

BIOMEDICAL MATHEMATICS:

**Promising Directions in Imaging,
Therapy Planning, and Inverse Problems**

BIOMEDICAL MATHEMATICS:
**Promising Directions in Imaging,
Therapy Planning, and Inverse Problems**

Yair Censor, Ming Jiang, Ge Wang
Editors

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Contents

	Preface	ix
	Contributing Authors	xi
1	Planning and Optimizing Treatment Plans for Actively Scanned Proton Therapy	1
	<i>Francesca Albertini, Sylvain Gaignat, Matthias Bosshardt, Antony J. Lomax*</i>	
2	Identification and Characterization of Transcriptome-based Biomarkers in Arthritis and Cancer for Personalized Medicine by Translational Genomics	19
	<i>Ashok R. Amin* and Ge Wang</i>	
3	Approximate Stability Estimates in Inverse Transport Theory	33
	<i>Guillaume Bal* and Alexandre Jollivet</i>	
4	General Resolvents for Monotone Operators: Characterization and Extension	57
	<i>Heinz H. Bauschke*, Xianfu Wang, and Liangjin Yao</i>	
5	Clustering, Classification, and Contour Approximation of Data	75
	<i>Adi Ben-Israel* and Cem Iyigun</i>	
6	Multi-Slice CT: Optimizing the Use of Intravenous Contrast Material	101
	<i>James A. Brink, M.D.</i>	
7	Statistical Iterative Reconstruction for X-Ray Computed Tomography	113
	<i>Bruno De Man* and Jeffrey A. Fessler</i>	
8	On the Estimation of Motion-Induced Temporal Dose Variations in Intensity Modulated Radiotherapy Treatment Fields	141
	<i>Eric D. Ehler and Wolfgang A. Tomé*</i>	

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Contents

9	A Class of Iterative Methods: Semi-convergence, Stopping Rules, Inconsistency, and Constraining 157 <i>Tommy Elfving*</i> , <i>Touraj Nikazad</i> , and <i>Constantin Popa</i>
10	Radiation Therapy Planning with a Given Set of Binary Matrices 185 <i>Çigdem Güler</i> and <i>Horst W. Hamacher*</i>
11	Mathematical Theory for X-Ray Phase-Contrast Imaging with 2D Grating Interferometry 201 <i>Ming Jiang*</i> and <i>Ge Wang</i>
12	An Approach to Motion Compensation in Tomography 221 <i>Alexander Katsevich</i>
13	Iterative Algorithms for the Multiple-Sets Split Feasibility Problem 243 <i>Genaro López</i> , <i>Victoria Martín-Márquez</i> , and <i>Hong-Kun Xu*</i>
14	X-Ray Phase Imaging with Talbot Interferometry 281 <i>Atsushi Momose*</i> , <i>Wataru Yashiro</i> , and <i>Yoshihiro Takeda</i>
15	Acoustic Imaging in 3D 321 <i>Frank Natterer</i>
16	Optimization of Physical and Biological Dose Distributions in Hadron Therapy 329 <i>Uwe Oelfke*</i> , <i>Joanne Kang</i> , <i>Daniel Pflugfelder</i> , and <i>Jan Jakob Wilkens</i>
17	Block-Iterative and String-Averaging Projection Algorithms in Proton Computed Tomography Image Reconstruction 347 <i>Scott N. Penfold*</i> , <i>Reinhard W. Schulte</i> , <i>Yair Censor</i> , <i>Vladimir Bashkirov</i> , <i>Scott McAllister</i> , <i>Keith E. Schubert</i> , and <i>Anatoly B. Rosenfeld</i>
18	Advanced Contrast Modalities for X-Ray Radiology: Phase-Contrast and Dark-Field Imaging Using a Grating Interferometer 369 <i>Franz Pfeiffer*</i> , <i>Martin Bech</i> , <i>Torben Jensen</i> , <i>Oliver Bunk</i> , <i>Tilman Donath</i> , <i>Christian David</i> , <i>Timm Weitkamp</i> , <i>Geraldine Le Duc</i> , <i>Alberto Bravin</i> , and <i>Peter Cloetens</i>

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Contents

19	Comparison of Some Reconstruction Schemes for Optical Tomography.....	385
	<i>Martin J. Schweiger and Simon R. Arridge*</i>	
20	Seminorm-Induced Oblique Projections for Sparse Nonlinear Convex Feasibility Problems	405
	<i>Alexander Segal and Yair Censor*</i>	
21	3D Fluorescence Lifetime Imaging in Turbid Inhomogeneous Media by Using Time-Gated Data Acquisition.....	423
	<i>Vadim Y. Soloviev*, Cosimo D'Andrea, Gianluca Valentini, Rinaldo Cubeddu, and Simon R. Arridge</i>	
22	Towards a New Paradigm for Radiation Treatment Planning.....	441
	<i>George Starkschall</i>	
23	Towards the Patient-Adaptive Approach to Risk Evaluation, Treatment Planning, and Delivery of Thoracic Radiotherapy.....	457
	<i>Alexei Trofimov*, Cornelia Gansemer, Adam D. Yock, Christian Vrancic, Thomas Bortfeld, and Noah C. Choi</i>	
24	Imaging Biomarkers	475
	<i>Michael Vannier</i>	
25	Interior Tomography: Practical Applications	495
	<i>Ge Wang*, Hengyong Yu, Yangbo Ye</i>	
26	Real-Time Imaging for Radiation Therapy Guidance.....	509
	<i>Rodney D. Wiersma*, Nadeem Riaz, and Lei Xing</i>	
27	Interior Tomography: Mathematical Analysis	543
	<i>Yangbo Ye*, Hengyong Yu, Ge Wang</i>	

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Preface

This book brings together 27 state-of-the-art, refereed and subsequently revised, research and review papers, by leading experts and practitioners in mathematical methods in biomedical imaging, in intensity-modulated radiation therapy (IMRT) and in optimization and inverse problems. The emphasis is on trying to discover relations and connections between these fields that will enhance progress in each of them. As this volume shows, applicable mathematical work in these fields goes hand-in-hand with real-world applications and the mutual “technology transfers” between them leads to further progress.

The topics covered here include mathematical aspects and practical problems in current major and emerging technologies in diagnostic and therapeutic medicine and biology research. The contributed work signifies the interdisciplinary cooperation between mathematicians and scientists from medical physics, engineering, clinical medicine, and biology that leads to mathematically based better solutions of practical problems in biomedical imaging and IMRT.

The Huangguoshu National Park of China, Guizhou, China, under the leadership of Mr. Degang Yuan, President of the Huangguoshu Tourism Group Company, LTD, recognizing the importance of the field and the need for interaction between theoreticians and practitioners, and desiring to create a high-profile cultural activity at the Huangguoshu National Park, provided us with a special grant to organize the “Huangguoshu International Interdisciplinary Conference on Biomedical Mathematics—Promising Directions in Imaging, Therapy Planning, and Inverse Problems.” The Conference took place during November 3–9, 2008, in the breathtaking Huangguoshu National Park of China.

The Conference was conducted under the scientific auspices of the Mathematical Center of the Ministry of Education of China at Peking University (PKU) in Beijing, China; the Center for Computational Mathematics and Scientific Computation (CCMSC) at the University of Haifa, Haifa, Israel; the School of Biomedical Engineering & Sciences at the Virginia Polytechnic Institute and State University, Virginia, USA; and the Guizhou University in Guiyang, Guizhou, China.

Experts from around the world were invited and participated. They came from Australia, Canada, Germany, Israel, Italy, Japan, Korea, P.R. China, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America. Most of the papers in this volume originated from the lectures presented at the Conference, while others were written in the wake of discussions held during the Conference.

Preface

It is our pleasure to heartily thank Mr. Degang Yuan and the team of the Huangguoshu Tourism Group, Peking University, and Virginia Tech for their devoted and efficient work throughout all phases of the preparations for the conference. In particular we thank Dr. Lingyin Zhao, Zongmin (Tracy) Mao, Haifeng (Mountain) Tong, and Gang (Leo) Xie, from the the Huangguoshu Tourism Group; Prof. Tie Zhou, Dr. Caifang Wang, Dr. Xin Jiang, and Yuanzheng Si, Yu Zhou, Shengkun Shi, from Peking University (PKU); and Deepak Bharkhada, from Wake Forest University, for their cooperation and extraordinary support in organizing and conducting the Conference. Many thanks are due to the referees whose work enhanced the final versions of the papers which appear here. Last but not least, we thank the participants of the Conference and the authors who contributed their work to this volume. We gratefully acknowledge the help of Ms. Betsey Phelps, Managing Editor, Medical Physics Publishing, Madison, WI, USA, for her and her team's work on the production of this volume.

We hope that researchers in applied mathematics, medical physics, biomedical imaging, and intensity-modulated radiation therapy will find this book a useful tool in their current research and development efforts.

Yair Censor, Ming Jiang and Ge Wang
Haifa, Beijing, and Blacksburg, VA, respectively
January 31, 2010

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