

# Gary A. Ybarra

**130 Hudson Hall**  
**Box 90291**  
**Durham, NC 27708**  
**919-660-5220**

**Current Position:** Professor of the Practice and Director of Undergraduate Studies, Duke University  
Department of Electrical and Computer Engineering

**Education:** BSEE (1983), MSEE (1986), PhD (1992), North Carolina State University  
Ph.D. Dissertation: High Resolution Target Range Estimation in Inhomogeneous Media using Millimeterwave Radar.

M.S. Thesis: Speech Enhancement using Multiple Impulse Excitation.

**Career Goals:** To lead the Department of Electrical and Computer Engineering at Duke University in innovative undergraduate education leading to a top 10 national ranking.  
To establish and sustain a national model Engineering K-Ph.D. outreach program.

## Previous Positions:

2005-Present Professor of the Practice and Director of Undergraduate Studies  
2000-2005 Associate Professor of the Practice and Director of Undergraduate Studies  
1993-2000 Assistant Research Professor

## Research:

1995-Present Microwave Imaging and Electrical Impedance Tomography.  
1995-1999 Automatic target recognition using synthetic aperture radar.  
1990-1997 Optimal signal processing of frequency-stepped CW and DSB-SC radar data.  
1986-1989 Least squares signal processing.  
1984-1986 Multipulse speech compression algorithms for medium bit-rate transmission.

## Teaching:

1993-2008 Duke University  
4 semesters ECE 27: Fundamentals of Electrical and Computer Engineering (100 students)  
1 semester EGR 20: Engineering Innovation (10 students)  
32 semesters ECE 61: Intro. to Electric Circuits (1,500 students)  
3 semesters ECE 64: Linear Systems (150 students)  
2 semesters ECE 181: Intro. to Signal Processing and Communications (70 students)  
2 semesters ECE 164: Electronic Design for the Environment (20 students)  
5 semesters ECE 186: Wireless Communications (150 students)  
2 semesters STH 112: Science, Technology, and Human Values (22 students)  
1983-1992 North Carolina State University  
17 semesters ECE-211: Electric Circuits I (1,200 students)  
6 semesters ECE-221: Electric Circuits II (250 students)  
4 semesters ECE-301: Linear Systems (500 students)  
4 semesters ECE-331: Electric Circuits I for non-majors (300 students)  
1 semester ECE-432: Communications Engineering (50 students)

1989-Present Industrial Short-Courses

- 14 21-hour courses Circuits and Systems - Institute for Transportation, Research, and Education (Raleigh, NC)
- 2 18-hour courses Circuits and Systems - Carolina Power and Light (Raleigh, NC)
- 2 18-hour courses Electronic Circuit Analysis and Design - CP&L (Raleigh, NC)
- 1 40-hour course Analog and Digital Electronic Circuit Design - Nortel (Research Triangle NC)
- 1 24-hour course Advanced Digital Signal Processing - IBM (Research Triangle NC)
- 2 16-hour courses Hazard Analysis - Motorola Radio Design Center (Ft. Lauderdale, FL)

### Book Chapters

1. W.T. Joines, Q.H. Liu, G.A. Ybarra, *Bioengineering and Biophysical Aspects of Electromagnetic Fields*, "Chapter 12 Electromagnetic Imaging of Biological Systems," CRC Handbook of Biological Effects of Electromagnetic Fields, CRC Press, 2006.
2. G.A. Ybarra, Q.H. Liu, W.T. Joines, R.T. George, G. Ye, K.H. Lim, "Breast Imaging using Electrical Impedance Tomography (EIT)," *Emerging Technologies in Breast Imaging and Mammography*, American Scientific Publishers, 2006.
3. G.A. Ybarra, Q.H. Liu, W.T. Joines, J. Stang, "Microwave Breast Imaging," *Emerging Technologies in Breast Imaging and Mammography*, American Scientific Publishers, 2006.

### Refereed Journal Publications

1. C. Yu, M. Yuan, J. Stang, E. Bresslour, R. T. George, G. A. Ybarra, W. T. Joines, and Q. H. Liu, "Active microwave imaging II: 3-D system prototype and image reconstruction from experimental data," *IEEE Trans. Microwave Theory Tech.*, vol. 56, no. 4, pp. 991-1000, 2008.
2. G. Ye, K. H. Lim, R. George, Jr., G. Ybarra, W. T. Joines, and Q. H. Liu, "3-D EIT for Breast Cancer Imaging: System, Measurements, and Reconstruction," *Microwave Opt. Technol. Lett.*, vol. 50, no. 12, pp. 3261-3271, 2008.
3. C. Yu, M. Yuan, Y. Zhang, J. Stang, R. T. George, G. A. Ybarra, W. T. Joines, and Q. H. Liu, "Microwave imaging in layered media: 3-D image reconstruction from experimental data," *IEEE Trans. Antennas Propagat.*, submitted, 2008.
4. L.G. Huettel, A. Brown, L. Collins, K. Coonley, M.R. Gustafson, J. Kim, and G. Ybarra, Fundamentals of ECE: A Rigorous, Integrated, Introduction to Electrical and Computer Engineering, *IEEE Transactions on Education*, August, 2007.
5. K.H. Lim, G. Shi, K. McCarter, R.T. George, G.A. Ybarra, W.T. Joines, and S. Wartenberg, 2D EIT for Breast Cancer Imaging: Design, Measurement, Simulation, and Image Reconstruction, *Microwave and Optical Technology Letters*, vol. 49, no. 12, pp. 2989-2998, 2007.
6. G. Ye, K.H. Lim, R.T. George, G.A. Ybarra, W.T. Joines, and Q.H. Liu, 3D EIT for Breast Cancer Imaging: System Design and Measurements, *IEEE Transactions on Medical Imaging*, in press.
7. Q. Zhang, Q.H. Liu, C. Xiao, E. Ward, G. Ybarra, W.T. Joines, Microwave Breast Imaging: 3-D Forward Scattering Simulation, *IEEE Transactions on Biomedical Engineering*, pp. 1180-1189, October, 2003.
8. Q.H. Liu, Q. Zhang, T. Wang, J.A. Bryan, G. Ybarra, L.W. Nolte, W.T. Joines, Active Microwave Imaging I-2-D Forward and Inverse Scattering Methods, *IEEE Transactions on Microwave Theory and Techniques*, pp. 123-133, January, 2002.
9. S.M. Wu, G.A. Ybarra, and W.E. Alexander, A Complex Optimal Signal Processing Algorithm for Frequency-Stepped CW Data, *IEEE Transactions on Circuits and Systems II*, Vol. 45, No. 6, pp. 754-757, June 1998.

10. G.A. Ybarra, S.M. Wu, G.L. Bilbro, S.H. Ardalan, C.P. Hearn, and R.T. Neece, Optimal Signal Processing of Frequency-Stepped CW Radar Data, *IEEE Transactions on Microwave Theory and Techniques*, January 1995, Pg. 94-105.
11. G.A. Ybarra, S.H. Ardalan, C.P. Hearn, R.E. Marshall, and R.T. Neece, Detection of Target Distance in the Presence of an Interfering Reflection using a Frequency-Stepped Double Sideband Suppressed Carrier Microwave Radar System, *IEEE Transactions on Microwave Theory and Techniques*, May 1991, Pg. 809-818.

### Refereed Conference Proceedings

1. Q. H. Liu, C. Yu, J. Stang, M. Yuan, R. T. George, G. A. Ybarra, and W. T. Joines, "Progress of a High-Resolution 3-D Microwave Imaging System for Breast Cancer Detection," Progress in Electromagnetics Research Symposium, Boston, Massachusetts, July 2008.
2. C. Yu, M. Yuan, Q. H. Liu, J. Stang, Y. Zhang, R. T. George, G. A. Ybarra, and W. T. Joines, "Microwave Imaging for Targets in Layered Media: Image Reconstruction from Experimental Data," URSI Meeting, San Diego, CA, July 2008.
3. C. Yu, M. Yuan, Q. H. Liu, J. Stang, Y. Zhang, R. T. George, G. A. Ybarra, and W. T. Joines, "Microwave Imaging for Targets in Layered Media: Image Reconstruction from Experimental Data," URSI Meeting, San Diego, CA, July 2008.
4. V. Weston, A. Bonhivert, A. Elia, H. Hsu Kim, and G.A. Ybarra, An Educational Outreach Day for Young Females, *Proceedings of Frontiers in Education*, Saratoga Springs, NY, October, 2008.
5. L.G. Huettel, J. Forbes, L. Franzoni, R. Malkin, J. Nadeau, K. Nightingale, G.A. Ybarra, Transcending the Traditional: Using Tablet PCs to Enhance Engineering and Computer Science Instruction, *Proceedings of Frontiers in Education*, Milwaukee, Wisconsin, October, 2007.
6. L. Huettel, Kip Coonley, M. Gustafson, J. Kim, G. Ybarra, L. Collins, Experiment, Explore, Design: A Sensor-Based Introductory ECE Laboratory, *Proceedings of the American Society for Engineering Education*, Honolulu, Hawaii, June, 2007.
7. G. Kelly, P. Klenk, G. Ybarra, Assessment of Gender Differences on Ratings of Engineering Learning Modules in Middle School Youth in an After-School Setting, *Proceedings of the American Society for Engineering Education*, Honolulu, Hawaii, June, 2007.
8. F. Dreher, E. Condon, P. Klenk, L. Oliver, G. Ybarra, N. Shaw, Assessing English-as-a-Second-Language Middle School Students' Ability to Learn Engineering Concepts, *Proceedings of the American Society for Engineering Education*, Honolulu, Hawaii, June, 2007.
9. W.H. Hwang, A. Bissell, D. Kaplan, M. Mian, V. Agrawal, J. Manson, and G.A. Ybarra, Design and Evaluation of Innworks: A Portable, Interdisciplinary Science and Engineering Program by Volunteer College Students for Middle School Youth from Underprivileged Backgrounds, *Proceedings of the American Society for Engineering Education*, Chicago, Illinois, June, 2006.
10. G.A. Ybarra, P.A. Klenk, G.T. Kelly, Thriving or Surviving K-12 Engineering Outreach at a Research Extensive University, *Proceedings of the American Society for Engineering Education*, Chicago, Illinois, June, 2006.
11. L. Huettel, L. Collins, G.A. Ybarra, M.G. Gustafson, J. Kim, A. Brown, K. Coonley, A Novel Introductory Course for Teaching the Fundamentals of Electrical and Computer Engineering, *Proceedings of the American Society for Engineering Education*, Chicago, Illinois, June, 2006.
12. L. Collins, G. Ybarra, K. Coonley, L. Huettel, S. Cummer, M.R. Gustafson, J. Holmes, H. Massoud, J. Board, A. Brown, Redesign of the ECE Core Curriculum at Duke University, *Proceedings of the American Society for Engineering Education*, Chicago, Illinois, June, 2006.
13. G. Ye, K. Lim, R. George, G. Ybarra, W. Joines and Q. Liu, A 3D EIT System for Breast Cancer Imaging, *International Symposium on Biomedical Imaging*, Arlington, VA, April, 2006.
14. L. Huettel, L. Collins, A. Brown, G. Ybarra, J. Holmes, S. Cummer, H. Massoud, M. Gustafson, J. Board, and J. Kim, Theme-Based Redesign of the Duke University ECE Curriculum: The First Steps, *Proceedings of the American Society for Engineering Education*, Portland, Oregon, June, 2005.

15. G.T. Kelly, M. Hebrank, G.A. Ybarra, P.A. Klenk, Teaching K-12 Engineering using Inquiry-Based Instruction, *Proceedings of the American Society for Engineering Education*, Portland, Oregon, June, 2005.
16. P.A. Klenk, G.A. Ybarra, G.T. Kelly, K-12 Engineering Outreach Impact on University Teaching Fellows, *Proceedings of the American Society for Engineering Education*, Portland, Oregon, June, 2005.
17. G.A. Ybarra, P. Klenk, L. Wang, Techtronics II: Hands-on Exploration of Technology in Everyday Life, *Proceedings of the American Society for Engineering Education*, Nashville, Tennessee, June, 2003.
18. G.A. Ybarra and M. Syamal, Measuring Middle School Students' Ability to Understand Mechanical Engineering, *Proceedings of the American Society for Engineering Education*, Nashville, Tennessee, June, 2003.
19. G.A. Ybarra and G. Kelly, MUSCLE: Math Understanding through the Science of Life, *Proceedings of the American Society for Engineering Education*, Nashville, Tennessee, June, 2003.
20. G.A. Ybarra, P. Klenk and K. Barcus, Techtronics: Hands-on Exploration of Technology in Everyday Life, *Proceedings of the Frontiers in Education Symposium*, Boston, MA, October, 2002.
21. G.A. Ybarra, M.S. Absher, T.P. Fitts, S. Wynn, J. Russell, K. Ford and G. Kelly, MUSCLE: Math Understanding through the Science of Life, *Proceedings of the American Society for Engineering Education*, Montreal, Canada, June, 2002.
22. M.R. Gustafson, G.A. Ybarra, V.C. Chancey, and C.L. Merdes, Multimedia Teaching Modules in the Engineering K-Ph.D. Program at Duke University, *Proceedings of the Frontiers in Education Symposium*, Reno, NV, October, 2001.
23. G.A. Ybarra, L.J. Bottomley, M.R. Gustafson, J.D. Elson, and I.D. Ast, Duke-NCSU Teaching Fellows in Elementary Education, *Proceedings of the American Society for Engineering Education*, June, 2000.
24. G.A. Ybarra, Ethics in Engineering Education Worldwide, *Proceedings of the International Conference on Engineering Education*, September, 1999, Istanbul, Turkey.
25. G.A. Ybarra, The Use of Virtual and Automatic Instrumentation and Data Acquisition in the Undergraduate Engineering Curriculum at Duke University, *Proceedings of the International Conference on Engineering Education*, 1999, Istanbul, Turkey.
26. L. Carin, G.A. Ybarra, P. Bharadwaj, and P. Runkle, Physics-Based Classification of Targets in SAR Imagery using Subaperture Sequences, *Proceedings of the International Conference on Acoustics, Speech, and Signal Processing*, Phoenix, 1999.
27. P. Runkle, L. Nguyen, G. Ybarra, and L. Carin, Multi-Aspect Target Detection in SAR Imagery using Hidden Markov Models, *Proceedings of the International Society for Optical Engineering*, April 1999.
28. P. Runkle, G. Ybarra, P. Bharadwaj, L. Carin and L. Nguyen, Physics-Based Target Classification from SAR Imagery via Subaperture Processing and Hidden Markov Models, *Proc. of the International Geoscience and Remote Sensing Symposium*, Hamburg, Germany, June 1999.
29. T.G. Wood, D.J. Sauer, and G.A. Ybarra, Matched Pursuits Analysis of Synthetic-Aperture Radar Images in the Digital Spatial Domain, *Proc. of the International Society for Optical Engineering*, San Diego, CA, July, 1998.
30. G.A. Ybarra, The Next Generation Introductory Circuits Laboratory at Duke University: Introduction to Wireless Control and Virtual Instrumentation using LabVIEW, *Proceedings of the American Society for Engineering Education*, Seattle, WA, June 1998.
31. K. Olson, G. Ybarra, Performance Comparison of Neural Network and Statistical Pattern Recognition Approaches to Automatic Target Recognition of Four Ground Vehicles Using SAR Imagery, *Proc. of the International Society for Optical Engineering*, San Diego, CA, July, 1997.

32. G.A. Ybarra, S.M. Wu and R. Avent, The Effect of Doppler Shift on the Optimal Processing of Frequency-Stepped CW Radar Data, *Proc. of the International Society for Optical Engineering*, Denver, CO, August, 1996.
33. G.A. Ybarra, and S.M. Wu, *Invited Paper*, The Optimal Signal Processing of Frequency-Stepped CW Radar Data, *Proc. of the Asia-Pacific Microwave Symposium*, New Delhi, India, December, 1996.
34. S.M. Wu, G.A. Ybarra, and W.E. Alexander, Effects of Noise on the Optimal Processing of Frequency-Stepped CW Radar Data, *Proc. of the International Society for Optical Engineering*, San Diego, CA, July, 1995.
35. W.T. Lawson, Jr., G.S. Wagner, R.S. Startt-Selvester, G.A. Ybarra, New Method for Digitization and Computerized Analysis of Paper Recordings of Standard 12-Lead Electrocardiograms, *Computers in Cardiology*, Vienna, September, 1995.
36. S.M. Wu, G.A. Ybarra, and W.E. Alexander, A Generalized Optimal Signal Processing Algorithm for Frequency-Stepped CW Data, *Proc. IEEE Microwave Theory and Techniques Symposium*, Orlando, FL, May, 1995.
37. G.A. Ybarra, G.L. Billbro, S.M. Wu, S.H. Ardalan, C.P. Hearn, and R.T. Neece, High Resolution Target Range Estimation using Frequency-Stepped CW Radar, *Proc. IEEE Microwave Theory and Techniques Symposium*, Atlanta, GA, June, 1993.
38. G.A. Ybarra, S.H. Ardalan, R.E. Marshall, and R.T. Neece, Detection of Non-Uniform Plasma Densities Developed During Space Vehicle Atmospheric Re-Entry using a Millimeterwave Radar System, *Proc. IEEE International Conference on Geoscience and Remote Sensing*, Helsinki, Finland, June, 1991.
39. G.A. Ybarra, S.H. Ardalan, R.E. Marshall, and R.T. Neece, Detection of Electron Plasma Densities Developed During Space Vehicle Atmospheric Re-Entry using a Frequency-Stepped Double Sideband Suppressed Carrier Millimeterwave Radar System, *Proc. IEEE International Union of Radio Science*, London, Ontario, June, 1991.
40. G.A. Ybarra, and S.T. Alexander, Effects of Ill-Conditioned Data on Least Squares Adaptive Filters, *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing*, New York, 1988.

### Other Publications

1. G. Ye, Q.H. Liu, K.H. Lim, G. Shi, K. McCarter, R.T. George, G.A. Ybarra, and W.T. Joines, A 3-D EIT System for Breast Cancer Detection, *IEEE Antennas and Propagation Symposium*, Washington, DC, 2005.
2. G.A. Ybarra and M.R. Gustafson, *MATLAB for Circuits* (Supplement to R.C. Dorf and J.A. Svoboda, *Introduction to Electric Circuits* 4th Ed., Wiley, 1998).

### Invited Presentations

1. G.A. Ybarra, L.G. Huettel, L.M. Collins, "Integrating Sensing and Information Processing in an Undergraduate ECE Curriculum," National Science Foundation, Departmental Level Reform Workshop, May 15, 2008.
2. G.A. Ybarra and Laura J. Bottomley, "Technology Transfer from the University to K-8," 2002 Conference on K-12 Outreach from University Science Departments: Using Technology to Link the Classroom to the Laboratory, Burroughs Welcome Fund, February, 2002.

### Professional Activities

Active reviewer for the *American Society for Engineering Education* and *Frontiers in Education*.

Member of IEEE Education Society, and the American Society for Engineering Education.

National Science Foundation *Shaping the Future* Steering Committee member, 1998.

Chair, Remote Sensing of the Atmosphere, *IEEE International Conference on Geoscience and Remote*

*Sensing*, Helsinki, Finland, June, 1991.

Chair, Plenary Session, Joint Conference on Information Sciences, Research Triangle Park, NC, 1998.

## **Awards**

1. Senior Member of the IEEE, September, 2006
2. American Society for Engineering Education 2005 K-12 Division Chair's Award
3. IEEE 2002 Engineering Educator of the Year Award, Southeastern NC Section.
4. Pratt School of Engineering Faculty Distinguished Undergraduate Teaching Award 2002
5. DuPont Teaching Fellow 1991
6. NCSU ECE Department Outstanding Teacher Award 1987
7. NCSU ECE Department Outstanding Graduate Student Teacher Award 1983

## **Grants Awarded**

1. National Science Foundation, "TASC: Teachers and Scientists Collaborating," a targeted Math-Science Partnership, \$196,108, September 5, 2008 through September 30, 2009.
2. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$250,000, June 15, 2008 through June 14, 2009.
3. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$250,000, June 15, 2007 through June 14, 2008.
4. National Science Foundation, "TASC: Teachers and Scientists Collaborating," a targeted Math-Science Partnership, \$200,000, October 1, 2007 through September 30, 2009.
5. National Science Foundation, "TechXcite: Discover Engineering!," an Informal Science Education Program with National 4-H Afterschool, \$2.42M, August 15, 2007 through August 14, 2012.
6. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$250,000, June 15, 2006 through June 14, 2007.
7. National Science Foundation, "Collaborative Research: A Comprehensive Pathway for K-Gray Engineering Education," \$147,165, October 1, 2005 through September 30, 2008."
8. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$250,000, June 15, 2005 through June 14, 2006.
9. Burroughs Wellcome Fund, "Techtronics: Hands-on Exploration of Technology in Everyday Life," \$180,000, January 1, 2004 through December 31, 2007.
10. (Co-PI) National Science Foundation, "Theme-Based Redesign of the ECE Undergraduate Curriculum at Duke University," \$997,805, September 1, 2004 through August 30, 2007.
11. Progress Energy, "Support of TASC: Teachers and Scientists Collaborating," \$50,000, September 1, 2004 through August 31, 2005.
12. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$140,000, June 15, 2004 through June 14, 2005.
13. Lord Foundation of North Carolina, "EGR 20 Engineering Innovation," \$24,875, September 1, 2004 through August 30, 2005.
14. National Science Foundation, "MUSIC: Math Understanding through Science Integrated with Curriculum," \$1,424,744, December 1, 2003 through November 30, 2008.
15. Progress Energy, "Support of TASC: Teachers and Scientists Collaborating," \$50,000, September 1, 2003 through August 31, 2004.
16. GlaxoSmithKline, "Support of TASC: Teachers and Scientists Collaborating," \$120,000, June 15, 2003 through June 14, 2004.
17. National Science Foundation, "TASC: Teachers and Scientists Collaborating," \$5,328,333, October 1, 2002 through September 30, 2007.

18. National Science Foundation, "TeachEngineering.com," \$31,227, October 1, 2002 through September 30, 2004.
19. GE Fund, "MUSCLE: Math Understanding through the Science of Life," \$300,000, August 2001.
20. Lord Foundation, "Automatic and Virtual Instrumentation in the Undergraduate Electrical Engineering Curriculum at Duke University," \$50,000, April 2001.
21. Burroughs Wellcome Fund, "Techtronics: Hands-on Exploration of Technology in Everyday Life," \$167,500, March 2001.
22. Microsoft Research University Programs, "Support of the Duke-NCSU Teaching Fellows in Elementary Education Program and the Engineering K-Ph.D. Program," \$120,000, December 2000.
23. IBM, "Support of the Duke-NCSU Teaching Fellows in Elementary Education Program," \$14,000, October 2000.
24. Hewlett Packard, "Support of the Introductory Circuits Wireless Control Laboratory," \$8,370, September 2000.
25. Dell Computer Corporation, "Dell Strategic Technology and Research Program," \$24,430, Jan. 1, 2000 through Dec. 31, 2000.
26. National Science Foundation, "Duke-NCSU Teaching Fellows in Elementary Education Program," \$347,328, Sept. 1, 1999 through August 30, 2002.
27. The Lord Foundation of North Carolina, "The Next Generation Introductory Circuits Laboratory at Duke University," \$27,000, January 1997.
28. The National Science Foundation, "The Next Generation Introductory Circuits Laboratory at Duke University," \$27,289, June 1996.
29. Hewlett Packard, "Support of the New Introductory Circuits Wireless Control Laboratory," \$22,335, January 1995.
30. Hewlett Packard, "Support of the New Introductory Circuits Wireless Control Laboratory," \$32,080, January 1994.
31. The Lord Foundation of North Carolina, "Automatic Control of Laboratory Test Instruments using LabVIEW," \$14,895, March 1994.
32. National Instruments, "Automatic Control of Laboratory Test Instruments using LabVIEW," \$10,000, April 1994.

### **National Committees**

1. Institute for Advanced Study-Carnegie Commission on Mathematics and Science Education
2. National Science and Technology Education Partnership Board of Trustees
3. American Society for Engineering Education EngineeringK-12 Center Advisory Board Member.
4. American Society for Engineering Education Pre-College Division Executive Committee.

### **Site Reviews**

1998 National Cancer Institute microwave imaging program assessor, Dartmouth College, New Hannover, NH.