

## **JAMES M. KATES**

6796 Audubon Ave.  
Niwot, CO 80503  
Home: (303)-652-1523  
Mobile: (720)-226-1266  
jimkates@comcast.net

**EDUCATION:** Electrical Engineer, MIT (1972). Post-MS professional degree  
M.S., MIT (1971), Electrical Engineering  
B.S., MIT (1971), Electrical Engineering  
National Science Foundation Fellow 1970-1973

### **EXPERIENCE:**

- 2012- : University of Colorado, Boulder, CO  
Scholar in Residence, Department of Speech Language and Hearing Sciences.  
Research in monaural and binaural auditory perception and signal processing for hearing aids, with an emphasis on using auditory models to predict speech intelligibility and speech and music quality. Supervise graduate thesis projects and also taught courses in hearing-aid technology.
- 2003-2012: GN ReSound, Boulder, CO. (Retired in 2012)  
Research Fellow. Continuation of hearing-aid research activities begun at AudioLogic and continued under contract with GN ReSound while an employee of Cirrus Logic. Adjunct faculty in Speech, Language, and Hearing Sciences (SLHS) at the University of Colorado (CU) in Boulder, conducting joint research projects in auditory perception and hearing-aid signal processing and teaching courses in digital hearing-aid technology along with supervision of graduate thesis projects.
- 1997-2003: Cirrus Logic, Broomfield, CO (initially with AudioLogic, purchased by Cirrus Logic in July 1999). Senior Scientist, working under a contract with GN ReSound. Research and development of signal processing for digital hearing aids based on a proprietary DSP chip. Algorithms include adaptive feedback cancellation, dynamic-range compression, speech enhancement, binaural signal processing, tinnitus masking, signal and ambient sound classification, and adaptive microphone arrays. Adjunct faculty appointment in SLHS at CU in Boulder.
- 1988-1997: Graduate School, City University of New York.  
Senior Research Scientist, Center for Research in Speech and Hearing Sciences. Research in signal processing for hearing aids, measurement of hearing-aid performance, models of auditory perception, and visual perception of speech. PI on NIH research grant for developing directional microphones for hearing aids. Adjunct Assistant Professor in the academic program, teaching a course in auditory physiology and modeling of the cochlea.
- 1985-1988: Siemens Hearing Instruments, Inc, Piscataway, NJ  
Director of Basic Research. Responsible for new signal-processing approaches for hearing aids, including development of digital hearing-aid processing. Set specifications and supervised design and construction of a real-time digital prototype hearing aid. Additional work in modeling the electro-acoustics of hearing aids, new product development, and in negotiating and supervising outside research. Co-manager of department which had an annual budget of \$1 million.

- 1978-1985: SIGNATRON, Inc., Lexington, Mass.  
Senior Engineering Analyst. Established and managed small research group on signal processing and systems design. Recipient of NSF Small Business Innovation Research grant to develop speech processing techniques for improved hearing aids. Research in speech enhancement, adaptive noise cancellation, digital speech coding, and modeling of the peripheral auditory system. Additional work in developing new high-resolution direction finding techniques, HF communications, signal processing applications, and scientific computing.
- 1975-1978: Teledyne Acoustic Research, Norwood, Mass.  
Associate Research Director for Systems Development. Applied research for audio products, and analog and digital signal processing for loudspeaker evaluation and design. Supervised psychoacoustics and digital design activities.
- 1973-1975: CBS Laboratories (CBS Research Center), Stamford, Conn.  
Senior Electrical Engineer in the Acoustics and Magnetics Department. Project engineer responsible for loudspeaker design, study of subliminal encoding in audio broadcasting, and signal processing for sonar applications.
- AWARDS: 2015 Samuel F. Lybarger career achievement award, American Acad. Audiology.  
2017 Peak Performance Award, Colorado Academy of Audiology.
- SOCIETIES: Fellow of the Acoustical Society of America. Fellow of the Audio Engineering Society. Senior Member of the IEEE, past member of the Audio Technical Committee and past Associate Editor of the Transactions on Signal Processing. Member Tau Beta Pi, Eta Kappa Nu, Sigma Xi (Associate). Past Assistant Editor of the Journal of the American Auditory Association.

**PUBLICATIONS**

## PROFESSIONAL JOURNAL ARTICLES (83 Published/Accepted Papers)

- K.H. Arehart, E. Lundberg, S-H. Chon, L.O. Harvey Jr., J.M. Kates, M.C. Anderson, V.H. Rallapalli, and P.E. Souza (2021), "A comparison of speech intelligibility and subjective quality with hearing-aid processing in older adults with hearing loss," submitted for publication.
- E.M.H. Lundberg, S.-H. Chon, J.M. Kates, M.C. Anderson, and K.H. Arehart (2020), "The type of noise influences quality ratings for noisy speech in hearing aid users," *J Speech Lang Hear Res.* Vol. 63(12), pp 4300-4313. PMID: 33253602. DOI: [10.1044/2020\\_JSLHR-20-00156](https://doi.org/10.1044/2020_JSLHR-20-00156).
- J.M. Kates and E.J. Brandewie (2020), "Adding air absorption to simulated room acoustic models," *J. Acoust. Soc. Am.* Vol. 147(5), pp EL408-EL413. DOI: 10.1121/10.0002489
- J.M. Kates and K.H. Arehart (2020), "The hearing-aid speech perception index (HASPI) version 2," to appear in *Speech Comm.* DOI: 10.1016/j.specom.2020.05.001.
- V. Rallapalli, M. Anderson, J. Kates, L. Balmert, L. Sirow, K. Arehart, and P. Souza (2020), "Quantifying the range of signal modification in clinically-fit hearing aids," *Ear & Hearing* Vol. 41(2), pp 433-441. DOI: 0.1097/AUD.0000000000000767
- J.M. Kates (2020), "Limitations of the Envelope Difference Index (EDI) as a metric for nonlinear distortion in hearing aids," *Ear & Hearing* Vol. 41(2), pp 356-361. DOI: 10.1097/AUD.0000000000000768.
- J.M. Kates, K.H. Arehart, and L.O. Harvey, Jr. (2019), "Integrating a remote microphone with hearing-aid processing," *J. Acoust. Soc. Am.* Vol. 145(6), pp 3551-3566. DOI: 10.1121/1.5111339.
- J.M. Kates, K.H. Arehart, M.C. Anderson, R. Kumar Muralimanohar, and L.O. Harvey, Jr. (2018), "Using objective metrics to measure hearing-aid performance," *Ear & Hearing* Vol. 39(6), pp 1165–1175. DOI: 10.1097/AUD.0000000000000574.
- J.M. Kates, K.H. Arehart, R. Kumar Muralimanohar, and K. Sommerfeldt (2018), "Externalization of remote microphone signals using a structural binaural model of the head and pinna," *J. Acoust. Soc. Am.* Vol. 143(5), pp 2666-2677. DOI: 10.1121/1.5032326.
- J.M. Kates and S. Prabhu (2018), "The dynamic gammawarp auditory filterbank," *J. Acoust. Soc. Am.* Vol. 143(3), pp 1603-1612. DOI: 10.1121/1.5027827.
- I.-K. Jin, J.M. Kates, and K.H. Arehart (2018), "Authors' rebuttal to Smits et al. (2017), 'Comments on "Sensitivity of the speech intelligibility index to the assumed dynamic range" by Jin et al. (2017)'", *J. Speech Lang. Hear. Res.* Vol. 61, pp 189-190. DOI:10.1044/2017\_JSLHR-H-17-0359.
- C.-H. Lee, J.M. Kates, B.D. Rao, and H. Garudadri (2017), "Speech quality and stable gain trade-offs in adaptive feedback cancellation for hearing aids," *J. Acoust. Soc. Am.* Vol. 142(4), pp EL388-EL394. DOI: 10.1121/1.5007278
- I.-K. Jin, J.M. Kates, and K.H. Arehart (2017), "Sensitivity of the Speech Intelligibility Index to the assumed dynamic range," *J. Speech Lang. Hear. Res.* Vol. 60(6), pp 1674-1680. DOI:10.1044/2017\_JSLHR-H-16-0348

- R. Kumar Muralimanohar, J.M. Kates, and K.H. Arehart (2017), "Using envelope modulation to explain speech intelligibility in the presence of a single reflection," *J. Acoust. Soc. Am.* Vol. 141(5), pp EL482-EL487. DOI: 10.1121/1.4983630
- J.M. Kates (2017), "Modeling the effects of single-microphone noise-suppression," *Speech Comm.* Vol. 90, pp 15-25. DOI: 10.1016/j.specom.2017.04.004
- I.-K. Jin, J.M. Kates, and K.H. Arehart (2017), "Does language matter when using graphical method for calculating the Speech Intelligibility Index?" *J. Am. Acad. Audiol.* Vol. 28, pp 119-128, DOI: 10.3766/jaaa.15131.
- J.M. Kates and K.H. Arehart (2016), "The hearing aid audio quality index (HAAQI)", *IEEE Trans. Audio Speech and Lang. Proc.* Vol. 24(2), pp 354-365. DOI: 10.1109/TASLP.2015.2507858.
- J.M. Kates and K.H. Arehart (2015), "Comparing the information conveyed by envelope modulation for speech intelligibility, speech quality, and music quality", *J. Acoust. Soc. Am.* Vol. 138(4), pp 2470-2482. PMID: PMC4627935. DOI: 10.1121/1.4931899
- K.H. Arehart, P.E. Souza, J.M. Kates, T. Lunner, and M.S. Pedersen (2015), "Relationship between distortion, hearing loss, and working memory for digital noise reduction", *Ear and Hearing* Vol. 36(5), pp 505-516. PMID: 25985016. DOI: 10.1097/AUD.0000000000000173
- I.-K. Jin, J.M. Kates, K. Lee, and K.H. Arehart (2015), "Derivations of the band-importance function: A cross-procedure comparison", *J. Acoust. Soc. Am.*, Vol. 138(2), pp 938-941. PMID: 26328709. DOI: 10.1121/1.4927412.
- P.E. Souza, K.H. Arehart, J. Shen, M.C. Anderson, and J.M. Kates (2015), "Working memory and intelligibility of hearing-aid processed speech," *Frontiers Psych.*, Vol. 6, Article 526. PMID: PMC4423473. DOI: 10.3389/fpsyg.2015.00526
- T.H. Falk, V. Parsa, J.F. Santos, K.H. Arehart, O. Hazrati, R. Huber, J.M. Kates, and S. Scollie (2015), "Objective quality and intelligibility prediction for users of assistive listening devices," *IEEE Sig. Proc. Mag.* 32(2), 114-124. PMID: 26052190. DOI: 10.1109/MSP.2014.2358871
- I.-K. Jin, J.M. Kates, and K.H. Arehart (2014), "The dynamic range for speech materials in Korean, English, and Mandarin: A cross-language comparison," *J Speech Lang. Hear. Res.*, Vol. 57, pp 2024-2030. PMID: 24826909. DOI:10.1044/2014\_JSLHR-H-14-0002
- N.B.H. Croghan, K.H. Arehart, and J.M. Kates (2014), "Music preferences with hearing aids: Effects of signal properties, compression settings, and listener characteristics", *Ear and Hearing*, Vol. 35(5), pp e170-e184. PMID: 25010635. DOI: 10.1097/AUD.0000000000000056
- J.M. Kates and K.H. Arehart (2014), "The hearing aid speech perception index (HASPI)", *Speech Comm.*, Vol. 65, pp 75-93. DOI: 10.1016/j.specom.2014.06.002
- M.C. Anderson, K.H. Arehart, and J.M. Kates (2014), "The effects of noise vocoding on speech quality perception", *Hearing Res.*, Vol. 309, pp 75-83. PMID: 24333929. DOI:10.1016/j.heares.2013.11.011
- J.M. Kates and K.H. Arehart (2014), "The hearing aid speech quality index (HASQI) version 2", *J. Audio Eng. Soc.*, Vol. 62(3), pp 99-117. DOI: 10.17743/jaes.2014.0006

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- J.M. Kates, K.H. Arehart, and P.E. Souza (2013), "Integrating cognitive and peripheral factors in predicting hearing-aid processing benefit", *J. Acoust. Soc. Am.*, Vol. 134(6), pp 4458-4469. PMID: PMC3874061. DOI: 10.1121/1.4824700
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- I.-K. Jin, J.M. Kates, and K.H. Arehart (2012), "The effect of noise envelope modulation on quality judgments of noisy speech", *J. Acoust. Soc. Am.*, Vol. 132(4), pp EL277-EL283. PMID: 23039565. DOI: 10.1121/1.4748343
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- J.M. Kates (1995), "Two-tone suppression in a cochlear model", *IEEE Trans. Speech and Audio Proc.*, Vol. 3(5), pp 396-406. DOI: 10.1109/89.466656
- J.M. Kates (1995), "On the feasibility of using neural nets to derive hearing-aid prescriptive procedures", *J. Acoust. Soc. Am.*, Vol. 98(1), pp 172-180. PMID: 7608397. DOI: 10.1121/1.413753
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- J.M. Kates (1993), "Towards a theory of optimal hearing-aid processing", *J. Rehab. Res. and Devel.*, Vol. 30(1), pp 39-48. PMID: 8263828
- J.M. Kates (1993), "Superdirective arrays for hearing aids", *J. Acoust. Soc. Am.*, Vol. 94(4), pp 1930-1933. PMID: 8227739 PMID: 8227739. DOI: 10.1121/1.407515
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#### TRADE JOURNAL AND POPULAR ARTICLES

- K.H. Arehart, J.M. Kates, and P.E. Souza (2014), "The role of metrics in studies of hearing and cognition", *ENT & Audiol. News*, Vol 23(3), pp 92-93. PMID: PMC4459607
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#### BOOKS

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#### BOOK CHAPTERS



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## REPORTS

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- J.M. Kates and K.H. Arehart (2019), "Recent model developments and applications," Hear. Aid Devel. Forum, Oldenburg, June 13-14, 2019.
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- J.M. Kates (2019), "What does the envelope difference index (EDI) measure?" Am. Aud. Soc. 2019 Meeting, Scottsdale, AZ, Feb 28 - March 2, 2019.
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