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research and future perspectives on applying engineering technology to medical and healthcare challenges. The book has 22 chapters under 5 sections: cardiovascular engineering, neuroengineering, cellular and molecular bioengineering, medical and biological imaging, and medical

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devices. The challenges and future perspectives of engineering in medicine are discussed, with novel methodologies that have been implemented in innovative medical device development being described. This is an ideal general resource for biomedical engineering

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researchers at both universities and in industry as well as for undergraduate and graduate students. Presents a broad perspective on the state-of-the-art research in applying engineering technology to medical and healthcare challenges that cover cardiovascular

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expertise in immunology, nanobiomaterials and heat transfer. Topical coverage includes an introduction to the fundamentals of bioengineering and engineering approaches for cancer diagnosis, cancer treatment via case studies, and sections on imaging,

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diagnosis of cancer

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the traditional line between engineering and medical science ever thinner. This is an excellent resource for biomedical engineers working in industry and academia on developing medical technologies. It covers challenges in the application of technology in the clinic with views

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from an editorial team that is highly experienced in engineering, biomaterials, surgical practice, biomedical science and technology, and that has a proven track record of publishing applied biomedical science and technology. For medical practitioners, this book covers

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multidisciplinary and readers can learn techniques to apply acquired knowledge for various applications of biomedical design. Further, this book encourages readers to discover and convert newly reported technologies into products and services for the future development of biomedical

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Under the direction of John Enderle, Susan Blanchard and Joe Bronzino, leaders in the field have contributed chapters on the most relevant subjects for biomedical engineering students. These chapters coincide with courses

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biomedical engineering research on translational capabilities for the diagnosis, prevention, and treatment of clinical disease states, the need for reviews of the state-of-art and current needs in orthopaedics is very timely. Orthopaedic Biomechanics provides an

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in-depth review of the current knowledge of orthopaedic biomechanics across all tissues in the musculoskeletal system, at all size scales, and with direct relevance to engineering and clinical applications. Discussing the relationship between

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mechanical loading, function, and biological performance, it first reviews basic structure-function relationships for most major orthopedic tissue types followed by the most-relevant structures of the body. It then addresses multiscale modeling and biologic

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considerations. It concludes with a look at applications of biomechanics, focusing on recent advances in theory, technology and applied engineering approaches. With contributions from leaders in the field, the book presents state-of-the-art findings, techniques,

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and perspectives. Much of orthopaedic, biomechanical, and biomedical engineering research is directed at the translational capabilities for the "real world". Addressing this from the perspective of diagnostics, prevention, and treatment in orthopaedic

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biomechanics, the book supplies novel perspectives for the interdisciplinary approaches required to translate orthopaedic biomechanics to today ' s real world.

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engineering from materials, devices, imaging, and information perspectives. The contributors are senior members of the Research Center for Biomedical Engineering, supported by the Ministry of Education, Culture, Sports, Science and Technology, Japan. All chapters

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are results of collaborative research in engineering and life sciences and cover nanotechnology, materials, optical sensing technology, imaging technology, image processing technology, and biomechanics, all of which are important areas in

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are at the interface of the biological sciences and engineering. Biomaterials, biomedical devices and techniques play a significant role in improving the quality of health care in the developed world. The book covers an extensive range of topics related to biomedical

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engineering, including biomaterials, sensors, medical devices, imaging modalities and imaging processing. In addition, applications of biomedical engineering, advances in cardiology, drug delivery, gene therapy, orthopedics, ophthalmology, sensing

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and tissue engineering are explored. This important reference work serves many groups working at the interface of the biological sciences and engineering, including engineering students, biological science students, clinicians, and industrial researchers.

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against which all other references of this nature are measured. As such, it has served as a major resource for both skilled professionals and novices to biomedical engineering. Molecular, Cellular,

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and Tissue Engineering, the fourth volume of the handbook, presents material from respected scientists with diverse backgrounds in molecular biology, transport phenomena, physiological modeling, tissue

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field of physiology and biomedical engineering. The application of such mathematical and computational tools requires a formal or explicit understanding of physiology. Formal models and analytical

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techniques are interlinked in physiology as in any other field. This book takes a unitary approach to physiological systems, beginning with signal measurement and acquisition, followed by signal processing,

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linear systems modelling, and computer simulations. The signal processing techniques range across filtering, spectral analysis and wavelet analysis. Emphasis is placed on fundamental understanding of the concepts

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as well as solving numerical problems. Graphs and analogies are used extensively to supplement the mathematics. Detailed models of nerve and muscle at the cellular and systemic levels provide

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and an understanding that the application of ethical measures will seldom reach consensus even among fellow engineers and scientists. The

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solutions are never completely technical, so the engineer must continue to improve the means of incorporating a wide array of societal perspectives, without

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sacrificing sound
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principles. Dan Vallerio
understands that
engineering is a
profession that
profoundly affects the

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quality of life from the subcellular and nano to the planetary scale. Protecting and enhancing life is the essence of ethics; thus every engineer and design

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professional needs a foundation in bioethics. In high-profile emerging fields such as nanotechnology, biotechnology and green engineering, public

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concerns and attitudes become especially crucial factors given the inherent uncertainties and high stakes involved. Ethics thus means more than a

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commitment to abide by professional norms of conduct. This book discusses the full suite of emerging biomedical and environmental issues that must be addressed

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by engineers and scientists within a global and societal context. In addition it gives technical professionals tools to recognize and address

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bioethical questions and illustrates that an understanding of the application of these measures will seldom reach consensus even among fellow engineers

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describe the basic principle of medical imaging devices and the application of computers in medicine, particularly in the fields of data management, critical care, clinical laboratory,

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is valuable as a general reference for courses in a biomedical engineering curriculum.

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intricate structures of large-scale data and is ideally suited to many of the hardware architectures that are currently available. The ever-expanding amount of data that can be gathered

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through biomedical and clinical information sensing devices necessitates the development of machine learning and AI techniques such as Deep Learning and Convolutional Neural

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Networks to process and evaluate the data. Some examples of biomedical and clinical sensing devices that use Deep Learning include: Computed Tomography (CT), Magnetic Resonance Imaging

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neuroimaging, data fusion,
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diagnosis for diseases such
as Alzheimer's, ADHD, and
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multimodal imaging analysis. Presents a comprehensive handbook of the biomedical engineering applications of DL, including computational neuroscience, neuroimaging, time series data such as MRI,

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areas of DL such as early diagnosis of specific diseases such as Alzheimer's, ADHD, and ASD, and tumor prediction through MRI and translational multimodality imaging and biomedical

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their applications for biomedical engineering, which will provide a base for researchers in the biomedical field to conduct further investigation. The entire book is classified into

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three levels. It starts with the first level, which presents the single physical fields including structural analysis, fluid simulation, thermal analysis, and acoustic modeling. Then, the second

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level consists of various couplings between two physical fields covering structural thermal coupling, porous media, fluid structural interaction (FSI), and acoustic FSI. The third

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level focuses on multi-coupling that coupling with more than two physical fields in the model. Each part in all levels is organized as the physical feature, finite element implementation,

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modeling procedure in ANSYS, and the specific applications for biomedical engineering like the FSI study of Abdominal Aortic Aneurysm (AAA), acoustic wave transmission in the

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ear, and heat generation of the breast tumor. The book should help for the researchers and graduate students conduct numerical simulation of various biomedical coupling

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problems. It should also provide all readers with a better understanding of various couplings.

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developing novel materials has motivated an increasing need for biological and medical studies in a variety of clinical applications. Indeed, it is clear that to achieve the requisite

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mechanical, chemical and biomedical properties, especially for new bioactive materials, it is necessary to develop novel synthesis routes. The tremendous success of materials science

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in developing new biomaterials and fostering technological innovation arises from its focus on interdisciplinary research and collaboration between materials and medical

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sciences. Materials scientists seek to relate one natural phenomenon to the basic structures of the materials and to recognize the causes and effects of the phenomena. In this way,

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they have developed explanations for the changing of the properties, the reactions of the materials to the environment, the interface behaviors between the

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artificial materials and human tissue, the time effects on the materials, and many other natural occurrences. By the same means, medical scientists have also studied the

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biological and medical effects of these materials, and generated the knowledge needed to produce useful medical devices. The concept of biomaterials is one of the

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most important ideas ever generated by the application of materials science to the medical field. In traditional materials research, interest focuses primarily on the synthesis, structure, and

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mechanical properties of materials commonly used for structural purposes in industry, for instance in mechanical parts of machinery.

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