The Encyclopedia of MEDICAL ROBOTICS

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

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The Encyclopedia of Medical Robotics combines contributions in four distinct areas of Medical robotics, namely: Minimally Invasive Surgical Robotics, Micro and Nano Robotics in Medicine, Image-guided Surgical Procedures and Interventions, and Rehabilitation Robotics.

The volume on Minimally Invasive Surgical Robotics focuses on robotic technologies geared towards challenges and opportunities in minimally invasive surgery and the research, design, implementation and clinical use of minimally invasive robotic systems.

The volume on Micro and Nano robotics in Medicine is dedicated to research activities in an area of emerging interdisciplinary technology that is raising new scientific challenges and promising revolutionary advancement in applications such as medicine and biology. The size and range of these systems are at or below the micrometer scale and comprise assemblies of micro and nanoscale components.

The volume on Image-guided Surgical Procedures and Interventions focuses primarily on the use of image guidance during surgical procedures and the challenges posed by various imaging environments and how they related to the design and development of robotic systems as well as their clinical applications. This volume also has significant contributions from the clinical viewpoint on some of the challenges in the domain of image-guided interventions.

Finally, the volume on Rehabilitation Robotics is dedicated to the state-of-the-art of an emerging interdisciplinary field where robotics, sensors, and feedback are used in novel ways to re-learn, improve, or restore functional movements in humans.

Readership: Researchers, graduates, and post-graduate students active in the field of bioengineering and robotics.

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Assessment for Robotics-Assisted Minimally Invasive Surgery —

Part 1: Historical Perspective and Challenges; Training and Skill Assessment for Robotic-Assisted Minimally Invasive Surgery —

in Robot-Assisted Minimally Invasive Surgery; Teleoperation for Invasive, Single Port, and Intraluminal Surgeries; Flexible Meso-

Design, Planning, and Sensing; Snake-Like Robots for Minimally Surgical Robotic Demonstrator; Single-Port Access Robots for Invasive Robotic Gastrointestinal Surgery; The DLR MiroSurge Application of Surgical Robotics for Radical Prostatectomy; The da Vinci Surgical System; A Clinical Perspective on the Contents:

assessment in the use of robotic MIS systems.

the need to provide reliable and efficient training and objective focuses on surgical training and skills assessment necessitated of touch). Technology for implementing the latter in a clinical surgical robotic systems — teleoperation and haptics (the sense of robotic technology for surgery is that of training in the appropriate use of the technology, and in the assessment of acquired skills. This volume covers the topics mentioned above in four sections. The first section gives an overview of the evolution and current state the da Vinci® system and clinical perspectives from three groups who use it on a regular basis. The second focuses on the research, and describes a number of new developments in surgical robotics that are likely to be the basis for the next generation of robotic MIS systems. The third deals with two important aspects of surgical robotic systems — teleoperation and haptics (the sense of touch). Technology for implementing the latter in a clinical setting is still very much at the research stage. The fourth section focuses on surgical training and skills assessment necessitated by the novelty and complexity of the technologies involved and the need to provide reliable and efficient training and objective assessment in the use of robotic MIS systems.

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Volume 3, Image-guided Surgical Procedures and Interventions, focuses on several aspects ranging from understanding the challenges and opportunities in this domain, to imaging technologies, to image-guided robotic systems for clinical applications. The volume includes several contributions in the area of imaging in the areas of X-Ray fluoroscopy, CT, PET, MR Imaging, Ultrasound imaging, and optical coherence tomography. Ultrasound-based diagnostics and therapeutics as well as ultrasound-guided planning and navigation are also included in this volume in addition to multi-modal imaging techniques and its applications to surgery and various interventions. The application of multi-modal imaging and fusion in the area of prostate biopsy is also covered. Imaging modality compatible robotic systems, sensors and actuator technologies for use in the MRI environment are also included in this work, as is the development of the framework incorporating image-guided modeling for surgery and intervention. Finally, there are several chapters in the clinical applications domain covering cochlear implant surgery, neurosurgery, breast biopsy, prostate cancer treatment, endovascular interventions, neurovascular interventions, robotic capsule endoscopy, and MRI-guided neurosurgical procedures and interventions.

Contents:
Image-Guided Surgical Procedures and Interventions: Challenges and Opportunities; X-Ray fluoroscopy, CT, PET, and MR Imaging; Ultrasound: Diagnostics and Therapeutics; Optical Coherence Tomography (OCT); Multi-modal Imaging for Surgery and Interventions; Ultrasound-Guided Planning and Navigation; Multimodality Imaging (MRI, PET, and Ultrasound) and Fusion Targeted Biopsy of the Prostate; Sensors, Actuators, and Robots for MRI-Guided Surgery and Interventions; Image-Guided Procedures in Surgery and Intervention: Challenges in Image-to-Physical Registration and Beyond; Image-Guided Robotic Cochlear Implant Surgery; Meso-Scale Robotic Systems for Neurosurgery; Image-Guided Robotic Neurosurgery; MRI-Guided Robotic Breast Biopsy and Therapeutics; Image-Guided Robotic Interventions for Prostate Cancer Treatment; Image-Guided Endovascular Interventions; Image-Guided Neurovascular Interventions; Robotic Capsule Endoscopy; Image-Guided Neurosurgical Procedures and Interventions.

Volume 4, Rehabilitation Robotics, is dedicated to the state-of-the-art of an emerging interdisciplinary field where robotics, sensors, and feedback are used in novel ways to relearn, improve, or restore functional movements in humans. This volume attempts to cover a number of topics relevant to the field. The first section addresses an important activity in our daily lives: walking, where the neuromuscular system orchestrates the gait, posture, and balance. Conditions such as stroke, vestibular deficits, or old age impair this important activity. Three chapters on robotic training, gait rehabilitation, and cooperative orthoses describe the current works in the field to address this issue. The second section covers the significant advances in and novel designs of soft actuators and wearable systems that have emerged in the area of prosthetic lower limbs and ankles in recent years, which offer potential for both rehabilitation and human augmentation. These are described in two chapters. The next section addresses an important emphasis in the field of medicine today that strives to bring rehabilitation out from the clinic into the home environment, so that these medical aids are more readily available to users. The current state-of-the-art in this field is described in a chapter. The last section focuses on rehab devices for the pediatric population. Their impairments are life-long and rehabilitation robotics can have an even bigger impact during their lifespan. In recent years, a number of new developments have been made to promote mobility, socialization, and rehabilitation among the very young: the infants and toddlers. These aspects are summarized in two chapters of this volume.

Contents:
Journal of Medical Robotics Research (JMRR)
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Editor-in-Chief
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About JMRR: Aims & Scope

Medical robotics has been progressively revolutionizing treatment for at least the past two decades. The Journal of Medical Robotics Research (JMRR) invites fundamental contributions to all areas of medical robotics including clinical evaluation studies. The journal is primarily aimed towards bringing the scientific and technological developments as well as clinical evaluation studies in the area of medical robotics to a wider robotics and clinical audience.

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