

Michael J. Zipparo, Ph. D.

Phone: 443-466-6124 • e-mail: michael.zipparo@gmail.com

OBJECTIVE

I am an energetic and experienced scientist with knowledge across a diverse range of technology associated with electroacoustic energy conversion and associated system level control and interface. I am pursuing opportunities around medical and industrial application of ultrasound for imaging and / or therapeutic applications. This includes transducer and array acoustic design and processing, as well as integration of probes to a system for optimal imaging performance. I am also pursuing the development, prototyping, and custom implementation of high performance sound reproduction systems for music and home theater listening with an unusual combination of fidelity and acoustic output.

EDUCATION

The Pennsylvania State University

12/96 Ph.D. Bioengineering – Dissertation “Very high frequency (50-100 MHz) ultrasonic transducers for medical imaging applications.” Course work including medical imaging technology (CT, MRI, ultrasound), medical instrumentation, physiology, material science and crystallography.

12/93 M.S. Acoustics, Thesis “Computer modeling of ultrasonic piezoelectric transducers.” Course work including fundamentals wave propagation, transmission at interfaces, electroacoustic transduction, equivalent circuit modeling, and signal processing.

5/91 B.S. Electrical Engineering, Honors Thesis “Development of a moving-coil underwater transducer”. Course work including electrical circuit design, microelectronics, signal analysis, digital signal processing.

PROFESSIONAL EXPERIENCE

Sylvan Acoustics, Inc. – Founder and President (09/14– present) Consultation and design of high performance electroacoustic transducers and systems for sound (audio) and ultrasound (medical imaging / diagnostics and therapeutics, and industrial NDT applications).

Ultrasound: Design, development, and manufacture of high performance arrays for medical imaging and therapy applications, including but not limited to:

- a. Active (piezo) and passive material physical characterization
- b. Acoustic stack design for wide bandwidth and high sensitivity
- c. Interconnect design for high density and minimal package volume
- d. Acoustic design and fabrication process for 1.25-D to 2-D arrays
- e. Design of miniature arrays for scope and catheter based intervention
- f. Low loss arrays for improved power delivery capability
- g. Manufacturing support for improved yield and performance uniformity and lower labor content
- h. System integration of ultrasound probes

Audio: Design, development, and prototyping of custom sound reproductions systems for audio and home theater

- a. Subwoofer enclosure design and driver selection for optimum low frequency response
- b. Woofer, midrange, tweeter integration for uniform power and temporal accuracy
- c. Electronic crossover design and multiple power amp implementations
- d. Horn design for improved efficiency
- e. Loudspeaker line arrays
- f. Component and system design, manufacture, and setup for in-room sound and aesthetics.

W. L. Gore and Associates – Ultrasound Technologist (4/05– 05/14) Broad range of roles including research and development, engineering pre-production, release to manufacturing, and manufacturing support for ultrasound imaging arrays and cabling products. Manufacturing engineering, troubleshooting, materials and process optimization for improved yield and process stability. Refinement of miniature ultrasound imaging array fabrication process for catheter-based products. Materials characterization for super-attenuative backing and application to third-generation MicroArray process. Transition of complicated array manufacturing process to East Coast, including development of transition plan, training of engineers and technicians, evaluation of transition metrics and progress, and validation of process replication at destination.

Tetrad Corp. – Research and Development Engineer (5/98– 4/05) Primary responsibility developing and implementing advanced piezoelectric materials and interconnect / packing approaches for ultrasound imaging transducers, funded under multiple government programs, university collaborations, and industry product development. Preparation of proposals for government funding agencies (DARPA, ONR, NIH) through SBIR program. Program management from contract negotiation, budgeting, resource and technical planning, through to final reporting. Longer-term commercial product development was emphasized when selecting and conducting research programs. Main projects include single crystal relaxor ferroelectrics and multilayer ceramics / composites applied to a variety of high-end medical imaging arrays. Also, development of multirow array technology, including arrays with electronics integrated into the handle. Managed a group consisting of three technicians and one R&D engineer, plus support from Engineering, Quality, and Manufacturing departments. Responsible for planning short term to long term strategies for reaching technical goals, including developing experiments and test methods, troubleshooting problems, and optimizing available resources to most efficiently reach objectives. Implemented finite element modeling (PZFlex) to serve as a tool for designing complicated high performance transducers. Also provided input to Engineering, Quality, and Manufacturing departments on acoustics, manufacturing troubleshooting, Q/A testing and test method development, and a variety of other technical issues.

Advanced Coronary Intervention, Inc. - Principal Engineer (1/97 – 5/98) Primary leadership in developing 1.2 mm diameter circular ultrasound array for intravascular imaging applications. Responsibilities include design and testing of custom multi-layer flex circuit; acoustic design and manufacturing of piezoceramic array including tooling, bonding, dicing and forming methods; testing of prototypes; design and interconnection of multi-coax bundle to flex, including interaction with imaging system; catheter design and fabrication methods; developing methods to attach custom ASIC MUX chip to flex circuit by flip chip bonding.

Sound Technology, Inc. - Transducer Engineer - (6/95 – 1/97) Internship / consulting. Implementation and verification of custom KLM model in Mathcad. Use of model as an optimization tool for curved linear array transducers, including electric and acoustic matching. Study of the effect of acoustic testing conditions on the measured response.

Blatek, Inc. - Design Engineer - (6/91 - 3/93) Planning and implementing designs of ultrasonic transducers for medical and industrial applications. Responsibility for projects from customer interface through to manufacturing and quality control testing. Responsibility for all production testing including development and supervision of testing procedures for all phases of the production cycle.

PEER REVIEWED ARTICLES

Michael J. Zipparo, Kristin F. Bing, and Kathy R. Nightingale, "Imaging Arrays with Improved Transmit Power Capability." *IEEE Trans. UFFC*, vol 57, No 9, pp 2076-2090, Sept. 2010.

M.J. Zipparo, K.K. Shung and T.R. Shrout, "Piezoelectrics for high frequency (20-100 MHz) single element imaging transducers, *IEEE Trans. UFFC*, vol 44, pp 1028-1048, 1997.

K.K. Shung and M. Zipparo, "Ultrasonic Transducers and Arrays," *IEEE Eng. Med Biol.*, Vol 15, pp 20-30, 1996.

CONFERENCE ARTICLES AND PRESENTATIONS

Zipparo, M.J., Oakley, C. ; Denny, R. ; Azim, S. ; Balannik, V. ; Soferman, Z. ; Berman, M. ; Nechushtai, R. ; Kopelman, D., "3-D laparoscopic imaging," *Proc. 2008 IEEE Ultras. Symp.*, Beijing, China, Nov. 2008 (did not present).

M. Zipparo, "Ultrasound Imaging Arrays with Improved Transmit Power Capability," *Proc. 2008 International Symposium on the Application of Ferroelectrics*, Santa Fe, NM, Feb 2008.

M. Zipparo, "Ultrasound Imaging Arrays with Improved Transmit Power Capability," 2007 USC Ultrasound Transducer Engineering Conference, Los Angeles, CA, April 2007 (Invited).

M.J. Zipparo, C.G. Oakley, M. Stolberg, and J. Kuhnke, "Direct attach of planar-based and ribbon-based cables to ultrasound imaging arrays," *Proc. 2007 IEEE Ultras. Symp.*, New York, NY, Oct. 2007 (poster).

C. Oakley, M. Zipparo, D. Patwa, J. Mueller, "A Matrix Method for Modeling Electrical Crosstalk Applied to Ultrasonic Imaging Probes using Micro-miniature Ribbon Cable," *Proc. 2006 IEEE Ultras. Symp.*, Vancouver, Canada, (Oct. 2006, did not present).

M. J. Zipparo, "Multilayer ultrasound imaging arrays showing improved thermal performance," *Proc. 2005 IEEE Ultras. Symp.* Rotterdam, the Netherlands (Sept. 2005, poster).

M. J. Zipparo and C. G. Oakley, "Transducer technologies for emerging imaging modes," American Institute of Ultrasound in Medicine (AIUM), Orlando, FL, June 2005 (Invited).

M. J. Zipparo, C. G. Oakley, D. M. Mills, A. M. Dentinger, and L. S. Smith, "A multirow single crystal phased array for wideband ultrasound imaging," *Proc. 2004 IEEE UFFC Joint Conf. on Ultras. Ferroel. And Freq. Cont.*, Montreal, Canada, (August 2004).

Michael J. Zipparo, "Mid to high power ultrasound imaging arrays – from ARFI to HIFU", *Proc. 2003 IEEE Ultras. Symp.*, Honolulu, Hawaii, (October 2003).

M. J. Zipparo and C.G. Oakley, "Advanced transducer materials for ultrasonic imaging probes," *Proc. 2002 IEEE Ultras. Symp.*, Munich, Germany, (Oct. 2002).

M.J. Zipparo and C.G. Oakley, "Application of single crystal relaxor ferroelectric materials to medical imaging arrays," 142nd Meeting of the Acous. Soc. Amer., Dec. 6, 2001, Ft. Lauderdale, FL (Invited).

M. J. Zipparo and C. G. Oakley, "Finite Element Modeling of PZN-PT and PMN-PT Single Crystal Materials," *Proc. 2001 IEEE Ultras. Symp.*, Atlanta, GA, (Oct 2001).

C. Oakley and M. Zipparo, "Single crystals, a revolutionary development for transducers," *Proc. 2000 IEEE Ultras. Symp.*, San Juan, Puerto Rico, (Oct 2000, did not present).

M. Zipparo, and C. Oakley, "Medical Imaging Phased Arrays using Multilayer Ceramics and Composites," *Proc. 2000 IEEE Ultras. Symp.*, San Juan, Puerto Rico, (Oct 2000).

M.J. Zipparo and C.G. Oakley, "Single crystal PMN-PT and PZN-PT ultrasonic imaging arrays," *Proc. 2000 International Symposium on the Application of Ferroelectrics*, Honolulu, HA, (Aug 2000).

M.J. Zipparo, C.G. Oakley, and M. He, "Multilayer ceramics and composites for ultrasonic imaging arrays," *Proc. 1999 IEEE Ultras. Symp.*, pp. 947-952., Lake Tahoe, NV, (Oct. 1999).

M. Zipparo, C. Oakley, W. Hackenberger, L. Hackenberger, "Single crystal 1-3 composites and transducers," *Proc. 1999 IEEE Ultras. Symp.*, Lake Tahoe, NV, (Oct. 1999).

C.G. Oakley, M.J. Zipparo, L.M. Koornneer, B.G. Pazol, K.M. Gabriel, M.S. Callahan, "A 2.5 MHz phased array made from stacked piezoelectric composite," *Proc. 1998 IEEE Ultras. Symp.*, Sendai, Japan, (Oct. 1998, did not present).

Zipparo, M.J., Shung, K.K., and Shrout, T.R., "Piezoceramics for high frequency (20-100 MHz) transducers and arrays," *Proc. of the 1997 IEEE Ultrasonics Symp.*, pp. 1663-1667, Toronto, Canada, (Oct. 1997).

Zipparo, M.J., Shung, K.K., and Shrout, T.R., "Piezoceramics for high frequency (50-100 MHz) single element imaging transducers", *Proc. of SPIE – Thin International Society for Optical Engineering*, vol. 3037, pp. 148-157, (1997).

Zipparo, M.J., Shung, K.K., and Shrout, T.R., "Piezoceramics for high frequency (50-100 MHz) single element imaging transducers", *Proc. of the 1996 IEEE Ultrasonics Symp.*, pp. 929-934, San Antonio, TX, (Oct. 1996).

Park, S.-E., Mulvihill, M.L., Lopath, P.D., Zipparo, M.J., and Shrout, T.R., "Crystal growth and ferroelectric related properties of $(1-x)\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3-x\text{PbTiO}_3$ ($A=\text{Zn}^{2+}, \text{Mg}^{2+}$)," *Proc. of the 10th IEEE International Symposium on the Applications of Ferroelectrics (ISAF)*, East Brunswick, NJ, (Aug 1996, did not present).

M.J. Zipparo, T.R. Shrout, and K.K. Shung, "High frequency properties of piezoceramic resonators," *Proc. 1996 International Symposium on the Application of Ferroelectrics*, East Brunswick, NJ, (Aug 1996)

M.J. Zipparo, K.K. Shung and T.R. Shrout, "Piezoelectric properties of fine grain PZT materials," *Proc. 1995 IEEE Ultras. Symp.*, Seattle, WA, (Oct 1995).

PATENTS

"Ultrasonic Attenuation Materials, C.G. Oakley, M.J. Shepard, H. Scholz, and M.J. Zipparo, US 8,556,030, October 2013

"Ultrasonic Attenuation Materials, C.G. Oakley, M.J. Shepard, H. Scholz, and M.J. Zipparo, US 7,956,514, June 2011

"Method of Manufacturing an Ultrasound Probe Transducer Assembly," M.J. Zipparo, M.P. Johnson, C.G. Oakley, D.R. Dietz, M.R. LaBree, M.N. Donhowe, US 7,908,721, March 2011

"Improved Ultrasonic Attenuation Materials, C.G. Oakley, M.J. Shepard, H. Scholz, and M.J. Zipparo, US 7,808,157 Oct. 2010

"Ultrasound Probe," M.J. Zipparo and M.P. Johnson, US 7,249,513, July 2007

"Ultrasound transducer array probe for intraluminal imaging catheter", A. Hadjicostis, M.J. Zipparo, and L.P. Westwood, US 5,947,905, Sept. 1999.

AWARDS AND HONORS

Research Grants

NIH Phase II SBIR (1R43EB00852-01), Principal Investigator – Ultrasound Imaging Arrays with Improved Transmit Power Capability

NIH Phase I SBIR, Principal Investigator – Ultrasound Imaging Arrays with Improved Transmit Power Capability

DARPA Phase II SBIR, Principal Investigator – Ultrasound Blanket / Deep Bleeder Acoustic Coagulator

DARPA Phase I SBIR (DAAH01-02-C-R044), Principal Investigator – A Study on the feasibility of designing, fabricating, and operating a virtual ultrasound array, 11//2001 – 7/2002

DARPA Phase I SBIR, Principal Investigator – Multilayer single crystal composites

ONR/DARPA Phase II SBIR (N00014-98-C-0280), Co-Principal Investigator – Single crystal materials applied to multirow arrays for combat casualty care, 5/1998 – 7/2003

NIH Program Review Panel Participant

NIH Review Session 2008-05 ZRG1 SBIB-U (91) S - February 18, 2008

NIH Review Session ZRG1 SBIB-U (91) CSR Special Emphasis Panel Innovative Ultrasound and Imaging - October 11, 2007

NIH Review Session ZRG1 SBMI-R(12)B - June 27, 2005

Peer-reviewer

IEEE Trans. UFFC
Ultrasonics

Misc.

Member IEEE, UFFC Society, IEEE Single crystal relaxor ferroelectrics standards committee, IEEE Standards Association

INTERESTS

Woodworking, bicycling, hiking, camping, photography, home brewing, independent music.