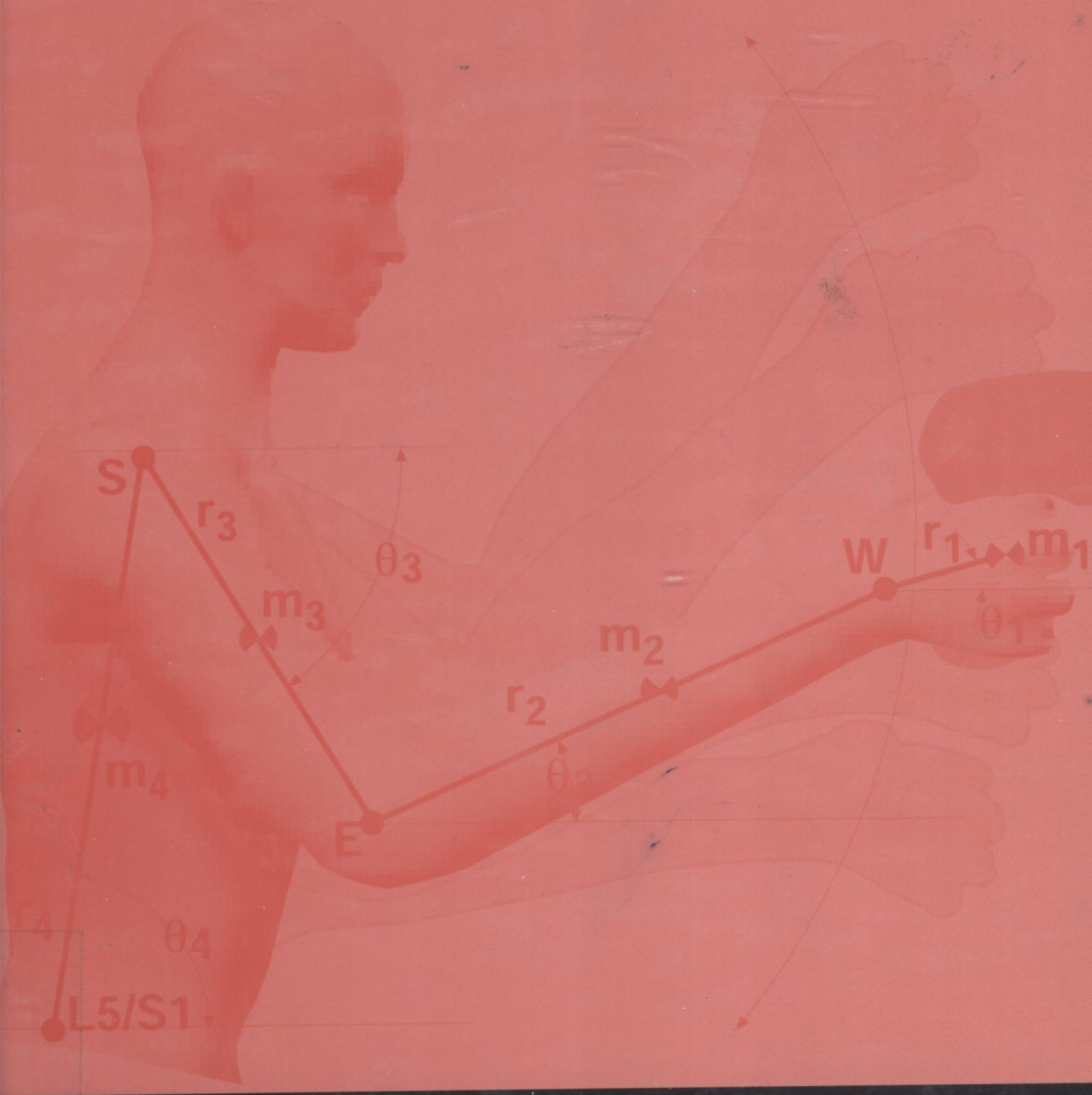


Third Edition

OCCUPATIONAL BIOMECHANICS



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Occupational Biomechanics

Third Edition

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Occupational Biomechanics

Foreword

The decade of the 1990s has seen numerous changes in the methods and technologies utilized in the manufacturing environment, but one aspect has not changed. The process of manufacturing is accomplished through the efforts of people. The recognition of this basic premise has led to one of the more significant changes, the integration of ergonomics and the application of sound ergonomic principles into every aspect of product and process designs. This integration has resulted in reduced worker injury and illness, improved product quality, and increased productivity, but most importantly it has improved the quality of life for the workers.

The first edition of *Occupational Biomechanics*, published in 1984, provided a comprehensive resource for those applying the science of occupational biomechanics to the workplace. The second edition, in 1991, provided evidence that the science was becoming more integrated into the study of workplace designs. This third edition provides the necessary information for academics, practitioners and ergonomics specialists, including engineers responsible for designing workplace environments, to capitalize and utilize ergonomics in the process and product design system.

The authors of this edition of *Occupational Biomechanics* have contributed not only to the theoretical understanding of the science, but have provided the foundation for integration of this knowledge into the tools and methods used daily by manufacturing process designers. This edition expands on the previous editions by incorporating new knowledge gained through close collaboration with industry.

As we move forward into the twenty-first century, increased manufacturing flexibility and nimble processes will demand designs that accommodate a broad range of workers, differing work methods, increased process knowledge, and high product quality, while maintaining high levels of human performance. These increases in worker performance levels have required manufacturing and product engineers to

collaborate in designing cost effective competitive workplaces. To accomplish advances in productivity, while improving the quality of life for workers, the application of sound ergonomic principles has become essential.

ROMAN KRYGIER

*Vice President, Advanced Manufacturing Engineering
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Preface

This textbook is dedicated to the belief that a sound understanding and application of biomechanical principles is important both in the prevention of musculoskeletal disorders in industry and to improve manual working conditions and worker performance in general. The book condenses an extensive amount of recent biomechanical literature along with the authors' personal research findings. It reflects over 75 years of combined experience by the authors in applying biomechanics in various industries and work situations.

Occupational biomechanics can be defined as a science concerned with the mechanical behavior of the musculoskeletal system and component tissues when physical work is performed. As such, it seeks to provide an understanding of the physics of manual activities in industry. Similarly, over the last 50 years, psychologists have provided the behavioral knowledge necessary to define a human factors discipline useful in the evaluation and design of information displays and controls. Likewise, exercise physiologists have provided the basic concepts necessary to define a work physiology discipline that predicts the metabolic, respiratory, and cardiovascular responses to prolonged, strenuous activities in industry. In a very real sense, occupational biomechanics complements the existing psychological and physiological knowledge to provide a broader foundation for contemporary ergonomics.

Today the need to apply occupational biomechanics principles to improve different work situations appears to be even greater than in past years. There is an increasing awareness by both management and labor organizations that musculoskeletal harm and reduced human performance capabilities are often the result of a physical mismatch between workers and the manual tasks required of them. Unfortunately, the conditions that are at the origin of such a mismatch are usually complex. The early identification and modification of such adverse conditions requires special expertise. Such expertise requires the combined knowledge of mechanics and musculoskeletal anatomy and physiology, along with knowledge of industrial work specification and practice.

In working with various industries we became convinced that a large amount of appropriate literature existed, but only in the form of various research papers and

technical reports. Furthermore, the information was published in a diverse set of journals in several different disciplines, and some reports were accessible only in university research libraries. The growing need for expertise in this field and lack of a comprehensive textbook that would join research methods and industrial applications prompted us to write this book. Our hope is that it will stimulate students in engineering, medicine, and occupational health and safety to study and contribute to this growing and important field in future years.

Although the organization of the book remains unchanged from the first two editions, the rapidly emerging knowledge in the area of biomechanics has required major revisions of most sections. The balance between introducing new research findings and keeping the book simple and reasonably sized is difficult. Some readers may feel that the emphasis should be different. Our readers' suggestions in the past have resulted in what we consider major improvements in this third edition. We continue to welcome and value your comments.

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