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# Intraoperative Imaging and Image-Guided Therapy



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Ferenc A. Jolesz  
Editor

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 Springer

*Editor*

Ferenc A. Jolesz, MD  
National Center for Image Guided Therapy  
Department of Radiology  
Brigham and Women's Hospital  
Harvard Medical School  
Boston, MA  
USA

ISBN 978-1-4614-7656-6      ISBN 978-1-4614-7657-3 (eBook)  
DOI 10.1007/978-1-4614-7657-3  
Springer New York Heidelberg Dordrecht London

Library of Congress Control Number: 2013955743

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Printed on acid-free paper

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## Preface

After some hesitation, due to the enormity of the task, I decided that it is now time for a comprehensive book in which the fundamental, technical, and clinical aspects of image-guided therapies, known throughout this book also as “IGT,” are discussed, and the state of the art of the field is presented. Also, I recognized that there is a need to thoroughly cover clinical applications for IGT not only in fields such as neurosurgery and ear-nose-and-throat (ENT) surgery for which intraoperative image guidance is well recognized and routinely used but also for other application areas that are in a less developed stage. Today, image guidance has changed multiple medical procedures including cardiovascular surgeries and interventions, various endoscopies, and orthopedic procedures. At the same time, image acquisition technologies like real-time MRI or CT fluoroscopy, molecular imaging with PET/CT, and optical imaging are also entering into operating rooms. Tracking and sensing technologies for navigation and image processing methods using laptops and high-performance computing are also fast progressing, and their clinical utility is more and more obvious. Advanced treatment methods, especially those that require image guidance for targeting, monitoring, and the control, are also gaining recognition, and they are comparable with conventional surgical approaches. This comparison between competing alternative technologies is an important feature of the book.

IGT is a multidisciplinary, multimodality field in which teams of physicians, physicists, engineers, and computer scientists are working closely. This “team approach” is reflected in the organization of the book. The book covers all important aspects of this emerging field. Among other subjects, the reader will learn the basic concepts of image guidance, the technologies involved in therapy delivery, and the special requirements for the design and construction of image-guided operating rooms and interventional suites. In addition to being a review of several of the leading clinical applications of IGT, the book also covers future developments like molecular imaging-guided surgeries and novel innovative therapies like MRI-guided focused ultrasound surgery.

The book is organized into five main parts in which different aspects of image guidance are discussed. It starts with an introduction to the field and explains the principles that make the later parts easier to understand. The first three parts discuss imaging methods and guidance technologies and present the therapy delivery systems used today or that will be introduced in the future. The last two parts discuss the design of procedure rooms and all the potential clinical applications and compare them (invasiveness, effectiveness, and outcome) with conventional methods.

Chapters were contributed by the members of our National Center of Image-Guided Therapy (NCIGT) program and international leaders of the field of IGT. Our program has been at the forefront of IGT research, and this is reflected in the content and list of authors. From outside our team, I tried to invite those who contributed significantly to the advancement of IGT to contribute, but even in this relatively large book, there is not enough room to incorporate everybody who is pivotal to this field in the past or present. I tried to achieve a cross-sectional representation of the rapidly evolving field as it exists today, but I know that neither a full coverage of the entire subject nor inclusion of all prominent investigators is possible.

This was hard work for everybody who contributed, and it required sacrifice from all the authors and their families. Therefore, I am grateful for my family for tolerating my extracurricular activity, and, at the same time, I want to express my gratitude for all the families who put up with the work of the authors.

I would like to acknowledge the work of those who helped me edit and review the chapters. They are listed in alphabetical order: Robert Cormack, PhD; Andriy Fedorov, PhD; Gabor Fichtinger, PhD; Alexandra Golby, MD; Eva Gombos, MD; Nobuhiko Hata, PhD; Jayender Jagadeesan, PhD; Dan Kacher, MD; Tina Kapur, PhD; Ron Kikinis, MD; Nathan McDannold, PhD; Paul Morrison, MS; Isaiah Norton, BS; Daniel Orringer, MD; Larry Panych, PhD; Steve Pieper, PhD; Ehud Schmidt, PhD; Junichi Takuda, PhD; Clare Tempany, MD; Kemal Tuncali, MD; Kirby Vosburgh, PhD; William “Sandy” Wells, PhD

Special thanks to Ms. Kimberly Lawson who coordinated the long and difficult process of editing and review. Finally, I deeply appreciate the intention of the publisher to make this book possible despite all the difficulties. Springer’s as well as our efforts will not be wasted if this book reaches its ultimate goal: the further advancement of IGT for the benefit of patients.

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## Contributors

**K.J.T. Anderson, BSc** Imaging Research, Sunnybrook Health Sciences Centre, Toronto, ON, Canada

Department of Medical Biophysics, University of Toronto, Toronto, ON, Canada

**Filip Banovac** Department of Radiology, Georgetown University Hospital, Washington, DC, USA

**Soenke Bartling, MD, PhD** Department of Medical Physics in Radiology, German Cancer Research Center, Heidelberg, Germany

**Miriam H.A. Bauer** Department of Neurosurgery, University of Marburg, Marburg, Germany

**Christoph D. Becker, MD** Department of Radiology, University of Geneva, Geneva, Switzerland

Department of Imaging and Information Sciences, Geneva University Hospital, Geneva, Switzerland

**Brett Bell, PhD** ARTORG Center for Biomedical Engineering Research, University of Bern, Bern, Switzerland

**Jeffrey Berman** Jeffrey Berman Architect, New York, NY, USA

**Peter McL. Black, MD** Department of Neurosurgery, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Richard Boyd** VueKlar Cardiovascular Ltd., Edinburgh, UK

**John Bracken, PhD** Department of Medical Biophysics, Sunnybrook Hospital, University of Toronto, Toronto, ON, Canada

**John G. Byrne, MD** Vanderbilt Heart & Vascular Institute, Nashville, TN, USA

Department of Cardiac Surgery, Vanderbilt University Medical Center, Nashville, TN, USA

**Daniel Candinas, MD** Clinic of Visceral Surgery and Medicine, Visceral and Transplantation Surgery, University Hospital Bern and University of Bern, Bern, Switzerland

**Diana L. Caragacianu, MD** Hallmark Health System Comprehensive Breast Center, Stoneham, MA, USA

**John Carrino, MD, MPH** Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, USA

**Marco Caversaccio, MD** Department of Otorhinolaryngology, Head and Neck Surgery, Inselspital, University of Bern, Bern, Switzerland

**William C. Chapman, MD** Section of Transplantation, Division of General Surgery, Washington University, St. Louis, MO, USA

**Kevin Cleary, PhD** Bioengineering Initiative, Sheikh Zayed Institute for Pediatric Surgical Innovation, Washington, DC, USA

**Michael Conditt, PhD** MAKO Surgical Corp, San Antonio, TX, USA

**Robert A. Cormack, PhD** Department of Radiation Oncology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Zsolt Cselik, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Stephan A. Danik, MD** Department of Cardiology, Massachusetts General Hospital, Boston, MA, USA

**Alexander J. Dick, MD** Department of Cardiology, University of Ottawa Heart Institute, Ottawa, ON, Canada

**Patrick Dubach, MD** Department of Otorhinolaryngology, Head and Neck Surgery, Inselspital, University of Bern, Bern, Switzerland

BMBF - Innovation Center for Computer Aided Surgery (ICCAS), University of Leipzig, Leipzig, Germany

**Charles L. Dumoulin, PhD** Department of Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

**Timo M. Ecker, MD** Department of Orthopaedic Surgery, Inselspital, University of Berne, Berne, Switzerland

**Jan Egger, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Ole Jacob Elle** National Imaging Center, Rikshospital, University of Oslo, Oslo, Norway

**Michael J. Ellis, MD** Division of Neurosurgery, The Hospital for Sick Children, University of Toronto, Toronto, ON, Canada

**Raúl San José Estépar, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Rebecca Fahrig, PhD** Departments of Bioengineering and Radiology, Stanford University, Stanford, CA, USA

**Andriy Fedorov, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Fabiola Fernández-Gutiérrez** Institute for Medical Science and Technology IMSaT, Ninewells Hospital and Medical School, University Dundee, Dundee, UK

**Gabor Fichtinger, PhD** Queen's University, School of Computing, Kingston, ON, Canada

**Marvin P. Fried, MD** Department of Otolaryngology, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

**Jan Fritz, MD** Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, USA

**Robert L. Galloway, PhD** Center for Technology-Guided Therapy, Vanderbilt University, Nashville, TN, USA

**Marc Gibber, MD** Department of Otorhinolaryngology – Head and Neck Surgery, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

**Orçun Göksel, PhD** Computer Vision Laboratory, ETH Zürich, Zürich, Switzerland

**Alexandra J. Golby** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Mehra Golshan, MD, FACS** Breast Surgical Services, Dana-Farber Cancer Institute, Brigham and Women's Hospital, Boston, MA, USA

Department of Surgery, Harvard Medical School, Boston, MA, USA

**Eva C. Gombos, MD** Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**David R. Green** Imaging Research, Sunnybrook Health Sciences Centre, Toronto, ON, Canada

**Rajiv Gupta, MD, PhD** Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA

**Walter A. Hall, MD, MBA** Department of Neurosurgery, SUNY Upstate Medical University, Syracuse, NY, USA

**Ahin Handa, BArch** Payette, Boston, MA, USA

**Heinz Handels, PhD** Institute of Medical Informatics, University Hospital Schleswig-Holstein, University of Lübeck, Lübeck, Germany

**Niels J. Harlaar, MD** Department of Surgical Oncology, University Medical Center Groningen, Groningen, The Netherlands

**Nobuhiko Hata, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Graeme Houston** Institute for Medical Science and Technology IMSaT, Ninewells Hospital and Medical School, University Dundee, Dundee, UK

**Erwin Immel, PhD** Institute for Medical Science and Technology IMSaT, University Dundee, Dundee, UK

**D.A. Jaffray, PhD** Department of Medical Biophysics, Princess Margaret Hospital, University of Toronto, Toronto, Canada

**Jagadeesan Jayender, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Ferenc A. Jolesz, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Leo Joskowicz, PhD** CASMIP Laboratory, The Hebrew University of Jerusalem, Jerusalem, Israel

**Gregory F. Jost, MD** Department of Neurosurgery, University Hospital Basel, Basel, Switzerland

**Mark Kachelriess, PhD** Department of Medical Physics in Radiology, German Cancer Research Center, Heidelberg, Germany

**Daniel F. Kacher, MS** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Tina Kapur, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Pierre Khuri-Yakub, PhD** Edward L. Ginzton Laboratory, Stanford University, Stanford, CA, USA

**Marie Foley Kijewski, ScD** Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Ron Kikinis, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Jun Koizumi, MD, PhD** Department of Radiology, Tokai University School of Medicine, Isehara, Kanagawa, Japan

**Philip T. Komljenovic, BSc** Imaging Research, Sunnybrook Health Sciences Centre, Toronto, ON, Canada

**Daniela Kuhnt, MD** Department of Neurosurgery, University of Marburg, Marburg, Germany

**Jan Kuntz, PhD** Department of Medical Physics in Radiology, German Cancer Research Center, Heidelberg, Germany

**Marzia Leacche, MD** Vanderbilt Heart & Vascular Institute, Nashville, TN, USA

**Prasheel V. Lillaney, PhD** Departments of Radiology and Biomedical Imaging, University of California San Francisco, San Francisco, CA, USA

**Ernst Martin-Fiori, MD** MR-Center, University Children's Hospital Zürich, Zürich, Switzerland

**Mitsunori Matsumae, MD, DMSc** Department of Neurosurgery, Tokai University School of Medicine, Isehara, Kanagawa, Japan

**Nathan J. McDannold, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Hubertus Maximilian Mehdorn, MD, PhD** Clinic of Neurosurgery, University Hospital Schleswig-Holstein, Campus Kiel, Kiel, Germany

**Andreas Melzer, MD, DDS** Institute for Medical Science and Technology IMSaT, Universities Dundee and St Andrews, Dundee, UK

VueKlar Cardiovascular Ltd., Edinburgh, UK

**Thomas M. Moriarty, MD, PhD** Pediatric Neurosurgery, Kosair Children's Hospital, Norton Neuroscience Institute, Louisville, KY, USA

**Paul R. Morrison, MS (Deceased)** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Jason W. Motkoski, BSc** Division of Neurosurgery, Seaman Family MR Research Centre, Foothills Medical Centre, Calgary, AB, Canada

**Ian Mutchnick, MD** Pediatric Neurosurgery, Kosair Children's Hospital, Norton Neuroscience Institute, Louisville, KY, USA

**Arya Nabavi, MD, PhD, MaHM** Clinic of Neurosurgery, University Hospital Schleswig-Holstein, Campus Kiel, Kiel, Germany

**Amin Nikoozadeh, PhD** Edward L. Ginzton Laboratory, Stanford University, Stanford, CA, USA

**Christopher Nimsy, MD, PhD** Department of Neurosurgery, University of Marburg, Marburg, Germany

**Peter-Lutz Nolte, PhD** Institute for Surgical Technology and Biomechanics, University of Bern, Bern, Switzerland

- Isaiah H. Norton, BS** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Vasilis Ntziachristos, PhD** Munich Institute for Biological and Medical Imaging (IBMI), Helmholtz Zentrum München, Neuherberg, Germany
- Ömer Oralkan, PhD** Edward L. Ginzton Laboratory, Stanford University, Stanford, CA, USA
- Darren B. Orbach, MD, PhD** Division of Interventional and Neurointerventional Radiology, Children's Hospital Boston, Harvard Medical School, Boston, MA, USA
- Marek Orban** International Clinical research Center, St Anne's University Hospital, Brno, Czech Republic
- Sebastian Ordas** Functional Neurosurgery Section, Hospital Italiano de Buenos Aires, Buenos Aires, Argentina
- Daniel A. Orringer, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Lawrence P. Panych, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Norbert J. Pelc** Departments of Bioengineering and Radiology, Stanford University, Stanford, CA, USA
- Vitor Mendes Pereira, MD** Department of Diagnostic and Interventional Neuroradiology, University of Geneva Medical Center, Medical Faculty of the University of Geneva, Geneva, Switzerland
- Mathias Peterhans, PhD** ARTORG Center for Computer Aided Surgery, University of Bern, Bern, Switzerland  
CAScination AG, Bern, Switzerland
- Steven D. Pieper, PhD** Surgical Planning Laboratory, Isomics Incorporated, Cambridge, MA, USA
- Marc Puls, PhD** Department of Orthopaedic Surgery, Inselspital, University of Berne, Berne, Switzerland
- Maximilian F. Reiser, MD** Department of Clinical Radiology, Ludwig-Maximilians-University, Munich, Germany  
Department of Neurosurgery, LKH Klagenfurt, Klagenfurt, Austria  
Institute for Clinical Radiology, Ludwig-Maximilians-University Munich, Klagenfurt, Germany
- Petter Risholm, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Normand Robert, PhD** Imaging Research, Sunnybrook Health Sciences Centre, Toronto, ON, Canada
- Martin Roche, MD** Holy Cross Orthopedic Institute, Fort Lauderdale, FL, USA
- John A. Rowlands, PhD** Thunder Bay Regional Research Institute, Thunder Bay Regional Health Sciences Center, Thunder Bay, ON, Canada
- Ichiro Sakuma, PhD** Medical Device Development and Regulation Research Center, Department of Bioengineering and Department of Precision Engineering, School of Engineering, The University of Tokyo, Tokyo, Japan



**Karl Schaller, MD** Department of Neurosurgery, University of Geneva Medical Center, Medical Faculty of the University of Geneva, Geneva, Switzerland

**Christian Schichor, MD** Department of Neurosurgery, Ludwig-Maximilians-University Munich, Munich, Germany

**Ehud J. Schmidt, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Michael Schulder, MD** Department of Neurosurgery, The Cushing Neuroscience Institute, Hofstra North Shore – LIJ School of Medicine, Manhasset, NY, USA

**Jeff Stoll** Division of Ultrasound, Siemens Healthcare, CA, USA

**Tormod Selbekk, PhD** Department of Medical Technology, SINTEF, Trondheim, Norway

**Roberto Blanco Sequeiros, MD, PhD** Department of Radiology, Oulu University Hospital, Oulu, Finland

**Edward R. Smith, MD** Pediatric Cerebrovascular Surgery, Department of Neurosurgery, Children's Hospital Boston, Harvard Medical School, Boston, MA, USA

**Natalia V. Solenkova, MD, PhD** Vanderbilt Heart & Vascular Institute, Nashville, TN, USA

**Ole Solheim, MD, PhD** Department of Neurosurgery, St. Olavs University Hospital, Trondheim, Norway

**Stephen B. Solomon, MD** Department of Radiology, Memorial Sloan-Kettering Cancer Center, New York, NY, USA

**Garnette R. Sutherland, MD, FRCS(C)** Department of Clinical Neurosciences, University of Calgary, Calgary, AB, Canada

Division of Neurosurgery, Seaman Family MR Research Centre, Foothills Medical Centre, Calgary, AB, Canada

**Gábor Székely, PhD** Computer Vision Laboratory, ETH Zürich, Zürich, Switzerland

**Moritz Tannast, MD** Department of Orthopaedic Surgery, Inselspital, University of Berne, Berne, Switzerland

**Clare M.C. Tempany, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Sylvain Terraz, MD** Department of Radiology, University Hospitals of Geneva, Geneva, Switzerland

**Christopher C. Thompson, MD** Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Nathan Todnem** Department of Neurosurgery, Georgia Regents University, Augusta, GA, USA

**Matthew Toews, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Junichi Tokuda, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

**Jörg-Christian Tonn, MD** Neurosurgical Clinic and Polyclinic, University of Munich Hospital, Munich, Germany

Department of Neurosurgery, Ludwig-Maximilians-University Munich, Munich, Germany

**Chip Truwit, MD** Department of Radiology, HCMC, University of Minnesota School of Medicine, Minneapolis, MN, USA



- Atsushi Tsugu, MD, PhD** Department of Neurosurgery, Tokai University School of Medicine, Isehara, Kanagawa, Japan
- Kemal Tuncali, MD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Eberhard Uhl, MD** Department of Neurosurgery, LKH Klagenfurt, Klagenfurt, Austria
- Ramanan Umakanthan, MD** Vanderbilt Heart & Vascular Institute, Nashville, TN, USA
- Geirmund Unsgård, MD, PhD** Department of Neurosurgery, University Hospital of Trondheim, Trondheim, Norway
- Sudhakar Vadivelu, DO** Department of Neurosurgery, The Cushing Neuroscience Institute, Hofstra North Shore – LIJ School of Medicine, Manhasset, NY, USA
- Gooitzen M. Van Dam, MD, PhD** Department of Surgical Oncology, University Medical Center Groningen, Groningen, The Netherlands
- Ronald A. von Jako, MD, PhD** Department of Surgery, Semmelweis University School of Medicine, Department of Medical and Clinical Affairs, GE Healthcare, Boston, MA, USA
- Kirby G. Vosburgh, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Conor Walsh, PhD** School of Engineering and Applied Sciences, Wyss Institute for Biologically Inspired Engineering, Harvard University, Boston, MA, USA
- Irene S. Wang** Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA
- Stefan Weber, PhD** ARTORG Center for Biomedical Engineering Research, University of Bern, Bern, Switzerland
- William M. Wells, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
- Daniel Wendt, MD** West German Heart Center, University Essen, Essen, Germany
- Christian Wengert, PhD** Computer Vision Laboratory, ETH Zürich, Zürich, Switzerland
- Beat Werner, MSc** MR-Center, University Children's Hospital Zürich, Zürich, Switzerland
- Brendan Whalen, BArch** Partners HealthCare, Boston, MA, USA
- Emmanuel Wilson, MSc** Bioengineering Initiative, Sheikh Zayed Institute for Pediatric Surgical Innovation, Washington, DC, USA
- Malgorzata Wolska-Krawczyk, MD** Department of Radiology, University of Homburg-Saar, Homburg, Saarland, Germany
- Kenneth S. Yonemura, MD** Heiden Davidson Orthopedics, Salt Lake City, UT, USA
- Stefan Zausinger, MD** Neurosurgical Department, Klinikum Grosshadern, Munich, Germany  
Department of Neurosurgery, Ludwig-Maximilians-University Munich, Munich, Germany
- Lei Zhao, PhD** Symbow Medical Technology Co., Ltd., Beijing, China
- Guoyan Zheng, PhD** Institute for Surgical Technology and Biomechanics, University of Bern, Bern, Switzerland
- Gary P. Zientara, PhD** National Center for Image Guided Therapy, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA