OPTIMIZATION OF LEFT VENTRICULAR MUSCLE FIBER ORIENTATION

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1. Introduction

The left ventricle (LV) of the heart is a hollow muscle, that pumps blood through the systemic circulation. The muscular wall resembles a thick-walled truncated ellipsoid, and consists largely of muscle fibers (cells), that are oriented in a complex, but highly organized pattern (figure 1).

It is still a matter of debate whether or not all muscle cells contribute equally to the global performance of the left ventricle. The contribution of the individual cell is determined by the local state of stress and strain in the tissue. In the absence of experimental techniques to determine these quantities with sufficient reliability and spatial resolution, mathematical models have been designed to predict them [1, 4, 5, 8, 9]. In one model, using a measured wall geometry and muscle fiber orientation, an inhomogeneous distribution of stress and strain was found [8]. In other models, it was found that predicted local stresses and strains depend strongly on the choice of the muscle fiber orientation [1, 4, 5, 9]. Within the range of experimental data on the fiber orientation, from the models virtually any spatial distribution of stresses and strains could be predicted, including rather homogeneous distributions.

Starting point for the present study was the hypothesis that, in the real left ventricle, muscle fiber orientation is such, that mechanical load is evenly distributed across the wall. The hypothesis was based on observed changes in left ventricular wall geometry, following changes in mechanical loading of the ventricle [6, 12]. The geometric changes, that originate from the ability of the myocardial cells to adapt structurally to alterations in experienced deformation [10, 16], are expected to restore the original mechanical load.

The aim of this study was 1) to optimize the muscle fiber orientation field in a mathematical model of LV mechanics, such that systolic fiber

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Optimization of Left Ventricular Muscle Fiber Orientation Johannes Matthias Rijcken,1997 *Multiscale Modeling of the Ventricles* David Urs Josef Keller,2014-08-22 This work is focused on different aspects within the loop of multiscale modeling On the cellular level effects of adrenergic regulation and the Long QT syndrome have been investigated On the organ level a model for the excitation conduction system was developed and the role of electrophysiological heterogeneities was analyzed On the torso level a dynamic model of a deforming heart was created and the effects of tissue conductivities on the solution of the forward problem were evaluated **Functional Imaging and Modeling of the Heart** Alejandro F. Frangi,Petia I. Radeva,Andres Santos,Monica Hernandez,2005-06-13 The1stand2ndInternationalConferencesonFunctionalImagingandModelling of the Heart FIMH were held in Helsinki Finland in November 2001 and in Lyon France in June 2003 These meetings were born through a fruitful sci ti c collaboration between France and Finland that outreached to other groups and led to the start of this biennial event The FIMH conference was the rst attempt to agglutinate researchers from several complementary but often i lated elds cardiac imaging signal and image processing applied mathematics and physics biomedical engineering and computer science cardiology radi ogy biology and physiology In the rst two editions the conference received an enthusiastic acceptance by experts of all these communities FIMH was ori nally started as a European event and has increasingly attracted more and more people from the US and Asia This edition of FIMH received the largest number of submissions so far with a result of 47 papers being accepted as either oral presentations or posters There were a number of submissions from non EU institutions which con rms the growing interest in this series of meetings All papers were reviewed by up to four reviewers The accepted contributions were organized into 8 oral sessions and 3 poster sessions complemented by a number of invited talks This year we tried to allocate as many papers as possible as oral presentations to facilitate more active participation and to stimulate multidisciplinary discussions **IUTAM Symposium on Synthesis in Bio Solid Mechanics** Pauli Pedersen,Martin P. Bendsøe,2006-04-11 This book contains the edited version of invited lectures presented at the IUTAM Sym sium Synthesis in Bio Solid Mechanics held at Hotel Frederiksdal Virum Copenhagen Denmark May 24 to May 27 1998 The symposium was attended by 48 scientist from 14 countries Biomechanics has been a very active research area in the last 25 years and covers a very broad class of problems The present symposium concentrated on the solid mechanics main of biomechanics where important problems of synthesis presently are an active and challenging part Characteristics of biomechanical materials are not only the inhomogeneity and anisotropy but also the capability to change in relation to actual use These living materials call for new methods of analysis and also new methods for synthesis By the synthesis in this context is meant design of implants or artificial control of material growth Bone mechanics is closely related to recent work on analysis and design of microstructural anisotropic materials Also recent work in shape design can to some extent be useful in the more complicated

problems of biomechanics Here interface problems play an essential role The symposium brought together scientists from mechanics mathematics and medicine *Functional Imaging and Modeling of the Heart* ,2005 *Heart Mechanics* El-Sayed H. Ibrahim,2017-09-19 MRI techniques have been recently introduced for non invasive qualification of regional myocardial mechanics which is not achievable with other imaging modalities Covering more than twenty three years of developments in MRI techniques for accessing heart mechanics this book provides a plethora of techniques and concepts that assist readers choose the best technique for their purpose It reviews research studies and clinical trials that implemented MRI techniques for studying heart mechanics **Applied Mechanics Reviews** ,1994 *Proceedings of the ... Bioengineering Conference* ,1999 Mechanical Properties of Intact Ventricular Muscle Julius Matteo Guccione,1990 **Effects of Collagen Dysregulation on Structure and Mechanics of Normal and Post-infarction Myocardium** Sara Maree Weis,2000 **Proceedings of the 20th Annual International Conference of the IEEE Engineering in Medicine and Biology Society** IEEE Engineering in Medicine and Biology Society. Annual Conference,1998 These proceedings document the 20th Annual International Conference of the IEEE EMB Society held in Amsterdam in 1998 Covering the entire field of biomedical including the latest development in instrumentation neourotechnology rehabilitation engineering imaging signal Medical Imaging Clinical Engineering Medical Informatics Signal Processing Neuromuscular Systems Biomechanics Physiological Systems Modeling Instrumentation Constitutive Modeling and Testing of Biological Soft Tissue Jeffrey Edward Bischoff,2001 *Advances in Bioengineering* ,1996 **Records of the IEEE International Workshop on Memory Technology, Design and Testing** David Lepejian,1998 Annotation The 14 papers in this collection from the August 2001 workshop are divided into five sessions on semiconductor memory design BIST redundancy and error control fault models and multi port SRAM testing and verification and testing Some of the topics are evaluation of redundancy analysis algorithms a parallel approach for testing multi port static random access memories a low output resistance charge pump for flash memory programming BIST based bitfail mapping of an embedded DRAM and an orthogonal transpose RAM cell array architecture with an alternate bit line to bit line contact scheme No subject index c Book News Inc *Brinkman's catalogus van boeken en tijdschriften* ,2001 With 1901 1910 1956 1960 Repertoium is bound Brinkman s Titel catalohus van de gedurende 1901 1910 1956 1960 Title varies slightly *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society* IEEE Engineering in Medicine and Biology Society. Annual Conference,1988 *Medical Imaging* ,2006 **Brinkman's cumulatieve catalogus van boeken** ,1997 Voorts een alphabetische lijst van Nederlandsche boeken in Belgi uitgegeven Pandex Current Index to Scientific and Technical Literature ,1971 Philosophical Transactions ,2001

Unveiling the Magic of Words: A Report on "**Optimization Of Left Ventricular Muscle Fiber Orientation**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their power to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Optimization Of Left Ventricular Muscle Fiber Orientation**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book is central themes, examine its distinctive writing style, and assess its profound affect the souls of its readers.

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