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**Education**

- 7/81 Ph.D., Chemical Engineering, University of Wisconsin–Madison
- 4/81 M.S., Statistics, University of Wisconsin–Madison
- 6/76 B.S. with *First Class Honors*, Chemical Engineering, University of Lagos, Nigeria

**Honors and Awards**

- 2016 Fellow, American Association for the Advancement of Science (AAAS)
- 2015 Fellow, National Academy of Inventors
- 2015 *Katz Lectures*, University of Michigan, Ann Arbor, March 26-27, 2015
- 2013 *Smith Lecture*, University of California–Davis, May 16, 2013
- 2012 US National Academy of Engineering
- 2012 Fellow, Nigerian Academy of Engineering
- 2012 *Bayer Lecture*, Carnegie Mellon University, Pittsburgh, April 10, 2012.
- 2011 *D. B. Robinson Distinguished Lecture*, University of Alberta, Canada, Feb. 17, 2011.
- 2009 Fellow, American Institute of Chemical Engineers
- 2008 *Inaugural McFerrin Lectures*: Texas A & M University, Nov 12 & 13, 2008.
- 2008 *Control Engineering Practice Award*, American Automatic Control Council (AACC).
- 2007 *Donald P. Eckman Education Award*, Instrumentation, Systems and Automation (ISA) Society.
- 2005 University of Delaware, *Slocomb Excellence in Teaching Award*
- 2004 William L. Friend Professor of Chemical Engineering
- 2004 University of Delaware, College of Engineering *Excellence in Teaching Award*
- 2002 *Centennial Lecture*, Illinois Institute of Technology, Chicago, Illinois
- 2001 *Lindsey Lecture*, Texas A & M, College Station, Texas

- 1999 *Plenary Lecture*, Control of Particulate Processes VI
- 1998 *Plenary Lecture*, American Control Conference
- 1998 *Computing Practice Award*, American Institute of Chemical Engineers, Computer and Systems Technology Division
- 1997 *Invited Speaker*, National Academy of Engineering Symposium on “Frontiers of Engineering”
- 1995 *Plenary Lecture*, IFAC Symposium on Dynamics and Control of Chemical Reactors, Distillation Columns, and Batch Processes
- 1994 *Plenary Lecture*, IEEE/IFAC International Conference on CACSD
- 1978 National Honorarium for Contributing to the New Nigerian National Anthem

### **Employment History**

- 7/13 – Present **Dean**, College of Engineering, University of Delaware, Newark
- 7/11 – 6/13 **Interim Dean**, College of Engineering, University of Delaware, Newark
- 7/10 – 6/11 **Deputy Dean**, College of Engineering, University of Delaware, Newark
- 9/08 – Present **William L. Friend Chair**, Chemical Engineering Department, University of Delaware, Newark
- 1/04 – 9/08 **William L. Friend Professor**, Chemical Engineering Department, University of Delaware, Newark
- 6/08– Present **Affiliated Faculty**, African University of Science and Technology, Abuja, Nigeria
- 9/02 – 12/03 **Professor**, Chemical Engineering Department, University of Delaware, Newark
- 9/02 – Present **Professor**, Center for Systems Biology, Delaware Biotechnology Institute, University of Delaware
- 2/95 – 9/03 **Research Fellow**, Central Research and Development, E.I. du Pont de Nemours and Co., Wilmington, Delaware
- 9/00 – 9/03 **Six Sigma Master Black Belt**, Central Research and Development, E.I. du Pont de Nemours and Co., Wilmington, Delaware
- 5/93 – 2/95 **Senior Research Associate**, Central Research and Development, E.I. du Pont de Nemours and Co., Wilmington, Delaware
- 8/91 – 5/93 **Research Associate**, Polymer Products Department, E.I. du Pont de Nemours and Co., Wilmington, Delaware
- 7/89 – 8/91 **Senior Research Engineer**, Polymer Products, E.I. du Pont de Nemours and Co., Wilmington, Delaware
- 7/89 – 9/03 **Adjunct Professor**, Chemical Engineering Department, University of Delaware, Newark

- 7/88 – 7/89 **Visiting Professor**, Chemical Engineering Department, University of Wisconsin, Madison
- 12/82 – 6/88 **Assistant/Associate Professor**, Chemical Engineering Department, University of Lagos, Nigeria
- 12/82 – 6/88 **Assistant/Associate Professor**, Department of Statistics, University of Lagos, Nigeria
- 12/81 – 12/82 **Research Engineer**, Systems Development Department, Shell Development Company, Houston, Texas

## Professional Experience

- 1981 – 1982 **Systems Development Department, Shell Development Co., Houston, TX**
- Design/implementation of advanced control schemes at two refineries (Martinez, California; and Norco, Louisiana)
  - Statistics-based modeling techniques for “Dynamic Matrix Control”
- 1982 – 1988 **University of Lagos, Nigeria**  
**(Joint appointment in Chemical Engineering and Statistics)**
- Courses taught in the Chemical Engineering Department: *Process Dynamics and Control*; *Chemical Engineering Analysis*; *Transport Phenomena*; *Polymer Science and Engineering*
  - Courses taught in the Statistics Department: *Engineering Statistics*; *Design of Experiments*; *Time Series Analysis*
  - Supervised numerous BS Honors Theses, 8 MS Theses, and 1 PhD Thesis in Chemical Engineering; Co-supervised 1 MS Thesis in Econometrics
- 1989 – **Chemical Engineering Department, University of Delaware, Newark**
- Courses taught: *Process Dynamics & Control* (graduate and undergraduate); *Random Phenomena–Applied Probability & Statistics for Engineering Problem Solving*
  - Short Courses taught: *Statistical Process Control*; *Process Dynamics and Control*; *Design of Experiments*
  - Co-supervised PhD theses; member of other PhD/MS thesis committees
- 1989 – 2003 **Polymers Product Department, and Central Research & Development, E.I. du Pont de Nemours and Co., Wilmington, DE**
- On-line dynamic modeling for various processes
  - Design and implementation of advanced control schemes for polymer reactors and other processes
  - Linear/nonlinear model identification and control research, with emphasis on industrial application
  - State and parameter estimation research, with emphasis on industrial application
  - New process development, with emphasis on design for operability and robustness
  - Co-director of Neurocontrol program on “Reverse Engineering” neurobiological control schemes for industrial chemical process applications (1991-1998)
  - Technical Leader, Advanced Process Control Network

- Academic Liaison with various University Process Control research programs
- Member of various Science and Engineering Technology advisory panels (to the Director of Science & Engineering and Senior VP Central Research & Development)
- Design for Six Sigma pilot group member
- Six Sigma Master Black Belt (Design for Six Sigma Implementation)
- New product development for DuPont Textiles and Interiors

## Interests

### Process Control

- Nonlinear model-based control
- Intelligent control
- Model predictive control for uncertain processes
- Multirate and inferential control
- Data-driven, information theory approaches to industrial control
- Model-based control of reactive extrusion processes

### Process Synthesis & Design

- Design for operability and inherent robustness

### Process Modeling and Identification for Control, and Applied Statistics for Process Operation

- Empirical nonlinear model development
- Hybrid modeling
- Nonlinear model reduction
- Data-driven statistical approaches to industrial control system structure determination & design

### Modeling and Analysis of Biological Systems

- Neurobiological control system structure and design
- Systems analysis of cellular processes
- Cellular modeling and analysis of cancer

### Applications of Probability and Statistics in Molecular Biology

- Probabilistic and statistical analysis of gene expression
- Stochastic activity network modeling of cellular pathways

## Professional Activities

### Editorial Positions

- Associate Editor, *IEEE Transactions on Control Systems Technology*, 1996–1999
- Associate Editor, *Industrial & Engineering Chemistry Research*, 1999–Present

### Conference Planning & Organization

- CAST Area 10b: *Programming Vice Chair*, Nov 1994 – Nov 1996
- CAST Area 10b: *Programming Chair*, Nov 1996 – Nov 1998
- CAST Area 10b: *AACC–AIChE Director*, Jan 1998 – Jan 2000
- Member of the International Programming Committee for many international conferences
- Co-Chair, *International Conference on Chemical Process Control VI*, Jan 2001

- Vice-Chair, *Gordon Conference on Statistics in Chemistry and Chemical Engineering*, July 2003
- Chair, *Gordon Conference on Statistics in Chemistry and Chemical Engineering*, July 2005
- Session Chair at numerous AIChE, ACC, and other conferences

#### **Book, Journal, Research Proposal Review**

- Reviewer for various textbook publishers: *Oxford, Prentice-Hall, Springer Verlag, etc.*
- Reviewer for various journals: *Automatica, AIChE J., IEEE Trans. on Control Systems Technology, Ind. Eng. Chem. Res., Comp. & Chem. Eng., Technometrics, JASA, etc.*
- Proposal reviewer for various organizations: *NSF, NIH, DoE, ACS-PRE, Israel Science Foundation, Italian Ministry of Science and Technology, etc.*

#### **Professional Society Memberships**

- AIChE (American Institute of Chemical Engineers), Fellow
- ASA (American Statistical Association)
- AAAS (American Association for the Advancement of Science)

#### **Other**

- Past Member, Visiting Committee, University of Wisconsin – Madison
- Past Member, Ph.D. Program Review Committee, Texas A & M
- Past Chair, Ph.D. Program Review Committee, University of Maryland University

#### **Patents**

US Patent # 7203555B2: *Predictive Regulatory Controller*, Issued April 10, 2007.

#### **Publications**

##### **Books**

1. B. A. Ogunnaike, *Principles of Mathematical Modelling and Analysis in Chemical Engineering*, DONE Publishers, Lagos, Nigeria, 1985 (244 pages).
2. B. A. Ogunnaike and W. H. Ray, *Process Dynamics Modeling and Control*, Oxford University Press, N.Y., 1994 (1200 pages).
3. F. J. Doyle, R. K. Pearson, and B. A. Ogunnaike, *Identification and Control Using Volterra Models*, Springer Verlag, London, 2002 (314 pages).
4. J. B. Rawlings, B. A. Ogunnaike, and J. W. Eaton, Editors, *Chemical Process Control VI*, AIChE Press, N.Y., 2002 (456 pages).
5. B. A. Ogunnaike, *Random Phenomena: Fundamentals of Probability & Statistics for Engineers*, CRC Press/Taylor & Francis, Boca Raton, FL., 2009 (1023 pages)

##### **Book Chapters**

1. B.A. Ogunnaike, "Controller design for process systems," Chapter 33 of: *Handbook of Heat and Mass Transfer*, Vol. 3, N.P. Cheremisinoff (Ed), Gulf Publishers, West Orange, NJ, 1989.
2. R.K. Pearson and B.A. Ogunnaike, "Nonlinear model identification," Chapter 2 of: *Nonlinear Process Control*, M.A. Henson and D.E. Seborg (Eds), Prentice-Hall, Englewood Cliffs, NJ, 1996.

3. F.J. Doyle III, M.A. Henson, B. A. Ogunnaike, J.S. Schwaber, and I. Rybak, "Neuronal modeling of the baroreceptor reflex with applications in process modeling and control," Chapter 5 of: *Neural Systems for Control*, O. Omidvar and D.L. Elliot (Eds), Academic Press, San Diego, 1997.
4. A. Banerjee, Y. Arkun, R.K. Pearson, and B.A. Ogunnaike, " $H_\infty$  control of nonlinear processes using multiple linear models," Chapter 12 of: *Multiple Model Approaches to Modelling and Control*, R. Murray-Smith and T.A. Johansen (Eds), Taylor & Francis, London, 1997.
5. B.A. Ogunnaike and R.A. Wright, "Industrial applications of nonlinear control" in: *Chemical Process Control V*, J.C. Kantor, C.E. Garcia, and B. Carnahan (Eds), AIChE Press, NY 1997.
6. J.D. Bomberger, D.E. Seborg, and B.A. Ogunnaike, "RBFN identification of an industrial polymerization reactor model" in: *Application of Neural Networks and Other Learning Technologies in Process Engineering*, I.M. Mujtaba and M.A. Hussain (Eds), Imperial College Press, London, 2001.
7. B.A. Ogunnaike "Nonlinear control of industrial processes," Chapter 10 of: *Nonlinear Predictive Control*, B. Kouvaritakis and M. Cannon (Eds), The Institution of Electrical Engineers, London, 2001.
8. N Hernjak, F.J. Doyle, III, B.A.Ogunnaike, and R.K. Pearson, "Chemical Process Characterization for Control Design" in *Integration of Design and Control*, P. Seferlis and M. Georgiadis (Eds), Elsevier 2004.
9. A.D. Shapiro, V. Agrawal, Dhurjati P.S., K.J Czymmek., B.A. Ogunnaike, and C. Zhang , "Systems Biology Explanations of Cell-to-Cell Communication Coordinating the Arabidopsis Hypersensitive Response." pp275-280 In: *Biology of Plant-Microbe Interactions*, Vol. 5, Sanchez F. and Geiger O. (Eds.) International Society for Molecular Plant-Microbe Interactions, St. Paul, Minnesota. 2006.
10. M. R. Birtwistle, B. Kholodenko, and B. A. Ogunnaike, "Experimental Design for Parameter Identifiability in Biological Signal Transduction Modeling," Chapter 10 in *Systems Analysis of Biological Networks*, Ed. A. Jayaraman and J. Hahn, Artech House, London, 2009.
11. B. A. Ogunnaike, G. François, M. Soroush, and D. Bonvin, "Control of Polymerization Processes," Chapter 12 in *The Control Handbook*, 2nd Edition, Ed. William Levine, CRC Press, Boca Raton, FL. 2010.
12. Melissa St Amand, Peter Millili, Meghan McCabe, and Babatunde A. Ogunnaike, "A Strategic Vision for Integrated PAT and Advanced Control in Biologics Manufacturing," Chapter 3 in *PAT Applied in Biopharmaceutical Process Development And Manufacturing: An Enabling Tool for Quality-by-Design*, Ed. C. Undey, D. Low, M. Menezes and M. Koch, CRC Press, Boca Raton, FL. 2011.

### Journal Articles

1. B.A. Ogunnaike and W.H. Ray, "Multivariable controller design for linear systems having multiple time delays," *AIChEJ.*, 25, 1043, 1979.
2. B.A. Ogunnaike, "A new approach to observer design for time delay systems," *Int. J. of Control*, 33, 519, 1981.
3. B.A. Ogunnaike and W.H. Ray, "Computer-aided multivariable control system design for processes with time delays," *Comp. & Chem. Eng.*, 6, 311, 1982.

4. B.A. Ogunnaike, J.P. Lemaire, M. Morari, and W.H. Ray, "Advanced multivariable control of a pilot plant distillation column," *AIChE J.*, 29, 632, 1983.
5. B.A. Ogunnaike and W.H. Ray, "Incomplete state feedback for time delay systems: Observer applications in multidelay compensation," *AIChE J.*, 30, 717, 1984.
6. B.A. Ogunnaike, "An optimal controller for discrete time delay systems requiring no prediction," *Chem. Eng. Comm.*, 37, 249, 1985.
7. B.A. Ogunnaike, "Dynamic matrix control: A non-stochastic, industrial process control technique with parallels in applied statistics," *Ind. & Eng. Chem. Fund.*, 25, 712, 1986.
8. B.A. Ogunnaike, "Controller design for nonlinear process systems via variable transformations," *Ind. & Eng. Chem. Proc. Des. Dev.*, 25, 241, 1986.
9. B.A. Ogunnaike and K.E.P. Adewale, "Dynamic matrix control for processes with time varying parameters," *Chem. Eng. Comm.* 47, 295, 1986.
10. B.A. Ogunnaike, "On-line modeling and predictive control of an industrial terpolymerization reactor," *Int. J. of Control*, 59, 711-729, 1994.
11. M.A. Henson, B.A. Ogunnaike, J.S. Schwaber, and F.J. Doyle, "The baroreceptor reflex: A biological control system with applications in chemical process control," *Ind. Eng. Chem. Res.*, 33, 2453-2466, 1994.
12. M.A. Henson, B.A. Ogunnaike, and J.S. Schwaber, "Habituating control strategies for process control," *AIChE J.*, 41, 604-618, 1995.
13. F.J. Doyle III, B.A. Ogunnaike, and R.K. Pearson, "Nonlinear model-based control using second-order Volterra series models," *Automatica*, 31, 669-714, 1995.
14. B.A. Ogunnaike, "The role of CACSD in contemporary industrial process control," *IEEE Trans. on Control Systems Technology*, 2, 41-47, 1995.
15. G.R. Srinivas, Y. Arkun, I.-L. Chien, and B.A. Ogunnaike, "Nonlinear identification and control of a high-purity distillation column: A case study," *J. of Process Control*, 5, 149-162, 1995.
16. B.R. Maner, F.J. Doyle III, B.A. Ogunnaike, and R.K. Pearson, "Nonlinear model predictive control of a simulated polymerization reactor using second-order Volterra models," *Automatica*, 32, 1285-1301, 1996.
17. R.K. Pearson, B.A. Ogunnaike, and F.J. Doyle III, "Identification of structurally constrained second-order Volterra models," *IEEE Trans. Sig. Proc.*, 44, 2837-2846, 1996.
18. M. Pottmann, M.A. Henson, B.A. Ogunnaike, and J.S. Schwaber, "A parallel control strategy abstracted from the baroreceptor reflex," *Chem. Eng. Sci.*, 52, 931-945, 1996.
19. B.A. Ogunnaike, "A contemporary industrial perspective on process control theory and practice," *Annual Reviews in Control*, 20, 1-8, 1996.

20. F. Allgöwer and B.A. Ogunnaike, "Dual-mode adaptive control of nonlinear processes," *Comp. & Chem. Eng.*, 21, S155-S160, 1997.
21. A. Banerjee, Y. Arkun, B.A. Ogunnaike, and R.K. Pearson, "Estimation of nonlinear systems using linear multiple models," *AIChE J.*, 43, 1204-1226, 1997.
22. Chien, I-Lung and B. A. Ogunnaike, "Modeling and Control of a Temperature-Based High-Purity Distillation Colum", *Chem. Eng. Comm.*, Vol. 158, 71-105 (1997)
23. S.A. Russell, P. Kesavan, J.H. Lee, and B.A. Ogunnaike, "Recursive data-based prediction and control of batch product quality," *AIChE J.*, 44, 2442-2458, 1998.
24. S.A. Russell, D.G. Robertson, J.H. Lee, and B.A. Ogunnaike, "Quality monitoring and control of Nylon 6,6 autoclaves," *Chem. Eng. Sci.*, 53, 3685-3702, 1998.
25. Y. Chikkula, J.H. Lee, and B.A. Ogunnaike, "Dynamic scheduled model predictive control using hing-ing hyperplane models," *AIChE J.*, 44, 2658-2674, 1998.
26. S. Tatiraju, M. Soroush, and B.A. Ogunnaike, "Multirate nonlinear state estimation with application to a polymerization reactor," *AIChE J.*, 45, 769-780, 1999.
27. A. Kordon, Y.O. Feuntes, B.A. Ogunnaike, and P.S. Dhurjati, "An intelligent parallel control system structure for plants with multiple operating regimes," *J. of Process Control*, 9, 453-460, 1999.
28. S.A. Russell, D.G. Robertson, J.H. Lee, and B.A. Ogunnaike, "Model-based quality monitoring of batch and semi-batch processes," *J. of Process Control*, 10, 317-332, 2000.
29. M. Pottmann, B.A. Ogunnaike, A.A. Adetayo, and B.J. Ennis, "Model-based control of a granulation system," *Powder Technology*, 108, 192-201, 2000.
30. A. Adetayo, B.A. Ogunnaike, and M. Pottmann, "Developing an effective control strategy for granu-lation processes," *KONA Powder and Particle*, 17, 183-189, 2000.
31. G.-Y. Zhu, M.A. Henson, and B.A. Ogunnaike, "A hybrid model predictive control strategy for nonlin-ear plant-wide control," *J. of Process Control*, 10, 449-458, 2000.
32. M.P. Harold and B.A. Ogunnaike, "Perspective: Process control in the evolving chemical industry," *AIChE J.*, 46, 2123-2127, 2000.
33. B.W. Bequette and B.A. Ogunnaike, "Chemical process control education and practice," *IEEE Control Systems Magazine*, 10-17, April 2001.
34. R.S. Parker, D. Heemstra, F.J. Doyle III, R.K. Pearson, and B.A. Ogunnaike, "The identification of non-linear models for process control using tailored 'plant-friendly' input sequences," *J. of Process Con-trol*, 11 (2), 237-250, 2001.
35. H. Perez, B.A. Ogunnaike, and S. Devasia, "Output tracking between points for nonlinear processes: Van de Vusse example," *IEEE Trans. on Control Systems Technology*, 10, 611-617, 2002.
36. N. Zambare, M. Soroush, and B.A. Ogunnaike, "A method of robust multi-rate state estimation," *J. of Process Control*, 13, 337-355, 2003.



37. R.J. Brendel, B.A. Ogunnaike, and P.S. Dhurjati, "Nonlinear PI controllers based on low-order empirical process models," *Ind. Eng. Chem. Res.*, 42, 4668-4677, 2003.
38. N. Mehranbod, M. Soroush, M. Piovoso, and B.A. Ogunnaike, "Probabilistic model for sensor fault detection and identification," *AIChE J.*, 49, 1787-1802, 2003.
39. V. Mikkilineni, R.D. Mitra, J.R. DiTonno, J. Merritt, G.M. Church, B.A. Ogunnaike, and J.S. Edwards, "Digital quantitative measurements of gene expression," *Biotech. and Bioeng.*, 86, 117-124, 2004.
40. R. J. Hendershot, W. B. Rogers, C. M. Snively, B. A. Ogunnaike, J. Lauterbach, "Development of NOx Storage and Reduction Catalysts Using Statistically Guided High-throughput Experimentation," *Catalysis Today*, 98, 375-385, 2004.
41. B. A. Ogunnaike, "Design of multivariable controllers by direct synthesis: Theory and experimental implementation," *Special Issue of the J. Chin. Inst. Chem. Engrs.*, 35, 335-351, 2004.
42. D.E. Zak, R. Vadigepalli, G E. Gonye, F.J. Doyle III, J.S. Schwaber, and B.A. Ogunnaike, "Unconventional systems analysis problems in molecular biology: A case study in gene regulatory network modeling," *Comp. & Chem. Eng.*, 29, 547-563, 2005.
43. M. Pottmann, B.A. Ogunnaike, and J.S. Schwaber, "Development and Implementation of a High performance Sensor System for an Industrial Polymer Reactor", *Ind. Eng. Chem. Res.*, 44, 2606-2620, 2005.
44. A. V. Tendulkar, M.A. Sohoni, B.A. Ogunnaike and P. P. Wangikar, "A geometric invariant-based framework for the analysis of protein conformational space", *Bioinformatics*, 21 (8), 3622-3628, 2005.
45. J. Merritt, J. A. Butz, B. A. Ogunnaike, and J. S. Edwards, "Parallel Analysis of Mutant Human Glucose 6-Phosphate Dehydrogenase in Yeast Using PCR Colonies", *Biotech. and Bioeng.*, 92(5):519-531, 2005; Published on-line 22 August, 2005. doi: 10.1002/bit.20726.
46. K. J. Kauffman, B. A. Ogunnaike and J. S. Edwards, "Designing experiments that aid in the identification of regulatory networks" *Br. Funct. Genomic and Proteomics*, 4, (4) 331-342, 2006 Published on-line Dec 2005, doi:10.1093/bfgp/eli004.
47. B. A. Ogunnaike, "Elucidating the digital control mechanism for DNA damage repair with the p53-Mdm2 System: Single cell data analysis and ensemble modeling", *J. Roy. Soc. Interface*, 3, 175-184, 2006.
48. B. A. Ogunnaike, and K. Mukati, "Design, development and implementation of an alternative structure for next generation regulatory controllers", *J. of Process Control*, 16, 499-509, 2006.
49. H. Hao, Zak D. E., Sauter T, Schwaber J, and B. A. Ogunnaike, "Modeling the VPAC2-Activated cAMP/PKA Signalling Pathways: From Receptor to Circadian Clock Gene Induction", *Biophys J.*, 90, 1560-1571, 2006.
50. N. Yalamanchili, D. E. Zak, B. A. Ogunnaike, J. S. Schwaber, A. Kriete, and B. N. Kholodenko, "Quantifying gene network connectivity in silico: Scalability and accuracy of a modular approach" *IEE Proceedings Systems Biology* 153, 236-246, 2006.

51. D.E. Zak, H. Hao, R. Vadigepalli, G. Miller, B.A. Ogunnaike and J. S. Schwaber, "Systems Analysis of circadian context-dependent neuronal epidermal growth factor receptor signaling", *Genome Biology*, 7:R48, 2006. (doi:10.1186/gb-2006-7-6-r48).
52. T. F. Edgar, B. A. Ogunnaike, J. J. Down, K. R. Muske, B. W. Bequette, "Renovating the undergraduate process control course"; *Comp. and Ch. E.* 30 (10), p.1749-1762, 2006.
53. T.F. Edgar, B.A. Ogunnaike, and K.R. Muske, "A global view of graduate process control education;" *Comp. and Ch. E.* 30 (10), p.1763-1774, 2006.
54. A. Samant, B. A. Ogunnaike and D. G. Vlachos, "A hybrid multiscale Monte Carlo algorithm (HyMSMC) to cope with disparity in time scales and species populations in intracellular networks", *BMC Bioinformatics*, 8:175, 2007.
55. S.C. Garge, M.D. Wetzal, and B.A. Ogunnaike, "Quantification of the Melting Process in a Co-rotating Twin-Screw Extruder: A Hybrid Modeling Approach," *Polymer Eng. Sci.*, 47, (7), 1040-1051, 2007.
56. A. Malcolm, J. Polan, B. A. Ogunnaike and A. Linninger, "Integrating Systems Design and Control using Dynamic Flexibility Analysis", *AIChE J*, 53, (8), 2048-2061, 2007.
57. A. V. Tendulkar, B. A. Ogunnaike, and P. P. Wangikar, "Protein local conformations arise from a mixture of Gaussian distributions," *J Biosciences*, 32(5), 899-908, 2007.
58. M. R. Birtwistle, M. Hatakeyama, N. Yumoto, B. A. Ogunnaike, J. B. Hoek, and B. N. Kholodenko, "Ligand-dependent responses of the ErbB signaling network: experimental and modeling analyses," *Molecular Systems Biology* 3:144,1-16, 2007.
59. J. G. VanAntwerp, A. P. Featherstone, R. D. Braatz, and B. A. Ogunnaike, "Cross-directional control of sheet and film processes," *Automatica*, 43, 191-211, 2007.
60. D.B. Skliar, C. Gelmi, T. Ogunnaike, B.G. Willis, "Interaction of 2,2,6,6-tetramethyl-3,5-heptanedione with the Si(100)-2 × 1 surface: Scanning tunneling microscopy and density functional theory study," *Surface Science*, 601, 2887-2895, 2007.
61. A-J Su, C-C Yu, and B. A. Ogunnaike, "On the interaction between measurement strategy and control performance in semiconductor manufacturing," *J. Process Control*, 18 (3), 266-276, 2008.
62. K. Mukati, M. Rasch and B. A. Ogunnaike, "An Alternative Structure for next generation Regulatory Controllers: Part II Stability analysis and tuning rules and experimental Validation," *J. Process Control*, 19 (2), 272-287, 2009. doi:10.1016/j.jprocont.2008.03.004.
63. S.-W. Chung, F.L. Miles, R.A. Sikes, C.R. Cooper, M. C. Farach-Carson, and B. A. Ogunnaike, "Quantitative Modeling and Analysis of the Transforming Growth Factor Signaling Pathway," *Biophys. Journal* 96, 1733-1750, 2009.
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66. A. M. Shough, D. J. Doren, and B. A. Ogunnaike, "Transition Metal Substitution in ETS-10: DFT Calculations and a Simple Model for Electronic Structure Prediction," *Chem. Mater.*, 21, 1232–1241, 2009.
67. M. R. Birtwistle, B. Kholodenko, and B. A. Ogunnaike, "Experimental Design for Parameter Identifiability in Biological Signal Transduction Modeling"; Chapter 10 in *Methods in Bioengineering*, Ed. A Jayaraman and J Hahn, Artech House, 2009.
68. E.S. Welf, B.A. Ogunnaike, and U.P. Naik, "Quantitative statistical description of integrin clusters in adherent cells," *IET Syst. Biol.*, 3, (5), 307–316, 2009.
69. Y. Li, B. A. Ogunnaike, C. J. Roberts "Multi-Variate Approach to Global Protein Aggregation Behavior and Kinetics: Effects of pH, NaCl, and Temperature for  $\alpha$ -Chymotrypsinogen A," *J. of Pharmaceutical Sc.*, 99, (2), 645–662, 2009.
70. T. Nakakuki, M.R. Birtwistle, Y. Saeki, N. Yumoto, K. Ide, T. Nagashima, L. Bruschi, B.A. Ogunnaike, M. Okada-Hatakeyama, and B.N. Kholodenko, "Ligand-Specific c-Fos Expression Emerges from the Spatiotemporal Control of ErbB Network Dynamics," *Cell*, 141, 884–896, 2010.
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### Selected Proceedings Papers

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3. R.K. Pearson, B. A. Ogunnaike, and F.J. Doyle, III, "Identification of nonlinear input/output models using non-gaussian input sequences," Paper TM7, *Proc. of the American Control Conference (ACC)*, San Francisco, CA, 1993.
4. B.A. Ogunnaike, I.-L. Chien, and Y. Arkun, "Nonlinear model predictive control of high-purity distillation columns using polynomial ARMA models," *Proc. of the European Control Conference*, Groningen, The Netherlands, June 1993.
5. B.A. Ogunnaike, R.K. Pearson, and F.J. Doyle III, "Chemical process characterization: with applications in the rational selection of control strategies," *Proc. of the European Control Conference*, Groningen, The Netherlands, June 1993.
6. B.A. Ogunnaike, "Problems and challenges of industrial process control: A commercial polymerization reactor case study," **Plenary Paper #3**, *Proc. of the IEEE/IFAC International Conference on Computer Aided Control Systems Design*, Tucson, AZ, March 1994.
7. B.A. Ogunnaike, R.K. Pearson, N. Samardzija, and J.D. Bomberger, "Low-order empirical modeling for nonlinear systems," *Proc. of the International Conference on the Advanced Control of Chemical Processes '94*, Kyoto, Japan, June 1994.
8. B.A. Ogunnaike and R.K. Pearson, "Detection of unmodeled disturbance effects by coherence analysis," *Proc. of the International Conference on the Advanced Control of Chemical Processes '94*, Kyoto, Japan, June 1994.
9. J.J. Downs and B.A. Ogunnaike, "Design for control and operability: An industrial perspective," Invited Paper: *Proc. of the International Symposium on Foundations of Computer Aided Process Design*, Snowmass, CO, July 1994.
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11. B.A. Ogunnaike, "A contemporary industrial perspective on process control theory and practice," **Plenary Paper**, *Proc. of the 4th IFAC Symposium on Dynamics and Control of Chemical Reactors, Distillation Columns, and Batch Processes '95*, Elsignore, Denmark, 1-8, June 1995.

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13. Y. Chikkula, J.H. Lee, and B.A. Ogunnaike, "Robust model predictive control of nonlinear systems using input-output models," *Proc. of the American Control Conference (ACC)*, Seattle, WA, 2205-2209, 1995.
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16. B.A. Ogunnaike, "Application of hybrid modeling in control system analysis and design for an industrial low-boiler column," *Proc. of the 3rd European Control Conference*, Rome, 2339-2344, 1995.
17. M. Pottmann, B.A. Ogunnaike, A.A. Adetayo, and B.J. Ennis, "Model-based control of a granulation system," *Control of Particulate Processes IV*, Kananaskis, Canada, 1995.
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19. R.D. Braatz, B.A. Ogunnaike, and A.P. Featherstone, "Identification, estimation, and control of sheet and film processes," *Proc. of the IFAC World Congress*, San Francisco, CA, Paper 7c-01-1, 1996.
20. R.K. Pearson and B.A. Ogunnaike, "Geometric model predictive control: A practical approach to modeling and control of uncertain industrial processes," *Proc. of the IFAC World Congress*, San Francisco, CA, Paper 7a-02-3, 1996.
21. S. Tatiraju, M. Soroush, and B.A. Ogunnaike, "Multi-rate nonlinear state estimation in a polymerization reactor," *Proc. of the Engineering Foundations Conference on Polymer Reaction Engineering III*, Palm Coast, FL, March 1997.
22. B.A. Ogunnaike, "Process control for chemical production: An industrial success story," *Frontiers of Engineering: Proceedings of the 1997 National Academy of Engineering Symposium* 31-37, Irvine, CA, September 1997.
23. N.C. Zambare, M. Soroush, and B.A. Ogunnaike, "A hybrid decentralized-cascade control method for processes with multi-rate measurements," *Proc. of the American Control Conference (ACC)*, San Diego, CA, Paper TP03-5, June 1999.
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28. R.K. Pearson, and B.A. Ogunnaike, "Target Set Control," *Proc. of the 7th International Symposium on Advanced Control of Chemical Processes*, Vol. 1, 393-398, 2004.
29. A. V. Tendulkar, B.A. Ogunnaike and P. P. Wangikar, "Gaussian mixture modeling of  $\alpha$ -helix subclasses: Structure and sequence variations", *Proceedings Pacific Conference on Systems Biology*, Dec 2005.
30. E. S. Welf, U. P. Naik and B. A. Ogunnaike, "A Diffusion-Reaction Model for Integrin Clustering", *Proceedings of the FOSBE 2007*, 115-120, Stuttgart, Sept 2007.
31. M. R. Birtwistle, B. N. Kholodenko, A. Kiyatkin, Jan B. Hoek, and B. A. Ogunnaike, "Probabilistic modeling and analysis of switch-like signal transduction systems." *Proceedings of the FOSBE 2007*, 207-212, Stuttgart, Sept 2007.

#### **Selected Conference/Workshop Presentations**

1. B.A. Ogunnaike, "Pole assignment for delay-differential systems via ring model descriptions," Paper 10d, *AIChE Annual Meeting*, Los Angeles, CA, November 1982.
2. B.A. Ogunnaike, "Design of robust control systems by direct synthesis," Paper 21h, *AIChE Annual Meeting*, San Francisco, CA, November 1989.
3. R.K. Pearson, B.A. Ogunnaike, and E.J. Doyle III, "Identification of discrete convolution models for nonlinear processes," Paper 125b, *AIChE Annual Meeting*, Miami Beach, FL, November 1992.
4. E.J. Doyle III, B.A. Ogunnaike, and R.K. Pearson, "Nonlinear model predictive control using second-order Volterra models," Paper 123a, *AIChE Annual Meeting*, Miami Beach, FL, November 1992.
5. I.-L. Chien and B.A. Ogunnaike, "Modeling and control of high-purity distillation columns," Paper 2a, *AIChE Annual Meeting*, Miami Beach, Florida, November 1992.
6. B.A. Ogunnaike, and R.K. Pearson, "Application of coherence analysis in linear and nonlinear input/output model identification," *AIChE Annual Meeting*, San Francisco, CA, November 1994.
7. A. Banerjee, Y. Arkun, B.A. Ogunnaike, and R.K. Pearson, "Robust nonlinear control by scheduling multiple model-based controllers," *AIChE Annual Meeting*, San Francisco, CA, November 1994.
8. N. Samardzija and B.A. Ogunnaike, "New results on the structure and design of polynomial nonlinear feedback controllers," *AIChE Annual Meeting*, San Francisco, CA, November 1994.
9. R.D. Braatz, B.A. Ogunnaike, and J.S. Schwaber, "Failure tolerant optimal control via parallel design," *AIChE Annual Meeting*, San Francisco, CA, November 1994.
10. B.A. Ogunnaike, "Controlling industrial chemical processes," **Plenary Paper**, *American Control Conference*, Philadelphia, PA, June 1998.

11. S. Tatiraju, M. Soroush, and B.A. Ogunnaike, "Multi-rate nonlinear control of a polymerization reactor," *AIChE National Meeting*, New Orleans, LA, March 1998.
12. N. Zambare, M. Soroush, and B.A. Ogunnaike, "Robust state estimation," *AIChE National Meeting*, Los Angeles, CA, November 2000.
13. N. Mehranbod, M. Soroush, M.J. Piovoso, and B.A. Ogunnaike, "Sensor fault detection and classification by Bayesian belief networks," *AIChE National Meeting*, Reno, NV, November 2001.
14. B.A. Ogunnaike, C.A. Gelmi, J.S. Edwards, "A new probabilistic framework for for cDNA microarray data analysis," Paper 125h, *AIChE National Meeting*, San Francisco, CA, November 2003.
15. R.J. Hendershot, Y. Fu, C. M. Snively, J. Lauterbach, R.K. Pearson, and B.A. Ogunnaike, "Combined Experimental and theoretical effort for rational design of novel catalytic material," Paper 508b, *AIChE National Meeting*, San Francisco, CA, November 2003.
16. D.E. Zak, R.K. Pearson, R. Vadigepalli, G.E. Gonye, J.S. Schwaber, and B.A. Ogunnaike, "Assigning significance to the appearance of regulatory elements in experimentally defined collections of DNA sequences using empirical reference distributions," Paper 555a, *AIChE National Meeting*, San Francisco, CA, November 2003.
17. S.C. Garge, M.D. Wetzel, and B.A. Ogunnaike, "Control-relevant modeling of reactive extrusion processes," Paper 436e, *AIChE National Meeting*, San Francisco, CA, November 2003.
18. B.A. Ogunnaike and K. Mukati, "Development, design and implementation of an alternative structure for next generation regulatory controllers," Paper 438a, *AIChE National Meeting*, San Francisco, CA, November 2003.
19. D.E. Zak, T.G. Lombardo, B.N. Kholodenko, C. Su, and B.A. Ogunnaike, "Modeling the interaction of growth factor and apoptosis subsystem in cancer," Paper 478b, *AIChE National Meeting*, San Francisco, CA, November 2003.
20. K. Kauffmann, B.A. Ogunnaike, and J.S. Edwards, "Design of high-throughput profiling experiments: A mathematical analysis of network identification," Paper 483a, *AIChE National Meeting*, San Francisco, CA, November 2003.
21. K. Mukati and B. A. Ogunnaike, "Tuning rules for the RTDA controller," Paper 412e, *AIChE National Meeting*, Austin, TX, November 2004.
22. D. E. Zak, B. Egan, J. S. Schwaber, and B. A. Ogunnaike, "Gene Dynamics and transcription networks," Paper 428c, *AIChE National Meeting*, Austin, TX, November 2004.
23. H. Hao, Zak D. E., Sauter T, Schwaber J, and B. A. Ogunnaike, "VIP signal transduction pathway modeling in SCN 2.2 cells," Paper 457e, *AIChE National Meeting*, Austin, TX, November 2004.
24. G. M. Miller, D. E. Zak, J. S. Schwaber, and B. A. Ogunnaike, "Modeling and Identification of the gene regulatory network describing the liver response to corticosteroids," Paper 499c, *AIChE National Meeting*, Austin, TX, November 2004.
25. M. R. Birtwistle, T. Lombardo, and B. A. Ogunnaike, "Analysis and Optimization of cell-cycle specific cancer chemotherapy," Paper 505g, *AIChE National Meeting*, Austin, TX, November 2004.



26. B. A. Ogunnaïke, "Elucidating the control mechanism for DNA damage repair with the p53-Mdm2 system: Single cell data analysis and ensemble modeling," Paper 510a, *AIChE National Meeting*, Austin, TX, November 2004.
27. K. Mukati, B. A. Ogunnaïke and R. W. Birkmire, "Design and control considerations for scale-up of a CIGS inline co-evaporative physical deposition process," Paper 9a, *AIChE National Meeting*, Cincinnati, OH, November 2005.
28. B. A. Ogunnaïke, C. A. Gelmi, A. Folarin, S. B. Nagl, and M. A. Konerding, "Probabilty model-based analysis of tumor vasculature data," Paper 240h, *AIChE National Meeting*, Cincinnati, OH, November 2005.
29. E. S. Welf, U. P. Naik, and B. A. Ogunnaïke, "A diffusion-reaction model for integrin clustering in response to cell adhesion," Paper 248f, *AIChE National Meeting*, Cincinnati, OH, November 2005.
30. D. E. Zak, H. Hao, G. M. Miller, R. Vadigepalli, B. A. Ogunnaïke, and J. S. Schwaber, "Systems analysis of context-dependent EGFR signalling in the circadian pacemaker," Paper 295a, *AIChE National Meeting*, Cincinnati, OH, November 2005.
31. A. J. Su, C.-C. Yu, and B. A. Ogunnaïke, "Effects of sampling rate, metrology delay and process hold on the stability of Run-to-Run control," Paper 375c, *AIChE National Meeting*, Cincinnati, OH, November 2005.
32. S. C. Garge, M. D. Wetzel, and B. A. Ogunnaïke, "On identification and control of reactive extrusion processes," Paper 387a, *AIChE National Meeting*, Cincinnati, OH, November 2005.
33. S. Metta, M. Soroush, N. Mehranbod, M. J. Piovoso, and B. A. Ogunnaïke, "Probabilistic sensor fault detection and identification in distributed parameter systems," Paper 402g, *AIChE National Meeting*, Cincinnati, OH, November 2005.
34. P. P. Wangikar, A. Tendulkar, and B. A. Ogunnaïke, "Visualization and characterization of protein conformational space via geometric techniques," Paper 456h, *AIChE National Meeting*, Cincinnati, OH, November 2005.
35. S. C. Garge, and B. A. Ogunnaïke, "Customer feedback control for assuring acceptable product end-use performance," Paper 150f, *AIChE National Meeting*, Salt Lake City, UT, November 2007.
36. M. R. Birtwistle, A. Kiyatkin, J. B. Hoek, B. N. Kholodenko, and B. A. Ogunnaïke, "Experimental investigations and probabilistic modeling of Switch-like signal transduction systems," Paper 422c, *AIChE National Meeting*, Salt Lake City, UT, November 2007.
37. K. Mukati, R. W. Birkmire, and B. A. Ogunnaïke, "Scale-up of a Physical Vapor Deposition Evaporation Source using Thermal and Effusion Modeling," Paper 484f, *AIChE National Meeting*, Salt Lake City, UT, November 2007.
38. M. R. Birtwistle, B. N. Kholodenko, J. B. Hoek, and B. A. Ogunnaïke, "Optimal Experimental Design for Parameter Estimation in Biological Signal Transduction Modeling," Paper 538d, *AIChE National Meeting*, Salt Lake City, UT, November 2007.

39. G. M. Miller, R. Vadigepalli, M. R. Birtwistle, B. N. Kholodenko, B. A. Ogunnaike and J. S. Schwaber, "Computational Modeling of Angiotensin II Signaling in the Neural Regulation of Blood Pressure," Paper 620d, *AIChE National Meeting*, Salt Lake City, UT, November 2007.
40. Takashi Nakakuki, Marc R. Birtwistle, Yuko Saeki, Noriko Yumoto, Nagashima Takeshi, Babatunde A. Ogunnaike, Hatakeyama Mariko and Boris N. Kholodenko, "Ligand Specificity of C-Fos Expression Emerges from Spatiotemporal Control of ErbB Network Dynamics," Paper 101c, *AIChE National Meeting*, Philadelphia, PA, November 2008.
41. Erik S. Welf, Ulhas P. Naik and Babatunde A. Ogunnaike, "Computational Investigation of How Integrin Clustering Affects Cell Adhesion and Migration," Paper 275e, *AIChE National Meeting*, Philadelphia, PA, November 2008.
42. Babatunde A. Ogunnaike, "Design and Process Control Issues In Nanomanufacturing," Paper 373d, *AIChE National Meeting*, Philadelphia, PA, November 2008.
43. Seung-Wook Chung, Fayth L. Miles, Carlton R. Cooper, Mary C. Farach-Carson and Babatunde A. Ogunnaike, "Quantitative Modeling and Analysis of the Transforming Growth Factor Beta Signaling Pathway," Paper 416f, *AIChE National Meeting*, Philadelphia, PA, November 2008.
44. Marc R. Birtwistle and Babatunde A. Ogunnaike, "Development and Analysis of Models for Cell-to-Cell Variability In Protein Expression," Paper 482e, *AIChE National Meeting*, Philadelphia, PA, November 2008.
45. Mary K. McDonald, James S. Schwaber and Babatunde A. Ogunnaike, "Modeling the Control of An Excitatory Neurotransmitter Receptor during Alcoholism and Alcohol Withdrawal," Paper 487e, *AIChE National Meeting*, Philadelphia, PA, November 2008.
46. Yi Li, Babatunde A. Ogunnaike and Christopher J. Roberts, "Synergetic Approach to Nonnative Aggregation by Multi-Assay Design of Experiments, Multivariate Statistics, and Mechanistic Kinetics," Paper 504a, *AIChE National Meeting*, Philadelphia, PA, November 2008.
47. E. S. Welf, U. P. Naik and B. A. Ogunnaike, "A Control Engineering Model for Hemostasis Following Blood Vessel Injury," Paper 538d, *AIChE National Meeting*, Philadelphia, PA, November 2008.
48. Gregory M. Miller, Rajanikanth Vadigepalli, James S. Schwaber and Babatunde A. Ogunnaike, "The Effect of Biological Variability on the Angiotensin II Gene Regulatory Network In the Central Regulation of Blood Pressure," Paper 565e, *AIChE National Meeting*, Philadelphia, PA, November 2008.
49. Gregory M. Miller, Rajanikanth Vadigepalli, James S. Schwaber and Babatunde A. Ogunnaike, "Elucidating the Transcriptional Regulatory Network Underlying the Nts Response to Acute Hypertension," Paper 572r, *AIChE National Meeting*, Philadelphia, PA, November 2008.
50. Erik S. Welf, Babatunde A. Ogunnaike and Ulhas P. Naik, "An Experimental Method for Characterizing Spatially-Localized Integrin Signaling Phenomena," Paper 572z, *AIChE National Meeting*, Philadelphia, PA, November 2008.
51. Marc R. Birtwistle, Peter G. Millili and Babatunde A. Ogunnaike, "A First-Principles Model for Eukaryotic DNA Synthesis Dynamics and the Implications for Cell Cycle Analysis," Paper 737a, *AIChE National Meeting*, Philadelphia, PA, November 2008.

52. Gregory M. Miller, Rajanikanth Vadigepalli, James S. Schwaber and Babatunde A. Ogunnaike, "Quantitative Analysis of the Gene Regulatory Network Activated by Angiotensin II Type 1 Receptor in the Brainstem," Paper 151c, *AIChE National Meeting*, Nashville, TN, November 2009.
53. Melissa St. Amand, Peter G. Millili, Meghan McCabe, Mark Stitz and Babatunde A. Ogunnaike, "Development of Process Analytical Technology (PAT) Methods for Online Control of Glycosylation Profiles During Monoclonal Antibody (MAb) Production," Paper 164c, *AIChE National Meeting*, Nashville, TN, November 2009.
54. Babatunde A. Ogunnaike, Swapnil C. Garge and Mark D. Wetzel, "Inference-Based Control of Reactive Extrusion Processes," Paper 258b, *AIChE National Meeting*, Nashville, TN, November 2009.
55. Mary K. McDonald, James S. Schwaber, Babatunde A. Ogunnaike and Rajanikanth Vadigepalli, "An Automated Framework for High-Throughput Kinetic Analysis of qRT-PCR Data," Paper 261b, *AIChE National Meeting*, Nashville, TN, November 2009.
56. Erik S. Welf, Ulhas P. Naik and Babatunde A. Ogunnaike, "Mathematical Modeling of Heterogeneous Sub-Cellular Structures: Probability Models for Integrin Cluster Properties in Adherent Cells," Paper 262a, *AIChE National Meeting*, Nashville, TN, November 2009.
57. Mary K. McDonald, Rajanikanth Vadigepalli, Babatunde A. Ogunnaike and James S. Schwaber, "A High-Throughput, Multi-Dimensional Investigation of the Brain's Transcriptomic Response to Alcohol Withdrawal," Paper 283a, *AIChE National Meeting*, Nashville, TN, November 2009.
58. Ketan P. Detroja, Swapnil C. Garge, Qian Gou and Babatunde A. Ogunnaike, "Customer Feedback Controller Design and Implementation," Paper 302b, *AIChE National Meeting*, Nashville, TN, November 2009.
59. Seung-Wook Chung, Carlton R. Cooper, Mary C. Farach-Carson and Babatunde A. Ogunnaike, "A Control Engineering Approach to Understanding the Paradoxical Roles of TGF- $\beta$  in Cancer," Paper 664e, *AIChE National Meeting*, Nashville, TN, November 2009.
60. Melissa M. St. Amand, Anne S. Robinson and Babatunde A. Ogunnaike, "Towards Online Control of Protein Glycosylation: Establishing Nutrient Setpoint Control in Bioreactors," Paper 130g, *AIChE National Meeting*, Salt Lake City, UT, November 2010.
61. Qian Gou, Mark D. Wetzel and Babatunde A. Ogunnaike, "Integrated Product Design and Control in Manufacturing Processes," Paper 239a, *AIChE National Meeting*, Salt Lake City, UT, November 2010.
62. Seung-Wook Chung, Mary C. Farach-Carson, Carlton R. Cooper and Babatunde A. Ogunnaike, "Quantitative Modeling and Analysis of TGF- $\beta$ -Induced Erk/MAPK and Smad Signaling," Paper 541b, *AIChE National Meeting*, Salt Lake City, UT, November 2010.
63. Babatunde A. Ogunnaike, "Optimizing In-vitro Fertilization Treatment: A Pedagogical Case Study of Random Phenomena Analysis," Paper 163e, *AIChE National Meeting*, Minneapolis, MN, October 2011.
64. Mary M. Staehle, Babatunde A. Ogunnaike, James Schwaber and Rajanikanth Vadigepalli, "Uncovering 'Hidden' Variability and Dynamic Patterns: Strategies for Analyzing High-Dimensional Data Sets," Paper 306c, *AIChE National Meeting*, Minneapolis, MN, October 2011.

65. Jacob McGill, Nasser Mohieddin Abukhdeir, Babatunde A. Ogunnaike and Dion G. Vlachos, "Optimization and Control of Heteroepitaxial Surface Morphologies," Paper 367a, *AIChE National Meeting*, Minneapolis, MN, October 2011.
66. Seung-Wook Chung, Carlton R. Cooper, Mary C. Farach-Carson and Babatunde A. Ogunnaike, "A Novel Mathematical Model of TGF- $\beta$ -Induced Apoptosis Signaling Pathways," Paper 653f, *AIChE National Meeting*, Minneapolis, MN, October 2011.
67. Melissa M. St. Amand, Kevin Tran, Devesh Radhakrishnan, Anne S. Robinson and Babatunde A. Ogunnaike, "Controllability Analysis of Protein Glycosylation In CHO Cells," Paper 701g, *AIChE National Meeting*, Minneapolis, MN, October 2011.
68. Devesh Radhakrishnan, Andrew Bitner, Melissa St. Amand, Kevin Tran, Anne S. Robinson and Babatunde A. Ogunnaike, "A Stochastic Model of Glycosylation of Monoclonal Antibodies," Paper 100h, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
69. Christopher R. Christie, Luke E. K. Achenie and Babatunde A. Ogunnaike, "A Control Engineering Perspective to Modeling Calcium Regulation and Related Pathologies," Paper 309d, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
70. Babatunde A. Ogunnaike, "Using Probability Models to Represent Process Engineering Phenomena," Paper 496d, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
71. Daniel Cook, Lakshmi Kuttippurathu, Biswanath Patra, Jan Hoek, Babatunde A. Ogunnaike and Rajanikanth Vadigepalli, "Combinatorial Transcriptional Regulatory Network Driving Aberrant Effects of Chronic Alcohol Consumption On Liver Regeneration," Paper 564f, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
72. Zachary S. Whiteman, Piyush Bubna, Ajay K. Prasad and Babatunde A. Ogunnaike, "Design, Analysis, Operation and Control of a Photovoltaic/PEM Fuel Cell/NiCd Battery Hybrid Renewable Energy System (HRES) for Urban Transit Applications," Paper 630a, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
73. James Park, Anthony Brureau, Sonali Gulati, Carmen Nichols, Rajanikanth Vadigepalli, Babatunde A. Ogunnaike and James S. Schwaber, "Identifying Transcriptional Phenotypes Associated with Single Cell Variability in Hypertension," Paper 662f, *AIChE National Meeting*, Pittsburgh, PA, October 2012.
74. Qian Gou, Mark D. Wetzel and Babatunde A. Ogunnaike, "Quantification of Layered Silicates Dispersion in Polymer Nanocomposites," Paper 708e, *AIChE National Meeting*, Pittsburgh, PA, October 2012.

### **Invited Seminars**

1. Lehigh University, Bethlehem, PA, *April 19, 1990.*
2. University of Wisconsin–Madison, Madison, WI, *May 16, 1992.*
3. Auburn University, Auburn, AL, *October 15, 1992.*
4. University of Pennsylvania, Philadelphia, PA, *Nov. 9, 1992.*

5. University of Colorado, Boulder, CO, *Dec. 2, 1992.*
6. Purdue University, West Lafayette, IN, *April 15, 1993.*
7. Stevens Institute of Technology, Hoboken, NJ, *Oct. 20, 1993.*
8. Carnegie Mellon University, Pittsburgh, PA, *Nov. 30, 1993.*
9. Arizona State University, Tempe, AZ, *March 4, 1994.*
10. Technion, Israel Institute of Technology, Haifa, Israel, *April 27, 1994.*
11. City University of New York, New York, NY, *Oct. 24, 1994.*
12. University of California at Santa Barbara, Santa Barbara, CA, *Nov. 10, 1994.*
13. University of Delaware, Newark, DE, *Dec. 2, 1994.*
14. University of Washington, Seattle, WA, *Jan. 23, 1995.*
15. Drexel University, Philadelphia PA, *May 1, 1995.*
16. University of California at Berkeley, Berkeley, CA, *Oct. 30, 1995.*
17. University of Connecticut, Storrs, CT, *Feb. 12, 1996.*
18. University of Illinois, Urbana, IL, *Nov. 5, 1996.*
19. Rutgers University, New Brunswick, NJ, *Dec. 5, 1996.*
20. Princeton University, Princeton, NJ, *May 30, 1997.*
21. University of Texas at Austin, Austin, TX, *Dec. 12, 1997.*
22. University of Utah, Salt Lake City, UT, *Jan. 30, 1998.*
23. University of Maryland, College Park, MD, *Feb. 3, 1998.*
24. Technion, Israel Institute of Technology, Haifa, Israel, *June 3, 1998.*
25. Imperial College, London, U.K. *Sept. 18, 1998.*
26. Rice University, Houston, TX, *Dec. 3, 1998.*
27. Université Catholique de Louvain, Belgium. *Feb. 19, 1999.*
28. Texas Tech University, Lubbock, TX, *Oct. 29, 1999.*
29. Louisiana State University, Baton Rouge, LA. *Nov. 19, 1999.*
30. Iowa State University, Ames, IA, *Jan. 27, 2000.*
31. University of California at Santa Barbara, Santa Barbara, CA, *Feb. 24, 2000.*
32. Technion, Israel Institute of Technology, Haifa, Israel, *Mar. 15, 2000.*

33. Texas A & M, College Station, Texas, **Lindsey Lecture**, *Sept. 28, 2001*.
34. Illinois Institute of Technology, Chicago, IL, **Centennial Lecture**, *Feb. 27, 2002*.
35. Queens University, Kingston, Ontario, Canada, *Mar. 6, 2002*.
36. Rensselaer Polytechnic Institute, Troy, NY, *Oct. 9, 2002*.
37. University of Stuttgart, Stuttgart, Germany, *Feb. 28, 2003*.
38. Process Modeling and Control Center and Department of Chemical Engineering, Lehigh University, Bethlehem, PA, *April 8, 2003*.
39. Department of Chemical Engineering, National Taiwan University, Taiwan, *Dec. 10, 2003*.
40. Department of Chemical Engineering, University of Guanajuato, Mexico, *Jan. 9, 2004*.
41. Seminarios de Ingenieria Quimica, Instituto Tecnologico Celaya, Mexico, *Jan. 13-16, 2004*.
42. Isaac Newton Institute, Cambridge University, Cambridge, England, *Jan. 21, 2004*.
43. Department of Chemical Engineering, University of Michigan, Ann Arbor, MI, *Feb. 19, 2004*.
44. Department of Chemical Engineering, École Polytechnique, Montréal, *Oct. 14, 2004*.
45. Department of Chemical Engineering, IIT Bombay, India, *April 26, 27, 2005*.
46. National Taiwan University, Taipei, Taiwan, *Nov 16, 2005*.
47. Industrial Technology Research Institute, Hsinchu, Taiwan, *Nov 18, 2005*.
48. Department of Chemical Engineering, University of Guanajuato, Mexico, *Jan 9, 2006*.
49. Seminarios de Ingenieria Quimica, Instituto Tecnologico Celaya, Mexico, *Jan 10-13, 2006*.
50. Lehigh University, Bethlehem, PA, *March 15, 2006*.
51. University of Notre Dame, Notre Dame, IN, *May 2, 2006*.
52. Tufts University, Medford, MA, *Oct 2, 2006*.
53. Hong Kong University of Science and Technology, Hong Kong, *Nov 30–Dec 1, 2006*.
54. University of Maryland, Baltimore County, Baltimore, MD, *Mar 5, 2007*.
55. University of California–Los Angeles, Los Angeles, CA, *Apr 13, 2007*.
56. University of Southern California, Los Angeles, CA, *Oct 11, 2007*.
57. University of Minnesota, Minneapolis, MN, *Nov 30, 2007*.
58. Department of Chemical Engineering, University of Guanajuato, Mexico, *Jan 11, 2008*.
59. Seminarios de Ingenieria Quimica, Instituto Tecnologico Celaya, Mexico, *Jan 14–18, 2008*.

60. Hong Kong University of Science and Technology, Hong Kong; *Sept 12–18, 2008.*
61. Rutgers University, New Brunswick, NJ. *Oct 29, 2008.*
62. Bristol Myers Squibb (BMS), New Brunswick, NJ. *Dec 4, 2008.*
63. University of Stuttgart, Stuttgart, Germany, *June 30, 2009.*
64. Otto von Guericke Universität, Magdeburg, Germany, *July 2, 2009.*
65. National University of Singapore, *July 27, 2010*
66. Corning, Inc (Process Control Group), *September 23, 2010*
67. University of California, San Diego, *October 15, 2010*
68. India Institute of Technology, Madras, *November 30, 2010*
69. Department of Chemical Engineering, University of Alberta, Canada, **D. B. Robinson Distinguished Lecture**, *Feb. 17, 2011.*
70. Department of Chemical Engineering, Georgia Institute of Technology, *March 16, 2011*
71. Department of Chemical Engineering, University of Pennsylvania, *October 12, 2011*
72. Department of Chemical Engineering, Auburn University, *November 9, 2011*
73. Department of Chemical Engineering, McMaster University, Canada *April 4, 2012*
74. Department of Chemical Engineering, Carnegie Mellon University, **Bayer Lecture**, *April 10, 2012.*
75. Department of Chemical Engineering, University of Pittsburgh, *March 1, 2013.*
76. Department of Chemical Engineering, University of Waterloo, *May 2, 2013.*
77. Department of Chemical Engineering, University of California–Davis, **Smith Lecture**, *May 16, 2013.*
78. Department of Chemical Engineering, Northwestern University, *October 10, 2013.*
79. Department of Chemical Engineering, MIT, *October 24, 2014.*
80. Department of Chemical Engineering, Tulane University, *November 7, 2014.*