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Ultrasonic Imaging and Signal Processing

Stephen A. McAleavey
Jan D'hooge
Editors

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Contents

- ix *Conference Committee*
xi *In Memoriam: Robert F. Wagner (1938–2008)*

SESSION 1 EXPERIMENTAL ULTRASOUND SYSTEMS

- 7265 02 **Experimental validation of A-mode ultrasound acquisition system for computer assisted orthopaedic surgery** [7265-01]
D. De Lorenzo, E. De Momi, E. Beretta, P. Cerveri, Politecnico di Milano (Italy); F. Perona, I.R.C.C.S. Istituto Ortopedico Galeazzi (Italy); G. Ferrigno, Politecnico di Milano (Italy)
- 7265 03 **The ultrasound brain helmet: early human feasibility study of multiple simultaneous 3D scans of cerebral vasculature** [7265-02]
B. D. Lindsey, N. M. Ivancevich, J. Whitman, E. Light, M. Fronheiser, Duke Univ. (United States); H. A. Nicoletto, D. T. Laskowitz, Duke Univ. Medical Ctr. (United States); S. W. Smith, Duke Univ. (United States)
- 7265 04 **High-frequency 3D echodentographic imaging modality for early assessment of periodontal diseases: in vitro study** [7265-03]
A. M. Mahmoud, P. Ngan, R. Crout, O. M. Mukdadi, West Virginia Univ. (United States)
- 7265 05 **Dedicated ultrasound speckle tracking to study tendon displacement** [7265-04]
J.-W. H. Korstanje, R. W. Selles, H. J. Stam, S. E. R. Hovius, J. G. Bosch, Erasmus MC (Netherlands)
- 7265 06 **Breast ultrasound tomography with total-variation regularization** [7265-05]
C. Li, N. Duric, Karmanos Cancer Institute (United States); L. Huang, Los Alamos National Lab. (United States)

SESSION 2 ULTRASOUND SYSTEM DESIGN

- 7265 07 **The first harmonic as a known source for wavefront correction** [7265-06]
S. W. Dianis, O. T. von Ramm, Duke Univ. (United States)
- 7265 08 **PE-CMOS-based C-mode ultrasound: signal acquisition and time gating** [7265-42]
S.-C. B. Lo, Georgetown Univ. Medical Ctr. (United States); C.-C. Liu, Georgetown Univ. Medical Ctr. (United States) and Virginia Polytechnic Institute and State Univ. (United States); M. T. Freedman, S.-K. Mun, Georgetown Univ. Medical Ctr. (United States); J. Kula, M. E. Lasser, B. Lasser, Imperium, Inc. (United States); Y. J. Wang, Virginia Polytechnic Institute and State Univ. (United States)
- 7265 09 **Simulation and experimental analysis of ultrasonic clutter in fundamental and harmonic imaging** [7265-08]
J. J. Dahl, Duke Univ. (United States); G. F. Pinton, ESPCI (France); M. Lediju, G. E. Trahey, Duke Univ. (United States)

- 7265 0A **Ultrasonic array beamforming with iterative spatial filters** [7265-09]
N. Q. Nguyen, Univ. of Illinois at Urbana-Champaign (United States) and Beckman Institute, Univ. of Illinois at Urbana-Champaign (United States); C. K. Abbey, Univ. of California, Santa Barbara (United States); M. F. Insana, Univ. of Illinois at Urbana-Champaign (United States) and Beckman Institute, Univ. of Illinois at Urbana-Champaign (United States)
- 7265 0B **Efficient implementations of ultrasound color Doppler algorithms on VLIW architectures** [7265-10]
U. Dasgupta, D. P. Magee, M. Ali, Texas Instruments Inc. (United States)
- 7265 0C **Waveform synthesis for the design and image reconstruction of step FMCW ultrasound imaging systems with conformal transducer arrays** [7265-11]
M. Lee, Univ. of California, Los Angeles (United States); R. S. Singh, M. O. Culjat, Univ. of California, Los Angeles (United States) and Univ. of California, Santa Barbara (United States); S. Natarajan, B. P. Cox, Univ. of California, Los Angeles (United States); E. R. Brown, Univ. of California, Los Angeles (United States) and Univ. of California, Santa Barbara (United States); W. S. Grundfest, Univ. of California, Los Angeles (United States); H. Lee, Univ. of California, Los Angeles (United States) and Univ. of California, Santa Barbara (United States)

SESSION 3 IMAGE PROCESSING IN ULTRASOUND

- 7265 0D **Automatic alignment of standard views in 3D echocardiograms using real-time tracking** [7265-12]
F. Orderud, H. Torp, Norwegian Univ. of Science and Technology (Norway); S. I. Rabben, GE Vingmed Ultrasound (Norway)
- 7265 0E **Real-time kidney ultrasound image segmentation: a prospective study** [7265-13]
S. Dahdouh, E. Frenoux, A. Osorio, Lab. d'Informatique pour la Mécanique et les Sciences de l'Ingénieur (France)
- 7265 0F **Fetal skull analysis in ultrasound images based on iterative randomized Hough transform** [7265-14]
Y. Shen, Old Dominion Univ. (United States); J. Yu, Fudan Univ. (China); Y. Shen, Old Dominion Univ. (United States); Y. Wang, Fudan Univ. (China)
- 7265 0G **Automated ultrasound measurement of artery thickness** [7265-15]
D. Tahmouh, Univ. of Maryland, College Park (United States); Y.-B. Lee, M.-H. Kim, Ewha Womans Univ. (Korea, Republic of)
- 7265 0H **A Markov-random-field-based filter for speckle reduction in ultrasound imagery** [7265-16]
O. Lankoande, Instrument Technology, Inc. (United States); M. M. Hayat, B. Santhanam, The Univ. of New Mexico (United States)

SESSION 4 KEYNOTE AND PHOTO-ACOUSTICS

- 7265 0J **Simultaneous imaging of ultrasound attenuation, speed of sound, and optical absorption in a photoacoustic setup** [7265-18]
R. G. H. Willeminck, S. Manohar, J. Jose, K. Slump, F. van der Heijden, T. G. van Leeuwen, Univ. of Twente (Netherlands)

- 7265 OK **Photoacoustic imaging with integrating line detectors** [7265-19]
H. Grün, T. Berer, A. Hochreiner, Upper Austrian Research GmbH (Austria) and Research Ctr. for Nondestructive Testing GmbH (Austria); R. Nuster, G. Paltauf, Karl-Franzens-Univ. Graz (Austria); P. Burgholzer, Upper Austrian Research GmbH (Austria) and Research Ctr. for Nondestructive Testing GmbH (Austria)
- 7265 OL **Influence of inhomogeneity of optical absorbers on optoacoustic signals: a comparison between experiment and theory** [7265-20]
A. G. Gertsch, Institute of Cancer Research and The Royal Marsden NHS Foundation Trust (United Kingdom); M. Jaeger, Univ. of Bern (Switzerland); N. L. Bush, Institute of Cancer Research and The Royal Marsden NHS Foundation Trust (United Kingdom); M. Frenz, Univ. of Bern (Switzerland); J. C. Bamber, Institute of Cancer Research and The Royal Marsden NHS Foundation Trust (United Kingdom)
- 7265 OM **Quantitative acousto-optic imaging in tissue-mimicking phantoms** [7265-21]
R. Molenaar, A. Bratchenia, R. P. H. Kooyman, Univ. of Twente (Netherlands)

SESSION 5 ULTRASOUND SURGERY AND GUIDANCE

- 7265 ON **2D array transducers for real-time 3D ultrasound guidance of interventional devices** [7265-22]
E. D. Light, S. W. Smith, Duke Univ. (United States)
- 7265 OO **Real-time 3D ultrasound guidance of autonomous surgical robot for shrapnel detection and breast biopsy** [7265-23]
A. J. Rogers, E. D. Light, Duke Univ. (United States); D. von Allmen, Univ. of North Carolina School of Medicine (United States); S. W. Smith, Duke Univ. (United States)
- 7265 OQ **Temperature monitoring during tissue freezing using ultrasound speed measurements** [7265-25]
I. Jovanović, A. Hormati, Ecole Polytechnique Fédérale de Lausanne (Switzerland); P. Littrup, N. Duric, O. Rama, Karmanos Cancer Institute (United States); M. Vetterli, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 7265 OR **Three-dimensional heat-induced echo-strain imaging for monitoring high-intensity acoustic ablation** [7265-26]
E. M. Boctor, N. Deshmukh, M. S. Ayad, C. Clarke, Johns Hopkins Medical Institutions (United States); K. Dickie, Ultrasonix Medical Corp. (Canada); M. A. Choti, Johns Hopkins Medical Institutions (United States); E. C. Burdette, Acoustic MedSystems, Inc. (United States)

SESSION 6 NEW DEVELOPMENTS IN VASCULAR IMAGING

- 7265 OS **Elastography based on mechanical and image energy minimization** [7265-27]
M. Abdelali, Institut de Génie Biomédical, École Polytechnique de Montréal (Canada); R. Mongrain, McGill Univ. (Canada) and Montreal Heart Institute (Canada); M. J. Bertrand, Institut de Génie Biomédical, École Polytechnique de Montréal (Canada) and Montreal Heart Institute (Canada)

- 7265 OT **Simple fast noninvasive technique for measuring brachial wall mechanics during flow mediated vasodilatation analysis** [7265-28]
A. M. Mahmoud, P. A. Stapleton, J. C. Frisbee, A. D'Audiffret, O. M. Mukdadi, West Virginia Univ. (United States)
- 7265 OU **Understanding quantification of microvasculature with high-frequency power Doppler ultrasound** [7265-29]
S. Z. Pinter, J. C. Lacefield, The Univ. of Western Ontario (Canada) and Robarts Research Institute, The Univ. of Western Ontario (Canada)
- 7265 OV **Color flow image segmentation** [7265-30]
J. Zhang, W. Hu, Univ. of Wisconsin, Milwaukee (United States); Z. Wu, GE Healthcare (United States)
- 7265 OW **Supercompound imaging with Weiner deconvolution** [7265-31]
T. Chiu, J. Macione, S. Contreras, E. Sirois, W. Sun, M. Fox, Univ. of Connecticut (United States)
- 7265 OX **IVUS coronary volume alignment for distinct phases** [7265-32]
M. M. S. Matsumoto, P. A. Lemos, Heart Institute do Hospital das Clínicas da Faculdade de Medicina Univ. de São Paulo (Brazil); S. S. Furuie, Heart Institute do Hospital das Clínicas da Faculdade de Medicina Univ. de São Paulo (Brazil) and Univ. de São Paulo (Brazil)

SESSION 7 ULTRASOUND TOMOGRAPHY

- 7265 OY **A novel synthetic aperture technique for breast tomography with toroidal arrays** [7265-33]
F. Simonetti, Imperial College London (United Kingdom) and Los Alamos National Lab. (United States); L. Huang, Los Alamos National Lab. (United States)
- 7265 OZ **Enhancement of compounded ultrasound images using spatial filtering** [7265-34]
J. Nebeker, T. R. Nelson, Univ. of California, San Diego (United States)
- 7265 10 **Breast imaging with acoustic tomography: a comparative study with MRI** [7265-35]
B. Ranger, P. Littrup, N. Duric, C. Li, J. Lupinacci, L. Myc, O. Rama, L. Bey-Knight, Karmanos Cancer Institute, Wayne State Univ. (United States)

SESSION 8 ULTRASOUND ELASTICITY IMAGING

- 7265 11 **Frequency compounding in multifrequency vibroacoustography** [7265-36]
M. W. Urban, A. Alizad, M. Fatemi, Mayo Clinic College of Medicine (United States)
- 7265 12 **Acoustic-radiation-force-induced shear wave propagation in cardiac tissue** [7265-37]
R. R. Bouchard, P. D. Wolf, S. J. Hsu, D. M. Dumont, G. E. Trahey, Duke Univ. (United States)
- 7265 13 **Prostate cancer detection using crawling wave sonoelastography** [7265-38]
B. Castaneda, Univ. of Rochester (United States) and Pontificia Univ. Católica del Perú (Peru); L. An, S. Wu, Univ. of Rochester (United States); L. L. Baxter, J. L. Yao, J. V. Joseph, Univ. of Rochester Medical Ctr. (United States); K. Hoyt, The Univ. of Alabama at Birmingham (United States); J. Strang, D. J. Rubens, Univ. of Rochester Medical Ctr. (United States); K. J. Parker, Univ. of Rochester (United States)

- 7265 14 **Estimating elastic modulus of soft tissue from incomplete displacement measurement** [7265-39]
Y. Yamashita, K. Machida, F. Yan, Nihon Univ. (Japan)

POSTER SESSION

- 7265 15 **Spatial compounding of large sets of 3D echocardiography images** [7265-40]
C. Yao, King's College London (United Kingdom); J. M. Simpson, Evelina Children's Hospital (United Kingdom); C. H. P. Jansen, A. P. King, G. P. Penney, King's College London (United Kingdom)
- 7265 16 **Tissue typing with ultrasound RF time series: phantom studies** [7265-41]
M. Moradi, Univ. of British Columbia (Canada); P. Mousavi, Queen's Univ. (Canada); R. Rohling, Univ. of British Columbia (Canada); P. Abolmaesumi, Queen's Univ. (Canada)
- 7265 17 **Monitoring breast masses with ultrasound tomography in patients undergoing neoadjuvant chemotherapy** [7265-43]
J. Lupinacci, N. Duric, P. Littrup, D. Wang, C. Li, S. Schmidt, O. Rama, L. Bey-Knight, L. Myc, Karmanos Cancer Institute, Wayne State Univ. (United States)
- 7265 18 **Operator guidance in 2D echocardiography via 3D model to image registration** [7265-44]
C. Bergmeir, N. Subramanian, GE Global Research (India)
- 7265 19 **Super-resolution of ultrasound images by displacement, averaging, and interlacing** [7265-45]
S. H. Contreras Ortiz, J. Macione, T. Chiu, M. D. Fox, Univ. of Connecticut (United States)
- 7265 1A **Fusion of electromagnetic tracking with speckle-tracked 3D freehand ultrasound using an unscented Kalman filter (Honorable Mention Poster Award)** [7265-46]
A. Lang, P. Mousavi, G. Fichtinger, P. Abolmaesumi, Queen's Univ. (Canada)
- 7265 1B **Multi-modality fusion of CT, 3D ultrasound, and tracked strain images for breast irradiation planning (Cum Laude Poster Award, Best Student Paper Runner-Up)** [7265-47]
P. Foughi, C. Csoma, H. Rivaz, The Johns Hopkins Univ. (United States); G. Fichtinger, The Johns Hopkins Univ. (United States) and Queen's Univ. (Canada); R. Zellars, G. Hager, E. Boctor, The Johns Hopkins Univ. (United States)
- 7265 1C **Three-dimensional visualization of pulsatile tissue-motion in B-mode ultrasonogram of neonatal cranium** [7265-48]
M. Fukuzawa, H. Kawaguchi, M. Yamada, N. Nakamori, Kyoto Institute of Technology (Japan); Y. Kitsunozuka, Saiseikai Hyogo-ken Hospital (Japan)
- 7265 1D **New flexible multi-volume rendering technique for ultrasound imaging** [7265-49]
E.-H. Kim, Univ. of Washington (United States); R. Managuli, Univ. of Washington (United States) and Hitachi Medical Systems America, Inc. (United States); Y. Kim, Univ. of Washington (United States)
- 7265 1E **Semiautomatic determination of the reconstruction volume for real-time freehand 3D ultrasound reconstruction** [7265-50]
Y. Dai, J. Tian, J. Zheng, Institute of Automation (China)

- 7265 1F **Harmonic Golay coded excitation using mutually orthogonal Golay codes and pulse inversion** [7265-51]
S.-M. Kim, J.-H. Song, T.-K. Song, Sogang Univ. (Korea, Republic of)
- 7265 1G **Detection and characterization of breast masses with ultrasound tomography: clinical results** [7265-52]
N. Duric, P. Littrup, C. Li, O. Rama, L. Bey-Knight, S. Schmidt, J. Lupinacci, Karmanos Cancer Institute, Wayne State Univ. (United States)
- 7265 1H **Minimizing errors in ultrasound measurements** [7265-53]
D. Tahmouh, Univ. of Maryland, College Park (United States) and U.S. Army Research Lab. (United States)
- 7265 1I **Reconstruction algorithms for interior and exterior spherical Radon transform-based ultrasound imaging** [7265-54]
R. S. Vaidyanathan, M. A. Lewis, The Univ. of Texas Southwestern Medical Ctr. at Dallas (United States); G. Ambartsoumian, T. Aktosun, The Univ. of Texas at Arlington (United States)

Author Index

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Session Chairs

- 1 Experimental Ultrasound Systems
Jan D'hooge, Katholieke Universiteit Leuven (Belgium)
- 2 Ultrasound System Design
Kai E. Thomenius, GE Global Research (United States)
- 3 Image Processing in Ultrasound
Johan G. Bosch, Erasmus Universiteit Rotterdam (Netherlands)
- 4 Keynote and Photo-acoustics
Jan D'hooge, Katholieke Universiteit Leuven (Belgium)
Stanislav Y. Emelianov, The University of Texas at Austin (United States)
- 5 Ultrasound Surgery and Guidance
Gregg E. Trahey, Duke University (United States)

- 6 New Developments in Vascular Imaging
Michael F. Insana, University of Illinois at Urbana-Champaign
(United States)
- 7 Ultrasound Tomography
Stephen A. McAleavey, University of Rochester (United States)
- 8 Ultrasound Elasticity Imaging
Stephen A. McAleavey, University of Rochester (United States)

In Memoriam
Robert F. Wagner
1938–2008



**A founding scientist and prolific contributor
to modern medical imaging science and SPIE**

Robert F. "Bob" Wagner was a tremendous innovator in the field of medical imaging and image assessment methodologies. He was a key figure in the creation of the SPIE Medical Imaging symposium. An SPIE Fellow since 1988, Bob was active on the program committee of the Physics of Medical Imaging conference at the Medical Imaging symposium, and author of numerous technical papers published by SPIE.

"The medical imaging community has lost one of its founding fathers and most highly regarded members," said Kyle Myers, director of the Division of Imaging and Applied Mathematics at the Center for Devices and Radiological Health (CDRH), U.S. Food and Drug Administration (FDA). "Bob's career was dedicated to the development of consensus measurement methods for the assessment of medical imaging systems, quantitative medical imaging and tissue characterization, and computer-aided diagnosis. He earned an international reputation in these areas and applied his expertise to a wide range of regulatory issues central to the FDA's mission. He enlightened the scientific community within the agency as well as the international scientific community through the many invited presentations and tutorials he gave in and outside of the FDA, his numerous publications, his many professional society activities, and his assistance in regulatory decision making."

At this 2009 Medical Imaging symposium, a joint keynote session hosted by the CAD and Image Perception conferences honored Bob's many contributions from the early 1970s to the present through a series of presentations by some of his closest collaborators.

David Brown (CDRH/FDA) recalled Bob's early years in the field, relating that after graduate and post-graduate work on the physics of nuclear interactions with radiation, Bob was hired by the Bureau of Radiological Health [a precursor to CDRH] to assess the dose reduction potential of radiographic intensifying screens made with phosphors developed in the color TV industry. Within three months he published a review of the relevant imaging literature from the medical, defense, consumer, and scientific communities, together with a charter for a laboratory program. Soon after, Bob introduced digital noise analysis to radiography, and showed that the new technology offered a 1.6- to 2.5-fold exposure reduction without compromising imaging performance. He then launched a program of inter-laboratory comparison of measurements on radiographic film samples that were circulated among fifteen commercial, government, and academic laboratories worldwide. In the process he became the prime mover for work toward consensus methodology for quantitative imaging performance measurements.

Mike Insana (Univ. of Illinois at Urbana-Champaign) shared memories of his years as Bob's post-doctoral student, working with Bob on the statistical characterization of ultrasound images. He described Bob as an exemplary mentor who shared his passion and joy for science.

Myers agreed, "Bob's greatest legacy may be the many young scientists he nurtured, who either worked directly under his tutelage at the FDA or otherwise benefitted from his unflinching patience and unselfish ease of availability."

Harry Barrett (Univ. of Arizona) began his presentation by relating noise-equivalent quanta (NEQ)—a concept central to Bob's unified approach to objective image performance assessment—to historical information-theoretic methods for evaluation of imaging systems. Barrett went on to describe the many ways in which NEQ was extended to address problems beyond the simple signal-known-exactly, background-known-exactly (SEK/BKE) task.

Ken Hanson (Los Alamos National Lab.) described his years of collaboration with Bob. He said they worked together, first in the area of noise characterization of radiographic and CT images and later on the evaluation of images confounded by artifacts. In this latter work, Bob and Ken pioneered the application of a decision theoretic approach to the assessment of image reconstruction algorithms, demonstrating that the common mean-square-error metric did not predict visual task performance as measured by detectability.

Bob's contemporary work, as described by Myers, "involved the consideration of the random effects associated with multiple readers of medical images and the logical extension of this work to the problem of the evaluation of multiple competing classifiers in statistical pattern recognition. Bob tackled problems of increasing complexity over the course of his career, relying throughout on the application of a unified, decision theoretic framework. In the process he brought about consensus on the importance of a task-based approach to the objective assessment of imaging systems."

During more than forty years of professional life, Bob Wagner made numerous contributions to the field of medical imaging that significantly impacted academia, industry, and the FDA. His brilliant mind, incredible intuition, passion for science, sense of humor, charm, and warm friendship will be greatly missed.