Preface

It is now evident that one of the major application targets of the service robots is to use them as assistive devices for rehabilitation of the physically disabled and for the elderly people. Rehabilitation robotics (RR) is a relatively young but dynamically developing area of research. Some rehabilitation robots have already got out of the research laboratories and have become important members in everyday lives of growing users from many developed countries. It is expected that, in the near future, the rehabilitation robots (RR) will become a significant component of the futuristic welfare service systems in the world. Primarily limited to a small number of relatively simple movement tasks such as object replacement and eating, the application areas of the rehabilitation robotics, along with various intelligent technologies for movement assistance of people with disabilities, are continuously expanding to new dimensions that aim at improved assistance in different kinds of activities and entertainment of people with disabilities and aged people as well. We are witnessing that such intensive development of novel human-machine interfaces, intelligent control algorithms, new materials and efficient actuators have made it possible to invent and test various advanced design ideas. Common understanding and main tendency in the rehabilitation robotics design is that the robots should be human-friendly in the sense that the robotic machine and peripheral devices must be designed for the user to feel more comfortable, safer, and more convenient. Recent intelligent robotic devices for movement assistance are often designed to be equipped with the control strategies that do not cause high cognitive load to the users with various severe movement disorders.

The idea for organizing this volume was inspired from the 8th International Conference on Rehabilitation Robotics (ICORR'2003) that was held during April 22-25, 2003 at Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. The papers presented at the conference represent of course most recent tendencies of R&D in the rehabilitation robotics and intelligent assistive technology. With confidence, however, we like to declare that the current book is not just a variant of the conference proceedings! Different from the papers reported at the ICORR 2003 where specific problems and solutions of various subjects were discussed, the chapters of this book include original, reworked, and generalized materials that match

to the style and objectives of the book. The book contains not only review articles on some advanced theoretical ideas in the rehabilitation robotics and results from some of the latest projects under development but also details on new advanced rehabilitation devices which have been recently transferred to the industry. A significant part of the book is devoted to the assessment of new rehabilitation technologies and evaluation of prototype devices with end-users. Safety of rehabilitation robots, historical remarks and perspective of rehabilitation robotics are also commented in the book. Also, different from many other books on rehabilitation engineering, the present volume includes a long chapter on robot-assisted neuro-rehabilitation that is considered as one of the latest trends in that area.

One of the principal aims of this book is to promote dissemination of the information on the recent status of the rehabilitation robotics (RR). Our intention was to arrange the book in such a way that it is not just a simple collection of papers that would be of some interest to the specialists in a particular area, but rather, a book that contains some basics on the rehabilitation research and can help beginners to start their work in the same area, such as students and young researchers, or can help lecturers who want to introduce their students basics of the modern rehabilitation technology. In order to achieve this objective, most of the articles contain a detailed introduction to the problem to be discussed and an extended overview on the particular subject matter.

The chapters that are contained in this book are authored by leading researchers in the field of rehabilitation robotics and represent a large part of the international research community. The book contains 27 chapters, which are grouped into 7 parts. The book begins with an introductory Part 1 devoted to description of the role of the rehabilitation robotics and some important issues of its development. The same part represents also some important milestones of the development of rehabilitation robotics. The chapters included in Part 2 cover three important issues on rehabilitation robotics for assistance of human movements: conceptions and experimental design, safety issues of the rehabilitation robots, and rehabilitation-robot evaluation. Some recent issues of the prosthetics and orthotics design are discussed in Part 3. Part 4 is concerned with the intelligent wheelchairs that can be considered as special mobile robots, designed to accomplish indoor user transportation. A recent trend in the design of assistive devices for mobility is the mechatronic devices for assistance in walking that sense the user's movement intentions and provide gentle gait support, giving independency and safety to the user. Some examples of such devices are given in Part 5. Part 6 is dedicated to robot-assisted neurorehabilitation. Examples of both upper limb robot mediated therapy and lower limb robot mediated therapy are commented in that part of the book. The final part of the book (Part7) talks about the perspectives and trends of the rehabilitation robotics.

We are assured that the book would provide with a comprehensive overview of the field of rehabilitation robotics, and would satisfy a large group of readers, including researchers in the field, graduate and postgraduate students, and designers that use the RR technology. We believe that the book will become a representative selection of the latest trends and achievements on the rehabilitation robotics area. We would be extremely happy if such an important goal would be achieved.

Finally, as the Editors of present volume, we like to take this opportunity to express our heartiest appreciation for all the authors who have worked their chapters with dedication and integrity, and contributed to the highest standard of this volume. We would like to thank also to Dr. Thomas Ditzinger and Ms. Heather King from Springer-Verlag for encouraging us in editing the present book and for their help in arranging this volume.

Daejeon   Z. Zenn Bien
March 2004   Dimitar Stefanov