

ROBERT C. MAHER, PH.D., P.E.

Work: Electrical and Computer Engineering
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PROFESSIONAL EXPERIENCE

MONTANA STATE UNIVERSITY, Bozeman, Montana **2002-PRESENT**

Professor of Electrical and Computer Engineering with tenure (7/08 – present)

Department Head, Electrical and Computer Engineering (8/07-8/17)

Affiliate Professor of Music Technology (05/09-present)

Associate Professor of Electrical and Computer Engineering with tenure (5/05-8/07)

Associate Professor of Electrical and Computer Engineering (8/02-5/05)

- ◆ Academic administration, teaching, research and service responsibilities.
- ◆ Established a funded research program in audio DSP.
- ◆ Teaching a variety of courses at both the undergraduate and graduate levels.

UNIVERSITY OF COLORADO, Boulder, Colorado **2001-2002**

Associate Professor Adjunct of Electrical and Computer Engineering

- ◆ Academic instructional assignment for Senior Design Lab, and DSP Microprocessor Lab.

EUPHONICS, INC./3COM CORPORATION/U.S. ROBOTICS CORPORATION **1997-2001**

EUPHONICS was acquired by 3COM in 1998 and spun off as part of U.S. ROBOTICS in 2000.

Engineering Manager, Research and Development, U.S. ROBOTICS (6/00-6/01)

Engineering Manager for Audio Product Development, 3COM (11/98-6/00)

Vice President of Engineering, EUPHONICS (5/97-11/98)

Director of Engineering, EUPHONICS (1/97-5/97)

- ◆ Hands-on experience creating new DSP algorithms, publications, and patents.
- ◆ Hired, trained and supervised ten DSP software engineers (including guidance, annual evaluations and individual goal setting).
- ◆ Direct budget responsibility of \$1.2M per year.

UNIVERSITY OF NEBRASKA, Lincoln, Nebraska **1989-1997**

Associate Professor of Electrical Engineering with tenure (8/95-1/97)

Assistant Professor of Electrical Engineering (8/89-8/95)

- ◆ Initiated and directed a funded research and teaching program in audio DSP.
- ◆ Supervised theses of 19 graduate students in the field of digital audio signal processing.
- ◆ Broad participation in the electrical engineering academic program.

AUDIO DSP CONSULTING **1989-PRESENT**

Sole Proprietor, Consulting and Contracting Professional Services

- ◆ Consulting services to clients in digital signal processing for audio and entertainment products.
- ◆ Supervision of sub-contractors for embedded software development.

PROFESSIONAL EXPERIENCE (cont.)

UNIVERSITY OF ILLINOIS, Urbana, Illinois

1985-1989

Research Assistant, Electrical Engineering

- ◆ Software development for digital audio applications (DSP and Intel assembler, and C).
- ◆ Implemented a set of six computer-based musical acoustics demonstrations.
- ◆ Wrote one of the first PC-based real-time direct-to-disk digital audio recorders in assembler for a Texas Instruments DSP chip in a standard IBM PC-AT.

EDUCATION

Ph.D. - Electrical Engineering, University of Illinois,
College of Engineering, Urbana, Illinois, 1989

Thesis: "An Approach for the Separation of Voices in Composite Musical Signals"
Thesis Advisor: James W. Beauchamp

MS - Electrical Engineering, University of Wisconsin,
College of Engineering, Madison, Wisconsin, 1985

Report: "Development of a Software-Based Real-Time Digital Synthesizer"

BS - Electrical Engineering, *Magna Cum Laude*, Washington University,
School of Engineering, St. Louis, Missouri, 1984

RESEARCH FUNDING SPONSORS (COMPETITIVE)

National Institute of Justice, U.S. Department of Justice
National Science Foundation
National Park Service
NASA/Montana Space Grant Consortium
The Engineering Foundation
Advanced Acoustic Concepts, Inc.
Ariel Corporation
EuPhonics, Inc.
General Atomics, Inc.
Motorola Corporation
Sanchez Industrial Design, Inc.
Northwest Academic Computing Consortium
MSU Space Science and Engineering Laboratory
Montana Institute on Ecosystems
University of Illinois Research Board
UNL Center for Communication and Information Science
Nebraska Research Initiative

LEADERSHIP ACTIVITIES and PROFESSIONAL AFFILIATIONS

- ◆ Licensed Professional Engineer, Montana, License #18993
- ◆ Fellow, Audio Engineering Society
- ◆ Associate Technical Editor, Journal of the Audio Engineering Society (2007-present)
- ◆ Review Board Member, Audio Engineering Society (1998-present)
- ◆ Papers Co-Chair, Audio Engineering Society 141st Convention (2016)
- ◆ Papers Co-Chair, Audio Engineering Society 137th Convention (2014)
- ◆ Papers Co-Chair, Audio Engineering Society 129th Convention (2010)
- ◆ Papers Co-Chair, Audio Engineering Society 125th Convention (2008)
- ◆ Papers Co-Chair, Audio Engineering Society 121st Convention (2006)
- ◆ Papers Co-Chair, Audio Engineering Society 117th Convention (2004)
- ◆ Student Technical Paper Awards Coordinator, Audio Engineering Society (2008-present)
- ◆ Chairman, Audio Engineering Society Colorado Section (1998-2001)
- ◆ Member, Audio Engineering Society Technical Committee on Audio Forensics
- ◆ Member, Audio Engineering Society Technical Committee on Signal Processing
- ◆ Member, Acoustical Society of America
- ◆ Member, American Society for Engineering Education
- ◆ Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
- ◆ Associate Member, American Academy of Forensic Sciences
- ◆ Publications Chair, IEEE Digital Signal Processing Workshop (2006)
- ◆ Chairman, IEEE Nebraska State Section (1995-1996)
- ◆ Chairman, IEEE Central Montana Section (2017-present)
- ◆ Publications Chair, IEEE Workshop Applications of Signal Processing to Audio & Acoustics (1995)
- ◆ Advisory Board Member, National Center for Media Forensics (2009-2012)
- ◆ MSU Sigma Xi (Scientific Research Society) chapter co-president (2007-present)
- ◆ MSU Planning Council Representative for College of Engineering (2011-2015)
- ◆ MSU Graduate Council Representative for College of Engineering (elected) (2003-2009)
- ◆ MSU Advising Council Representative for College of Engineering (appointed) (2005-2007)
- ◆ External Advisory Board, University of Nebraska Electrical Engineering (1998-2000)
- ◆ International Program Committee member, IEEE Electro Information Technology conference (2005)
- ◆ FCC Amateur Radio License, Amateur Extra class, Call Sign NR7B

ACADEMIC HONOR SOCIETIES

Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, and Sigma Xi.

AWARDS and HONORS

- ◆ MSU College of Engineering Outreach Award (2017)
- ◆ MSU Academic Advising Award (2013)
- ◆ National Academic Advising Association (NACADA) Outstanding Faculty Advisor Award (2012)
- ◆ MSU James and Mary Ross Provost's Award for Excellence (2009)
- ◆ MSU Buy-out for Enhancing Scholarship and Teaching (BEST) Award (2004)
- ◆ U. of Nebraska College Distinguished Teaching Award (1995)
- ◆ U. of Nebraska Parents' Association Recognition Award for Contributions to Students (1991, 93, 94)
- ◆ U. of Nebraska IEEE Student Chapter: Outstanding Faculty Award (1990, 1994); Tau Beta Pi: Outstanding Teacher Award (1993); College of Engineering: College Teaching Award (1992)

SCHOLARSHIPS/FELLOWSHIPS

- ◆ NSF Graduate Fellowship
- ◆ Audio Engineering Society Educational Grant
- ◆ University of Illinois and University of Wisconsin Graduate Fellowships
- ◆ Washington University Langsdorf Undergraduate Fellowship
- ◆ National Merit and National Honor Society Scholarships

UNITED STATES PATENTS

- (4) D. Kosek and R.C. Maher, "Audio Spectral Noise Reduction Method and Apparatus," Patent Number 7,742,914, June 22, 2010.
- (3) R.C. Maher and J. Barish, "Scalable Audio Processing on a Heterogeneous Processor Array," Patent Number 6,301,603, October 9, 2001.
- (2) R.C. Maher, "Audio Spatial Enhancement Apparatus and Methods," Patent Number 6,111,958, August 29, 2000.
- (1) R.C. Maher, "Audio Spatial Localization Apparatus and Methods," Patent Number 6,078,669, June 20, 2000.

FULLY REFEREED JOURNAL ARTICLES

These are formal papers invited or accepted for scholarly publication based on full peer review of the completed manuscript.

- (14) R.C. Maher, "Lending an ear in the courtroom: forensic acoustics," *Acoustics Today*, vol. 11, no. 3, pp. 22-29, 2015.
- (13) R.C. Maher, "Audio forensic examination: authenticity, enhancement, and interpretation," *IEEE Signal Processing Magazine*, vol. 26, no. 2, March, 2009.
- (12) R.C. Maher, "Control of synthesized vibrato during portamento musical pitch transitions," *J. Audio Eng. Soc.*, vol. 56, no. 1/2, pp. 18-27, 2008.
- (11) Z. Chen and R.C. Maher, "Analytical expression for impulse response between two nodes in 2-D rectangular digital waveguide mesh," *IEEE Signal Processing Letters*, vol. 15, pp. 221-224, 2008.
- (10) Z. Chen and R.C. Maher, "Semi-automatic classification of bird vocalizations using spectral peak tracks," *J. Acoust. Soc. Am.*, vol. 120, no. 5, pp. 2974-2984, 2006.
- (9) R.C. Maher, "Wavetable synthesis strategies for mobile devices," *J. Audio Eng. Soc.*, vol. 53, no. 3, pp. 205-213, 2005.
- (8) P.K. Ramarapu and R.C. Maher, "Methods for reducing audible artifacts in a wavelet-based broad-band denoising system," *J. Audio Eng. Soc.*, vol. 46, no. 3, pp. 178-190, 1998.
- (7) S.M. Joseph and R.C. Maher, "Subjective evaluation of four low-complexity audio coding schemes," *J. Acoust. Soc. Am.*, vol. 97., no. 6, pp. 3657-3662, 1995.
- (6) R.C. Maher, "A method for extrapolation of missing digital audio data," *J. Audio Eng. Soc.*, vol. 42, no. 5, pp. 350-357, 1994.
- (5) R.C. Maher and J.W. Beauchamp, "Fundamental frequency estimation of musical signals using a Two-Way Mismatch procedure," *J. Acoust. Soc. Am.*, vol. 95., no. 4, pp. 2254-2263, 1994.
- (4) R.C. Maher, "On the nature of granulation noise in uniform quantization systems," *J. Audio Eng. Soc.*, vol. 40, no. 1/2, pp. 12-20, 1992.
- (3) R.C. Maher, "A method for envelope warping in digital audio synthesis," *J. Audio Eng. Soc.*, vol. 39, no. 12, pp. 934-944, 1991.

(2) R.C. Maher, "Evaluation of a method for separating digitized duet signals," J. Audio Eng. Soc., vol. 38, no. 12, pp. 956-979, 1990.

(1) R.C. Maher and J.W. Beauchamp, "An investigation of vocal vibrato for synthesis," Applied Acoustics, vol. 30, no. 2-3, pp. 219-245, 1990.

FULLY REFEREED BOOK CHAPTERS

These are chapters of published reference books with full peer review of the completed manuscript.

(3) R.C. Maher, "Overview of Audio Forensics," book chapter, Intelligent Multimedia Analysis for Security Applications, Berlin: Springer-Verlag, pp. 127-144, 2010.

(2) R.C. Maher, "Lossless Audio Coding," book chapter, Lossless Compression Handbook, K. Sayood, ed., San Diego: Academic Press, 2003.

(1) J.W. Beauchamp and R.C. Maher, "Digital Audio," book chapter, Handbook of Acoustics, M. Crocker, ed., New York: John Wiley & Sons, pp. 1967-1978, 1997.

FULLY REFEREED CONFERENCE PROCEEDINGS

These are formal papers invited or accepted for a scholarly conference based on full peer review of the completed manuscript.

(16) R.C. Maher and T.K. Routh, "Gunshot acoustics: pistol vs. revolver," Proc. Audio Engineering Society Conference, Audio Forensics—Finding Signal in the Noise, Arlington, VA, June, 2017.

(15) Â.M.C.R. Borzino, R.C. Maher, J.A. Apolinário and M.L.R. de Campos, "Employing wavelet-based texture features in ammunition classification", Proc. SPIE 10184, Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security, Defense, and Law Enforcement Applications XVI, 101840D; doi:10.1117/12.2262282, May 2017.

(14) R.C. Maher and S.R. Shaw, "Gunshot recordings from digital voice recorders," Proc. Audio Engineering Society 54th Conference, Audio Forensics—Techniques, Technologies, and Practice, London, U.K., June, 2014.

(13) R.C. Maher and J. Studniarz, "Automatic search and classification of sound sources in long-term surveillance recordings," Proc. Audio Engineering Society 46th Conference, Audio Forensics—Recording, Recovery, Analysis, and Interpretation, Denver, CO, June, 2012.

(12) R.C. Maher and S.R. Shaw, "Directional aspects of forensic gunshot recordings," Proc. Audio Engineering Society 39th Conference, Audio Forensics—Practices and Challenges, Hillerød, Denmark, June, 2010.

(11) R.C. Maher, J. Becker, T. Sharpe, J. Peterson, and B.A. Towle, "Development and implementation of a robot-based freshman engineering course," Proc. 2005 American Society for Engineering Education Annual Conference, Portland, OR, June, 2005.

(10) B.J. Gregoire and R.C. Maher, "Harmonic Envelope Detection and Amplitude Estimation Using Map Seeking Circuits," Proc. IEEE International Conference on Electro Information Technology (EIT2005), Lincoln, NE, May, 2005.

(9) R.C. Maher, "Concurrent Audio And Modem Acceleration," Proc. 1999 Windows Hardware Engineering Conference (WinHEC), Los Angeles, CA, March, 1999.

(8) R.C. Maher, "Single-ended spatial enhancement using a cross-coupled lattice equalizer," Proc. 1997 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, Mohonk, NY, October, 1997.

(7) R.C. Maher, "Simple But Useful Tools for Interactive WWW Development," Proc. 1996 Frontiers in Education Conference, Salt Lake City, UT, November, 1996.

- (6) Y.J. Chen and R.C. Maher, "Subband coding of audio using a recursively indexed quantizer," Proc. 1995 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, Mohonk, NY, October, 1995
- (5) R.C. Maher, "Computationally efficient compression of audio signals by means of RIQ-DPCM," Proc. 1993 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, Mohonk, NY, October, 1993.
- (4) R.C. Maher, "Control of interharmonic beating in polyphonic music," Proc. 1991 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, Mohonk, NY, pp. 1-2, October, 1991.
- (3) R.C. Maher, "Development and evaluation of a method for the separation of musical duet signals," Proc. IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, Mohonk, NY, pp. 1-2, October, 1989.
- (2) J.W. Beauchamp and R.C. Maher, "Significance of frequency vs. time variations and amplitude beating in additive synthesis of piano tones," Iowa Acoustics Colloquium, Iowa City, IA, p. 1, 1987.
- (1) J.W. Beauchamp and R.C. Maher, "Musical acoustics demonstrations, lessons," Proc. IBM Advanced Education Projects Conference, San Diego, CA, 1986.

FORMAL PROFESSIONAL CONFERENCE PROCEEDINGS

These are formal papers invited or accepted for a scholarly conference by peer review of an abstract or extended summary.

- (53) R.C. Maher, "Challenges of audio forensic evaluation from personal recording devices," Preprint 9897, Proc. 143rd Audio Engineering Society Convention, New York, NY, October, 2017.
- (52) T.K. Routh and R.C. Maher, "Determining muzzle blast duration and acoustical energy of quasi-anechoic gunshot recordings," Preprint 9635, Proc. 141st Audio Engineering Society Convention, Los Angeles, CA, October, 2016.
- (51) R.C. Maher and T.K. Routh, "Wideband audio recordings of gunshots: waveforms and repeatability," Preprint 9634, Proc. 141st Audio Engineering Society Convention, Los Angeles, CA, October, 2016.
- (50) T.K. Routh and R.C. Maher, "Recording anechoic gunshot waveforms of several firearms at 500 kHz sampling rate," Proc. Mtgs. Acoust. 26, 030001 (2016); <http://dx.doi.org/10.1121/2.0000262>, May, 2016.
- (49) R.C. Maher, "Explaining microphones and loudspeakers in a musical acoustics course for non-scientists," invited paper, J. Acoust. Soc. Am., vol. 139, no. 4, part 2, p. 2096 (abstract), April, 2016.
- (48) T. Routh and R.C. Maher, "Recording anechoic gunshot waveforms of several firearms at 500 kilohertz sampling rate," J. Acoust. Soc. Am., vol. 139, no. 4, part 2, p. 2066 (abstract), April, 2016.
- (47) R.C. Maher, "Gunshot recordings from a criminal incident: who shot first?" J. Acoust. Soc. Am., vo. 139, no. 4, part 2, p. 2024 (abstract), April, 2016.
- (46) R.C. Maher and T. Routh, "Advancing forensic analysis of gunshot acoustics," Preprint 9471, Proc. 139th Audio Engineering Society Convention, New York, NY, October, 2015.
- (45) J. Studniarz and R.C. Maher, "Sound identification from MPEG-encoded audio files," Preprint 8984, Proc. 135th Audio Engineering Society Convention, New York, NY, October, 2013.
- (44) R.C. Maher, "A method for enhancement of background sounds in forensic audio recordings," Preprint 8731, Proc. 133rd Audio Engineering Society Convention, San Francisco, CA, October, 2012.
- (43) R.C. Maher, "Teaching and learning musical acoustics in a music technology program," J. Acoust. Soc. Am., vol. 132, no. 3, part 2, p. 1958 (abstract), October, 2012.
- (42) R.C. Maher, "Soundscape collaboration for science, management, and public outreach at a national historic site," invited paper, J. Acoust. Soc. Am., vol. 130, no. 4, part 2, p. 2497 (abstract), October, 2011.

- (41) R.C. Maher, "Acoustical modeling of gunshots including directional information and reflections," Preprint 8494, Proc. 131st Audio Engineering Society Convention, New York, NY, October, 2011.
- (40) R.C. Maher, "Automated analysis and interpretation of long-term soundscape audio recordings," invited paper, J. Acoust. Soc. Am., vol. 129, no. 4, part 2, p. 2570 (abstract), April, 2011.
- (39) R.C. Maher, "Maintaining Sonic Texture with Time Scale Compression by a Factor of 100 or More," Preprint 8250, Proc. 129th Audio Engineering Society Convention, San Francisco, CA, November, 2010.
- (38) R.C. Maher, "Cultural soundscape of the Grant-Kohrs Ranch national historic site," invited paper, J. Acoust. Soc. Am., vol. 127, no. 3, part 2, p. 1745 (abstract), April, 2010.
- (37) D. Reed and R.C. Maher, "An investigation of early reflection's effect on front-back localization in spatial audio," Preprint 7884, Proc. 127th Audio Engineering Society Convention, New York, NY, October, 2009.
- (36) R.C. Maher, "Acoustics of national parks and historic sites: the 8,760 hour MP3 file," Preprint 7893, Proc. 127th Audio Engineering Society Convention, New York, NY, October, 2009.
- (35) R.C. Maher, "Baseline sound monitoring plan for Grant-Kohrs Ranch national historic site," J. Acoust. Soc. Am., vol. 125, no. 4, part 2, p. 2716 (abstract), 2009.
- (34) R.C. Maher, "All about PHASE," Proc. IEEE Signal Processing Society 5th Signal Processing Education Workshop, Marco Island, FL, pp. 218-222, January, 2009.
- (33) R.C. Maher and S.R. Shaw, "Deciphering gunshot recordings," Proc. Audio Engineering Society 33rd Conference, Audio Forensics—Theory and Practice, Denver, CO, June, 2008.
- (32) Z. Chen and R.C. Maher, "Addressing the Discrepancy Between Measured and Modeled Impulse Responses for Small Rooms," Preprint 7239, Proc. 123rd Audio Engineering Society Convention, New York, NY, October, 2007.
- (31) Z. Chen and R.C. Maher, "Modeling room impulse response by incorporating speaker polar response into image source method," J. Acoust. Soc. Am., vol. 121, no.5, part 2, p. 3174 (abstract), 2007.
- (30) R.C. Maher, "Acoustical characterization of gunshots," Proc. IEEE SAFE 2007: Workshop on Signal Processing Applications for Public Security and Forensics, Washington, DC, pp. 109-113, April, 2007.
- (29) R.C. Maher, "Modeling and signal processing of acoustic gunshot recordings," Proc. IEEE Signal Processing Society 12th DSP Workshop, Jackson Lake, WY, pp. 257-261, September, 2006.
- (28) B.J. Gregoire and R.C. Maher, "Map seeking circuits: a novel method of detecting auditory events using iterative template mapping," Proc. IEEE Signal Processing Society 12th DSP Workshop, Jackson Lake, WY, September, 2006.
- (27) R.C. Maher, "Crossing the bridge: taking audio DSP from the textbook to the DSP design engineer's bench," Proc. IEEE Signal Processing Society 4th Signal Processing Education Workshop, Jackson Lake, WY, September, 2006.
- (26) S.M. Pascarelle, B. Stewart, T.A. Kelly, A. Smith, and R.C. Maher, "An Acoustic / Radar System for Automated Detection, Localization, and Classification of Birds in the Vicinity of Airfields," 8th Joint Annual Meeting of Bird Strike Committee USA/Canada, St. Louis, MO, August, 2006.
- (25) R.C. Maher, J. Gregoire, and Z. Chen, "Acoustical monitoring research for national parks and wilderness areas," Preprint 6609, Proc. 119th Audio Engineering Society Convention, New York, NY, October, 2005.
- (24) R.C. Maher, "Audio enhancement using nonlinear time-frequency filtering," Proc. Audio Engineering Society 26th Conference, Audio Forensics in the Digital Age, Denver, CO, July, 2005.

- (23) G. Sanchez, R.C. Maher, and S. Gage, "Ecological and environmental acoustic remote sensor (EcoEARS) application for long-term monitoring and assessment of wildlife," U.S. Department of Defense Threatened, Endangered and at-Risk Species Research Symposium and Workshop, Baltimore, MD, June, 2005.
- (22) J. Gregoire and R.C. Maher, "Map seeking circuits for audio pattern recognition," Music Information Processing Workshop, Whistler, British Columbia, Canada, December, 2004.
- (21) R.C. Maher, "AES Technical Committee on Signal Processing Educational CD Project," Proc. 117th Audio Engineering Society Convention, Preprint 6313, San Francisco, CA, October, 2004.
- (20) R.C. Maher, "Compression and Decompression of Wavetable Synthesis Data," Proc. 2003 Audio Engineering Society Convention, Preprint #5937, New York NY, October, 2003.
- (19) M. Phillips, J. Barish, and R.C. Maher, "The modeling and synthesis of musical signals with PRISM," Proc. 2000 Audio Engineering Society Convention, Preprint #5187, Los Angeles, CA, September, 2000.
- (18) D.K. Reinhardt and R.C. Maher, "A real time DSP kernel for concurrent audio tasks," Proc. 1998 Audio Engineering Society Convention, Preprint #4825, San Francisco, CA, September, 1998.
- (17) R.C. Maher, "A low complexity spatial localization system," Proc. 1997 Audio Engineering Society Convention, Preprint #4567, New York, NY, November, 1997.
- (16) R.C. Maher, E. Lindemann, and J. Barish, "Old and new techniques for artificial stereophonic image enhancement," Proc. 1996 Audio Engineering Society Convention, Preprint #4371, Los Angeles, CA, November, 1996.
- (15) R.C. Maher, "Tunable bandpass filters in music synthesis," Proc. 1995 Audio Engineering Society Convention, Preprint #4098, New York, NY, October, 1995.
- (14) R. Peddibhotla, R.C. Maher and K. Sayood, "A low complexity audio coding scheme for wideband audio," Proc. 1994 Asilomar Conf. on Circuits and Systems, Pacific Grove, CA, vol. 2, pp. 1222-1226, November, 1994.
- (13) R.C. Maher, "An efficient scheme for lossy real-time audio data compression," Proc. 1994 Audio Engineering Society Convention, San Francisco, CA, Preprint #3922, pp. 1-13, November 10, 1994.
- (12) R.C. Maher and J.L. Varner, "Laboratory development for digital signal processing education," Proc. 1994 ASEE Midwest Section Meeting, Lincoln, NE, pp. 1-4, March 31 - April 2, 1994.
- (11) R.C. Maher, "A method for extrapolation of missing digital audio data," Proc. 1993 Audio Engineering Society Convention, New York, NY, Preprint #3715, pp. 1-19, October, 1993.
- (10) J.W. Beauchamp, R.C. Maher, and R. Brown, "Detection of musical pitch from recorded solo performances," Proc. 1993 Audio Engineering Society Convention, Berlin, Germany, Preprint #3541, pp. 1-15, March, 1993.
- (9) D.J. Cheenne, R.D. Kubik, R.C. Maher, and E. Bahar, "Full-wave modeling of the transmission of sound over theater seats: far field investigation," J. Acoust. Soc. Am., vol. 92, no. 4, part 2, p. 2347 (abstract), 1992.
- (8) R.C. Maher and J.W. Beauchamp, "Frequency tracking of solo and duet passages using a harmonic two-way mismatch procedure," invited paper, J. Acoust. Soc. Am., vol. 92, no. 4, part 2, p. 2429 (abstract), 1992.
- (7) E.P. Moss and R.C. Maher, 1992, "Synthesis and processing of audible notification and warning signals," Proc. 1992 Audio Engineering Society Convention, San Francisco, CA, Preprint #3354, pp. 1-10, October, 1992.
- (6) R.C. Maher, "Sinusoidal additive synthesis revisited," Proc. 1991 Audio Engineering Society Convention, New York, NY, Preprint #3128, pp. 1-19, October, 1991.

- (5) R.C. Maher, "Computer processing of audio signals by exclusion filters," *J. Acoust. Soc. Am. Suppl.* 1, vol. 88, p. 188 (abstract), 1990.
- (4) J.W. Beauchamp and R.C. Maher, "Partial synchrony in musical sounds: some recent results using time-variant spectral analysis," invited paper, *J. Acoust. Soc. Am. Suppl.* 1, vol. 84, pp. 103-104 (abstract), 1988.
- (3) R.C. Maher and J.W. Beauchamp, "Is there a single vibrato waveform?" *J. Acoust. Soc. Am. Suppl.* 1, vol. 83, p. 31 (abstract), 1988.
- (2) R.C. Maher and J.W. Beauchamp, "A microcomputer-based demonstration system for acoustics education" *J. Acoust. Soc. Am. Suppl.* 1, vol. 81, p. 32 (abstract), 1987.
- (1) R.C. Maher, J.H. Scandrett, R.E. Crawford, Jr., and K. Grant, "A low-cost digital synthesizer system for music applications and psychoacoustical research," *J. Acoust. Soc. Am. Suppl.* 1, vol. 77, p. 75 (abstract), 1985.

FORMAL PROFESSIONAL PRESENTATIONS

These are formal, invited lectures for an engineering group, academic seminar, employment interview, or technical meeting.

- (47) R.C. Maher, "Audio Forensics of Gunshot Sounds," invited seminar presentation, *National Institute of Justice Forensic Science Research and Development Symposium*, American Academy of Forensic Sciences 69th Annual Scientific Meeting, New Orleans, LA, February 14, 2017.
- (46) R.C. Maher, "Principles of Audio System Grounding and Signal Integrity," invited seminar presentation, *Montana Joint Engineers Conference*, Helena, MT, November 6, 2015.
- (45) R.C. Maher, "Gunshot Acoustical Interpretation," invited workshop presentation, *Audio Engineering Society 139th Convention*, New York, NY, October 30, 2015.
- (44) R.C. Maher, "Found Sound: Recording Studio, National Park, Courtroom," invited seminar presentation, *MSU Physics Colloquium*, Bozeman, MT, September 18, 2015.
- (43) R.C. Maher, "Introduction to academic advising at Montana State University," invited workshop presentation, *2015 New Faculty Orientation*, Bozeman, MT, August 20, 2015.
- (42) R.C. Maher, "Acoustical Fingerprinting," invited seminar presentation, *ES23 Executive Summit 2015*, American Board of Recorded Evidence, Santa Barbara, CA, August 7, 2015.
- (41) R.C. Maher, "Forensic Audio Authenticity," invited panel presentation, *ES23 Executive Summit 2015*, American Board of Recorded Evidence, Santa Barbara, CA, August 7, 2015.
- (40) R.C. Maher, "Environmental Soundscape Recording," invited workshop presentation, *Third Annual Research and Creative Activity Symposium*, College of Arts and Architecture, Bozeman, MT, January 28, 2015.
- (39) R.C. Maher, "Introduction to academic advising at Montana State University," invited workshop presentation, *2014 New Faculty Orientation*, Bozeman, MT, August 21, 2014.
- (38) R.C. Maher, "Introduction to academic advising at Montana State University," invited workshop presentation, *2013 New Faculty Orientation*, Bozeman, MT, August 22, 2013.
- (37) R.C. Maher, G. Young, B. Clinton, and J.P. Miller, "The Science of Sound: Decomposing Music," invited seminar presentation and live demonstration, *Montana State University President's Fine Arts Series*, Bozeman, MT, March 4, 2013.
- (36) R.C. Maher, "Sounds of silence and sounds of rivers," invited seminar presentations, *Montana Institute on Ecosystems Rough Cut Seminar Series*, Missoula, MT, September 17, 2012, and Bozeman, MT, September 19, 2012.
- (35) R.C. Maher, "Introduction to academic advising at Montana State University," invited workshop presentation, *2012 New Faculty Orientation*, Bozeman, MT, August 23, 2012.

- (34) R.C. Maher, "Soundscape management: the impact of change on soundscape," invited workshop presentation, *2012 Teacher Workshop, Grant-Kohrs Ranch National Historic Site*, Deer Lodge, MT, June 13, 2012.
- (33) R.C. Maher, "The Science of Sound: Acoustics and Audio Engineering," invited seminar presentation, *Aspen Pointe Speakers Series*, Bozeman, MT, September 23, 2010.
- (32) R.C. Maher, "Speech Production and Intelligibility," invited seminar presentation, *Gallatin Ham Radio Club*, Bozeman, MT, March 4, 2010.
- (31) R.C. Maher, "Forensic Acoustical Interpretation," invited workshop presentation, *Audio Engineering Society 127th Convention*, New York, NY, October, 2009.
- (30) R.C. Maher, "Baseline Sound Monitoring at Grant-Kohrs Ranch National Historic Site," invited workshop presentation, *National Cooperative Ecosystem Study Unit (CESU) Coordinators Meeting*, Deer Lodge, MT, May, 2009.
- (29) R.C. Maher, "Gunshot Acoustics for Audio Forensics," invited workshop presentation, *Audio Engineering Society 125th Convention*, San Francisco, CA, October, 2008.
- (28) R.C. Maher, "Research Trends in Digital Audio," invited seminar presentation, *MSU Physics Colloquium*, Bozeman, MT, January 18, 2008.
- (27) R.C. Maher, "Audio Science for Ham Radio Operators," invited seminar presentation, *Gallatin Ham Radio Club*, Bozeman, MT, December 6, 2007.
- (26) R.C. Maher, "Science and engineering demonstrations and opportunities," general interest PR presentation, *MSU For a Day*, Belgrade, MT, November 27-28, 2007.
- (25) R.C. Maher, "Acoustical gunshot analysis," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, October 24, 2007.
- (24) R.C. Maher, "MS or PhD in EE/CS: Should I Go To Graduate School?" invited seminar presentation, *Audio Engineering Society 121st Convention*, San Francisco, CA, October, 2006.
- (23) R.C. Maher, "Robots for Space Exploration," invited seminar presentation, Laurel High School seminar, *Montana Space Grant Consortium*, Bozeman, MT, January, 2006.
- (22) R.C. Maher, "A Primer on Microphones and Loudspeakers," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, August, 2005.
- (21) R.C. Maher, "Robots for Space Exploration," invited seminar presentation, Winifred High School teleconference, *Burns Telecommunications Center*, March, 2005.
- (20) R.C. Maher, "Ear Training, Audio Illusions, and Psychoacoustics," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, July, 2004.
- (19) R.C. Maher, "Principles of MP3 and Other Perceptual Audio Coders," invited seminar presentation, *Montana Society of Engineers—Bozeman Chapter*, Bozeman, MT, April, 2004.
- (18) R.C. Maher, "Engineering: Solving Problems, Designing Solutions," general interest PR presentation, *MSU For a Day*, Butte, MT, March, 2004.
- (17) R.C. Maher, "Nuts and Bolts Introduction to Digital Audio Effects," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, January, 2004.
- (16) R.C. Maher, "Technical Report on the 115th Audio Engineering Society Convention," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, October, 2003.
- (15) R.C. Maher, "Principles of Perceptual Audio Data Compression," invited seminar presentation, *Research Methods in Engineering Graduate Course*, Bozeman, MT, October, 2003.
- (14) R.C. Maher, "3-D Audio Using Time Delay, Filtering, and Cross-Talk Cancellation," invited seminar presentation, *Montana Audio and Acoustics Society*, Bozeman, MT, July, 2003.

- (13) R.C. Maher, "Perceptual Audio Coding: MP3, AC3, WMA, and AAC," invited seminar presentation, *Gilhousen Telecommunications Colloquium*, Bozeman, MT, April, 2003.
- (12) R.C. Maher, "Digital Methods for Noise Removal and Quality Enhancement of Audio Signals," invited seminar presentation, *Creative Advanced Technology Center*, Scotts Valley, CA, April, 2002.
- (11) R.C. Maher, "Simulating Spatial Hearing Cues with Digital Signal Processing," invited seminar presentation, *Montana State University*, Bozeman, MT, November, 2001.
- (10) R.C. Maher, "Essential features and characteristics of digital audio and digital music synthesis," formal continuing education presentation, *AKM Semiconductor*, Boulder, CO, July, 1998.
- (9) R.C. Maher, "Music from Sinewaves: Applications of Frequency Domain Processing," invited seminar presentation, *Colorado Section of the Audio Engineering Society*, Denver, CO, February, 1996.
- (8) R.C. Maher, "Audio Data Compression and Gap Extrapolation," invited seminar presentation, *Chicago Section of the Audio Engineering Society*, Chicago, IL, January, 1995.
- (7) R.C. Maher, "Fundamental Frequency Estimation for Audio Signals," *Communications and Control Seminar Series*, University of Nebraska-Lincoln, October, 1992.
- (6) R.C. Maher, "Granulation Noise in Uniform Quantization Systems for Audio," *Communications and Control Seminar Series*, University of Nebraska-Lincoln, September, 1991.
- (5) R.C. Maher, "Signal Processing Aspects of Electronic and Computer Music," *Communications and Control Seminar Series*, University of Nebraska-Lincoln, January, 1991.
- (4) R.C. Maher, "Noise Removal and Quality Enhancement in Digital Audio Signal Processing," *Communications and Control Seminar Series*, University of Nebraska-Lincoln, October, 1990.
- (3) R.C. Maher, "Some Recent Trends in Digital Audio Signal Processing Research," *Communications and Control Seminar Series*, University of Nebraska-Lincoln, February, 1990.
- (2) R.C. Maher, "Digital Audio with a Microcomputer," *Seminars in Music Computation*, University of Illinois-Urbana, October, 1987.
- (1) R.C. Maher, "The Digital Phase Vocoder," *Seminars in Music Computation*, University of Illinois-Urbana, April, 1987.

WHITE PAPERS AND RESEARCH MONOGRAPHS

These are formal articles prepared in response to a specific funding solicitation, a required progress report, or a specific query by a research sponsor.

- (12) R.C. Maher, "Acoustical Detection Research," project final report prepared for General Atomics Corp., San Diego, CA, 24 pages, January 31, 2008.
- (11) R.C. Maher and Z. Chen, "Compound Classifier Framework for the AAC Birdstrike Project," progress report prepared for Advanced Acoustic Concepts, Inc., Hauppauge, NY, 7 pages, November 2, 2006.
- (10) R.C. Maher, "Summary of Gunshot Acoustics," white paper prepared for Advanced Acoustic Concepts, Inc., Hauppauge, NY, 7 pages, April 4, 2006.
- (9) R.C. Maher, "Status Report 3: Obtaining Sound Level Metrics From .wav Files Using Matlab," progress report prepared for Sanchez Industrial Design, Inc., Middleton, WI, 7 pages, May 16, 2005.
- (8) Z. Chen and R.C. Maher, "Bird Species Identification Using Spectral Peak Track Matching," progress report prepared for Advanced Acoustic Concepts, Inc., Hauppauge, NY, 11 pages, May 1, 2005.
- (7) R.C. Maher, "Status Report 2: Obtaining Sound Level Metrics From .wav Files Using Matlab," progress report prepared for Sanchez Industrial Design, Inc., Middleton, WI, 10 pages, March 9, 2005.

- (6) R.C. Maher "Status Report 1: Obtaining Sound Level Metrics From .wav Files Using Matlab," progress report prepared for Sanchez Industrial Design, Inc., Middleton, WI, 9 pages, January 14, 2005.
- (5) Z. Chen and R.C. Maher, "Parabolic Dish Microphone Principles and Characteristics," progress report prepared for Advanced Acoustic Concepts, Inc., Hauppauge, NY, 10 pages, August 12, 2005.
- (4) Z. Chen and R.C. Maher, "Atmospheric Sound Propagation Considerations for the Birdstrike Project," progress report prepared for Advanced Acoustic Concepts, Inc., Hauppauge, NY, 10 pages, July 28, 2004.
- (3) R.C. Maher, "Acoustical Surveillance," white paper prepared for General Atomics Corp., San Diego, CA, 5 pages, February 27, 2004.
- (2) R.C. Maher, "Obtaining Long-Term Soundscape Inventories in the U.S. National Park System," white paper prepared for National Park Service Natural Sounds Program Office, Fort Collins, CO, 12 pages, January 30, 2004.
- (1) R.C. Maher, "Data-adaptive time-frequency filters for enhancement of noisy speech signals," white paper prepared for Air Force Research Lab, Rome, NY, 9 pages, April 24, 2003.

OTHER PUBLICATIONS

These are formal articles solicited by the editor of a professional magazine, journal, or other official publication.

- (17) R.C. Maher, "AES International Conference Report: Audio Forensics—Finding Signal in the Noise," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 65, no. 9, pp. 762-769, 2017.
- (16) R.C. Maher, "AES 54th International Conference: Audio Forensics—Techniques, Technologies, and Practice," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 62, no. 9, pp. 622-630, 2014.
- (15) R.C. Maher, "AES 46th International Conference: Audio Forensics—Recording, Recovery, Analysis, and Interpretation," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 60, no. 9, pp. 718-728, 2012.
- (14) R.C. Maher, "AES 39th International Conference: Audio Forensics—Practices and Challenges," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 58, no. 10, pp. 842-852, 2010.
- (13) R.C. Maher, "AES 33rd International Conference: Audio Forensics—Theory and Practice," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 56, no. 9, pp. 728-739, 2008.
- (12) R.C. Maher, "PC audio subsystems: evolution and design," *Electronic Engineering Times*, Issue 1540, pp. 36-40, September, 2008.
- (11) R.C. Maher, "Musimathics," published book review, *J. Audio Eng. Soc.*, vol. 55, no. 11, pp. 1038-1040, 2007.
- (10) R.C. Maher, "Boston Marathon Diary," in *Big Sky Wind Drinkers Running Club Newsletter*, June, 2007.
- (9) R.C. Maher, "Sound System Engineering, Third Edition," published book review, *J. Audio Eng. Soc.*, vol. 55, no. 1/2, pp. 90-91, 2007.
- (8) R.C. Maher, "Thoughts on Personal Fitness," in *Big Sky Wind Drinkers Running Club Newsletter*, December, 2005.
- (7) R.C. Maher, "AES 26th International Conference: Audio Forensics in the Digital Age," conference review article (uncredited), *J. Audio Eng. Soc.*, vol. 53, no. 9, pp. 838-848, 2005.
- (6) R.C. Maher, "Running by the Numbers," in *Big Sky Wind Drinkers Running Club Newsletter*, May, 2005.
- (5) R.C. Maher, "Acoustic Echo and Noise Control: A Practical Approach," published book review, *J. Audio Eng. Soc.*, vol. 53, no. 5, pp. 457-458, 2005.
- (4) R.C. Maher, "Digital Sound Synthesis by Physical Modeling Using the Functional Transformation Method," published book review, *J. Audio Eng. Soc.*, vol. 52, no. 9, p. 980, 2004.

- (3) R.C. Maher, "Concurrent audio using a DSP real-time kernel," *Multimedia Systems Design*, vol. 2, no. 9, pp.18-23, September, 1998.
- (2) R.C. Maher, "Music Processing," published book review, *J. Audio Eng. Soc.*, vol. 43, no. 1/2, pp. 84-85, 1995.
- (1) R.C. Maher, "A meditation on a theme by Dr. Martin Luther King, Jr.," in "New Electronic Works from the University of Illinois," LP record album, track 1, May, 1989.