

# Computational Modeling and Simulation Examples in Bioengineering

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# Computational Modeling and Simulation Examples in Bioengineering

Edited by

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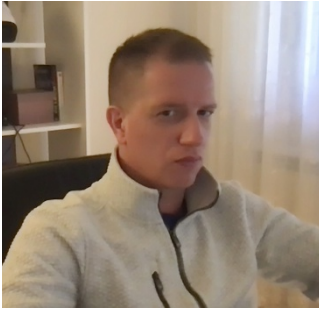
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## Preface

The aim of this book is to provide concrete examples of applied modeling in biomedical engineering. The book is accompanied by software on the web for studying the representative bioengineering problems in more detail ([www.bioengexambook.ac.rs](http://www.bioengexambook.ac.rs)). The primarily goal of the book is to serve as a textbook in various bioengineering university courses, as well as a support for basic and clinical research.

Different numerical examples in the area of bone, tissue, cardiovascular, augmented reality, and vertigo disease give readers an overview of typical problems that can be modeled and complete theoretical background with numerical method behind. The book can be used for lecturers of bioengineering courses at universities but also it can be very helpful for researchers, medical doctors, and clinical researchers. In comparison to the existing literature, this book will give more practical examples with supporting web platform in the area of modeling in bone, tissue, cardiovascular, cancer, lung, and vertigo diseases.

The book will be prepared mainly as a textbook for undergraduate or graduate courses in bioengineering, engineering and applied sciences in general, and medicine. There are different examples of application: bone, muscle, tissue, cardiovascular, cancer, lung, and vertigo disease. In chapters, it will be the theoretical background and basics of the computational methods used for the specific modeling. We consider that support by the software on the web should be of great help for lecturers when organizing classes. The theoretical presentations (either from the theoretical background or from bioengineering applications) can be accompanied by use of the software with menu-driven modeling and solution display. Use of the software can also aid students when studying various theoretical or bioengineering problems.

The book will be also prepared to be useful for researchers in various fields related to bioengineering and other scientific fields, including medical applications. The book will provide basic information about how a bioengineering (or

medical) problem can be modeled, which computational models can be used, and what is the background of the applied computer models.

In Chapter 1, some basic theoretical and numerical examples of computational Modeling of Abdominal Aortic Aneurysms are given. Chapter 2 describes modeling the motion of rigid and deformable objects in fluid flow. Application of computational methods in dentistry with some theoretical and practical numerical examples is given in Chapter 3.

Determining Young's modulus of elasticity of cortical bone from CT scans is described in Chapter 4. Parametric modeling of blood flow and wall interaction in aortic dissection is investigated in Chapter 5. Application of AR Technology in Bioengineering is well described in Chapter 6. Augmented Reality Balance Physiotherapy is presented in Chapter 7. Modeling of the human heart – ventricular activation sequence and ECG measurement are given in Chapter 8. In Chapter 9, medical image segmentation was described using contrast stretching, edge-detection and thresholds with coupled Simulink-XSG (Xilinx System Generator) tool and FPGA (Field Programmable Gate Arrays). The book is intended for pre-graduate and postgraduate students as well as for researchers in the domains of bioengineering, biomechanics, biomedical engineering, and medicine.

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