Donald M. Hummels

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RESEARCH INTERESTS

Nonlinear methods in signal processing and application to digitally implemented receivers. Fast data converter architecture, design, and applications. Real-time acoustic signal processing.

EDUCATION

Purdue University, Ph.D. in EE, Dec 1987.
Area of Emphasis: Communications and Signal Processing
Research Topic: Nonparametric Methods in Pattern Recognition
Dissertation Title: "Nonparametric Estimation of the Bayes Error"

Purdue University, MS in EE, May 1985.
Thesis Title: "Bayes Error Estimation Using Edited Nearest Neighbor Rules"

Kansas State University, BS in EE, May 1983, Honors Program, *Summa Cum Laude*

RESEARCH AND EXPERIENCE

University of Maine	**Electrical and Computer Engineering**
Professor	**Sep. 2000 – Present**
Associate Professor	**Sep. 1994 – Aug. 2000**
Assistant Professor	**Sep. 1988 – Aug. 1994**

Teaching and Research in the Communications and Signal Processing areas. Specialization in nonlinear signal processing and compensation of nonlinear systems. Taught courses in Communications (Graduate and Undergraduate), Stochastic Processes (Graduate), Optimal Filtering, Detection and Estimation, Signal Processing and Linear Systems (Graduate and Undergraduate).
Roger Clapp & Virginia Averill Castle Distinguished Professor, July 2003-Present
Interim Chairperson, Jan. 2003-Dec. 2003
Graduate Coordinator, 1996-2003

Engineer	**MIT Lincoln Laboratory - Group 47**
Lexington Mass.	**May – Aug. 1990**

Studied classification and identification of various targets based on polarimetric synthetic aperture radar images.

Consulting Engineer	**Central Florida Technical Services**
Altamonte Springs, Fla.	**Jan. – Aug. 1988**

Responsible for Analyzing, Construction and Debugging a prototype 3 bits/Hz Satellite Modem. Analysis included an evaluation of performance bounds for the modem when used in a limiting channel.

Consulting Engineer	**Nichols Research Corp**
Lynnfield Mass.	**May - Aug. 1985**

Researched the discrimination of optical signatures of reentry vehicles and decoys.

Consulting Engineer	**MIT Lincoln Laboratory - Group 47**
Lexington Mass.	**May - Aug. 1984**

Studied classification and identification of various targets based on polarimetric synthetic aperture radar images.

FUNDED PROJECTS

2009, CrossRate LLC, U.Maine Position Navigation and Timing Laboratory, $793,300
2008, FAA, eLoran/GPS User Receiver Development Platform, $150,000
2007, NUWC, Marine Mammal Monitoring on Navy Ranges, $24,911
2007, FAA, eLoran/GPS User Receiver Development, $150,000
2005, NUWC, Soft Impact Location Capability (SILC), $24,834
2004, NUWC, Soft Impact Location Capability Implementation, $24,729
2004, NUWC, Soft Impact Location Capability, $23,905
2003, NUWC, Marine Mammal Passive Acoustic Detection, $23,866
2002, Texas Instruments, ADC Test and Development Support, $50,000
2001, NUWC, Implementation, Refinement, and Demonstration of an Underwater Digital Acoustic Telemetry Modem, $40,441
2000, NUWC, Underwater Range Data Communications Underwater Digital Acoustic Telemetry Upgrade, $24,950
1999, NUWC, ECSWUWTR Underwater Digital Acoustic Telemetry Development, $24,958
1999, NUWC, East Coast Shallow Water Training Range Signal Processor, $24,435
1999, Texas Instruments, ADC Test and Development Support, $50,000
1997/98/99, DARPA/ONR, Distortion Compensation for Digital Receivers, $230,683
1998, Texas Instruments, ADC Test and Development Support, $50,000
1998, NUWC, Ping Detection Sample Rate Modification, $24,956
1997, NUWC, AUTEC Differentially Phase-Shift-Keyed (DPSK) Digital Signal Processor, $24,656
1996, NUWC, AUTEC Digital Signal Processor Development Study, $24,409
1995, NUWC, Continuous Wave Ping Detection Algorithm Development, $23,978
1995/96/97, ARPA/MTO, Multi-GHz Sampling Capability U. Maine UHF Test Facility, $334,911
1994/95, Motorola, ADC Comp. for Cellular Telephone, $32,460
1994/95, ARPA/ONR, ADC Test Support Program, $186,894
1994, NUWC, Acoustic Modeling, $24,474

PATENTS

2007 (Pending, through NUWC) Soft Impact Location Capability System and Method.

PH.D. DISSERTATIONS ADVISED

Alma Delić-Ibukić, Aug 2008
Digital Background Calibration Techniques for High-Resolution, Wide Bandwidth Analog-to-Digital Converters.

MS THESES ADVISED

Alma Delić-Ibukić, May 2004
Continuous Digital Calibration of Pipelined A/D Converters

Scott Saucier, December 2002
Multiband Analog-to-Digital Conversion

Kannan Sockalingam, August 2002
Error Compensation In Pipeline A/D Converters

Ray McAvoy, May 2002
Implementation of an Underwater Digital Acoustic Telemetry Receiver

Ronald Bryant, December 2000
Adaptive Turbo Equalization

Greg Friel, May 2000
Measurement and Compensation of Digital to Analog Converter Nonlinearity

Ryan Jacobson, August 1999
Multi-Band Digital to Analog Converter Compensation

Kirk Riley, August 1998
Dynamic Compensation of Digital to Analog Converters

Judith Robash, August 1997
A Simulink-Based Reliability Analysis Tool

Norm Dutil, August 1997
Implementation of Dynamic Compensation for Analog-to-Digital Converters

James McDonald, August 1997
Adaptive Compensation of Analog to Digital Converters

Jon Larrabee, August 1997
ADC Compensation Using a Sinewave Histogram Method

Daryl Rawnsley, May 1997
Virtual Instrument Bus Using Network Programming

Deron Gerow, August 1996
Error Mechanisms In Sigma-Delta Analog-to-Digital Converters

Ioannis Papantonopoulos, August 1995
Error Modeling for Folding and Interpolating Analog to Digital Converters

Wahid Ahmed, August 1994
Fast Orthogonal Search for Training Radial Basis Function Neural Networks

Shawn Kennedy, May 1992
Improved ADC Phase Plane Error Compensation

Jaio Ying, May 1992
Locally Optimal Detection of Small Sinusoidal Signals

PUBLICATIONS

- A. Delić-Ibukić, and D. Hummels, "Background Calibration of Gain Errors in $\Pi\Delta\Sigma$ A/D Converters," *IEEE Transactions on Instrumentation and Measurement*, In press. (Approved for publication July 15, 2009)

- E. Dudzik, A. Abedi, D. Hummels, and M. Pereira da Cunha, "Wireless Multiple Access Surface Acoustic Wave Coded Sensor System," *Electronics Letters*, vol. 44, no. 12, June 2008.

- E. Dudzik, A. Abedi, D. Hummels, and M. Pereira da Cunha, "Wireless Multiple Access Passive Coded Sensor System," *Proceedings of IEEE International Ultrasonics Symposium*, (Beijing, China), November 2008.

- E. Dudzik, A. Abedi, D. Hummels, and M. Pereira da Cunha, "Orthogonal Code Design for Passive Wireless Sensors," *Proceedings of 24th Queen's Biennial Symposium on Communications*, (Kingston Ontario, Canada), June 2008.

- A. Delić-Ibukić, and D. Hummels, "Continuous Digital Calibration of Pipeline A/D Converters," *IEEE Transactions on Instrumentation and Measurement*, vol. 55, no. 4, pp. 1175-1185, August 2006.

- A. Delić-Ibukić, and D. Hummels, "Continuous Gain Calibration of Parallel Sigma Delta A/D Converters," *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Sorrento, Italy), pp. 905-909, April 2006.

- D. Hummels and S. Scaucier, "Multiband analog to digital conversion," *Proceedings of the fifth IEE International Conference on Advanced A/D and D/A Conversion Techniques and Their Applicaions — ADDA 2005*, (Limerick, Ireland), pp. 51-55, July 2005.

- A. Delić-Ibukić, and D. Hummels, "Digital architecture for background calibration of pipeline ADCs," *Proceedings of the fifth IEE International Conference on Advanced A/D and D/A Conversion Techniques and Their Applicaions — ADDA 2005*, (Limerick, Ireland), pp. 277-282, July 2005.

- S. Kennedy, D. Hummels, D. Moretti, "A real-time polyphase digital signal processing algorithm for detecting and time-tagging surface impact acoustic signatures," *Proceedings of the Undersea Defense Technology (UDT) conference*, (Amsterdam, The Netherlands), June 2005.

- A. Delić-Ibukić, and D. Hummels, "Continuous digital calibration of Pipeline A/D Converters," *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Ottawa, Ontario, Canada), pp. 2-6, May 2005.

- S. Acunto, P. Arpaia, D. Hummels, F. Irons, "A New Bidimensional Histogram for the Dynamic Characterization of ADCs," *IEEE Trans. Instrumentation and Measurement*, vol. 52, Feb 2003.

- G. Friel, D. Hummels, and F. Irons, "Measurement and compensation of digital to analog converter nonlinearity (invited paper)," *Measurement, Journal of the International Measurement Confederation (IMEKO), Special Issue on DAC Modelling and Testing*, vol. 31, pp. 175–186, 2002.

- D. Hummels, "Performance improvement of all-digital wide-bandwidth receivers by linearization of ADCs and DACs," *Measurement, Journal of the International Measurement Confederation (IMEKO), Special Issue on ADC Modelling and Testing*, vol. 31, pp. 35–45, 2002.

- S. Acunto, P. Arpaia, D. Hummels and F. Irons, "A new bidimensional histogram for the dynamic characterization of ADCs," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Venice, Italy), pp. 1295–1298, May 1999.

- T. Linnebrink, S. Tilden, M. Hartshorne, J. Blair, E. McCarthy, D. Hummels, "After IEEE STD 1241: What's Next?" Proceedings of *IMEKO TC-4 Symposium Trends in Electrical Measurement and Instrumentation and 6th EuroWorkshop on ADC modelling and testing*, Lisbon, Portugal, Sept. 13-14, 2001.

- D. Hummels, "Linearization of ADCs and DACs for all-digital wide-bandwidth receivers (Invited Paper)," in *IMEKO TC-4 Symposium on Development in Digital Measuring Instrumentation and 4th International Workshop on ADC Modeling and Testing*, (Budapest, Hungary), May 21-23, 2001.

- G. Friel, D. Hummels, and F. Irons, "Simultaneous compensation of previous sample and slope dependent errors in analog to digital converters," in *Proc. of the Third International Conference on Advanced A/D and D/A Conversion Techniques and Their Applications*, (Glasgow, UK), July 1999.

- F. Irons, K. Riley, , and D. Hummels, "The noise power ratio - theory and ADC testing," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Venice, Italy), pp. 1507–1512, May 1999.

- K. Riley, D. Hummels, F. Irons, and A. Rundell, "Dynamic compensation of digital to analog converters," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Venice, Italy), pp. 1311–1315, May 1999.

- G. Kelso, D. Hummels, and F. Irons, "Fast compensation of analog to digital converters," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Venice, Italy), pp. 1295–1298, May 1999.

- J. Larrabee, F. Irons, and D. Hummels, "Using sine wave histograms to estimate analog-to-digital converter dynamic error functions," *IEEE Trans. Instrumentation and Measurement*, vol. 47, pp. 1448–1456, Dec. 1998.

- S. Kennedy and D. Hummels, "Digital signal processing algorithm for detecting interrupted continuous wave undersea tracking signals," in *Proc. of the Seventh International Conference on Electronic Engineering in Oceanography*, (Southampton Oceanography Centre, UK), June 1997.

- D. Rawnsley, D. Hummels, , and B. Segee, "A virtual instrument bus using network programming," in *Proc. of the ASEE Annual Conference*, (Milwaukee, WI), June 1997.

- D. Hummels, D. Gerow, , and F. Irons, "A compensation technique for sigma-delta analog-to-digital converters," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Ottawa Canada), pp. 1309–1312, May 1997.

- J. Larrabee, D. Hummels, , and F. Irons, "ADC compensation using sinewave histogram methods," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Ottawa Canada), pp. 628–631, May 1997.

- D. Rawnsley, D. Hummels, , and F. Irons, "A virtual instrument bus using network programming," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Ottawa Canada), pp. 694–697, May 1997.

- F. Irons and D. Hummels, "The modulo-time plot – a useful data acquisition diagnostic tool," *IEEE Trans. Instrumentation and Measurement*, vol. 45, pp. 734–738, June 1996.

- F. Irons, D. Hummels, and I. Papantonopoulos, "ADC error diagnosis," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Brussels), pp. 732–737, June 1996.

- D. Hummels, J. McDonald, and F. Irons, "Distortion compensation for time-interleaved ADCs," in *Proceedings of IEEE International Instrumentation and Measurement Technology Conference*, (Brussels), pp. 728–731, June 1996.

- D. Hummels, I. Papanonopoulos, and F. Irons, "Identification of error mechanisms in a folding and interpolating ADC," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (Atlanta, GA), pp. 176–179, May 1996.

- F. Irons, D. Hummels, and C. Zoldi, "ADC architectural diagnostic testing procedures," in *Proceedings of Government MicroCircuit Applications Conference*, (Orlando), pp. 79–80, Mar. 1996.

- S. Kennedy and D. Hummels, "A complex demodulation algorithm for AUTEC continuous wave signals," in *Proceedings of the Test Technology Transfer Symposium*, (Danvers), May 1995.

- D. Hummels, W. Ahmed, and F. Irons, "Measurement of random sample time jitter for ADCs," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (Seattle), pp. 708–711, May 1995.

- W. Ahmed, D. Hummels, and M. Musavi, "Application of fast orthogonal search for the design of RBFNN," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (Seattle), pp. 1952–1955, May 1995.

- D. Hummels, W. Ahmed, and M. Musavi, "Adaptive detection of small sinusoidal signals in non-Gaussian noise using a RBF neural network," *IEEE Transactions on Neural Networks*, pp. 214–219, Jan. 1995.

- M. Musavi, K. Chan, D. Hummels, and K. Kalantri, "On the generalization ability of neural network classifiers," *IEEE Trans. Pattern Analysis and Machine Intell.*, vol. 16, pp. 659–663, June 1994.

- D. Hummels, W. Ahmed, and M. Musavi, "Adaptive locally optimum detection using RBF neural network," in *Proceedings of IEEE International Joint Conference on Neural Networks*, June 1994.

- D. Hummels, F. Irons, R. Cook, and I. Papantonopoulos, "Characterization of ADCs using a non-iterative procedure," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (London), May 1994.

- W. Ahmed, D. Hummels, and M. Musavi, "Adaptive RBF neural network in signal detection," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (London), May 1994.

- M. Musavi, K.H.Chan, D. Hummels, K. Kalantriand, and W. Ahmed, "A probabilistic model for evaluation of neural network classifiers," *Pattern Recognition*, vol. 25, pp. 1241–1251, Oct. 1992.

- D. Hummels, R. Cook, and F. Irons, "Discrete-time dynamic compensation of analog-to-digital converters," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (Chicago), May 1993.

- M. Musavi, D. Hummels, A. Laffely, , and S. Kennedy, "Noise density estimation using neural networks," in *Proceedings of the 1992 IEEE Workshop on Neural Networks*, (Copenhagen, Denmark), pp. 484–492, Aug. 1992.

- D. Hummels and S. Kennedy, "Improved dynamic compensation of ADC's using an iterative estimate of the ADC input calibration signal," in *Proceedings of the Midwest Symposium on Circuits and Systems*, (Washington D.C.), Aug. 1992.

- M. Musavi, W. Ahmed, K. Chan, F. Faris, and D. Hummels, "On the training of radial basis function classifiers," *Neural Networks*, vol. 5, Aug. 1992.

- D. Hummels, F. Irons, , and S. Kennedy, "Using adjacent sampling for error correcting analog-to-digital converters," in *Proceedings of IEEE International Symp. on Circuits and Systems*, (San Diego), May 1992.

- F. Irons, D. Hummels, , and S. Kennedy, "A novel architecture for dynamic error correction of analog-to-digital converters," in *Proceedings of the 26th Conference on Information Sciences and Systems*, (Princeton), Mar. 1992.

- M. Musavi, K. Chan, D. Hummels, and K. Kalantri, "On the generalization ability of neural network classifiers," in *Proceedings of IEEE International Joint Conference on Neural Networks*, (Seattle WA), July 1991.

- F. Irons, D. Hummels, and S. Kennedy, "Improved error compensation for analog-to-digital converters," *IEEE Trans. Circuits and Systems*, vol. 38, pp. 958–961, June 1991.

- D. Hummels and J. Ying, "Locally optimal detection of unknown signals in non-Gaussian Markov noise," in *Proceedings of the 34th Midwest Symposium on Circuits and Systems*, (Monterey CA), May 1991.

- L. Novak, G. Owirka, and D. Hummels, "Statistical classification of polarimetric SAR images (classified)," (Huntsville AL), Oct. 1990.

- K. Fukunaga and D. Hummels, "Leave-one-out procedures for nonparametric error estimates," *IEEE Trans. Pattern Analysis and Machine Intell.*, vol. 11, pp. 421–423, 1989.

- K. Fukunaga and D. Hummels, "Bayes error estimation using Parzen and k-NN procedures," *IEEE Trans. Pattern Analysis and Machine Intell.*, vol. 9, pp. 634–643, Sept. 1987.

- K. Fukunaga and D. Hummels, "Bias of nearest neighbor error estimates," *IEEE Trans. Pattern Analysis and Machine Intell.*, vol. 9, pp. 103–112, Jan. 1987.

- D. Hummels and K. Fukunaga, "Bayes error estimation using edited nearest neighbor rules," in *Proceedings of the International Symposium on Information Theory*, (Brighton), June 1985.