

Marcus Pendergrass, PhD

Applied Mathematician

<mailto:Marcus@MarcusPendergrass.com>

Education

- PhD, Applied Mathematics, University of Alabama in Huntsville, 1994
- MA, Mathematics, University of Alabama in Huntsville, 1991
- BA, Mathematics, University of Alabama in Huntsville, 1988

Teaching Experience

July 2006 – present, Visiting Assistant Professor of Mathematics, Hampden-Sydney College. Undergraduate teaching research, service.

August 2004 – May 2006, Adjunct Faculty in Mathematics, Longwood University. Undergraduate teaching, research.

September 2002 – December 2003, University of Alabama in Huntsville, Adjunct Assistant Professor of Mathematics. Member of Graduate Faculty, teaching graduate-level courses in Information Theory and Probability. Also taught undergraduate Abstract Algebra.

August 1996 - May 1997, Alabama A&M, Assistant Professor of Mathematics. Undergraduate teaching (Calculus, Linear Algebra, Abstract Algebra, etc.), research, and service.

August 1995 - May 1996, Christian Brothers University (Memphis, Tennessee), Assistant Professor of Mathematics. Undergraduate teaching (Calculus, Business Math, Linear Algebra, etc.), research, service.

Industry Experience

January 2005 – present, Consultant, specializing in mathematical modeling, algorithm design, and simulation for communications and radar systems.

June 2003 – January 2005, Convergent Corporation. Founder, President and Chief Scientist for *Convergent*, a technical research, services, and consulting firm. Expertise in mathematical modeling and simulation development for communications and radar technology, including impulse-based systems, multiband orthogonal frequency division multiplexing radio, detectability analysis, algorithm development (e.g. leading edge detection, positioning solvers, radar discrimination), system design, and system analysis.

December 1999 – September 2003, Time Domain Corporation, Systems Scientist. Research, algorithm design, and analysis in ultrawideband radio technology for communications and radar. Designed channel coding schemes for UWB communications and radar, including time-hopping, bi-phase, and frequency-hopping codes. Codes were optimized for various metrics, including absence of spectral features, high channelization capabilities, and fast acquisition. Designed high-order modulation schemes for use in UWB communications. Supported design and analysis of a UWB physical layer for the IEEE 802.15.3 wireless personal area networking standard. Developed mathematical model for ultra-wideband receivers used in the analysis of receiver efficiency. Formulated statistical

models for UWB RF channels. Developed simulator for performance evaluation of UWB radios.

June 1997 – December 1999, COLSA Corporation, Scientist. Research, analysis, and software engineering in support of the National Missile Defense (NMD) program, primarily focused on automatic pattern recognition and signal processing technologies.

Computer Skills

Tools: Matlab, Maple (computer algebra system), Excel, etc.

Programming Languages: algorithm development in Java, C/C++

Representative Publications

1. Andreas Molisch, Marcus Pendergrass, *et al*, “UWB Propagation Channels”, in [UWB Communication Systems: A Comprehensive Overview](#), M. G. DiBenedetto, T. Kaiser, A. F. Molisch, I. Opermann, C. Politano, and D. Porcino (eds.), EURASIP Book Series on Signal Processing and Communications, Hindawi Publishing Company, 2006.
2. M. Leigh Lunsford, Marcus Pendergrass, Phillip Poplin, and David Shoenthal, “Naïve Calculus: The Product And Quotient Rules”, submitted, 2006.
3. M. Leigh Lunsford, Marcus Pendergrass, Phillip Poplin, and David Shoenthal, “Naïve Calculus: The Chain Rule”, submitted, 2006.
4. Andreas F. Molisch, Jeffrey R. Foerster, and Marcus Pendergrass, [Channel Models for Ultrawideband Personal Area Networks](#), IEEE Wireless Communications, December 2003.
5. Marcus Pendergrass, [Error Rates for a Class of Multiple Position Modulation Schemes](#), IEEE Vehicular Technology Conference, Spring 2002, May 6 - 9, 2002, Birmingham Alabama.
6. Marcus Pendergrass and Joy Kelly, [Proposal for Alternate Physical Layer for 802.15.3 \(supporting text\)](#), IEEE 802.15.3 Document Archives 03144r1P802-15_TG3a-TimeDomain-CFP-Document.pdf, March 2003.
7. Marcus Pendergrass and William Beeler, [Empirically Based Statistical Ultra-Wideband Channel Model](#), IEEE 802.15.3 Document Archives 02240r1p802-15_SG3a-Empirically_Based_UWB_Channel_Model.ppt, July, 2002.
8. Marcus Pendergrass, [Note on Optimal Receiver Design](#), Time Domain Technical Memorandum SYS-GEN-MP-043001RB, May 2, 2001.
9. Kyle Siegrist and Marcus Pendergrass, [Generalizations of Bold Play in Red and Black. Stochastic Processes and Their Applications](#), **92** (2001), 163-180.
10. Marcus Pendergrass, [Self-Similarity Templates for Data Compression](#), proceedings of the Workshop on Data Compression Processing Techniques for Missile Guidance Data Links, Special Report MG-99-5, March 1999, U.S. Army Aviation and Missile Command, ATTN:AMSAM-RD-MG.
11. Marcus Pendergrass, [Complexity of Set-Valued Maps](#), Ph.D. Dissertation, University of Alabama System, 1994.
12. Marcus Pendergrass, [The Saddle-Node Property, with Applications to a System from Population Biology](#), Master’s Thesis, University of Alabama in Huntsville, 1991.

Issued Patents

1. Richards, James L., Roberts, Mark D., and Pendergrass, Marcus H., “Method and Apparatus for Positioning Pulses in Time”, US Patent 6,959,032, October 25, 2005.
2. Pendergrass, Marcus H., and Roberts, Mark D., “System and Method for Positioning Pulses in Time Using a Code That Provides Spectral Shaping”, US Patent 6,937,639, August 30, 2005.
3. Kumar, P. Vijay, and Pendergrass, Marcus H., “Method and Apparatus for Generating a Large Number of Codes Having Desirable Correlation Properties”, US Patent 6,912,240, June 28, 2005.
4. Richards, James L., Roberts, Mark D., Pendergrass, Marcus H., and Fullerton, Larry W., “Method and Apparatus for Applying Codes Having Pre-Defined Properties”, US Patent 6,788,730, September 7, 2004.
5. Fullerton, Larry W., Roberts, Mark D., Richards, James L., and Pendergrass, Marcus H., “Method and Apparatus for Generating a Pulse Train With Specifiable Spectral Response Characteristics”, US Patent 6,778,603, August 17, 2004.
6. Brethour, Vernon R., Pendergrass, Marcus H., and Confer, Ryan N., “Method and Apparatus for Implementing Precision Time Delays”, US Patent 6,677,796, January 13, 2004.
7. Richards, James L., Roberts, Mark D., Pendergrass, Marcus H., and Fullerton, Larry W., “Method and Apparatus for Positioning Pulses Over Time by Applying Time-Hopping Codes Having Pre-Defined Characteristics”, US Patent 6,671,310, December 30, 2003.
8. Roberts, Mark D., Pendergrass, Marcus H., Fullerton, Larry W., Richards, James L., “Method for Specifying Non-Allowable Pulse Characteristics”, US Patent 6,636,567, October 21, 2003.
9. Roberts, Mark D., Pendergrass, Marcus H., Fullerton, Larry W., and Richards, James L., “Method and Apparatus for Specifying Pulse Characteristics Using a Code that Satisfies Pre-Defined Criteria”, US Patent 6,636,566, October 21, 2003.