TABLE of CONTENTS

1. The Design of Advanced Prosthetic Limb Systems  
   R.F. ff  Weir

2. Experience Fitting Partial Hand Prostheses with Externally Powered Fingers  
   J.E. Uellendahl and E.N. Uellendahl

3. In Human Implant of Intraneural Multielectrodes for Controlling a 5-Fingered Hand Prosthesis and Delivery of Sensorial Feedback  

4. Introduction to Assessment  
   P. J. Kyberd, W. Hill, L.N. Hermansson, S. Hubbard, A. Zinck, B. Jones and A. Murgia

5. Quantitative Motion Analysis for the Assessment of Myoelectric Prostheses and the Amputee Biomechanics  
   A.G. Cutti, I. Parel and E. Gruppioni

6. From Dexterous Robotic Hands to Prosthetic Hands: Issues for Design and Technology Transfer  
   G. Berselli and G. Vassura

7. Virtual Reality and Haptic Devices for the Simulation of Upper Limb Systems  
   M. Bergamasco, C.A. Avizzano, A. Frisoli and F. Salsedo

TARGET AUDIENCE
The book is mainly addressed to all the engineers, technicians and physicians that are involved in the specific field of Upper Limb Prosthetics. However, also other scientists working in the field of Upper Limb Robotic Rehabilitation are potential readers of a number of chapters, since many key issues are common to both the disciplines (actually the Prosthetics may be considered as a branch of Robotic Rehabilitation). Finally also the prosthesis users that are familiar with a technical/scientific language and that are interested in the most recent research results are a target of the proposed book.

ESTIMATED SUBMISSION DATE: NOVEMBER 2011
The loss or the congenital deficiency of a human upper limb part represents a serious physical and psychological trauma, apart from having an evident and considerable restriction on personal autonomy in everyday living. Rehabilitating an amputee with a proper device allows the patient to recover (part of) the lost autonomy and the sense of psychophysical integrity, and thus to enable his/her reintegration in domestic, working and social environments. The prosthetic intervention is a complex process which involves technical aspects and clinical issues strictly dependent on the amputee to be treated. Prosthetic rehabilitation is therefore carried out by a multidisciplinary team including physicians, technicians, therapists and psychologists which operates with the aim of providing the amputee with the device and the services that best match his/her different requirements. Prosthesis developers study different solutions with the aim of optimizing the prosthetic system performances, its usability, wearability, and maintenance. Therefore, also in the design process many key factors of different nature are of primary importance.

Due to many reasons, the technological level of the powered artificial arms for upper limb amputees has always been fairly poor so far if compared with that of other analogous systems (e.g. lower limb prostheses, assistive robots, human-robot interfaces, biomedical robots…). However, there is no doubt that in the recent years the upper limb research stimulated the most exciting developments in prosthetic technology. Indeed, new terminal devices (articulated hands, sensorized hands, partial hands for finger amputation…) and novel articulations for the artificial arm (wrist and shoulder with one or more degrees of freedom, elbow joint) have been recently proposed (and some of them are also commercially available); a new concept of the socket has been developed; the control hardware, software and firmware are in continuous progress for the implementation of more and more effective control options for the wearers as well as for an easier management of the electronic boards. Finally, also the clinical treatment of the patients is improving: the most important novelties of the last years are the surgical technique known as Targeted Muscle Reinnervation for an enhanced myoelectric control of the artificial arm, the implantation of nano-sensors on nerves for the development of neuroprosthetic systems, and the prosthesis osteointegration for the direct suspension of the prosthesis to the residual limb.

A number of internationally renowned public agencies and industries are investing a great amount of financial resources. For instance DARPA (Defense Advanced Research Projects Agency of the USA government) that recently invested tens of million dollars in two ambitious programs (involving many research teams) intended to face the increased incidence of amputation injuries being seen in the ongoing conflicts in Afghanistan and Iraq. In particular the prosthetics industry is trying to exploit the fruits of the Revolutionizing Prosthetics Program RP2009, which is probably the most outstanding project in upper limb prosthetics so far. On the other side, the wave of renewal of upper limb prosthetics systems is dragging also many other manufacturers and research institutes, which recently presented interesting enhancements of their own products and prototypes.

The proposed e-book aims at illustrating the most significant milestones provided by the scientists in this new prosthetic research era and also sheds lights on new trends, future developments, and on the most challenging issues of the fascinating field of rehabilitation robotics.