Preface

Electromagnetic (EM) energy is a basic force of nature, just like nuclear energy and gravity. This energy is utilized in various ways, though we still lack a full understanding of its fundamental properties. Many inventions of the late twentieth century, ranging from consumer products and services to medical equipment, are so important and advantageous that we wonder how we ever lived without them. These inventions have become an integral part of our modern life. Sure, they are useful; however, we need to know that they are safe!

OBJECTIVES

This book is distinguished by extensive descriptions of fundamental physical concepts and principles of EM fields and radiation, and their relevance to human health and therapeutic applications. Reflecting the transdisciplinary approach from several different intellectual streams involving physics, biology, epidemiology, medicine, environment, risk assessment, and various disciplines of engineering, this book is quite a venture into the battling studies to access research on bioeffects and therapeutic applications of EM energy. The book will permit a broad range of readers with reasonable backgrounds in the foundation of science to

- Understand necessary EM theory in the context of its interaction with human body
- Review many of cutting-edge research contributions regarding two major broad areas: EM health effects and EM therapy
- Realize techniques that have been developed to ensure adequate EM and thermal dosimetry required for health effects and thermal therapy
- Strengthen understanding of rapidly emerging areas of bioengineering and biomedical engineering

SCOPE

This book is divided into a two-chapter introduction and three self-contained parts. Chapter 1 provides an introduction to EM fields and radiation, while Chapter 2 discusses EM interaction mechanisms with biological systems. Part I (Chapters 3 through 7) deals with the health effects of EM fields and radiation, including extremely low frequency (ELF) fields (Chapters 3 and 4) and radiofrequency radiation (RFR) (Chapters 5 and 6). Chapter 7 discusses issues related to EM health risk analysis. Part II (Chapters 8 through 10) deals with EM therapy, including an introduction to newcomers in the field (Chapter 8), hyperthermia techniques (Chapter 9), and ablation techniques (Chapter 10). Part III is related to EM and thermal dosimetry (Chapter 11), and thermometry and imaging (Chapter 12).

AUDIENCE

In preparing the book as a learning resource for a wide range of audiences or as a reference for many courses in universities, the author strived to show that the subject matter is quite understandable to anyone interested in the details of the health effects and medical applications of EM energy. Because of its comprehensive coverage and the large number of detailed subjects, this book is useful as a primary reference volume for a course on the subject. The only prerequisite for understanding the material in this book is a basic knowledge of physics and biology.