Robotic Exoskeleton For Rehabilitation Of The Upper Limb

Proceedings of the 5th International Conference on Neurorehabilitation (ICNR2020), October 13–16, 2020
DESIGN AND DEVELOPMENT OF A ROBOTIC FINGER EXOSKELETON FOR REHABILITATION
Proceedings of the 20th International Conference on CLAWAR 2017
Exoskeletons in Rehabilitation Robotics
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Wearable Robots
(In 4 Volumes) Volume 1: Minimally Invasive Surgical Robotics Volume 2: Micro and Nano Robotics in Medicine Volume 3: Image-guided Surgical Procedures and Interventions Volume 4: Rehabilitation Robotics
Design, Control and Applications
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Interfacing Humans and Robots for Gait Assistance and Rehabilitation
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Design, Control and Experimentation
Proceedings of the 15th IFToMM World Congress on Mechanism and Machine Science
Textbook of Neural Repair and Rehabilitation
Systems and Applications
A Topological Classification, Synthesis, Design and Manufacture of a Novel Hand Exoskeleton
Proceedings of the 3rd International Conference on NeuroRehabilitation (ICNR2016), October 18-21, 2016, Segovia, Spain
Atlas of Orthoses and Assistive Devices E-Book
Proceedings of the 20th International Conference on Clawar 2017
Wearable Robotics: Challenges and Trends
Control and Dynamic Manipulability of a Dual-Arm/Hand Robotic Exoskeleton System (EXO-UL8) for Rehabilitation Training in Virtual Reality
Essentials of Physical Medicine and Rehabilitation
An Intelligent Pneumatic Muscle Actuated Exoskeleton for Robotic Gait Rehabilitation

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Proceedings of the 5th International Conference on Neurorehabilitation (ICNR2020), October 13–16, 2020 Control, Robotics and Sensors
This dissertation presents the development of an upper-body exoskeleton and its control framework for robotic rehabilitation of the arm and shoulder after a neurological disorder such as a stroke. The first step is designing an exoskeleton hardware that supports natural mobility of the human upper body with a wide range of motion for enabling most rehabilitation exercises. The exoskeleton is equipped with torque-controllable actuation units for implementing various robotic rehabilitation protocols based on force and impedance behaviors. The control framework is designed to exhibit a highly backdrivable behavior with a gravity compensation for the robot's weight and optional gravity support for user's arm weight to promote voluntary movements of patients with motor impairments. The control framework also serves as a `substrate' of other robotic control behaviors for rehabilitation exercises by superimposing desired force or impedance profiles. A stability analysis is performed to examine the coupled stability between the robot and human. After designing the hardware and control, several experiments are carried out to test the mobility and dynamic behavior of the robot. Lastly, a human subject study evaluates the effectiveness of the robot's shoulder mechanism and control algorithm in assisting the coordination around the shoulder. The results show that the robot induces desirable coordination in the presence of abnormalities at the shoulder.
DESIGN AND DEVELOPMENT OF A ROBOTIC FINGER EXOSKELETON FOR REHABILITATION Academic Press
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 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 professional engineers in robotics, control, mechanical, and electrical engineering who are interested in soft robotics, artificial intelligence, rehabilitation therapy, and 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 robotics 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
Proceedings of the 20th International Conference on CLAWAR 2017 Springer
This book gathers the proceedings of the 15th IFToMM World Congress, which was held in Krakow, Poland, from June 30 to July 4, 2019. Having been organized every four years since 1965, the Congress represents the world’s largest scientific event on mechanism and machine science (MMS). The contributions cover an extremely diverse range of topics, including biomechanical engineering, computational kinematics, design methodologies, dynamics of machinery, multibody dynamics, gearing and transmissions, history of MMS, linkage and mechanical controls, robotics and mechatronics, micro-mechanisms, reliability of machines and mechanisms, rotor dynamics, standardization of terminology, sustainable energy systems, transportation machinery, tribology and vibration. Selected by means of a rigorous international peer-review process, they highlight numerous exciting advances and ideas that will spur novel research directions and foster new multidisciplinary collaborations.
Exoskeletons in Rehabilitation Robotics World Scientific
Rehabilitation Robotics 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.
Advances in Automation and Robotics Research in Latin America Elsevier Health Sciences
Offering 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. And this 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 new chapters are added to this edition to help you learn how to better manage common orthopedic, cardiopulmonary, and neurologic conditions; become familiar with functional outcomes and assessments; and better understand the psychosocial aspects of aging. In all, you can rely on Guccione’s Geriatric Physical Therapy to help you effectively care for today’s aging patient population. Comprehensive coverage of geriatric physical therapy prepares students and clinicians to provide thoughtful, evidence-based care for aging patients. Combination of foundational knowledge and clinically relevant information provides a meaningful background in how to effectively manage geriatric disorders Updated information reflects the most recent and relevant information on the Geriatric Clinical Specialty Exam. Standard APTA terminology prepares students for terms they will hear in practice. Expert authorship ensures all information is authoritative, current, and clinically 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.
Paraplegia Springer
The coupling of several areas of the medical field with recent advances in robotic 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 development of advanced robotic systems has ushered with it an exponential number of trials 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 ap- plicable roles of robotic devices.
Technology and Application Springer Nature
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 improving 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 paraplegia 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.

Human-Centric Robotics Springer Nature

This book gathers the joint proceedings of the VIII Latin American Conference on Biomedical Engineering (CLAIB 2019) and the XLII National Conference on Biomedical Engineering (CNIB 2019). It reports on the latest findings and technological outcomes in the biomedical engineering field. Topics include: biomedical signal and image processing; biosensors, bioinstrumentation and micro-nanotechnologies; biomaterials and tissue engineering. Advances in biomechanics, biorobotics, neurorehabilitation, medical physics and clinical engineering are also discussed. A special emphasis is given to practice-oriented research and to the implementation of new technologies in clinical settings. The book provides academics and professionals with extensive knowledge on and a timely snapshot of cutting-edge research and developments in the field of biomedical engineering.

Development of Human-inspired Robotic Exoskeleton (HuREx) Designed for Lower-limb Gait Rehabilitation for Stroke Patients BoD – Books on Demand

Wearable Robotics: Systems and Applications provides a comprehensive overview of the entire field of wearable robotics, including active orthotics (exoskeleton) and active prosthetics for the upper and lower limb and full body. In its two major sections, wearable robotics systems are described from both engineering perspectives and their application in medicine and industry. Systems and applications at various levels of the development cycle are presented, including those that are still under active research and development, systems that are under preliminary or full clinical trials, and those in commercialized products. This book is a great resource for anyone working in this field, including researchers, industry professionals and those who want to use it as a teaching mechanism. 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

Proceedings of CLAIB-CNIB 2019, October 2-5, 2019, Cancún, México Academic Press

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 highlighting practical challenges related to the implementation of wearable robots in a number of fields. One of the focus is on clinical applications, which was encouraged by the colocation of WeRob2018 with the International Conference on Neurorehabilitation, INCR2018. 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, timely snapshot of the field of wearable technologies.

VIII Latin American Conference on Biomedical Engineering and XLII National Conference on Biomedical Engineering Elsevier Health Sciences

This book can serve as a reference resource for those very same design and control engineers who help connect their everyday experience in design with the control field of mechatronics. This book also consists of basic and main mechatronic system's laboratory applications for use in research and development departments in academia, government, and industry, and it can be used as a reference source in university libraries. It can also be used as a resource for scholars interested in understanding and explaining the engineering design and control process and for engineering students studying within the traditional structure of most engineering departments and colleges. It is evident that there is an expansion of mechatronics laboratories and classes in the university environment worldwide.

Proceedings of the 2nd International Symposium on Wearable Robotics, WeRob2016, October 18-21, 2016, Segovia, Spain IntechOpen

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.

Wearable Robots CRC Press

Advances in the material sciences, 3D printing technology, functional electrical stimulation, smart devices and apps, FES technology, sensors and microprocessor technologies, and more have lately transformed the field of orthotics, making the prescription of these devices more complex than ever before. Atlas of Orthoses and Assistive Devices, 5th Edition, brings you completely up to date with these changes, helping physiatrists, orthopaedic surgeons, prosthetists, orthotists, and other rehabilitative specialists work together to select the appropriate orthotic device for optimal results in every patient.

(In 4 Volumes) Volume 1: Minimally Invasive Surgical Robotics Volume 2: Micro and Nano Robotics in Medicine Volume 3: Image-guided Surgical Procedures and Interventions Volume 4: Rehabilitation Robotics Springer Nature

Volume 1 of the Textbook of Neural Repair and Rehabilitation covers the basic sciences relevant to recovery of function following injury to the nervous system.

Design, Control and Applications Academic Press

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 finger 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. The finger exoskeleton consists of 3 identical joint mechanisms which, for each, adopt a six-bar RCM as an equivalent revolute joint incorporating with 2 prismatic joints to form a close-loop mechanism with one anatomical joint. Cable and hose, known as Bowden cable transmission, is adopted to reduce burden from weight of driving modules. The prototype is driven by 3 motors moving flexion/extension of each joint individually, i.e. an MCP (metacarpophalangeal) joint, a PIP (proximal interphalangeal) joint and a DIP (distal interphalangeal) joint. The mechanism concept is preliminarily evaluated by simulation with the real anatomical joint trajectory. The simulation result shows that the mechanism can accommodate 2 adjacent phalanges at all 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.

Soft Robotics in Rehabilitation Springer Nature

Rehabilitation of the hands is critical for restoring independence in activities of daily living for individuals with upper extremity disabilities. Conventional therapies for hand 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 assist-as-needed control, on the other hand, estimates the coupled digit-exoskeleton system torque requirement of a subject using radial basis function (RBF) and on-the-y adapts the RBF magnitudes to provide a feed-forward assistance 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 subjects to dynamically regulate their joint torques. A pilot study carried out with healthy human subjects using the developed hand exoskeleton suggests that training under simultaneous adaptation of task, assistance and feedback can module challenge and affect their motor learning.

Proceedings of the 4th International Symposium on Wearable Robotics, WeRob2018, October 16-20, 2018, Pisa, Italy Cambridge University Press

This book contains the selected papers of the Sixth International Workshop on Medical and Service Robots (MESROB 2018), held in Cassino, Italy, in 2018. The main topics of the workshop include: design of medical devices, kinematics and dynamics for medical robotics, exoskeletons and prostheses, anthropomorphic hands , therapeutic robots and rehabilitation, cognitive robots, humanoid and service robots, assistive robots and elderly assistance, surgical robots, human-robot interfaces, haptic devices, and medical treatments.

Interfacing Humans and Robots for Gait Assistance and Rehabilitation LAP Lambert Academic Publishing

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 2nd International Symposium on Wearable Robotics, WeRob2016, held October 18-21, 2016, in Segovia, Spain, 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 highlighting practical challenges related to the implementation of wearable robots in a number of fields. One of the focus is on clinical applications, which was encouraged by the colocation of WeRob2016 with the International Conference on Neurorehabilitation, INCR2016. 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, timely snapshot of the field of wearable technologies.

Musculoskeletal Disorders, Pain, and Rehabilitation IntechOpen

The book reports on advanced topics in the areas of neurorehabilitation research and practice. It focuses on new methods for interfacing the human nervous system with electronic and mechatronic systems to restore or compensate impaired neural functions. Importantly, the book merges different perspectives, such as the clinical, neurophysiological, and bioengineering ones, to promote, feed and encourage collaborations between clinicians, neuroscientists and engineers. Based on the 2016 International Conference on Neurorehabilitation (ICNR 2016) held on October 18-21, 2016, in Segovia, Spain, this book covers various aspects of neurorehabilitation research and practice, including new insights into biomechanics, brain physiology, neuroplasticity, and brain damages and diseases, as well as innovative methods and technologies for studying and/or recovering brain function, from data mining to interface technologies and neuroprosthetics. In this way, it offers a concise, yet comprehensive reference guide to neurosurgeons, rehabilitation physicians, neurologists, and bioengineers. Moreover, by highlighting current challenges in understanding brain diseases as well as in the available technologies and their implementation, the book is also expected to foster new collaborations between the different groups, thus stimulating new ideas and research directions.

Wearable Robotics: Challenges and Trends Elsevier Health Sciences

Wearable exoskeletons are electro-mechanical systems designed to assist, augment, or enhance motion and mobility in a variety of human motion applications and scenarios. The applications, ranging from providing power supplementation 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 modelling challenges to researchers and manufacturers. Novel technologies 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.