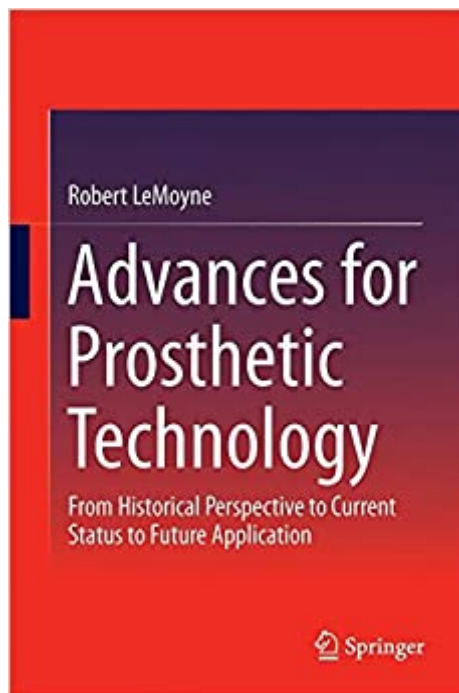




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# Advances For Prosthetic Technology: From Historical Perspective To Current Status To Future Application



## Synopsis

This book focuses on the advances in transtibial prosthetic technology and targets research in the evolution of the powered prosthesis such as the BiOM, which was derived from considerable research and development at the Massachusetts Institute of Technology. The concept of the book spans the historical evolution of prosthetic applications from passive to new and futuristic robotic prosthetic technologies. The author describes the reasons for amputation, surgical procedures, and an historical perspective of the prosthesis for the lower limb. He also addresses the phases and sub-phases of gait and compensatory mechanisms arising for a transtibial prosthesis and links the compensatory mechanisms to long-term morbidities. The general technologies for gait analysis central to prosthetic design and the inherent biomechanics foundations for analysis are also explored. The book reports on recent-past to current-term applications with passive elastic prostheses. The core of the book deals with futuristic robotic prostheses including their function and major subsystems, such as actuator technology, state machine control, and machine learning applications. Finally, the envisioned future trends in the prosthetic technology space are presented.

## Book Information

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## Customer Reviews

“The book aims to define the broad knowledge base required to inform research on transtibial prosthetic management. It does a fair job of surveying a considerable body of knowledge and presenting it in an easily readable manner appropriate for engineers and

biomechanists new to the transtibial prosthetic patient population. While the vast majority of prosthetic-oriented books focus on their clinical aspects, the engineering and research focus of this one likely will appeal to those working in academic and product development settings. (Christopher Robinson, Doody's Book Reviews, February, 2017)

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Advances in prosthetic technology, or better "Advances in prosthetic knee-ankle technology" are the topic of this interesting sounding title by Springer press. The scope of the book, which is targeted at readers without any prior knowledge about prosthetics, is ambitious, as evidenced by its subtitle. Author Robert LeMoyne is a biomedical engineer, who has researched the application of computer learning for powered limb prosthetics before. His experience in this area shines through in some of the more compelling sections of the book. The later chapters give a reasonably thorough overview of recent developments in the area of actuated ankle systems, including several experimental prototypes and concluded by the well-known Biom foot.

LeMoyne's narrative here stays close to previously published work, which makes it somewhat unoriginal. Long stretches, in some instances entire sub-chapters, are merely paraphrased summaries of a single selected paper by other authors. LeMoyne's own contributions are mentioned as well (such as his automated method to correctly classify between a SACH and a Biom foot), though for the most part he constrains himself to presenting his

version of Prosthetics 101. It is this early part where the book is most disappointing, as much of the information on offer is incomplete or misleading. For instance, Chapter 5, reviewing passive prostheses, completely neglects to mention such items as Total Surface Bearing sockets, Elevated Vacuum Suspension, passive hydraulic ankles, fiberglass feet, and many more. Other chapters have similar shortcomings. Instead, much time is spent on trivialities and inconsequential factoids. The author deemed it necessary to define terms like dorsi-flexion and Medicare "(an American institution)", and to include a paragraph about the first Japanese citizen Tanosuke Sawamura III to receive a prosthesis. On three different occasions he inserts a narrative about the development of the SACH foot in the 1950s. LeMoyne's writing style is another source of displeasure. Particular in the early going, his prose often reads like the work of an undergraduate student who tries to emulate the dense and difficult-to-read language found in many important scientific books by using as many fancy words and convoluted sentence structures as possible. On page 16, for instance, he writes "Human locomotion as of current has not been conclusively defined. The simple task of walking encompasses myriad of highly specialized medical professions, such as the podiatrist, neurologist, kinesiologist, physical therapist, and orthopedist (just to name some). The resolution of well-defined objectives for gait rehabilitation necessitates the synergistic contribution of multiple scientific and engineering fields. That may sound impressive to the casual reader but offers really nothing of substance. To the reader, it remains a mystery why the publisher considered it appropriate to task an early career researcher with the writing of such an ambitious book. LeMoyne is clearly out of his depth when attempting to give a concise and balanced overview of his subject. What is even more displeasing is his habit of playing fast and loose with established referencing practices. The book is permeated with references to LeMoyne's own published works, which once more may be inspired by the reading of seminal books written by eminent figures in medical history. The difference is that those books are usually written towards the later stages of an author's career, and that they are dedicated to a topic area in which the author has indeed made substantial contributions. LeMoyne's main contribution (based on the frequency with which it is cited in his own book) seems to be a review article published in the Journal of Mechanics in Medicine and Biology (impact factor ~0.7). In a quite preposterous move of self-promotion, this paper is being cited as key (and often only) reference on a vast number of ideas, including the iwalk Biom (page 23), the significance of plantar-flexors (page 24), muscle atrophy as a cause for gait asymmetry (page 33), use of force plates and metabolic assessment in gait analysis (page 41),

recent evolutions of Energy Storage and Return feet (page 60), and many more. His other papers are likewise prominently featured, such as the one he cites on page 42: “The Nyquist criterion defines the minimal sampling frequency as twice the upper threshold of the recorded frequency content (LeMoyne et al. 2009a).” Le Moyne succeeds in one thing: By citing up to 18 of his own works in each of the 10 book chapters and considering each chapter separately for his publication record, the author very successfully inflated his h-index to 14. The benefit for the readers may be highly doubted. In fact, if people like the ones described above (with no prior knowledge of the subject area) read this book, they may come away with the grotesquely inaccurate impression that Robert LeMoyne has been and is by far the most influential researcher in the field. Overall, the book is a disappointing offering from Springer Press. It is littered with signs of sloppy copy-editing. Typos can be found even in chapter headlines. The book title is grossly misleading, and the idea that what is essentially a poorly done 130-page literature review by a novice researcher should be worth \$100 is borderline insulting.

Dr. LeMoyne's book offers a clear, crisp discussion of the advances in prosthetic technologies for both biomedical engineers, physicians, and other professionals involved in the field. Discussion begins with Amputations/Prostheses and further discusses the kinematics of gait. Dr. LeMoyne continues discussion with how various devices including smartphones and portable media devices can be used to analyze gait. He also continues discussion on the architecture of exciting and advanced power prosthesis systems, in both single and dual actuator configurations. He ends the book with his excellent discussion on the MIT inspired powered prosthesis and also future/advanced concepts for powered prosthesis. The book is very accessible and straight forward. Highly recommended.

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