Preface

This book summarizes fundamental topics in biomechanics and provides procedures for biodynamic modeling.

In the last three or four decades, studies of biomechanics have expanded from simple topical applications of elementary mechanics to entire areas of study, occupying the attention of increasing numbers of scientists, engineers, and health care professionals. Today, studies and research in biomechanics exceed those in basic mechanics itself, even though basic mechanics underlies not only the study of biomechanics but many other fields as well.

Consequently, with today's knowledge base, a book or treatise on biomechanics can consider only a few of the many areas on the subject in any depth.

In this book, I have selected a few topics from the fundamentals of solid biomechanics with an emphasis on biodynamic modeling and on the analysis of human body models. The subject matter is a compilation of material drawn from a sequence of courses taught at the University of Cincinnati during the last 35 years or more.

This book is intended for students, researchers, and practitioners in various fields, with varying backgrounds, who are looking for a basic understanding of the principles of biomechanics analyses. The preparation needed is usually that acquired in the first years of undergraduate science and engineering curricula.

This book comprises 15 chapters together with an appendix containing a rather extensive listing of anthropometric data, a large glossary of terms and terminologies, and a bibliography for more in-depth studies.

Following a brief introductory chapter, this book presents a review of gross human anatomy and a summary of basic terminology currently in use. Chapters 3 through 5 describe methods of analysis from elementary mathematics to elementary mechanics, and on to fundamental concepts of the mechanics of materials.

Chapter 6 discusses the modeling of biosystems. Chapter 7 provides a brief overview of tissue biomechanics. Chapters 8 through 10 then introduce concepts of biodynamics and human body modeling, looking at the fundamentals of the kinematics, the kinetics, and the inertial properties of human body models.

Chapters 11 through 13 present a more detailed analysis of the kinematics, kinetics, and dynamics of these models. Chapter 14 discusses the numerical procedures for solving the governing dynamical equations.

Finally, in Chapter 15, the book concludes with a review of a few example applications of the biodynamic models. These include simple lifting, maneuvering in space, walking, swimming, and crash victim simulation. Each chapter contains its own list of references for additional study.

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