

Curriculum Vitae

Michael A. Henson
Department of Chemical Engineering
University of Massachusetts
Amherst, MA 01003-3110

EDUCATION

B.S. Chemical Engineering, University of Colorado, Boulder, Colorado, 1985.

M.S. Chemical Engineering, University of Texas, Austin, Texas, 1988.

Ph.D. Chemical Engineering, University of California, Santa Barbara, California, 1992.

RESEARCH EXPERIENCE

Research Assistant, University of Texas, Austin, Texas, Jan. 1987–1988.

Research Assistant, University of California, Santa Barbara, California, 1989–1992.

Visiting Research Scientist, Advanced Process Control Group, DuPont Company, Wilmington, Delaware, Aug. 1992–1993.

Assistant Professor, Department of Chemical Engineering, Louisiana State University, Baton Rouge, Louisiana, 1994–1999.

Associate Professor, Department of Chemical Engineering, Louisiana State University, Baton Rouge, Louisiana, 1999–2002.

Humboldt Research Fellow, Institute of Biochemical Engineering and Institute for Systems Theory in Engineering, University of Stuttgart, Stuttgart, Germany, 2001–2002.

Associate Professor, Department of Chemical Engineering, University of Massachusetts, Amherst, MA, 2002–2004.

Professor, Department of Chemical Engineering, University of Massachusetts, Amherst, MA, 2004–present.

Director, Center for Process Design and Control, University of Massachusetts, Amherst, MA, 2004–present.

Co-Director, Institute for Massachusetts Biofuels Research (TIMBR), 2007–present.

Visiting Professor, Department of Systems Biology, Harvard Medical School, Boston, MA, January–August, 2009.

AWARDS

Career Development Award, National Science Foundation, 1995.

Cross-Holloway Award for Excellence in Research and Service, Louisiana State University, 1998.

James McLaurin Shivers Professorship, Louisiana State University, 1999.

Research Fellowship, Alexander von Humboldt Foundation, 2001.

College of Engineering Outstanding Senior Faculty Award, 2008.

SELECTED PROFESSIONAL ACTIVITIES

Associate Editor

IEEE Control Systems Society Conference Editorial Board, 1994–1996.

Journal of Process Control, 2000–present.
Automatica, 2005–2011.
IET Systems Biology, 2009–present.

AICHE CAST Division

Director, Computing and Systems Technology (CAST) Division of AIChE, 2001–2003.
Programming Chair, CAST Area 10b, Systems and Process Control, 2003.

Other Activities

Member, Technical Committee on Industrial Process Control, IEEE Control Systems Society, 2002–present.

Member, Technical Committee on Chemical Process Control, International Federation of Automatic Control (IFAC), 2003–present.

Board of Directors, American Automatic Control Council, 2004–2005.

Trustee, Computer Aids for Chemical Engineering (CACHE), 2005–present.

Conference Organization

Chairman, Chemical Process Control 7, Lake Louise, Alberta, Canada, January 2006.

Chairman, Foundations of Systems Biology in Engineering, Denver, CO, August 2009.

Co-Chairman, Foundations of Systems Biology in Engineering, Santa Barbara, CA, July 2005.

Co-Chairman, Foundations of Systems Biology in Engineering, Japan, September 2011.

International Program Chair, Dynamics and Control of Process Systems, Auckland, New Zealand, June–July, 2013

PUBLICATIONS

Books

1. Henson, M. A. and D. E. Seborg (Eds.), *Nonlinear Process Control*, Prentice-Hall, Englewood Cliffs, NJ, 1997.

Book Chapters

1. Doyle, F. J., 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,” in *Neural Systems for Control*, D. L. Elliott (Ed.), Academic Press, New York, NY, 1997.
2. Doyle, F. J. and M. A. Henson, “Nonlinear Systems Theory,” in *Nonlinear Process Control*, Michael A. Henson and Dale E. Seborg (Eds.), Prentice-Hall, Englewood Cliffs, NJ, 1997. Prentice-Hall, Englewood Cliffs, NJ, 1997.
3. Henson, M. A. and D. E. Seborg, “Feedback Linearizing Control,” in *Nonlinear Process Control*, Michael A. Henson and Dale E. Seborg (Eds.), Prentice-Hall, Englewood Cliffs, NJ, 1997.
4. Hjersted, J. and M. A. Henson, “Determining Metabolite Production Capabilities of *Saccharomyces cerevisiae* using Dynamic Flux Balance Analysis,” in *Methods in Bioengineering: Systems Analysis of Biological Networks*, Arul Jayaraman and Juergen Hahn (Eds.), Artech House, Boston, MA, 149–178, 2009.

5. Henson, M. A., “Model-Based Control of Biochemical Reactors,” in *The Control Handbook*, 2nd edition, William Levine (Ed.), Taylor and Francis, New York, NY, 2010.

Journal Publications

1. Jordan, S. M., M. A. Henson, and W. J. Koros, “The Effects of Carbon Dioxide Conditioning on the Permeation Behavior of Hollow Fiber Asymmetric Membranes,” *J. Membrane Sci.*, **54**, 103–118 (1990).
2. Henson, M. A. and D. E. Seborg, “Input-Output Linearization of General Nonlinear Processes,” *AIChE J.*, **36**, 1753–1757 (1990).
3. Henson, M. A. and D. E. Seborg, “Critique of Exact Linearization Strategies for Process Control,” *J. Process Control*, **1**, 122–139 (1991).
4. Henson, M. A. and D. E. Seborg, “An Internal Model Control Strategy for Nonlinear Systems,” *AIChE J.*, **37**, 1065–1081 (1991).
5. Henson, M. A. and D. E. Seborg, “Nonlinear Control Strategies for Continuous Fermentors,” *Chem. Eng. Sci.*, **47**, 821–835 (1992).
6. Nahas, E. P., M. A. Henson, and D. E. Seborg, “Nonlinear Internal Model Control Strategy for Neural Network Models,” *Comput. chem. Engng.*, **16**, 1039–1057 (1992).
7. Henson, M. A. and D. E. Seborg, “Theoretical Analysis of Unconstrained Nonlinear Model Predictive Control,” *Int. J. Control*, **58**, 1053–1080 (1993).
8. Henson, M. A. and D. E. Seborg, “Time Delay Compensation for Nonlinear Processes,” *Ind. Eng. Chem. Res.*, **33**, 1493–1500 (1994).
9. Henson, M. A. and W. J. Koros, “Multi-Loop Control of a Pilot-Scale Membrane System for Gas Separations,” *Ind. Eng. Chem. Res.*, **33**, 1901–1907 (1994).
10. Henson, M. A. and D. E. Seborg, “Adaptive Nonlinear Control of a pH Neutralization Process,” *IEEE Trans. Control Systems Technology*, **2**, 169–182 (1994).
11. Henson, M. A., 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. Henson, M. A., B. A. Ogunnaike, and J. S. Schwaber, “Habituating Control Strategies for Process Control,” *AIChE J.*, **41**, 604–618 (1995).
13. Meadows, E. S., M. A. Henson, J. W. Eaton, and J. B. Rawlings, “Receding Horizon Control and Discontinuous State Feedback Stabilization,” *Int. J. Control*, **62**, 1217–1229 (1995).
14. Pottmann, M., M. A. Henson, B. A. Ogunnaike, and J. S. Schwaber, “A Parallel Control Strategy Abstracted from the Baroreceptor Reflex,” *Chem. Eng. Sci.*, **51**, 931–945 (1996).
15. McLain, R. B., M. J. Kurtz, M. A. Henson, and F. J. Doyle III, “Habituating Control for Non-Square Nonlinear Systems,” *Ind. Eng. Chem. Res.*, **35**, 4067–4077 (1996).

16. Qi, R. and M. A. Henson, "Approximate Modeling of Spiral-Wound Gas Permeators," *J. Membrane Science*, **121**, 11–24 (1996).
17. Kurtz, M. J. and M. A. Henson, "Input-Output Linearizing Control of Constrained Nonlinear Processes," *J. Process Control*, **7**, 3–17 (1997).
18. Henson, M. A. and D. E. Seborg, "Adaptive Input-Output Linearization of a pH Neutralization Process," *Int. J. Adapt. Control Signal Process.*, **11**, 171–200 (1997).
19. Qi, R. and M. A. Henson, "Modeling of Spiral-Wound Permeators for Multicomponent Gas Separations," *Ind. Eng. Chem. Res.*, **36**, 2320–2331 (1997).
20. Pottmann, M. and M. A. Henson, "Compactly Supported Radial Basis Functions for Adaptive Process Control," *J. Process Control*, **7**, 345–356 (1997).
21. Kurtz, M. J. and M. A. Henson, "Feedback Linearization of Discrete-Time Nonlinear Systems with Input Constraints," *Int. J. Control*, **70**, 603–616 (1998).
22. Qi, R. and M. A. Henson, "Optimization-Based Design of Spiral-Wound Membrane Systems for CO₂/CH₄ Separations," *Separation and Purification Technology*, **13**, 209–225 (1998).
23. Kurtz, M. J. and M. A. Henson, "State and Disturbance Estimation for Nonlinear Systems Affine in the Unmeasured Variables," *Comput. chem. Engng.*, **22**, 1441–1459 (1998).
24. Qi, R. and M. A. Henson, "Optimal Design of Spiral-Wound Membrane Networks for Gas Separations," *J. Membrane Science*, **148**, 71–89 (1998).
25. Kurtz, M. J., G.-Y. Zhu, A. Zamamiri, M. A. Henson, and M. A. Hjortso, "Control of Oscillating Microbial Cultures Described by Population Balance Models," *Ind. Eng. Chem. Res.*, **37**, 4059–4070 (1998).
26. Henson, M. A. "Nonlinear Model Predictive Control: Current Status and Future Directions," *Comput. chem. Engng.*, **23**, 187–202 (1998).
27. McLain, R. B., M. A. Henson, and M. Pottmann, "Direct Adaptive Control of Partially Known Nonlinear Systems," *IEEE Transactions on Neural Networks*, **10**, 714–721 (1999).
28. Kurtz, M. J., G.-Y. Zhu and M. A. Henson, "Constrained Output Feedback Control of a Multivariable Polymerization Reactor," *IEEE Transactions on Control System Technology*, **8**, 87–97 (2000).
29. Kurtz, M. J., M. A. Henson, and M. A. Hjortso, "Nonlinear Control of Competitive Mixed-Culture Bioreactors via Specific Cell Adhesion," *Canadian J. Chem. Eng.*, **78**, 237–247 (2000).
30. McLain, R. B. and M. A. Henson, "Principal Component Analysis for Nonlinear Model Reference Adaptive Control," *Comput. chem. Engng.*, **24**, 99–110 (2000).
31. Zhu, G.-Y., M. A. Henson, and B. A. Ogunnaike, "A Hybrid Model Predictive Control Strategy for Nonlinear Plant-Wide Control," *J. Process Control*, **10**, 449–458 (2000).
32. Qi, R. and M. A. Henson, "Membrane System Design for Multicomponent Gas Mixtures via Mixed-Integer Nonlinear Programming," *Comput. chem. Engng.*, **24**, 2719–2737 (2000).

33. Zhu, G.-Y., A. M. Zamamiri, M. A. Henson and M. A. Hjortso, "Model Predictive Control of Continuous Yeast Bioreactors Using Cell Population Models," *Chem. Eng. Sci.*, **55**, 6155–6167 (2000).
34. McLain, R. B. and M. A. Henson, "Nonlinear Model Reference Adaptive Control with Embedded Linear Models," *Ind. Eng. Chem. Res.*, **39**, 3007–3017 (2000).
35. Zhu, G.-Y., M. A. Henson, and L. Megan, "Dynamic Modeling and Linear Model Predictive Control of Gas Pipeline Networks," *J. Process Control*, **11**, 129–148 (2001).
36. Zhang, Y. and M. A. Henson, "Bifurcation Analysis of Continuous Biochemical Reactor Models," *Biotech. Progr.*, **17**, 647–660 (2001).
37. Zhu, G.-Y., M. A. Henson, and L. Megan, "Low-Order Dynamic Modeling of Cryogenic Distillation Columns Based on Nonlinear Wave Phenomenon," *Separation and Purification Technology*, **24**, 467–487 (2001).
38. Zhu, G.-Y. and M. A. Henson, "Model Predictive Control of Interconnected Linear and Nonlinear Processes," *Ind. Eng. Chem. Res.*, **41**, 801–816 (2002).
39. Cao, B. and M. A. Henson, "Modeling of Spiral Wound Pervaporation Modules with Application to the Separation of Styrene/Ethylbenzene Mixtures," *J. Membrane Science*, **197**, 117–146 (2002).
40. Zhang, Y., A. M. Zamamiri, M. A. Henson and M. A. Hjortso, "Cell Population Models for Bifurcation Analysis and Nonlinear Control of Continuous Yeast Bioreactors," *J. Process Control*, **12**, 721–734 (2002).
41. Zamamiri, A. M., Y. Zhang, M. A. Henson and M. A. Hjortso, "Dynamic Analysis of an Age Distribution Model of Oscillating Yeast Cultures," *Chem. Eng. Sci.*, **57**, 2169–2181 (2002).
42. Daoutidis, P. and M. A. Henson, "Dynamics and Control of Cell Populations in Continuous Bioreactors," *AIChE Symposium Series*, **326**, 274–289 (2002).
43. Mhaskar, P., M. A. Henson and M. A. Hjortso, "Cell Population Modeling and Parameter Estimation of Continuous Cultures of *Saccharomyces cerevisiae*," *Biotech. Progr.*, **18**, 1010–1026 (2002).
44. Henson, M. A., D. Müller and M. Reuss, "Cell Population Modeling of Yeast Glycolytic Oscillations," *Biochemical Journal*, **368**, 433–446 (2002).
45. Zhang, Y., M. A. Henson and Y. Kevrekidis, "Nonlinear Model Reduction for Dynamic Analysis of Cell Population Models," *Chem. Eng. Sci.*, **58**, 429–445 (2003).
46. Cao, B. and M. A. Henson, "Nonlinear Parameter Estimation for Solution-Diffusion Models of Membrane Pervaporation," *Annals of the New York Academy of Sciences*, **984**, 370–385 (2003).
47. Henson, M. A., "Dynamic Modeling and Control of Yeast Cell Populations in Continuous Biochemical Reactors," *Comput. chem. Engng.*, **27**, 1185–1199 (2003).

48. Henson, M. A., "Dynamic Modeling of Microbial Cell Populations," *Current Opinion in Biotechnology*, **14**, 460–467 (2003).
49. Li, R., M. A. Henson and K. J. Kurtz, "Selection of Model Parameters for Off-Line Parameters Estimation," *IEEE Transactions on Control System Technology*, **12**, 402–412 (2004).
50. Li, R., M. A. Henson, A. B. Corripio, K. M. Dooley and K. J. Kurtz, "Dynamic Modeling of Cross-linking and Gelation in Continuous Ethylene-Propylene-Diene Polymers Reactors using Pseudo-Kinetic Constant Approach," *Chem. Eng. Sci.*, **59**, 2297–2313 (2004).
51. Li, R., A. B. Corripio, M. A. Henson and K. J. Kurtz, "On-line State and Parameter Estimation of EPDM Polymerization Reactors," *J. Process Control*, **14**, 837–852 (2004).
52. Henson, M. A., "Modeling the Synchronization of Yeast Respiratory Oscillations," *J. Theoretical Biology*, **231**, 443–458 (2004).
53. Bian, S., M. A. Henson, P. Belanger and L. Megan, "Nonlinear State Estimation and Model Predictive Control of Nitrogen Purification Columns," *Ind. Eng. Chem. Res.*, **44**, 153–167 (2005).
54. Henson, M. A., "Cell Population Modeling of Autonomously Oscillating Yeast Cultures," *Comput. chem. Engng.*, **29**, 645–661 (2005).
55. Bian, S., S. Khowinij, M. A. Henson, P. Belanger and L. Megan, "Compartmental Modeling of High Purity Air Separation Columns," *Computers and Chemical Engineering*, **29**, 2096–2109 (2005).
56. Khowinij, S., M. A. Henson, P. Belanger and L. Megan, "Dynamic Compartmental Modeling of Nitrogen Purification Columns," *Separation and Purification Technology*, **46**, 95–109 (2005).
57. Bian, S. and M. A. Henson, "Measurement Selection for On-Line Estimation of Nonlinear Wave Models for High Purity Distillation Columns," *Chemical Engineering Science*, **61**, 3210–3222 (2006).
58. Gonzalez-Ruiz, R. A., B. Quevedo-Sanchez, R. L. Laurence, E. B. Coughlin and M. A. Henson, "Kinetic Modeling and Parameter Estimation of Slurry Propylene Polymerization using rac-Et(Ind)₂ZrCl₂/MAO," *AIChE J.*, **52**, 1824–1835 (2006).
59. Quevedo-Sanchez, B., E. B. Coughlin and M. A. Henson, "Analysis of the Formation of 4-Butenyl End-Group in Zirconocene Catalyzed Polypropylene," *Journal of Polymer Science Part A: Polymer Chemistry*, **44**, 3724–3728 (2006).
60. Henson, M. A., "Biochemical Reactor Modeling and Control: Exploiting Cellular Biology to Manufacture High Value Products," *IEEE Control Syst. Mag.*, **26**, August, 54–62 (2006).
61. Quevedo-Sanchez, B., J. F. Nimmons, B. E. B. Coughlin and M. A. Henson, "Kinetic Modeling of the Effect of MAO/Zr Ratio and Chain Transfer to Aluminum in Zirconocene Catalyzed Propylene Polymerization," *Macromolecules*, **39**, 4306–4316 (2006).

62. Parker, R. S., F. J. Doyle III and M. A. Henson, "Integration of Biological Systems Content and the Process Dynamics and Control Curriculum," *Chem. Eng. Educ.*, **40**, 181–188 (2006).
63. Venkatasubramanian, R., M. A. Henson and N. S. Forbes, "Incorporating Cellular Metabolism into Growth Models of Multicellular Tumor Spheroids," *J. Theoretical Biology*, **242**, 440–453 (2006).
64. Hjersted, J. and M. A. Henson, "Optimization of Fed-Batch Yeast Fermentation using Dynamic Flux Balance Models," *Biotechnology Progress*, **22**, 1239–1248 (2006).
65. Raikar N., S. R. Bhatia, M. F. Malone and M. A. Henson, "Self-Similar Inverse Population Balance Modeling for Turbulently Prepared Batch Emulsions: Sensitivity to Measurement Errors," *Chemical Engineering Science*, **61**, 7421–7435 (2006).
66. To, T.-L., M. A. Henson, E. D. Herzog and F. J. Doyle III, "A Computational Model for Intercellular Synchronization in the Mammalian Circadian Clock," *Biophysical Journal*, **92**, 3792–3803 (2007).
67. Hjersted, J., M. A. Henson and R. Mahadevan, "Genome-Scale Analysis of *Saccharomyces cerevisiae* Metabolism and Ethanol Production in Fed-Batch Culture," *Biotechnology and Bioengineering*, **97**, 1190–1204 (2007).
68. Bold K. A., Y. Zou, I. G. Kevrekidis and M. A. Henson, "Efficient Simulation of Coupled Biological Oscillators through Equation-Free Uncertainty Quantification," *Journal of Mathematical Biology*, **55**, 331–352 (2007).
69. Kambam, P. K. R., M. A. Henson and L. Sun, "Design and Mathematical Modeling of a Synthetic Symbiotic Ecosystem," *IET Systems Biology*, **2**, 33–38 (2008).
70. Venkatasubramanian, R., M. A. Henson and N. S. Forbes, "Integrating Cell Cycle Progression, Drug Penetration and Energy Metabolism to Identify Improved Cancer Therapeutic Strategies," *J. Theoretical Biology*, **253**, 98–117 (2008).
71. Hjersted, J. and M. A. Henson, "Steady-State and Dynamic Flux Balance Analysis of Ethanol Production by *Saccharomyces cerevisiae*," *IET Systems Biology*, **3**, 167–179 (2009).
72. Raikar N., S. R. Bhatia, M. F. Malone and M. A. Henson, "Experimental Studies and Population Balance Equation Modeling of Emulsion Drop Breakage," *Chemical Engineering Science*, **64**, 2433–2447 (2009).
73. Vasalou C., E. D. Herzog and M. A. Henson, "Small World Network Models of Intercellular Coupling Predict Enhanced Synchronization in the Suprachiasmatic Nucleus," *Journal of Biological Rhythms*, **24**, 243–254 (2009).
74. Vasalou C. and M. A. Henson, "A Multiscale Model to Investigate Circadian Rhythmicity of Pacemaker Neurons in the Suprachiasmatic Nucleus," *PLOS Computational Biology*, **6**: e1000706. doi:10.1371/journal.pcbi.1000706 (2010).
75. Kolewe, M. E., M. A. Henson and S. C. Roberts, "Characterization of Aggregate Size in Plant Cell Tissue Culture," *Plant Cell Reports*, **5**, 485–494 (2010).

76. Raikar N. B., S. R. Bhatia, M. F. Malone, D. J. McClements, C. Almeida-Rivera, P. Bongers and M. A. Henson, "Prediction of Emulsion Drop Size Distributions with Population Balance Equation Models of Multiple Drop Breakage," *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, **361**, 96–108 (2010).
77. Chen, Z., M. A. Henson, P. Belanger and L. Megan, "Nonlinear Model Predictive Control of High Purity Distillation Columns for Cryogenic Air Separation," *IEEE Transactions on Control System Technology*, **18**, 811–821 (2010).
78. Venkatasubramanian, R., R. B. Arenas, M. A. Henson and N. S. Forbes, "Mathematical Modeling with Dynamic Magnetic Resonance Images Predicts that Tumor Heterogeneity Decreases Therapeutic Response," *British Journal of Cancer*, **103**, 486–497 (2010).
79. Kambam, P. K. R. and M. A. Henson, "Engineering Bacterial Processes for Cellulosic Ethanol Production," *Biofuels*, **1**, 729–744 (2010).
80. Hanly, T. J. and M. A. Henson, "Dynamic Flux Balance Modeling of Microbial Co-Cultures for Efficient Batch Fermentation of Glucose and Xylose Mixtures," *Biotechnology and Bioengineering*, **108**, 376–385 (2010).
81. Vasalou, C., E. D. Herzog and M. A. Henson, "A Model for Intercellular Synchronization in Circadian Neural Networks," *Biophysical Journal*, accepted for publication.
82. Raikar, N. B., S. B. Bhatia, M. F. Malone, D. J. McClements and M. A. Henson, "Predicting the Effect of Pressure on the Drop Size Distributions of Homogenized Emulsions," *Industrial Engineering and Chemistry Research*, accepted for publication.

TEACHING EXPERIENCE

Mathematical Modeling (ChE 361), Spring 2007, Spring 2008, Spring 2010, Spring 2011.
 Chemical Engineering Laboratory I (ChE 401), Fall 2002.
 Chemical Engineering Laboratory II (ChE 402), Spring 2004.
 Chemical Process Control (ChE 446), Spring 2003, Fall 2003, Fall 2004, Fall 2005, Fall 2006, Fall 2007, Fall 2008, Fall 2009, Fall 2010, Fall 2011.
 Mathematical Modeling (ChE 461), Spring 2006.
 Molecular and Systems Biotechnology (ChE 697A), Spring 2005.
 Digital Control of Processes (LSU), Spring 1994, Fall 2000.
 Process Dynamics and Control (LSU), Fall 1994, Fall 1995, Spring 1996, Spring 1997, Spring 1998, Spring 1999, Spring 2000, Spring 2001.
 Development of Mathematical Models (LSU), Spring 1995.
 Measurements Laboratory (LSU), Spring 1995, Fall 1996, Fall 1997.
 Advanced Automatic Process Control (LSU), Fall 1996, Fall 1999.
 Advanced Chemical Engineering Analysis (LSU), Fall 1997.
 Unit Operations Laboratory (LSU), Fall 1998 Fall 1999, Fall 2000.