Mechanical Testing for the Biomechanical Engineer

A Practical Guide

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Marnie M. Saunders

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Mechanical Testing for the Biomechanical Engineer

A Practical Guide

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ABSTRACT

Mechanical testing is a useful tool in the field of biomechanics. Classic biomechanics employs mechanical testing for a variety of purposes. For instance, testing may be used to determine the mechanical properties of bone under a variety of loading modes and various conditions including age and disease state. In addition, testing may be used to assess fracture fixation procedures to justify clinical approaches. Mechanical testing may also be used to test implants and biomaterials to determine mechanical strength and appropriateness for clinical purposes. While the information from a mechanical test will vary, there are basics that need to be understood to properly conduct mechanical testing. This book will attempt to provide the reader not only with the basic theory of conducting mechanical testing, but will also focus on providing practical insights and examples.

KEYWORDS

biomechanics, orthopaedics, mechanical testing

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Preface

This book is intended to provide an introduction to the practical aspects of conducting biomechanical testing. As such it targets the biomechanical engineering student with a basic understanding of solid mechanics but with little practical experience.

The take-home message of this book is provided on the first page. In order to obtain reliable data from mechanical testing it is critical to take the time to conduct an accurate and reliable test. Ensuring that the test is conducted properly entails a conscious effort such that one is: understanding machine and testing basics; properly setting up tests by correctly using measurement tools; understanding how to load a specimen to get physiologically relevant data; designing/selecting appropriate testing fixtures; properly running the testing machine; and properly analyzing the data. The goal of any test is to obtain reliable data that can be confidently used to determine the study conclusions. The attention to detail in testing design, setup, running and analysis is key to obtaining reliable data. Here we discuss these details in the context of practical applications and examples.

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Larry Saunders, a machinist for over 50 years: My father taught me to value the practical aspects of machines and engineering; the ability to fabricate rather than merely design. My love of engineering started early when, as the youngest of 2 daughters, I found myself as the mechanic's helper on countless weekends. I carried the toolbox, handed the tools, ran any errands, and held the light. Although more often than not in the way, I eagerly anticipated every weekend. He could smell a screwdriver sale just by walking into Sears and I have him to thank for my colorful vocabulary. Above all, I thank him for his love and support.