

Preface

Assisting human movement using electrical stimulation and mechanical support is a challenging task. It must balance the demands of controlling highly complex, non-linear, time-varying dynamics with the practical requirements that exist when performing tests with neurologically impaired users. These demands naturally compete since the process of model identification and controller tuning is labour intensive, time-consuming, and may therefore fatigue or demotivate the user. This has led researchers in the field to focus on simplicity at the expense of performance and functional scope.

The motivation for this book is to develop a comprehensive control design framework to enable performance and pragmatism to be transparently balanced. Emphasis is placed on applying and translating robust performance results into intuitive procedures that are suitable for application in practice with users. These are illustrated by case studies demonstrating how the control approaches have been applied in a clinical setting, and the outcomes that have been achieved.

The rehabilitation systems developed and clinically evaluated in this book are a result of a decade of collaboration with my colleagues Dr. Ann-Marie Hughes and Professor Jane Burridge, both of the Faculty of Health Sciences at the University of Southampton. It is their clinical expertise that has driven the engineering component of this research, ensuring that it is strongly focused on solving real-world problems that meet users' needs. Clinical evaluation of the technology reported in this book has also involved substantial input from Dr. Katie Meadmore, Trish Sampson and Emma Hallewell. In terms of engineering contribution to the rehabilitation systems developed at Southampton, both Mustafa Kutlu and Dr. Tim Exell have provided critical input into the hardware development of the systems reported in Chaps. 7 and 9, respectively. In addition, Dr. Kai Yang and Dr. John Tudor developed the fabric electrodes described in Chap. 10, and Professor Mark

French has provided significant input to the estimation-based multiple model iterative learning control framework summarised in the same chapter. My sincere thanks to them all.

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