A torque controller based on sliding mode control (SMC) was derived from a model of the system and compared to a feedback-lineariser proportional derivative (PD) controller for pure trajectory tracking. It was found that the SMC controller was more robust to disturbances and modelling uncertainties. A feedback-lineariser control scheme and it was shown to reduce trajectory tracking error for both healthy participants and a participant diagnosed with cerebral palsy. Finally, a high-level gravity augmentation controller was developed that utilizes Denavit-Hartenberg parameters to estimate the component of gravity perpendicular to the forearm. With this information, the SMC torque controller can be commanded to exert a torque on the elbow that varies in response to orientation relative to the gravity vector, thus simulating the effect of leaning on the affected limb. The experiments were conducted with subjects wearing an exoskeleton system with surface electromyography (sEMG) signals recorded as a measure of exertion. While the controller was able to accurately vary the torque on the elbow as the orientation relative to gravity vector changed, it was not possible to draw statistically significant conclusions regarding the effect of the augmented gravity conditions on the participants’ physical exertion.

Robotic Rehabilitation summarizes the rationale for robot-assisted therapy and presents the technological steps in the evolution of the design and development of lower and upper extremity rehabilitation robots. After presenting the basic mechanisms of natural and artificial movement restoration, and the rationale for robot-aided movement therapy, it shows several design criteria that are relevant for the development of effective and safe rehabilitation robots. Every year there are about 800,000 new stroke patients in the US, and many of them suffer from upper limb neuromuscular disabilities including but not limited to: weakness, spasticity and abnormal synergy. Patients usually have the potential to recover at least partially, but their recovery is limited by the occurrence of neurological deficits such as paralysis and limited mobility. In the past, the only way to improve the recovery was through physiotherapy. However, the results were not always promising and the patients felt discouraged. In recent years, there has been an increased interest in developing robotic systems to aid in the rehabilitation of patients. These systems have the potential to provide a more personalized and effective therapy compared to traditional physiotherapy.

The book reports on advanced topics in the areas of wearable robotics research and practice. It focuses on new technologies, including neural interfaces, soft wearable robots, sensors and actuators technologies, and discusses important regulatory challenges, as well as clinical and ethical issues. Based on the 4th International Symposium on Wearable Robotics, WeRob2018, held October 16-20, 2018, in Pisa, Italy, the book addresses a large audience of academics and professionals working in government, industry, and medical centers, and end-users alike. It provides them with specialized information and with a source of inspiration for new ideas and collaborations. It discusses exemplary case studies high-level controllers related to the challenges faced in the development of wearable systems for the natural human motion and other applications.
In the last decade, diverse research areas have developed novel approaches to overcome dysfunctions after a spinal cord injury (SCI). Even though motor restoration attracts the most clinical attention, sensory, autonomic, and mental health are also aspects fundamental to the quality of life of SCI patients. Over four sections of therapeutic, rehabilitation, and technological approaches, this book examines preclinical and clinical studies using mesenchymal stem cells and pharmacological or electrical stimulation strategies. Chapters also address the impact of paraesthesia and associated loss of autonomic functions, including bowel and sexual dysfunction, as well as the convergence of new technologies aimed at providing postural support and enhancing mobility.

Soft Robotics in Rehabilitation explores the specific branch of robotics dealing with developing robots from compliant and flexible materials. Unlike robots built from rigid materials, soft robots behave in the way in which living organs move and adapt to their surroundings and allow for increased flexibility and adaptability for the user. This book is a comprehensive reference discussing the application of soft robotics for rehabilitation of upper and lower extremities separated by various limbs. The book examines various techniques applied in soft robotics, including the development of soft actuators, rigid actuators with soft behavior, intrinsically soft actuators, and soft sensors. This book is perfect for graduate students, researchers, and engineers in robotics, rehabilitation therapists, control, medical and rehabilitation device design and manufacturing. Outlines the application of soft robotic techniques to design platforms that provide rehabilitation therapy for disabled persons to help improve their motor functions. Discusses the application of soft robots for rehabilitation of upper and lower extremities separated by various limbs. Offers readers the ability to find soft robotics devices, methods, and results for any limb, and then compare the results with other options provided in the book.

In the area of wearable exoskeletons for rehabilitation, this book provides a comprehensive look at physical therapy science and practice, Guccione’s Geriatric Physical Therapy, 4th Edition is a perfect resource for both students and practitioners alike. Year after year, this text is recommended as the primary preparatory resource for the Geriatric Physical Therapy Specialization exam. The new fourth edition only gets better. Content is thoroughly revised to keep you up to date on the latest geriatric physical therapy protocols and conditions. Five additional topics include space applications and assistive technologies in the industry. The book merges together the engineering, medical, ethical and political perspectives, thus offering a multidisciplinary, regulatory challenges, as well as clinical and ethical issues. Based on the 2nd International Symposium on Wearable Robotics, WeRob2016, held October 18-21, 2016, in Segovia, Spain, the book addresses a large audience of academics and practitioners. This book addresses cutting-edge topics in robotics and related technologies for rehabilitation, covering basic concepts and providing the reader with the information they need to solve various practical problems. Intended as a reference guide to the application of robotics in rehabilitation, it covers e.g. musculoskeletal modelling, gait analysis, biomechanics, robotics modelling and simulation, sensors, wearable devices, and the Internet of Medical Things.

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This book presents the synthesis of a Hand Exoskeleton (HE) for the rehabilitation of post-stroke patients. Through the analysis of the state-of-the-art, a topological classification was proposed. Based on the proposed classification principles, the rehabilitation HEs were systematically analyzed and classified accordingly, that is effective to both perceive the demand for proposing application-specific solutions and provide some useful guidelines for the design of a new HE. Further, a novel rehabilitation HE was proposed to support patients with the aim to give them back the function of myoelectric control or to assist the wearers to situations where human motion is resisted for exercising applications, cover a wide range of domains such as medical devices for patient rehabilitation training recovering from trauma, movement aids for disabled persons, personal care robots for providing daily living assistance, and reduction of physical burden in industrial and military applications. The development of effective and affordable wearable exoskeletons poses several design, control and modeling challenges to researchers and manufacturers. Novel techniques are therefore being developed in adaptive motion controllers, human-robot interaction control, biological sensors and actuators, materials and structures, etc. In this book, the editors and authors report recent advances and technology breakthroughs in exoskeleton developments. It will be of interest to engineers and researchers in academia and industry as well as manufacturing companies interested in developing new markets in wearable exoskeleton robotics.

Living with Robots recounts a foundational shift in robotics, from artificial intelligence to artificial emotion, and foreshadows an inflection point in human evolution. As robots engage with people in socially meaningful ways, social robotics probes the nature of the human emotions that social robots are designed to emulate.

The new technological advances opened widely the field of application of robots. Robots are moving from the classical application scenario with structured industrial environments and tedious repetitive tasks to new application environments that required interaction with the humans. It is becoming ever more evident that the strategies used for designing robots must be designed on the base of the possible human-robot interaction of the robots. This book is aimed at presenting robots in a number of different contexts. It presents the state of art in the field of human–robot interaction, from a historical overview to a state-of-the-art survey. Moreover, it explains the main challenges and the main strategies to be found on the state of art. It is also providing a state-of-the-art survey of the field of human–robot interaction and interaction control, including humans, robots, and physical human–robot interaction (pHRI).

This book addresses cutting-edge topics in robotics and related technologies for rehabilitation, covering basic concepts and providing the reader with the information they need to solve various practical problems. Intended as a reference guide to the application of robotics in rehabilitation, it covers e.g. musculoskeletal modelling, gait analysis, biomechanics, robotics modelling and simulation, sensors, wearable devices, and the Internet of Medical Things.

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accurate. NEW! Thoroughly revised and updated content across all chapters keeps students up to date with the latest geriatric physical therapy protocols and conditions. NEW! References located at the end of each chapter point students toward credible external sources for further information. NEW! Treatment chapters guide students in managing common conditions in orthopedics, cardiopulmonary, and neurology. NEW! Chapter on functional outcomes and assessment lists relevant scores for the most frequently used tests. NEW! Chapter on psychosocial aspects of aging provides a well-rounded view of the social and mental conditions commonly affecting geriatric patients. NEW! Chapter on frailty covers a wide variety of interventions to optimize treatment. NEW! Enhanced eBook version is included with print purchase, allowing students to access all of the text, figures, and references from the book on a variety of devices.

This book provides state-of-the-art scientific and engineering research findings and developments in the area of service robotics and associated support technologies around the theme of human-centric robotics. The book contains peer reviewed articles presented at the CLAWAR 2017 conference. The book contains a strong stream of papers on robotic locomotion strategies and wearable robotics for assistance and rehabilitation. There is also a strong collection of papers on non-destructive inspection, underwater and UAV robotics to meet the growing emerging needs in various sectors of the society. Robot designs based on biological inspirations are also strongly featured.

This 2nd edition remains the only comprehensive evidence-based text on the Occupational Therapy management of the stroke patient. The book is based on the most up-to-date research on stroke rehabilitation and presents its content in a holistic fashion, combining aspects of background medical information, samples of functionally based evaluations, and treatment techniques and interventions. There are chapters on specific functional aspects of living after stroke, such as driving, sexuality, mobility and gait, and self-care. Instructor resources are available; please contact your Elsevier sales representative for details. Case studies are featured in every chapter to help the reader understand how concepts apply to the real world. 2 chapters that feature the true stories of stroke victims, presenting occupational therapy situations from the point of view of the patient. Key terms, chapter objectives, and review questions help students better understand and remember important information. 7 new chapters make this text more comprehensive than ever! Psychological Aspects of Stroke Rehabilitation Improving Participation and Quality of Life Through Occupation The Task-Oriented Approach to Stroke Rehabilitation Approaches to Motor Central Dysfunction: An Evidence-Based Review Vestibular Rehabilitation and Stroke How Therapists Think: Exploring Clinician’s Reasoning When Working With Clients Who Have Cognitive and Perceptual Problems Following Stroke A Survivor’s Perspective II: Stroke Reflects the current terminology and categorization used by the WHO and the new AOTA Practice Framework so students will be equipped with the latest standards when they enter the workforce. Updated medication chart presents the latest drugs used in stroke rehabilitation.

Rehabilitation Robotics gives an introduction and overview of all areas of rehabilitation robotics, perfect for anyone new to the field. It also summarizes available robot technologies and their application to different pathologies for skilled researchers and clinicians. The editors have been involved in the development and application of robotic devices for neurorehabilitation for more than 15 years. This experience using several commercial devices for robotic rehabilitation has enabled them to develop the know-how and expertise necessary to guide those seeking comprehensive understanding of this topic. Each chapter is written by an expert in the respective field, pulling in perspectives from both engineers and clinicians to present a multi-disciplinary view. The book targets the implementation of efficient robot strategies to facilitate the re-acquisition of motor skills. This technology incorporates the outcomes of behavioral studies on motor learning and its neural correlates into the design, implementation and validation of robot agents that behave as ‘optimal’ trainers, efficiently exploiting the structure and plasticity of the human sensorimotor systems. In this context, human-robot interaction plays a paramount role, at both the physical and cognitive level, toward achieving a symbiotic interaction where the human body and the robot can benefit from each other’s dynamics. Provides a comprehensive review of recent developments in the area of rehabilitation robotics Includes information on both therapeutic and assistive robots Focuses on the state-of-the-art and representative advancements in the design, control, analysis, implementation and validation of rehabilitation robotic systems

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