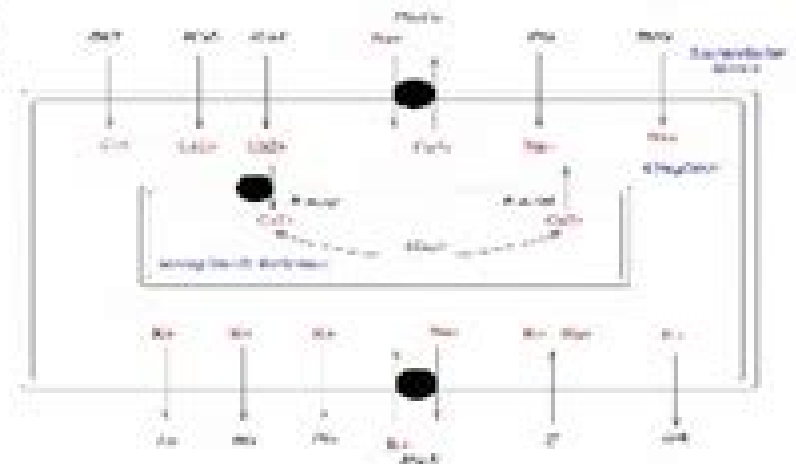


A guide to modelling cardiac electrical activity in anatomically detailed ventricles

By: faezeh heydari I



Mathematical Modelling Of Cardiac Electrical Activity

David Urs Josef Keller



Mathematical Modelling Of Cardiac Electrical Activity:

Mathematically Modelling The Electrical Activity Of The Heart: From Cell To Body Surface And Back Again

Andrew Pullan, Martin L Buist, Leo K Cheng, 2005-09-07 This book on modelling the electrical activity of the heart is an attempt to describe continuum based modelling of cardiac electrical activity from the cell level to the body surface the forward problem and back again the inverse problem Background anatomy and physiology is covered briefly to provide a suitable context for understanding the detailed modelling that is presented herein The questions of what is mathematical modelling and why one would want to use mathematical modelling are addressed to give some perspective to the philosophy behind our approach Our view of mathematical modelling is broad it is not simply about obtaining a solution to a set of mathematical equations but includes some material on aspects such as experimental and clinical validation

Modeling and Simulating Cardiac Electrical Activity Trine Krogh-Madsen, David J. Christini, 2020-12-03 This book provides a thorough introduction to the topic of mathematical modeling of electrical activity in the heart from molecular details of ionic channel dynamics to clinically derived patient specific models It discusses how cellular ionic models are formulated introduces commonly used models and explains why there are so many different models available The chapters cover modeling of the intracellular calcium handling that underlies cellular contraction as well as modeling molecular level details of cardiac ion channels and specialized topics such as cardiomyocyte energetics and signalling pathways It is an excellent resource for experienced and specialized researchers in the field but also biological scientists with a limited background in mathematical modelling and computational methods Key Features Thorough introduction to the topic of mathematical modeling of electrical activity in the heart Focuses on use of experimental data in mathematical modeling and on explanations rather than equations In addition to being experts in the field the contributing authors are expert science communicators

Mathematically Modelling the Electrical Activity of the Heart Andrew J. Pullan, Leo K. Cheng, Martin L. Buist, 2005 This book on modelling the electrical activity of the heart is an attempt to describe continuum based modelling of cardiac electrical activity from the cell level to the body surface the forward problem and back again the inverse problem Background anatomy and physiology is covered briefly to provide a suitable context for understanding the detailed modelling that is presented herein The questions of what is mathematical modelling and why one would want to use mathematical modelling are addressed to give some perspective to the philosophy behind our approach Our view of mathematical modelling is broad it is not simply about obtaining a solution to a set of mathematical equations but includes some material on aspects such as experimental and clinical validation

Mathematical Modelling of Cardiac Electrical Activity Within a Heterogeneous Bidomain Framework Thushka Maharaj, 2008

Computing the Electrical Activity in the Heart Joakim Sundnes, Glenn Terje Lines, Xing Cai, Bjørn Frederik Nielsen, Kent-Andre Mardal, Aslak Tveito, 2007-06-26

The heart is a fantastic machine during a normal lifetime it beats about 2.5 billion times and pumps 200 000 tons of blood

through an enormous system of vessels extending 160 000 kilometres throughout the body For centuries man has tried to understand how the heart works but there remain many unsolved problems problems that have captured the attention of thousands of researchers worldwide There is for example a huge amount of research being devoted to the analysis of single heart cells Other areas of research include trying to understand how it works as a complete muscle and how blood flows through the heart The entire process is extremely complex The history of bioelectricity can be traced back to the late eighteenth century and the experiments of Luigi Galvani A century later in 1887 Augustus Waller managed to measure the electrical signal generated by the heart at the surface of the body 142 His dog Jimmy earned a place in history by being the first to have his heart measured in this way see Figure 1 1 In 1903 Willem Einthoven developed the first commercial device for recording electrocardiograms ECGs see Figure 1 2

Modeling and Simulating Cardiac Electrical Activity Trine Krogh-Madsen, 2020-12-03 This book provides a thorough introduction to the topic of mathematical modeling of electrical activity in the heart from molecular details of ionic channel dynamics to clinically derived patient specific models It discusses how cellular ionic models are formulated introduces commonly used models and explains why there are so many different models available The chapters cover modeling of the intracellular calcium handling that underlies cellular contraction as well as modeling molecular level details of cardiac ion channels and specialized topics such as cardiomyocyte energetics and signalling pathways It is an excellent resource for experienced and specialized researchers in the field but also biological scientists with a limited background in mathematical modelling and computational methods

Key Features Thorough introduction to the topic of mathematical modeling of electrical activity in the heart Focuses on use of experimental data in mathematical modeling and on explanations rather than equations In addition to being experts in the field the contributing authors are expert science communicators

Finite Element Modeling of Cardiac Activation Dynamics Jack Moss Rogers, 1993

Mathematical Approaches to Cardiac Arrhythmias José Jalife, 1990

[Spatial Estimation of the 12-lead Electrocardiogram Using Linear Least-squares Modeling Techniques](#) Julie Ann Scherer, 1994

A Discrete-Event Simulation Model of Myocardial Electrical Activity: Mathematical Electrophysiology, 1994 This work unit was opened to provide a channel for in house work on mathematical modeling and computer simulation of the electrocardiogram ECG and its underlying electrophysiology This work was intended to complement work being done in contracted efforts aimed at model based enhancement of ECG diagnostic criteria for detection of coronary artery disease in USAF aircrew members Both the contract and in house efforts have been terminated due to funding constraints and organizational shifts in research focus In this technical paper we report on the development of a simulation model of the depolarization and repolarization processes in the ventricles which was to be used as a cardiac electrical source model in simulations of the ECG as well as attempt to provide some commentary regarding the relation of these efforts to broader contexts

A Model for the Mapping of Cardiac Events Onto the Electrocardiogram (ECG) in the Case of Coronary Artery Disease Abraham Tat

Chang Wong,1980 Computational Biology of the Heart Alexander V. Panfilov,Arun V. Holden,1997-03-28 Modelling the genesis and propagation of electrical activity in the heart in quantitative terms is one of the most important recent applications of mathematical modelling in biology The main research direction and the most important for biological and medical applications is the development of realistic models of electrical activity in cardiac tissue and the whole mammalian heart Recent progress in nonlinear dynamics advances in computer technology and experiments on cardiac tissue have made feasible the construction of such models Computational Biology of the Heart is the first book to provide a comprehensive survey of recent research together with a systematic overview of the subject The contributions all written by experts in the different areas of the subject cover all main aspects of whole heart modelling from excitation in single cells to two and three dimensional models of cardiac tissue and the whole heart Various computational models and techniques are described and then applied to reconstruct and visualise modelled activity in both normal and pathological heart tissues The models are nonlinear and use techniques of ordinary differential equations partial differential equations and eikonal equations The book also provides a review of modelling cardiac contraction mapping electrical activity from electrocardiograms and recent experimental observations of wave propagation in the whole heart Graduate students and researchers in such areas as applied mathematical biology clinical physiology and cardiology will find this book to be an invaluable resource for their work

Electrical Activity of the Heart Ontario Heart Foundation,1969 Multimodal Cardiovascular Imaging: Principles and Clinical Applications Olle Pahlm,Galen Wagner,2011-03-24 A complete guide to using multimodal imaging in cardiac practice Interactive DVD includes moving images from the text 4 STAR DOODY S REVIEW In addition to compiling the various imaging modalities used for clinical diagnosis in cardiovascular disease the book also summarizes the present and future applications of combined imaging modalities for better understanding the underlying pathophysiologic basis of cardiovascular diseases This book is unique in the way it comprehensively reviews both the current and future applications of multiple imaging modalities Doody s Review Service Multimodal Cardiovascular Imaging Principles and Clinical Applications offers a unique matrix approach to help you choose the most appropriate combination of imaging modalities for the management of patients with cardiovascular disease The book discusses the various options available how they work the benefits and drawbacks of each and what modalities will best work in conjunction with each other for a specific condition Featuring contributions from more than 60 international authors and enriched by 225 half tone modality images and 130 full color illustrations Multimodal Cardiovascular Imaging Principles and Clinical Applications is divided into three sections Section 1 contains chapters that focus on the use of ten specific clinically available diagnostic modalities and their broad application to clinical cardiology Modalities discussed include Echocardiography Phonocardiography Myocardial Perfusion SPECT and PET Coronary Angiography Cardiac CT Section 2 includes six chapters that present visions of the future for combining multiple diagnostic modalities They form the foundation for understanding the pathophysiologic basis of clinical

cardiovascular conditions using prototypes simulations models and tutorials Section 3 considers several cardiovascular conditions and how multimodal imaging can provide diagnostic and therapeutic decision support to optimize the clinical care for each of them Some chapters in this section also include case reports of how clinicians scientists are using multimodal imaging modalities to improve their clinical therapeutic decision support Conditions include Congenital Heart Disease Ischemic Heart Disease Acute Myocardial Infarction Aortic Disease Atrial Fibrillation *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society* IEEE Engineering in Medicine and Biology Society. Conference,1992 *A Computational and Experimental Study of a Heart-model-based Electrocardiographic Imaging Approach* Xin Zhang (Ph.D.),2005 **Computer Techniques in Clinical Medicine** Peter W. Macfarlane,1985

Pacemaker Activity and Intercellular Communication Jan D. Huizinga,1995-02-06 The book focuses on enhancing our understanding of pacemaker systems and associated mechanisms of intercellular communication Three different physiological systems are compared the cardiac system the cells of the pancreas and the gastrointestinal tract Experts in all three areas highlight the parallels and comparisons among the systems Emphasis is placed on finding precise characteristics of all cell types involved in pacemaker activity The interpretation of data on single isolated cells in light of tissue function receives thorough discussion Ion channel characteristics involved in the generation of action potential and pacemaker components are described in detail A fascinating but largely unexplored area is touched upon the electrical and metabolic coupling of different cell types A most valuable feature is that most investigators have explored a variety of techniques to examine cell function patch clamp studies intracellular voltage recording intracellular calcium measurements gap junction conductance measurements dye spread techniques and more Various aspects of the molecular biology of gap junction and ion channels are explored *Journal of Mathematical Biology* ,1990 Publishes papers in which mathematics is used to understand biological phenomena and mathematical papers which answer questions arising from models of biological phenomena **Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society** IEEE Engineering in Medicine and Biology Society. Annual Conference,1994

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