

## **CLEMENTS, MARK A. – Joseph M. Pettit Professor**

School of Electrical and Computer Engineering  
Georgia Institute of Technology  
Atlanta, Georgia 30332-0250

### **EDUCATIONAL BACKGROUND**

- Sc.D. (Doctorate), Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 1982
- E.E. (Engineer's), Electrical Engineering and Computer Science, Massachusetts Institute of Technology, 1979
- S.M. (Master's), Electrical Engineering and Computer Science Massachusetts Institute of Technology, 1978
- S.B. (Bachelor's), Electrical Engineering and Computer Science Massachusetts Institute of Technology, 1976

### **EMPLOYMENT HISTORY**

- Massachusetts Institute of Technology
  - Graduate Teaching Assistant 1976-1978
  - National Institutes of Health Trainee 1979-1981
  - Graduate Research Assistant 1981-1982
- Verbex Corporation Research Associate (Consulting) 1979-1981
- Georgia Institute of Technology
  - Assistant Professor 1982 - 1988
  - Associate Professor 1988 - 1993
  - Professor 1993-2008
  - Joseph M. Pettit Professor in Digital Signal Processing 2008-present.
  - Director, Interactive Media Technology Center, 2000-present

### **EXPERIENCE SUMMARY**

Dr. Clements has taught graduate and undergraduate courses in probability and speech and signal processing, pattern recognition, and random processes. He was technical program co-chairman of Speech Tech '86 and Technical Program Chair of ICASSP '96. He is a Fellow of the IEEE, has served a member of the IEEE speech technical committee, and has been an associate editor of speech processing for IEEE Trans. on Acoustics, Speech, and Signal Processing, and is on the Board of Governors for the IEEE Signal Processing Society. He has been principal investigator on numerous sponsored research projects, primarily concerned with speech processing. He is the Director of Georgia Tech's Interactive Media Technology Center and a founder and Director of Nexidia, an Atlanta company devoted to speech technology. He holds the Joseph M. Pettit Endowed Professorship in Digital Signal Processing.

## CURRENT FIELDS OF INTEREST

Digital speech processing and analysis, speech recognition, analysis and compensation of stress in speech, sensory aids for the hearing impaired, pattern recognition, digital signal processing, information retrieval

## Major Consulting Activities

1. Lanier Worldwide, 1982-2000 (Voice compression, analysis, recognition)
2. Clearline Communications, 1997-1998 (Speech enhancement for wireless telecom)
3. Medacoustics, 1999-2000 (Pattern recognition for heart disease diagnosis)
4. Galaxy Engineering, 1998 (Objective voice quality assessment)
5. Fast-Talk Communications, (now Nexidia, Inc.), 2000-present, member of the board of directors
6. Personics Laboratories 2007-present

## Teaching

### A. Individual Student Guidance

(1) Eric P. Farges

Graduation Date: December 1987

PhD Thesis Title: *An Analysis/Synthesis Hidden Markov Model of Speech*

Employer: Renault Motor Company, Paris, France.

(2) John H. Hansen

Graduation Date: September 1988

PhD Thesis Title: *Analysis and Compensation of Stressed and Noisy Speech with Application to Robust Automatic Recognition*

Employer: Professor of Electrical Engineering and School Chair, University of Texas Dallas.

(3) Janet C. Rutledge

Graduation Date: December 1989

PhD Thesis Title: *Time-Varying, Frequency-Dependent Compensation for Recruitment of Loudness*

Employer: Professor of Electrical Engineering and Associate Dean, University of Maryland

(4) David J. Pepper

Graduation Date: December 1990

PhD Thesis Title: *Large Hidden Markov Model State Interpretation as Applied to Automatic Phonetic Segmentation and Labeling*

Employer: Nuance

- (5) Beth A. Carlson  
Graduation Date: December 1991  
PhD Thesis Title: *A Projection-Based Measure for Automatic Speech Recognition in Noise*  
Most recent Employer: MIT Lincoln Laboratories
- (6) Kathleen E. Cummings  
Graduation Date: September 1992  
PhD Thesis Title: *Analysis, Synthesis, and Recognition of Stressed Speech*  
Most Recent Employer: School of Electrical Engineering, Georgia Tech.
- (7) Frederique Cesbron (GT-Georgia Tech Lorraine dual degree recipient)  
Graduation Date: September 1992  
MS Thesis Title: *Pitch Detection Using the Short-Term Phase Spectrum*
- (8) Philippe De Backer (GT-Georgia Tech Lorraine dual degree recipient)  
Graduation Date: September 1992  
MS Thesis Title: *Use of Prosody in Speech Recognition Systems*
- (9) Jianwei Miao  
Graduation Date: April 1996  
PhD Thesis Title: *Component Feature-Based Digital Waveform Analysis and Classification*  
Employer: Hewlett-Packard
- (10) Michael W. Macon  
Graduation Date: October 1996  
PhD Thesis Title: *Speech and Voice Synthesis Based on Sinusoidal Modeling*  
Recent Employer: Professor of ECE, Oregon Graduate Institute  
(Deceased April 2001)
- (11) David V. Anderson  
Graduation Date :March 1999  
PhD Thesis Title: *Audio Signal Enhancement Using Multi-resolution Sinusoidal Modeling*  
Employer: School of ECE, Georgia Institute of Technology
- (12) Burhan F. Necioglu  
Graduation Date :May 1999  
PhD Thesis Title: *Objectively Measured Descriptors for Perceptual Characterization of Speakers*  
Employer: Mitre Corporation
- (13) Trevor R. Trinkaus  
Graduation Date: December 1999  
PhD Thesis Title: *Perceptual Coding of Audio and Diverse Speech Signals*  
Employer: Rockwell-Collins

(14) Xiaozheng Zhang  
Graduation Date: April 2002  
PhD Thesis Title: *Automatic Speechreading for Improved Speech Recognition and Speaker Verification*  
Employer: California Polytechnic State University (Professor)

(14) Florent Maxime Hubert-Brierre  
Graduation Date: July 2001  
MS Thesis Title: *Distortion Compensation in Speech Signals Using a Blind Iterative Algorithm Based on Memoryless Symmetrical Nonlinearities*  
Employer: Zodiac SA (France), Research Engineer

(15) Woojay Jeon  
Graduation Date: December 2002  
MS Thesis Title: *Pitch Detection of Polyphonic Music Using Constrained Optimization*  
Employer: Motorola Labs.

(16) Adriane Swalm Durey  
Graduation Date: December 2003  
PhD Thesis: *Melody Spotting Using Hidden Markov Models*  
Employer: CardioMems

(17) Jon A. Arrowood  
Graduation Date: December 2003  
PhD Thesis: *Using Observation Uncertainty for Noise Robust Speech Recognition*  
Employer: Nexidia, Inc.

(18) Robert Morris  
Proposal Defense Completed, Graduation Date: December 2003  
PhD Thesis: *Enhancement and Recognition of Whispered Speech*  
Employer: Nexidia, Inc.

(19) Elliot Moore II  
Graduation Date: December 2003  
PhD Thesis: *Investigation of Objectively Measurable Features of Speech as Indicators of Depression*  
Employer: Professor of ECE, Georgia Institute of Technology

(19) Xin Zhong  
Graduation Date: December 2003  
PhD Thesis: *Speech coding and transmission for improved recognition in a communication network*  
Employer: Raytheon

(20) Gregory Rohling

Graduation Date: December 2004

PhD Thesis: *Multiple Objective Evolutionary Algorithms for Computationally Expensive Objective Evaluations*

Employer: Georgia Tech Research Institute

(21) Matthew Lee

Graduation Date: September 2005

PhD Thesis: *Singing Voice Synthesis*

Employer: National Security Agency

## B. Other Teaching Activities

### *Continuing Education Courses*

1. *Digital Speech Processing*, (Georgia Tech. Department of Continuing Education, June 11-15, 1984, Atlanta, GA.
2. *Digital Speech Processing*, Georgia Tech. Department of Continuing Education, April 1-5, 1985, Atlanta, GA.
3. *Digital Speech Processing*, Georgia Tech. Department of Continuing Education, June 2-6, 1986, Atlanta, GA.
4. *Digital Speech Processing*, Georgia Tech. Department of Continuing Education, June 10-12, 1987, Atlanta, GA.
5. *Digital Speech Processing*, Georgia Tech. Department of Continuing Education, June 8-10, 1988, Atlanta, GA.
6. *Applied Digital Signal Processing*, (Course Administrator and lectured 2 days. Also lecturing was M. Hayes), Georgia Tech. Department of Continuing Education, March 20-23, 1989, Atlanta, GA
7. *Applied Digital Signal Processing*, (Course Administrator and lectured 2 days. Also lecturing was M. Hayes), Contract Course for Harris Semiconductor, April 10-13, 1989, Melbourne, FL.
8. *Applied Digital Signal Processing*, (Course Administrator and lectured 2 days. Also lecturing was M. Hayes), Georgia Tech. Department of Continuing Education, September 25-28, 1989, Atlanta, GA.
9. *Applied Digital Signal Processing*, (Course Administrator and lectured 2 days. Also lecturing were R. Mersereau and M. Hayes), Georgia Tech. Department of Continuing Education, March 19-22, 1990, Atlanta, GA.
10. *Digital Signal Processing Applications*, (Course Administrator and lectured 2.5 days. Also lecturing was M. Hayes), Georgia Tech. Department of Continuing Education, March 3-7, 1990, Atlanta, GA..
11. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing was M. Hayes), Georgia Tech. Department of Continuing Education, Sept. 4-7, 1990, Atlanta, GA.
12. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing was M. Hayes), Georgia Tech. Department of Continuing Education, April 2-5, 1991, Atlanta, GA.
13. *Modern Speech Coding and Recognition*, (Lectured 2.5 days. Also lecturing was R. Schafer), CEI-Europe/Elsevier, September 9-13, 1991, Georgia Tech Lorraine, Metz, France.
14. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, October 14-18, 1991, Atlanta, GA
15. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, March 16-20, 1992, Atlanta, GA

16. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, October 19-23, 1992, Atlanta, GA.
17. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, February 8-11, MICOM, Redstone Arsenal, Huntsville, AL
18. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, October 18-22, 1993, Atlanta, GA
19. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, March 21-25, 1994, Atlanta, GA
20. *Digital Signal Processing*, (Course Administrator and lectured 5 days. Also lecturing were M. Hayes and R. Mersereau), Georgia Tech. Department of Continuing Education, July 26-Aug 6, 1994, Contract course for Saudi Arabia engineers, Atlanta, GA
21. *Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech. Department of Continuing Education, October 24-28, 1994, Atlanta, GA
22. *Fundamentals of Digital Signal Processing with Applications*, (Course Administrator and lectured 2 days. Also lecturing were M. Hayes and J. McClellan), Georgia Tech Department of Continuing Education, May 1-5, 1995, Atlanta, GA.

### ***New Courses Developed***

- 1) EE 8341, *Automatic Speech Recognition*, Special Topics course Summer 1994.
- 2) ECE 4270, *Digital Signal Processing*. Prof. Clements co-developed this course for semesters and was the first professor to teach it.
- 3) ECE 6255, *Digital Speech Processing*. Prof. Clements solely developed this course for semesters and is the only professor to have taught it.
- 4) ECE 6273 *Pattern Recognition with Applications to Voice*, Prof. Clements solely developed this course and is the only professor to have taught it.

## **AWARDS**

1. Supervised Investors Award for Best Teacher in Electrical Engineering, MIT - 1979
2. Technical Program Co-Chairman, SpeechTech '86 - 1986
3. Sigma Xi Doctoral Thesis Advisor Award, Georgia Tech - 1988, 1991, and 1997.
4. Sigma Xi Undergraduate Research Advisor Award, Georgia Tech - 1989
5. IEEE Fellow – 2005
6. Named to the Joseph M. Pettit Endowed Professorship -- 2008

## **Patents**

1. "Apparatus and Method for Modifying a Speech Waveform to Compensate for Recruitment of Loudness," Patent number 5,274,711, Granted: December 27, 1993.

2. "Singing Voice Synthesis," with E. George, M. Macon, L. Jensen-Link, J. Oliverio, Patent number 6,304,846, Granted: October 16, 2001.
3. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number, 7,263,484, Granted August 28, 2007.
4. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number, 7,313,521, Granted December 25, 2007.
5. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number, 7,324,939, Granted January 27, 2008
6. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number, 7,406,415, Granted July 29, 2008
7. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number 7,475,065, Granted January 6, 2009.
8. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Patent Number 7,769,587, Granted August 3, 2010.
9. "Digital Shaped Gaussian Monocycle Pulses in Ultra Wideband Communications," Jian-Wei Miao and Mark A. Clements, filed May 2004. Publication Number: 20040086001.
10. "Audio Search System," Gordon Edwards and Mark Clements, Filed November 2005,
11. "Method and Device for Sound Signature Detection," Steven Goldstein and Mark A. Clements, Filed October 2008, Publication Number 20080240458.
12. "Phonetic Searching," Peter Cardillo, Mark Clements, Ed Price, Filed March 26, 2009, Publication Number 20090083033.
13. "Word Spotting False Alarm Phrases," Robert Morris, Jon Arrowood. Mark Clements, Kenneth Griggs. Peter Cardillo, Marsal Gavalda, Filed February 24, 2009, Publication Number 20100217596.
14. "Feature Normalization for Speech and Audio Processing," Peter Cardillo and Mark Clements, Filed September 22, 2009, Publication Number 20100094622.

## **PUBLICATIONS**

### ***Theses***

1. M. A. Clements, "An Evaluation of Two Tactile Speech displays," S.M. Thesis, M.I.T., September 1978.
2. M. A. Clements, "A Comparative Evaluation of Different Signal Processing Techniques for Communication of Speech Through the Tactile Sense," Sc.D. Thesis, M.I.T., January 1982.

### ***Books or Parts of Books***

1. S. R. Quackenbush, T. P. Barnwell, and M. A. Clements, *Objective Measures for Speech Quality Testing*, Prentice-Hall, Englewood Cliffs, NJ 1988.
2. *Digital Signal Acquisition and Representation*, Chapter 2 in *Animal Acoustic Communications*, S. Hopp, (ed.) Springer-Verlag, 1998.
3. M. A. Clements, "Automatic Recognition of Speech in Stress," U.S. Army Human Engineering Laboratory Printing Office, Aberdeen Proving Ground, Maryland, 67 page research monograph, 1991.



4. G. Miao and M. Clements, *Digital Signal Processing and Statistical Pattern Recognition*, Artech House, 508 pages, June 2002.
5. Sabato Marco Siniscalchi, Jinyu Li, Giovanni Pilato, Giorgio Vassallo, Mark A. Clements, Antonio Gentile, Filippo Sorbello, "Application of EalphaNets to Feature Recognition of Articulation Manner in Knowledge-Based Automatic Speech Recognition," Chapter in *Neural Nets*, Springer Berlin / Heidelberg, 2006.

### ***Refereed Journal Publications***

1. M. Clements, D. Mook, N. Durlach, and L. Braida, "Experiments with Optacon-Based Speech Displays," *Speech Communication Papers of the Acoustic Society of America*, June 1979.
2. J. Snyder, M. Clements, C. Reed, N. Durlach, L. Braida, "Tactile Communication of Speech, Part I: Comparison of Tadoma and Frequency-Amplitude Spectral Display in a Consonant Discrimination Task," *J. Acoust. Soc. Am.*, 71, pp. 1249-1254, 1982.
3. M. Clements, L. Braida, and N. Durlach, "Comparison of Two Tactile Speech Codes," *J. Acoust. Soc. Am.*, 71, S59, 1982.
4. M. Clements, N. Durlach, L. Braida, "Tactile Communication of Speech Part II: Comparison of Two Spectral Displays in a Vowel Discrimination Task," *J. Acoust. Soc. Am.*, 72, pp. 1131-1135, 1982.
5. M. H. Hayes and M. A. Clements, "An Iterative Approach to Pisarenko's Harmonic Decomposition," *IEEE Trans. on Acoust., Speech, and Signal Processing*, 34, pp. 485-492, June 1986.
6. M. H. Hayes, M. A. Clements, and D. M. Wilkes, "Iterative Harmonic Decomposition of Non-Stationary Random Processes: Theory and Application to Spectral Line Tracking," *Mathematics in Signal Processing*, T. S. Durrani et al., Editors, pp. 105-119, Clarendon Press, Oxford, England, 1987.
7. M. A. Clements, "Voice Recognition Systems can be Designed to Serve a Variety of Purposes," *Industrial Engineering*, 19, 44-57, Sept. 1987.
8. M. A. Clements and S. H. Isabelle, "Reconstruction of a Positive Definite Toeplitz Matrix from Its Sequence of Minimum Eigenvalues," *IEEE Trans. on Acoust., Speech, and Signal Processing*, vol. ASSP-36, pp. 1784-86, November 1988.
9. M. A. Clements and J. Pease, "On Causal Linear Phase IIR Digital Filter," *IEEE Trans. on Acoust., Speech, and Signal Processing*, April 1989.
10. M. A. Clements, L. D. Braida, and N. I. Durlach, "Tactile Communication of Speech: III. Quantitative Evaluation of a Computer-Based Tactile Speech Display," *Journal of Rehabilitative Engineering*, May 1989.
11. D. J. Pepper, T. P. Barnwell, and M. A. Clements, "Using a Ring Parallel Processor for Hidden Markov Model Training," *IEEE Trans. on Acoust., Speech, and Signal Processing*, Feb. 1990.
12. D. J. Pepper and M. A. Clements, "Phonetic Recognition Using a Large Hidden Markov Model," *IEEE Trans. on Acoustics, Speech, and Signal Processing*, June 1992.
13. J. H. Hansen and M. A. Clements, "Constrained Iterative Speech Enhancement," *IEEE Trans. on Acoust., Speech, and Signal Processing*, Feb. 1991.

14. B. Carlson and M. Clements, "A Computationally Compact Divergence Measure for Speech Processing." *IEEE Trans. on Pattern Analysis and Machine Intelligence*, Dec. 1992, pp. 1255-1260.
15. B. Carlson and M. Clements, "A Projection-Based Likelihood Measure for Speech Recognition in Noise," *IEEE Trans. on Speech and Audio Processing*, Jan. 1994, pp. 97-102.
16. S. Lim and M. Clements, "Pseudo-Continuous Hidden Markov Modeling for Automatic Speech Recognition," *Proc. IEEE Southeastcon*, refereed, 7 pages, Birmingham, AL, April 12-15, 1992.
17. K. E. Cummings and M. A. Clements, "Glottal Models for Digital Speech Processing: A Historical Review and New Results," *Digital Signal Processing: A Review Journal*, Vol. 5, No. 1, pp. 21-42, January 1995. (invited)
18. R. Cole, L. Hirschman, et al. (including M. Clements), "the Challenge of Spoken Language Systems: Research Directions for the Nineties," *IEEE Trans. on Speech and Audio Processing*, Vol. 3, No. 1, pp. 1-21, January 1995.
19. K. Cummings, J. Maloney, and M. Clements, "Application of Yee's Finite Difference Method to Modelling Acoustic Wave Propagation in the Vocal Tract," *Journal of the Acoustical Society of America*, March 1995.
20. K. Cummings and M. Clements, "Analysis of the Glottal Excitation of Emotionally Stressed Speech," *Journal of the Acoustical Society of America*, July 1995, pp. 88-99.
21. J. Hansen and M. Clements, "Source Generation Equalization and Enhancement of Spectral Properties for Robust Speech Recognition in Noise and Stress," *IEEE Trans. of Speech and Audio Processing*, Sept. 1995, pp. 407-415.
22. M. Macon and M. Clements, "Sinusoidal Modeling and Modification of Unvoiced Speech," *IEEE Trans. on Speech and Audio*, Nov. 1997, pp. 557-560.
23. J. Miao and M. Clements, "On Canonical Discriminant Transform with Gaussian Spatial Filter for Digital Waveform Recognition," *IEEE Signal Processing Letters*, June 2003
24. J. Miao and M. Clements, "Comparison Studies of 2-D Transform Features Based Unsupervised Pattern Recognition for Digital Pulse Waveform Classification," submitted to *IEEE Transactions on Pattern Analysis and Machine Intelligence*, under revision.
25. David V. Anderson and Mark A. Clements, "Multi-resolution Sinusoidal Modeling," submitted to *IEEE Transactions on Speech and Audio Processing*, under revision.
26. R. Morris and M. Clements, "Modification of Formants in the Line Spectrum Domain," *IEEE Signal Processing Letters*, vol 9, pp 19-21 January 2002.
27. Cardillo, P. Clements, M., Miller, M., "Phonetic Searching vs Large Vocabulary Continuous Speech Recognition," *International Journal of Speech Technology*, pp 9-22, January 2002.
28. Robert Morris and Mark Clements, "Reconstruction of Speech from Whispers," *International Journal of Medical Engineering and Physics*, Dec 2002, pp 515-520.
29. Xiaozheng Zhang, Charles C. Broun, Russell M. Mersereau, Mark A. Clements, "Automatic Speechreading with Applications to Human-Computer Interfaces," *EURASIP JASP special Issue on Joint Audio-Visual Speech Processing*, October 2002, pp1228-1248.
30. G. Rohling, D. Lamm, and M. Clements, "Optimization of AAR-44A Missile Warning Receiver Algorithms using Multiple Objective Evolutionary Algorithms," *IEEE Journal of Evolutionary Algorithms*, November 2004

31. C. Demiroglu, D. Anderson and M. Clements "Segmentation-based Speech Enhancement for Intelligibility Improvement in MELP Coder in Harsh Noise Environments Using an Auxiliary Sensor," *IEEE Signal Processing Letters*, June 2004.
32. M. E. Lee, M. Clements, A. S. Durey, and E. Moore, "A Framework for an Ultra Low Bit Rate Speech Coder," *GESTS International Transaction on Acoustic Science and Engineering*, vol. 8, no. 1, pp. 112-123., May 2005.
33. Qiang Fu, Mark Clements. and Klaus Mewes, "A Study Of Neural Cell Type Classification Between Globus Pallidus Externus (Gpe) and Globus Pallidus Internus (Gpi) By Gaussian Mixture Model." Submitted to *IEEE Trans on Biomedical Engineering*, June 2006.
34. Demiroglu, Anderson, and Clements, "Multi-sensor Segmentation-Based Signal Presence Detection for Intelligibility Improvement in MELP Speech Coder." Submitted to *IEEE Transactions on Speech and Audio*, September 2006 (under revision).
35. Elliot Moore, Mark Clements, John Peifer, and Lydia Weisser, "Investigating the Impact of Voice Source Analysis in Classifying Clinical Depression," *IEEE Transactions on Biomedical Engineering*, vol. 55, no. 1, pp. 96-108, January 2008.
36. Harold Cheyne, Kaustubh Kalgaonkar, Mark Clements, and Patrick Zurek, "Talker-to-Listener Distance Effects on Speech Production and Perception," *Journal of the Acoustical Society of America*, Volume 126, Issue 4, pp. 2052-2060 (October 2009).

#### ***Refereed Conference Presentations with Proceedings***

1. M. Clements, L. Braida, N. Durlach, "Quantitative Methods for the Comparative Evaluation of Artificial Tactile Speech Displays," *Proceedings of 1983 Int'l Conference IEEE Engineering in Medicine and Biology Society*, Philadelphia, PA, September 1982. (Invited).
2. M. A. Clements, "Processing of Speech for Tactile Communication," *Proceedings of Southeastern Symposium on System Theory*, Huntsville, AL, March 1983. (Invited).
3. M. Clements, L. Braida, N. Durlach, "Speech Processing for Artificial Tactile Speech Displays," *Proceedings of 1983 IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, Boston, MA, April 1983.
4. M. A. Clements and R. C. Rose, "Linear Predictive Modeling with a Maximally Pulse-like Residual," *Proc. IEEE ASSP Workshop on DSP*, Cape Cod, 1984.
5. H. A. Hawkins, D. M. Wilkes, M. A. Clements, and M. H. Hayes, "Perceptual Weightings and Optimal Pulse-Positioning in Multipulse LPC Coding," *Proceedings of 1985 IEEE Int. Conference on Acoust., Speech, and Signal Processing*, Tampa, FL, March 1985.
6. R. C. Rose, M. A. Clements, "All-Pole Speech Modeling with a Maximally Pulse-Like Residual," *Proceedings of 1985 IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, Tampa, FL, March 1985.
7. M. H. Hayes, M. A. Clements, and D. M. Wilkes, "Iterative Harmonic Decomposition of Non-Stationary Random Processes: Theory and Application to Spectral Line Tracking," *Proceedings Mathematics in Signal Processing Conference*, Bath, England, Sept. 1985.

8. E. Farges and M. Clements, "Hidden Markov Models Applied to Very Low Bit Rate Coding," *Proceedings of 1986 IEEE Int. Conference on Acoust., Speech, and Signal Processing*, Tokyo, Japan, April 1986.
9. D. J. Healy and M. A. Clements, "Toward the Goal of Video-Deaf Communication over Public Telephone Lines," *Proceedings of SPIE: Visual Communication and Image Processing*, Vol. 77, pp. 83-90, Cambridge, MA, Sept. 1986.
10. M. A. Clements and S. Lim, "Hidden Markov Model Speech Recognition Based on Kalman Filtering," *Proceedings of IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, Dallas, TX, April 1987.
11. J. H. Hansen and M. A. Clements, "Iterative Speech Enhancement with Spectral Constraints," *Proceedings of IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, Dallas, TX, April 1987.
12. E. P. Farges and M. A. Clements, "An Analysis/Synthesis Hidden Markov Model of Speech," *Proceedings 1988 IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, New York, April 1988.
13. J. H. Hansen and M. A. Clements, "Constrained Iterative Speech Enhancement with Application to Automatic Recognition," *Proceedings 1988 IEEE Int. Conf. on Acoust., Speech, and Signal Processing*, New York, April 1988.
14. K. Cummings, M. Clements, and J. Hansen, "Estimation and Comparison of the Glottal Source Waveform Across Stress Styles Using Glottal Inverse Filtering," *Proc. IEEE Southeastcon*, Columbia, SC, pp. 776-781, April 1989.
15. J. Hansen and M. Clements, "Stress Compensation and Noise Reduction Algorithms for Robust Speech Recognition," *Proc. 1989 International Conf. on Acoustics, Speech, and Signal Processing*, vol. S1, pp. 266-269, May 1989.
16. J. Hansen and M. Clements, "Use of Objective Speech Quality Measures in Selected Effective Spectral Estimation Techniques for Speech Enhancement," *Proc. Midwest Symposium on Circuits and Systems*, Urbana-Champaign, IL, August 1989.
17. B. Carlson and M. Clements, "A Weighted Projection Measure for Robust Speech Recognition," *Proc. IEEE Southeastcon*, New Orleans, LA, April 1990.
18. K. Cummings and M. Clements, "Analysis of Glottal Waveforms Across Stress Styles," *Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, Albuquerque, NM, April 1990.
19. B. Carlson and M. Clements, "Application of a Weighted Projection Measure for Robust Hidden Markov Model Based Speech Recognition," *Proceedings of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, May 1991.
20. D. Pepper and M. Clements, "On the Phonetic Structure of a Large Hidden Markov Model," *Proceedings of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, May 1991.
21. J. Rutledge and M. Clements, "Time-Varying Frequency-Dependent Compensation for Recruitment of Loudness," *Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, Toronto, Canada, May 1991.
22. K. E. Cummings and M. A. Clements, "Improvements to and Applications of Analysis of Stressed Speech Using Glottal Waveforms," *Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, San Francisco, CA, March 23-26, 1992.

23. B. A. Carlson and M. A. Clements, "A Weighted Projection Measure for Mixture Density HMM Based Recognition in Noise," *Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, San Francisco, CA, March 23-26, 1992.
24. K. Cummings and M. A. Clements, "Application of the Analysis of Glottal Excitation of Stressed Speech to Speaking Style Modification," *Proc. of IEEE Int. Conf. on Acoustics, Speech, and Signal Processing*, Minneapolis, MN, April 27-30, 1993.
25. K. Cummings, M. Clements, and J. Maloney, "A Finite-Difference Time Domain Model of Speech Production," *Proc., First International Conf. on Neural, Parallel, and Scientific Computing*, May 1995, Atlanta, GA (6 pages), invited.
26. D. Lambert, K. Cummings, J. Rutledge, and M. Clements, "Synthesizing Styled Speech Using the Klatt Synthesizer," *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, Detroit, MI, May 1995.
27. K. Cummings and M. Clements, "Modelling Speech Production Using Yee's Finite Difference Method," *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, Detroit, MI, May 1995.
28. J. Miao and M. Clements, "Unsupervised Pattern Recognition for Digital Waveform Classification from Radiation Detectors," *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, Detroit, MI, May 1995.
29. M. W. Macon and M. A. Clements, "Speech Concatenation and Synthesis Using an Overlap-Add Sinusoidal Model," *Proc. ICASSP'96*, Vol.I, pp. 361-364, Atlanta, GA, 1996.
30. B. F. Necioglu, M. A. Clements, T. P. Barnwell III, "Objectively Measured Descriptors Applied To Speaker Characterization," *Proc. ICASSP'96*, Vol.I, pp. 483-486, Atlanta, GA, 1996.
31. J. Miao, M. A. Clements, "Optimal Discriminant Feature-Based Waveform Recognition With Neural Networks," *Proc. ICASSP'96*, Vol.I, pp. 3462-3466, Atlanta, GA, 1996.
32. J. Miao, M. A. Clements, "Canonical Discriminant Feature-Based Digital Waveform Recognition with Neural Networks," *Proc. International Conference on Signal Processing Applications and Technology*, Boston, MA, October 1996.
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37. P. Frazier, P. Cardillo, J. Kalter, and M. Clements, "Speech Recognition Applied to Medical Transcription," *Proceedings of the 16th Annual International Voice Technologies Applications Conference*, pp. 197-206, September 9-11, 1997.
38. N. Karaca, M. Clements, H. Gecim, "Speech Recognition under Adverse Environments - RASTA Filtering and the Weighted Projection Measure," *IEEE Nordic Processing Symposium*, June 8-11, 1998, Denmark.

39. N. Karaca, M. Clements, H. Gecim, "Turkish Speech Recognition under Noisy Environments - RASTA Processing and the Weighted Projection Measure," *Signal Processing Applications Conference*, May 28-30, 1998, Ankara, Turkey.
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48. "Efficient Multi-resolution Sinusoidal Modeling," David V. Anderson and Mark A. Clements *World Conference on Systemics, Cybernetics, and Informatics*, July 23-26, 2000 Orlando, FL Vol 6, pp 424-429, (invited).
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51. Robert Morris and Mark Clements, "Maximum Likelihood Compensation of Zero-Memory Nonlinearities in Speech Signals," *Proceedings, IEEE International Conference on Acoustics, Speech, and Signal Processing*, Salt Lake City, Utah, 2001.
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55. Adriane Swalm Durey and Mark A. Clements, "Features for Melody Spotting Using Hidden Markov Models," *Proceedings, IEEE Int. Conf. on Acoustics Speech and Signal Processing*, Orlando, Florida, May 2002.
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57. R. W. Morris, M. A. Clements, "Estimation of Speech Spectra from Whispers," *Proceedings, IEEE Int. Conf. on Acoustics Speech and Signal Processing*, Orlando, Florida, May 2002.
58. R. W. Morris, M. A. Clements, and J. S. Collura "Autoregressive Parameter Estimation of Speech in Noise," *Proceedings 2002 IEEE Speech Coding Workshop*, Tokyo (**Won award for best paper with a student as an author**).
59. Zhong, X, Arrowood, J., Clements, M., "Speech Coding and Transmission for Improved Automatic Recognition" *Proceedings 2002 International Conference on Spoken Language Processing*, Boulder CO USA, Sept 16-20, 2002.
60. Arrowood, J., Clements, M., "Using Observation Uncertainty in HMM Decoding," *Proceedings 2002 International Conference on Spoken Language Processing*, Boulder CO USA, Sept 16-20, 2002.
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63. X. Zhong, J. Arrowood, A. Moreno, and M. Clements, "Multiple Description Coding for Recognition of Voice Over IP," *Proceedings Digital Signal Processing Workshop*, Callaway Gardens, GA, October 2002.
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65. R. Morris, J. Arrowood, and M. Clements, "Markov Chain Monte Carlo Methods for Noise Robust Feature Extraction Using the Autoregressive Model," *Proceedings of EuroSpeech, 2003* (Geneva)
66. Adriane Swalm Durey and Mark A. Clements. Direct Estimation of Musical Pitch Contour from Audio Data. Accepted for *Proceedings of the International Conference on Acoustics, Speech, and Signal Processing*, Hong Kong, April 2003. (Presented ICASSP 04).
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72. Jon A. Arrowood and Mark A. Clements, "Extended Cluster Information Vector Quantization (ECI-VQ) for Robust Classification," *ICASSP 2004*, Montreal, Quebec, Canada, May, 2004.
73. Moore, E. and Clements, M., "Algorithm for automatic glottal waveform estimation without the reliance on precise glottal closure information," *ICASSP 2004*, Montreal, Quebec, Canada, May, 2004.
74. R. W. Morris, J. A. Arrowood, P. S. Cardillo, and M. A. Clements, "Scoring Algorithms for Wordspotting Systems," *Proceedings of the HLT-NAACL 2004 Workshop: Interdisciplinary Approaches to Speech Indexing and Retrieval*, pages 18-21, Boston, MA, May 2004
75. A. Durey and M. Clements, "Direct Estimation of Musical Pitch Contour from Audio Data," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Montreal, May 2004
76. C. Demiroglu, D. Anderson and M. Clements, "Segmentation based Speech Enhancement Using Auxiliary Sensors," *Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, CA, November 2004.
77. Matthew E. Lee, Adriane Swalm Durey, Elliot Moore, and Mark Clements, "Ultra Low Bit Rate Speech Coding Using an Ergodic Hidden Markov Model," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Philadelphia, March 2005.
78. Qiang Fu, Mark Clements. and Klaus Mewes, "Neuron Type Classification Between GPe and GPi," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Philadelphia, March 2005.
79. R. Morris, J. Arrowood, and M. Clements, "Comparison of Autoregressive Parameter Estimation Algorithms for Speech Processing and Recognition," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Philadelphia, March 2005.
80. Sabato Marco Siniscalchi, Jinyu Li, Giovanni Pilato, Giorgio Vassallo, Mark A. Clements, Antonio Gentile, Filippo Sorbello, "Application of EalphaNets to Feature Recognition of Articulation Manner in Knowledge-Based Automatic Speech Recognition," *Neural Nets, 16th Italian Workshop on Neural Nets, WIRN 2005, and*



*International Workshop on Natural and Artificial Immune Systems, NAIS 2005*, Vietri sul Mare, Italy, June 8-11, 2005, pp140-146

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82. Sabato M. Siniscalchi, Mark A. Clements, Antonio Gentile, Giorgio Vassallo, Filippo Sorbello, "A Study Of Perceptron Mapping Capability To Design Speech Event Detectors," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Toulouse, May 2006.
83. Cenk Demiroglu, David Anderson, Mark Clements, Thomas Barnwell, "Multi-Sensor Spectro-Temporal Comb Filtering for Speech Enhancement," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Honolulu, April 2007.
84. Cenk Demiroglu, David V. Anderson, Mark A. Clements, "A Missing Data-Based Feature Fusion Strategy for Noise-Robust Automatic Speech Recognition Using Noisy Sensors," *IEEE International Conference of Circuits and Systems (ISCAS)*, May 2007, New Orleans, 965-968
85. Kaustubh Kalgaonkar and Mark Clements, "Vocal Tract and Area Function Estimation with both Lip and Glottal Losses," *Proceedings of InterSpeech*, Antwerp, August 2007.
86. C.-H. Lee, M. Clements, S. Dusan, E. Fosler-Lussier, K. Johnson, B.-H. Juang, L. Rabiner, "An Overview on Automatic Speech Attribute Transcription (ASAT)," *Proceedings of Interspeech*, Antwerp, August 2007.
87. Harold Cheyne, Kaustubh Kalgaonkar, Mark Clements, and Patrick Zurek, "Talker-to-Listener Distance Effects on Speech Production & Perception," *American Speech-Language-Hearing Association Conference*, Boston, November 2007.
88. Mark Clements and Marsal Gavalda, "Voice/Audio Information Retrieval: Minimizing the Need for Human Ears," In *Proceedings of the IEEE Workshop on Automatic Speech Recognition and Understanding (ASRU)*, Kyoto, December 2007 (invited paper and talk).
89. Kaustubh Kalgaonkar and Mark Clements, "Vocal Tract Area Based Formant Tracking Using Particle Filters," *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Las Vegas, April 2008.
90. Kaustubh Kalgaonkar and Mark Clements, "Vocal Tract Area Based Artificial Bandwidth Extension," *2008 IEEE International Workshop on Machine Learning For Signal Processing (MLSP)*, Cancun, Mexico, October, 2008.
91. Brett Matthews and Mark Clements, "Automatic detection of speech activity from neural signals in Broca's Area," *Neuroscience 2008*, Washington DC, November, 2008.
92. Kaustubh Kalgaonkar and Mark Clements, "Sparse Probabilistic State Mapping and its Application to Speech Bandwidth Expansion," *Proceedings International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Taipei, Taiwan, April 2009.
93. Kaustubh Kalgaonkar and Mark Clements, "Constrained Probabilistic Subspace Maps Applied to Speech Enhancement," *Proceedings of Interspeech 2009*, Brighton, UK, September 2009.
94. P. Kennedy, D. Andreasen, J. Brumberg, M. Clements, F. Guenther, J. Kim, B. Matthews, C. Ramos, M. Velliste, E. Wright, "Human Speech Cortex: Tuning of Single Units During Listening and Imagined Singing of Tones and Musical Notes Using Feedback," *Neuroscience 2009*, Chicago, October 2009.

95. Kaustubh Kalgaonkar and Mark Clements, "Probabilistic State Mapping as a Model for Speech Production," Asilomar Conference on Signals, Systems, and Computers, November 2009 (invited).
96. Kaustubh Kalgaonkar and Mark Clements, "HMM Adaptation Using Sparse Probabilistic Space Mapping for Noisy Speech" *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Dallas, March 2010.
97. Brett Matthews, Jonathan Brumberg, Jonathan Kim, and Mark Clements, "A Probabilistic Decoding Approach to a Neural Prosthesis for Speech," *Proceedings IEEE International Conference on Bioinformatics and Biomedical Engineering*, Chengdu, China, June 2010

## Other Presentations

1. M. A. Clements, L. D. Braid, N. I. Durlach, "Comparison of Two Tactile Speech Codes," Spring 1982 Meeting of the Acoust. Soc. Am., Chicago, IL, April 1982.
2. M. A. Clements, "Objective Speech Quality Measures Based on Human Audition," Spring 1984 Meeting of the Acoust. Soc. Am., Norfolk, VA, May 1984.
3. J. H. Hansen and M. A. Clements, "Objective Quality Measures Applied to Enhanced Speech," Meeting of the Acoustical Society of America, Nashville, TN, Fall, 1985.
4. M. A. Clements and S. Lim, "A Continuous-Trial Hidden Markov Model for Speech Recognition," *Speech Research Symposium V*, Baltimore, MD, February 19-20, 1987. (invited)
5. M. A. Clements and E. P. Farges, "A Global Hidden Markov Model for Continuous Speech," *Speech Research Symposium VI*, Murray Hill, NJ, November 5-6, 1987. (invited)
6. J. H. Hansen and M. A. Clements, "Evaluation of Speech Under Stress and Emotional Conditions," Fall 1987 Meeting of Acoust. Soc. Am., Miami, FL, November 1987.
7. J. L. Lias and M. A. Clements, "Sinusoidal Modeling of Speech: Its Use in Simulating and Compensation for Recruitment of Loudness," Fall 1987 Meeting of Acoust. Soc. Am., Miami, FL, November 1987.
8. J. Rutledge, and M. Clements, "Time Varying/Frequency Varying Amplitude Compressions in Compensation for Recruitment of Loudness," Fall 1988 Meeting of the Acoustical Society of America, Honolulu, HI, November 1988.
9. M. A. Clements, "Subjective Assessment of Acoustic Patterns," *Proc. of National Academy of Science Workshop on the Quality of Digitally Processed Acoustic Signals*, Mystic, Conn., April 1990. (invited)
10. M. A. Clements, "Robust Automatic Speech Recognition," NSF Workshop on Speech and Natural Language, Washington, D.C., February 1992. (invited)
11. D. Lambert, K. Cummings, J. Rutledge, and M. Clements, "Synthesizing Multistyle Speech Using the Klatt Synthesizer," *Proc. of the 127th Meeting of the Acoustical Society of America*, Boston, Ma, June 1994.
12. K. Cummings and M. Clements, "Modelling Speech Production Using Finite Difference Techniques," *Proc. of the 127th Meeting of the Acoustical Society of America*, Boston, Ma, June 1994.

13. M. Macon and M. Clements, "Speech Synthesis Based on an Overlap-Sinusoidal Model," *Proc. of the 129th Meeting of the Acoustical Society of America*, Washington, DC, June 1995.
14. David V. Anderson and Mark A. Clements, "Noise Suppression in Speech Using Multi-resolution Sinusoidal Modeling," presented at the Fall 1998 *Meeting of the Acoustical Society of America*, Norfolk, VA.
15. David V. Anderson and Mark A. Clements, "Robust Speech Communications in Noisy Systems and Environments," presentation at GCATT Communications Conference, 1998.
16. Cardillo, P. and Clements, M. High Speed Wordspotting for Archive Retrieval, Georgia Tech Wireless Symposium, 1999.
17. Cardillo, P. and Clements, M. High Speed Forward-Backward Wordspotting, Georgia Center for Advanced Communications Technologies, NIGHTLIGHT, Jan 18, 2000.
18. Jon Arrowood, Brian Delaney, Mark Clements, Nikil Jayant, Voice User Interfaces for Wireless PDAs, YAMACRAW Conference, October 18, 2000.
19. Mark Clements, The Yamacraw User Interface, YAMACRAW Conference, October 19, 2000.
20. Mark A. Clements, "Commercialization of Novel Speech Technology," *First Georgia Tech Technology Symposium*, November 2001 (invited talk and invited panelist).
21. Mark A. Clements "Analysis of Acoustic Streams through Phonetic Processing," Washington DC, September 2004.
22. Mark A. Clements, "Next Generation Search Using Voice Analytics," *MIT Emerging Technologies Conference*, Cambridge, MA, November 2004 (Invited presenter and panelist).
23. Mark A. Clements "Applications of Automatic Language Identification," SpeechTek 2005, New York City, August 2005 (invited).
24. Mark A. Clements, "Search Using Voice and Audio Analytics," INFOX 2005, New York, September 2005 (invited).
25. Mark A. Clements "Progress in Automatic Language Identification," *ISS World*, Washington, DC, December 2005 (invited).

## Technical/Research Reports

1. M. A. Clements, "An Investigation of Perceptual Distance Measures for Speech," Final Report, RADC Contract F30602-81-C-0185, Feb. 1984.
2. T. P. Barnwell and M. A. Clements, "Improved Compactly Computable Objective Measures for Predicting the Acceptability of Speech Communications Systems," Final Report, DCA Contract DCA-100-83-C-0027, June 1984.
3. M. A. Clements, "Adaptation and Development of Speech Recognition Techniques as Applied to Improving Communications for Individuals with Hearing Impairments," Final Report, NSF Contract ECS-8206409, July 1985.
4. J. H. Hansen and M. A. Clements, "Speech Enhancement for Automatic Recognition," Final Report, Lockheed Contract 1084637, Sept. 1985.
5. R. Cole, Lynette Hirschman, et al. (including Mark Clements), "Workshop of Spoken Language Understanding," Oregon Graduate Institute Technical Report No. C/SE 92-

- 014, September 1, 1992. (This was a 63 page report of an NSF-sponsored two-day invited workshop to determine future trends and needs of automatic speech recognition research.)
6. Lim, Su How and Clements, Identification of Cancerous Tissue via Raman Spectroscopy, Report to Visionex, Inc., 1999.

## **Funded Grants and Contracts**

1. "Adaptation and Development of Speech Recognition Techniques as Applied to Improving Communication for Individuals With Hearing Impairments," National Science Foundation, July 1982-January 1983.
2. "Improved Compactly Computable Objective Measures for Predicting the Acceptability of Speech Communications Systems," Defense Communications Agency, January 1983-May 1984.
3. "Acoustic Phonetic Research for Speech Processing," Rome Air Development Center, September 1982-January 1984.
4. "Speech Enhancement for Automatic Recognition," Lockheed-Georgia Company July 1984-January 1985.
5. "Industrial Undergraduate Research Program," GTE Laboratories, June 1985-August 1985.
6. "Research in Digital Speech Processing," National Security Agency, September 1985-August 1988.
7. "Automatic Recognition of Speech in Stress," U.S. Army Human Engineering Laboratories, January 1986-May 1990.
8. "Speech Enhancement for Automatic Recognition," Lockheed-Georgia Company, June 1986-December 1986.
9. "Research in Digital Speech Processing," National Security Agency, September 1988-September 1990.
10. "Real-Time Compensation for Hearing Losses (Phase I)," IBM, July 1990-June 1991.
11. "NSF Postdoctoral Associateship for Kathleen E. Cummings," NSF, October 1992 - September 1994.
12. "Infrastructure and Research Program for Signal Processing in Multimedia Systems" National Science Foundation, , for three years (with Thomas Barnwell, James McClellan, Stephen McGrath, Russell Mersereau, and Ronald Schafer; Clements responsible of 25%).
13. "Robust Automatic Recognition of Turkish Speech," NATO, October 1992.
14. "Compression of Wideband Audio Signals," GCATT, July 1993-June 1994.
15. "Objective and Subjective Tests for Speaker Identifiability, Phase I," Naval Research Laboratory, October 1993-January 1994.
16. "Objective and Subjective Tests for Speaker Identifiability, Phase II," Naval Research Laboratory, January 1994-January 1996.
17. "Digital Spectroscopy," Westinghouse Savannah River Station, January 1993-December 1995.
18. "Improved Methods for Analysis-by-Synthesis Overlap Add Sinusoidal Speech Modeling," Lockheed-Sanders, October 1994-June 1995.

19. "Signal Processing & Pattern Recognition Applied to Raman Spectroscopy," Georgia Research Alliance and Visionex, 7/1/98-6/30/99.
20. "Cutting Edge Research Program in Speech Science," anonymous donor through COE, 10/13/97-12/31/99.
21. "Multi-speaker Speech Compression for Voice Memo Storage," Motorola Communications, 1998.
22. "Multi-speaker Speech Compression for Voice Memo Storage," Motorola Communications, 1999.
23. "Multi-speaker Speech Compression for Voice Memo Storage," Motorola Communications, 2000.
24. "Multi-speaker Speech Compression for Voice Memo Storage," Motorola Communications, 2001.
25. "Multi-speaker Speech Compression for Voice Memo Storage," Motorola Communications, 2002
26. "Robust Speech Recognition," NCR, 1997.
27. "Robust Speech Recognition," NCR, 1998.
28. "Robust Speech Recognition," NCR, 1999.
29. "Automatic Transcription," Lanier Worldwide, 1997.
30. "Voice Compression," Lanier Worldwide, 1998.
31. "Voice Compression," Lanier Worldwide, 1999.
32. "Voice Compression," Lanier Worldwide, 2000.
33. "Indexing for Multimedia Retrieval" Woodruff Foundation, 1998.
34. "Indexing for Multimedia Retrieval" Woodruff Foundation, 1999.
35. "Robust Speech Recognition," Texas Instruments, Sept 1999- May 2002.
36. "Robust Speech Recognition," Texas Instruments, Sept 2002- May 2003.
37. "Voice User Interfaces," Yamacraw, 7/01/99-6/30/04.
38. Georgia Research Alliance "Digital Content Cluster," Scott Shamp (UGA), Mark Clements and Ed Price (GT), Kay Beck and William Evans (Georgia State University), 2000.
39. Georgia Research Alliance, "Digital Content Cluster," Scott Shamp (UGA), Ron Schafer, Mark Clements and Ed Price (GT), Kay Beck and William Evans (Georgia State University), 2001.
40. Georgia Research Alliance, "Digital Content Cluster," Scott Shamp (UGA), Ron Schafer, Mark Clements and Ed Price (GT), Kay Beck and William Evans (Georgia State University), 2001.
41. "Analysis of Whispered Speech," National Security Agency, January 2000 – August 2003.
42. "Advanced Speech Encoding," DARPA, October 2002-January 2006.
43. "Signal Classification in Harsh Environments," CIA, 2005-2006
44. "Identification and Classification of Acoustic Cues of Vocal Change Effort," Sensimetrics Corp., 2005-2008.
45. "Automatic Speech Attribute Transcription," NSF, 2005-2009.
46. "GoupWear: Augmented Memory for Reporting," DARPA, 2005-2006.
47. "Recognition of Firing Patterns from Human Speech Cortex," NIH, 2007-2009.
48. "Expeditions in Computing," NSF, 2010-2015.