

## Edward P. Gatzke

### Associate Professor

Department of Chemical Engineering, University of South Carolina

#### Professional Preparation and Appointments:

Georgia Institute of Technology, Chemical Engineering, B.CHE. 1995, Highest Honors  
Purdue University, Chemical Engineering, 1995-1997, Advisor moved to Univ. of Delaware  
University of Delaware, Chemical Engineering, Ph.D. 2000  
Massachusetts Institute of Technology, Post-Doctoral Scholar, Chemical Engineering, 2000-2001

Associate Professor, University of South Carolina 8/07-present  
Assistant Professor, University of South Carolina 8/01-8/07

Honeywell Technology Center, Minneapolis, MN Summer 1997  
Mead Containerboard, Stevenson, AL Summers 1992-94  
Teledyne Brown Engineering (MSFC gas support) Huntsville, AL Summer 1995

#### Books and Book Chapters:

5. A. T. Stamps and E. P. Gatzke. "Design of Hybrid Electrochemical Devices." in Micropower Generation. Wiley, 2009.
4. Process Systems Engineering: Selected Topics and Supplemental Course Notes. E. P. Gatzke. Lulu Press. (2006) 163 pages.
3. Process Control Modules. F.J. Doyle III. with E. P. Gatzke and R. S. Parker. Prentice-Hall, New Jersey. (1999) 162 pages.
2. C. E. Long and E. P. Gatzke. "Hard Constraints for Prioritized Objective Nonlinear MPC." in Lecture Notes in Control and Information Sciences. Springer, London, 2006. Accepted December 2005.
1. R. S. Parker, E. P. Gatzke, R. Mahadevan, E. S. Meadows, and F. J. Doyle III. "Nonlinear Model Predictive Control: Issues and Applications" in Nonlinear Predictive Control, Theory and Practice. The Institution of Electrical Engineers, London, (2001) pgs. 33-58.

#### Journal Publications:

26. T. L. Aliyev and E. P. Gatzke. "Prioritized Constraint Handling NMPC Using Volterra Series Models." Optimal Control and Methods, 2009, accepted.
25. T. L. Aliyev and E. P. Gatzke. "Constrained NMPC Using Polynomial Chaos Theory." AT&P Journal, 2009, P 51-66.
24. P. K. Polisetty, E. P. Gatzke, and E. O. Voit. "Yield Optimization of Regulated Metabolic Systems Using Deterministic Branch-and-Reduce Methods." Bioengineering and Biotechnology, 2008, 99(5), 1154-1169.

23. A. T. Stamps, S. Santhanagopalan, and E. P. Gatzke. "Using Piecewise Polynomials to Model Open-Circuit Potential Data." *Journal of the Electrochemical Society*. 2007, 154, P20-P27.
22. J. A. Gantt and E. P. Gatzke. "Analysis of the Multidimensional Behavior of Granulation." *Materials Processing Technology*. 2007, 183, 140-147.
21. C. E. Long, P. K. Polisetty, and E. P. Gatzke. "Deterministic Global Optimization for Nonlinear Model Predictive Control of Hybrid Dynamic Systems." Submitted to *Int. J. Robust and Nonlinear Control*. 2007, 17, 1232-1250.
20. J. A. Gantt, I. T. Cameron, J. D. Litster, and E. P. Gatzke. "Determination of Coalescence Kernels for High Shear Granulation using DEM Simulations." *Powder Technology*. 2006, 170 53-63.
19. J. A. Gantt, K. K. Rochelle, and E. P. Gatzke. "Type 1 Diabetic Patient Insulin Delivery Using Asymmetric PI Control." Submitted to *Chemical Engineering Communications*. 2007, 194(5), 586-602.
18. J. A. Gantt and E. P. Gatzke. "Kinetic Theory of Granular Flow Limitations for Modeling High-Shear Mixing." *Ind. Eng. And Chem. Res.* 2006, 45, 6721-6727.
17. J. A. Gantt and E. P. Gatzke. "Stochastic Technique for Multidimensional Granulation Modeling." *AIChE Journal*. September, 2006, 52(9) 3067-3077.
16. A. T. Stamps and E. P. Gatzke. "Dynamic Modeling of a Methanol Reformer-PEMF Stack System for Analysis and Design" *Journal of Power Sources*. 2006, 162 356-370.
15. P. K. Polisetty, E. O. Voit, and E. P. Gatzke. "Identification of Metabolic System Parameters Using Global Optimization Methods." *Theoretical Biology and Medical Modeling*, January 2006, 3(4) 1-15.
14. C. E. Long, P. K. Polisetty, and E. P. Gatzke. "Nonlinear Model Predictive Control Using Deterministic Global Optimization." *Journal of Process Control*, 2006, 16(6) 635-643.
13. C. E. Long and E. P. Gatzke. "Experimental Air-Pressure Tank Systems for Process Control Education." *Chemical Engineering Education*. January 2006. 40(1) 24-31.
12. J. A. Gantt, E. P. Gatzke, V. Van Brunt, T. J. Deal, R. B. Haggard, M. Poirier, S. Fink, and C. Nash. "Dynamic Modeling of a Pilot-Scale Crossflow Filtration Process." *Filtration*, January, 2006. 6(1). 79-86.
11. A. T. Stamps, C. E. Holland, R. E. White, and E. P. Gatzke. "Analysis of Capacity Fade in a Lithium Ion Battery." *Journal of Power Sources*. October, 2005. 150(4) 229-239.
10. C. E. Long and E. P. Gatzke. "Model Predictive Control Algorithm for Prioritized Objective Inferential Control of Unmeasured States Using Propositional Logic." *Industrial and Engineering Chemistry Research*. April, 2005. 10(44) 3575-3584.

9. J. A. Gantt and E. P. Gatzke. "High-Shear Granulation Modeling Using a Discrete Element Simulation Approach." *Powder Technology*. August, 2005. 156(2-3), 195-212.
8. P. Kesavan, R. J. Allgor, E. P. Gatzke, and P. I. Barton. "Outer Approximation Algorithms for Separable Nonconvex Mixed-Integer Nonlinear Programs." *Mathematical Programming*. May, 2004. 100, 517-535.
7. E. P. Gatzke, J. E. Tolsma, and P. I. Barton. "Construction of Convex Relaxations Using Automated Code Generation Techniques." *Optimization and Engineering*. December, 2002. 3(3), 305-326.
6. E. P. Gatzke and F. J. Doyle III. "Use of multiple models and qualitative knowledge for on-line moving horizon disturbance estimation and fault diagnosis." *Journal of Process Control*. February, 2002. 12(2), 339-352.
5. E. P. Gatzke and F. J. Doyle III. "Model Predictive Control of a Granulation System Using Soft Output Constraints and Prioritized Control Objectives." *Journal of Powder Technology*. November, 2001. 121(2), 149-158.
4. R. Vadigepalli, E. P. Gatzke, and F. J. Doyle III. "Robust Control of a Multivariable Experimental Four-Tank System." *Industrial and Engineering Chemistry Research*. 2001. 40(8), 1916-1927.
3. E. P. Gatzke, E. S. Meadows, C. Wang, and F. J. Doyle III. "Model Based Control of a Four Tank System." *Computers and Chemical Engineering*. July, 2000. 24(2), 1503-1509.
2. E. P. Gatzke, R. Vadigepalli, E. S. Meadows, and F. J. Doyle III. "Experiences with an Experimental Project in a Graduate Control Course." *Chemical Engineering Education*. 1999. 33(4), 270-275.
1. F. J. Doyle III, E. P. Gatzke, and R. S. Parker. "Practical Case Studies for Undergraduate Process Dynamics and Control Using the Process Control Modules (PCM)." *Computer Applications in Engineering Education*. 1998. 6(3), 181-191.

### **Refereed Conference Proceedings**

13. T. L. Aliyev\* and E. P. Gatzke. "Constrained NMPC using Polynomial Chaos Theory." 2009 Process Control Conference, Strbske Pleso, Slovak Republic, June 2009. Contributed.
12. T. L. Aliyev\*, A. T. Stamps, and E. P. Gatzke. "Improved Crude Oil Processing Using Second-Order Volterra Models and Nonlinear Model Predictive Control." 2008 American Control Conference, Seattle, WA. August, 2008. Contributed.
11. A. A. Rivera-Montalvo, A. T. Stamps\*, and E. P. Gatzke. "Application of Dynamic Optimization-Based Parameter Estimation to a Diabetes Mellitus Patient Model." 2008 American Control Conference, Seattle, WA. August, 2008. Contributed.
10. C. E. Long and E. P. Gatzke\*. "Optimal Application of Hard Constraints for Prioritized Objective Nonlinear Model Predictive Control." International Workshop on the Assessment and Future

Directions of Model Predictive Control, Freudenstadt-Lauterbad, Germany. August, 2005. Contributed.

9. C. E. Long, J. A. Gantt, and E. P. Gatzke\*. "Identification and Control of a Continuous Granulation Circuit Exhibiting Hybrid Dynamics." Chemical Process Control 7. Lake Louise, Canada, 2006. Submitted August, 2005. Accepted September, 2005. Contributed.
8. P. K. Polisetty, E. O. Voit\*, and E. P. Gatzke\*. "Yield Optimization of *Saccharomyces Cerevisiae* Using a GMA Model and a MILP Based Piecewise Linear Relaxation Method." FOSBE, Fundamentals of Systems Biology and Engineering, Santa Barbara, CA. Submitted November 2004, Accepted January, 2005. Contributed.
7. C. E. Long, J. A. Gantt, and E. P. Gatzke\*. "Batch Granulation Control Using a Simplified Population Balance and Nonlinear Model Predictive Control." American Control Conference, Portland, OR. Submitted October 2004, Accepted January, 2005. Invited.
6. C. E. Long and E. P. Gatzke\*. "Globally Optimal Nonlinear Model Predictive Control." , *DYCOPS 7, the 7th International Symposium on Dynamics and Control of Process Systems*, Boston, June, 2004. Contributed.
5. E. P. Gatzke\* and E. O. Voit. "Modeling of Metabolic Systems Using Global Optimization Methods." *IFAC ADCHEM (Advanced Control of Chemical Processes) Conference*, Hong Kong, January, 2004. Invited. Poster.
4. E. P. Gatzke and F. J. Doyle III\*. "Moving Horizon Control and Estimation of a Hybrid Process." Proceedings of the 6th International Federation for Automated Control Symposium on Dynamics and Control of Process Systems, Jeju, Korea, June, 2001. Contributed.
3. P. Dufour, S. Bhartiya, T. J. English, E. P. Gatzke, P. S. Dhurjati, and F. J. Doyle III\*. "Faults Detection of the Continuous Pulp Digester." Proceedings of the 6th International Federation for Automated Control Symposium on Dynamics and Control of Process Systems, Jeju, Korea, June, 2001. Contributed.
2. F. J. Doyle III\*, K. Troutman, E. S. Meadows, E. P. Gatzke, R. Vadigepalli, K. Mahadevan, G. Whitmyre, G. Stoole, and P. Richards. "Innovative Control Education Using a 4-Tank Experiment and the WWT." Association for Control Education, Sydney, Australia, July, 2000. Contributed.
1. E. P. Gatzke\* and F. J. Doyle III. "Multiple Model Approach for CSTR Control." Proceedings of the International Federation for Automated Control World Congress, Beijing, July, 1999. Contributed.

#### **Conference Proceedings with Refereed Abstracts**

8. E. P. Gatzke.\* "Piecewise Linear Relaxations for Deterministic Global Solution of Nonconvex NLP Problems." 7th EUROPT Workshop on Advances in Continuous Optimization. Remagen, Germany. July, 2009. Contributed.

7. E. P. Gatzke.\* "Improved Reformer Operation." AvH Research Conference. Darmstadt, Germany. November, 2008. Invited.
6. J. Gantt\*, I. T. Cameron, J. D. Litster, and E. P. Gatzke. "Determination of Coalescence Kernels for High Shear Granulation Using DEM Simulations." 8th International Symposium on Agglomeration, Bangkok, March 2005. Contributed.
5. Justin A. Gantt and E. P. Gatzke\*. "Control of a Batch Granulation Process Using Nonlinear Model Predictive Control." American Control Conference, Boston, MA, Submitted October, 2003, Accepted January, 2004. Invited.
4. P. K. Polisetty and E. P. Gatzke\*. "Parallel Contraction of Variable Space for Global Solution of NLPs." *Foundations of Computer Aided Process Design, FOCAP D*, Princeton, NJ, Submitted October, 2003, Accepted February, 2004. Contributed.
3. C. E. Long\*, E. O. Voit, and E. P. Gatzke. "A Mixed Integer Moving Horizon Formulation for Prioritized Objective Inferential Control of a Bioprocess System." *American Control Conference*. Denver, CO, June, 2003. Contributed.
2. C. E. Long\*, J. Miles\*, C. Holland, and E. P. Gatzke\*. "A Flexible Multivariable Experimental Air Tank System for Process Control Education." *American Control Conference*. Denver, CO, June, 2003. Contributed.
1. F. J. Doyle III, R. S. Parker\*, and E. P. Gatzke. "Advanced Model Predictive Control (MPC) for Type I Diabetic Glucose Control." American Control Conference, Chicago, IL, June, 2000. Contributed.

#### **Abstracts and Unrefereed Publications:**

38. A. Rivera-Montalvo and E. P. Gatzke\*. "Estimation for Periodic Nonlinear Systems." *AIChE Annual Fall Meeting*, Nashville, TN, November, 2009. Contributed.
37. K. Mountain-Schlaperjahn and E. P. Gatzke\*. "Inferential Control For Improved Nylon Production Using Empirical Nonlinear Dynamic Models." *AIChE Annual Fall Meeting*, Salt Lake City, UT, November, 2007. Contributed.
36. E. P. Gatzke\* and J. Hahn. "CACHE Virtual Process Control Book: Online Resources for Graduate Process Control Education." *AIChE Annual Fall Meeting*, Salt Lake City, UT, November, 2007. Contributed.
35. P. K. Polisetty, E. O. Voit, and E. P. Gatzke\*. "Deterministic Optimization of Biological Systems." *Dynamic Systems and Applications*, Atlanta, GA. May, 2007. Invited.
35. A. T. Stamps\* and E. P. Gatzke. "Optimization of Hybrid Power Systems." *AIChE Annual Fall Meeting*, San Francisco, CA, November, 2006. Contributed.

34. J. A. Gantt and E. P. Gatzke\*. "Multiscale Modeling of High-Shear Granulation Processes." *AICHE Annual Fall Meeting*, San Francisco, CA, November, 2006. Contributed.
33. P. K. Polisetty, D. M. Gay, W. E. Hart, and E. P. Gatzke\*. "Parallel Global Optimization for NLP and MINLP Programming Problems" *AICHE Annual Fall Meeting*, San Francisco, CA, November, 2006. Contributed.
32. P. K. Polisetty, E. P. Gatzke, and D. M. Gay\*. "GNLP, an Open-Source Package for Rigorous Global Nonlinear Programming on Parallel Machines" INFORMS (Institute for Operations Research and Management Science), Pittsburgh, November, 2006.
31. J. A. Gantt, C. E. Long, and E. P. Gatzke\*. "Modeling and Control of a Continuous Granulation Process Exhibiting Hybrid Dynamics." IFPRI (International Fine Particle Research Institute) General Meeting, Santa Barbara, June, 2006.
30. C. E. Long, J. E. Wright, C. E. Holand, and E. P. Gatzke. "Low Cost Kits for Undergraduate Process Control Education." *CACHE News*, Summer 2006. [http://www.che.utexas.edu/cache/newsletters/summer2006\\_contents.html](http://www.che.utexas.edu/cache/newsletters/summer2006_contents.html)
29. C. E. Long, A. T. Stamps, and E. P. Gatzke\*. "Modeling and Control of an Experimental System Exhibiting Hybrid Dynamics." International Conference on Hybrid Systems, Louisiana, May, 2006.
28. C. E. Long\*, J. E. Wright, and E. P. Gatzke. "Low Cost Experiments for Internet Based Control Education." *AICHE Annual Fall Meeting*, Cincinnati, OH, November, 2005. Contributed.
27. A. T. Stamps\* and E. P. Gatzke. "Dynamic Modeling of a Methanol Reformer/PEMFC for Analysis and Design." *AICHE Annual Fall Meeting*, Cincinnati, OH, November, 2005. Contributed.
26. K. S. Schlaperjahn\*, and E. P. Gatzke. "Optimization of Multiple Effect Distillation With Reduced Production Rates." *AICHE Annual Fall Meeting*, Cincinnati, OH, November, 2005. Contributed.
25. P. K. Polisetty\* and E. P. Gatzke. "Deterministic Global Optimization Techniques for Solution of NLP and MINLP Problems Using Piecewise Linear Relaxations with Applications in Metabolic Engineering." *AICHE Annual Fall Meeting*, Cincinnati, OH, November, 2005. Contributed.
24. J. A. Gantt\* and E. P. Gatzke. "Discrete Element Method Application for Verification of Kinetic Theory of Granular Flow in a High Shear Mixer." *AICHE Annual Fall Meeting*, Cincinnati, OH, November, 2005. Contributed.
23. P. Polisetty and E. P. Gatzke\*. "Global Solution of Factorable Nonseparable MINLP's Using a Nonconvex Piecewise Linear Relaxation." IFORS Annual Meeting, Hawaii, July, 2005. Contributed.

22. P. Polisetty and E. P. Gatzke\*. "Variable Contraction Applying an MILP-Based Piecewise Linear Relaxation for Solution of Nonconvex NLP and MINLP Problems." SIAM Optimization Meeting, Sweden, May, 2005. Contributed.
21. P. Polisetty and E. P. Gatzke\*. "Nonconvex Method for Biochemical Systems Modeling and Optimization." SIAM Regional Meeting, Charleston, SC, April, 2005. Invited.
20. C. E. Long and E. P. Gatzke\*. "Application of Global Optimization Methods in Control and Identification." *AIChE Annual Spring Meeting*, Atlanta, March, 2005. Contributed.
19. Katherine Schlaperjahn and Edward P. Gatzke\*. "Batch Process Modeling and Control Using PCA." *AIChE Annual Fall Meeting*, Austin, November, 2004. Contributed.
18. Justin A. Gantt, Katherine A. Rochelle, and Edward P. Gatzke\*. "Type I Diabetic Patient Insulin Delivery Using Asymmetric PI Control." *AIChE Annual Fall Meeting*, Austin, November, 2004. Contributed.
17. J. Henry\*, C. E. Long, and E. P. Gatzke. "Enhancing Classroom Demonstrations and Home Assignments with Remote Experiments." *AIChE Annual Fall Meeting*, Austin, November, 2004. Contributed.
16. C. E. Long, A. Monti, D. Rocheleau, E. P. Gatzke\* and R. F. Fortin. "Experiments for a Multi-disciplinary Industrial Controls Course." *AIChE Annual Fall Meeting*, San Francisco, November, 2003. Contributed.
15. J. A. Gantt\* and E. P. Gatzke. "Granulation Process Modeling and Control Using a Dynamic Simulation Approach." *AIChE Annual Fall Meeting*, San Francisco, November, 2003. Contributed.
14. C. E. Long, J. Miles\*, C. Holland, and E. P. Gatzke. "A Flexible Multivariable Experimental Air Tank System for Process Control Education." Student poster session, first place. *AIChE Annual Fall Meeting*. San Francisco, November, 2003. Contributed.
13. E. P. Gatzke\* and R. F. Fortin. "Dynamic Modeling and Control Linking Hysys and Matlab." *ASEE Chemical Engineering Summer School*, Boulder, July, 2002. Contributed.
12. J. E. Gantt\*, E. P. Gatzke, and V. V. Brunt. "Modeling of Pilot-Scale Cross-flow Filtration of Simulated Nuclear Waste." *AIChE Annual Fall Meeting*, Indianapolis, November, 2002. Contributed.
11. J. E. Gantt\*, E. P. Gatzke, and V. V. Brunt. "Modeling and Operation of Pilot-Scale Cross-flow Filtration of Simulated Nuclear Waste." *AIChE Annual Fall Meeting*, Indianapolis, November, 2002. Contributed.
10. E. P. Gatzke\*, J. E. Tolsma, and P. I. Barton. "Automatic Generation of Convex Models using DAEPACK." *AIChE Annual Fall Meeting*, Reno, November, 2001. Contributed.
9. E. P. Gatzke\* and P. I. Barton. "Parallel Mixed Integer Optimization Using Outer Approximation Methods." *AIChE Annual Fall Meeting*, Reno, November, 2001. Contributed.

8. E. P. Gatzke\* and F. J. Doyle III. "Constrained Moving Horizon Control of a Granulation System." *AIChE Annual Fall Meeting*, Los Angeles, November, 2000. Contributed.
7. R. Mahadevan\*, E. P. Gatzke\*, and F. J. Doyle III. "Advanced Control Education Through the Integration of Laboratory Experiments and Simulation." *AIChE Annual Fall Meeting*, Los Angeles, November, 2000. Contributed.
6. F. J. Doyle III, E. S. Meadows, D. Saffer, E. P. Gatzke\*, and N. Hernjak\*. "Teaching Multivariable Control with the 4-Tank Experimental Process." *AIChE Annual Fall Meeting*, Los Angeles, November, 2000. Contributed.
5. E. P. Gatzke\* and F. J. Doyle III. "Moving Horizon Control and Estimation of an Experimental Process." *AIChE Annual Fall Meeting*, Dallas, November, 1999. Contributed.
4. R. Mahadevan\*, E. P. Gatzke\*, and F. J. Doyle III. "Merging Laboratory Experiments with Software Experiments." *AIChE Annual Fall Meeting*, Dallas, November, 1999. Contributed.
3. E. P. Gatzke\* and F. J. Doyle III. "Moving Horizon Parameter Estimation Using Qualitative Knowledge and Multiple Linear Models." *AIChE Annual Fall Meeting*, Miami, November, 1998. Contributed.
2. E. P. Gatzke\*, R. S. Parker\*, and F. J. Doyle III. "Interactive Multimedia for the Process Control Modules (PCM)." *AIChE Annual Fall Meeting*, Miami, November, 1998. Contributed.
1. E. P. Gatzke\*, R. S. Parker\*, and F. J. Doyle III. "Process Control Modules for MATLAB 5.1" *AIChE Annual Fall Meeting*, Los Angeles, November, 1997. Contributed.

### **Invited Seminars**

27. E. P. Gatzke. "Numerical Optimization Methods for Biological Systems Applications" Department of Chemical Engineering, University of Magdeburg, Germany, January, 2009.
26. E. P. Gatzke. "Numerical Optimization Methods for Biological Systems Applications" Department of Chemical Engineering, Aachen University, Germany, December, 2008.
25. E. P. Gatzke. "Numerical Optimization Methods for Biological Systems Applications" Department of Chemical Engineering, Imperial College, London, UK, July, 2008.
24. E. P. Gatzke. "Deterministic Optimization Methods for Systems Biology Applications." Department of Chemical Engineering, University of Puerto Rico, Mayaguez, PR, January, 2007.
23. P. K. Polisetty and E. P. Gatzke. "Optimization Methods for Systems Biology." Systems Biology Mini Symposium, Georgia Institute of Technology, Atlanta, GA, April, 2006.
22. E. P. Gatzke. "Efficient Nonconvex Optimization Methods for Systems Biology." Chemical Engineering Process Systems Symposium, Carnegie Mellon University, Pittsburgh, PA, April, 2006.



21. E. P. Gatzke. "Deterministic Optimization Methods for Systems Biology Applications." Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA, April, 2006.
20. E. P. Gatzke. "Deterministic Optimization Methods for Systems Biology Applications." Department of Chemical and Biological Engineering, University of Alabama, Tuscaloosa, AL, March, 2006.
19. E. P. Gatzke. "Deterministic Optimization Methods for Systems Biology Applications." Department of Chemical and Biomolecular Engineering, Georgia Institute of Technology, Atlanta, GA, October, 2005.
18. E. P. Gatzke. "Efficient Parallel Computing Methods for Global Optimization of Nonconvex Process Systems Engineering Problems." ExxonMobil Research, Annondale NJ, March, 2005.
17. E. P. Gatzke. "Efficient Nonconvex Optimization Methods for Process Systems Engineering." ExxonMobil Upstream Research, Houston, TX, November, 2004.
16. E. P. Gatzke. "Advanced Methods for Online Control and Estimation of Dynamic Systems." Becton Dickinson, Durham NC, September, 2003.
15. E. P. Gatzke. "Global Optimization for Metabolic Pathway Structure Identification." University of Alabama Bioinformatics Seminar Series, Huntsville, AL. November, 2002.
14. E. P. Gatzke. "Global Optimization for Metabolic Pathway Modeling." Charleston Symposium on the Interface of Process Control and Metabolic Engineering. Charleston, November, 2002.
13. E. P. Gatzke and R. S. Parker. "The Process Control Modules: An Educational Software Tool for Chemical Process Dynamics and Control." *ASEE Chemical Engineering Summer School*, Boulder, July, 2002.
12. E. P. Gatzke. "Recent Advances in Parallel Optimization Methods." Sandia National Laboratories, Albuquerque, June, 2002.
11. E. P. Gatzke. "Process Improvement of the Sheet Metal Coating Process." Consolidated Steel Industries Total Quality Management Meeting. Columbia, May, 2002.
10. E. P. Gatzke. "Parallel Optimization Methods and Applications." University of South Carolina Parallel Computing Lecture Series, Columbia, October, 2001.
9. E. P. Gatzke. "Distributed Memory Parallel Mixed-Integer Optimization." Drexel University, Philadelphia, February, 2001.
8. E. P. Gatzke. "Parallel Nonconvex Mixed-Integer Optimization." General Electric Corporate Research, Albany, January, 2001.
7. E. P. Gatzke. "Parallel Mixed-Integer Optimization Using Outer Approximation." Air Products, Allentown, December, 2000.

6. E. P. Gatzke. "Nonconvex Optimization Using Massively Parallel Computational Architectures." ExxonMobil Upstream Research, Houston, November, 2000.
5. E. P. Gatzke. "Parallel Mixed-Integer Optimization." M.I.T. Industrial Advisory Board, Boston, October, 2000.
4. E. P. Gatzke. "Application of Propositional Logic for Control and Estimation." University of South Carolina Dept. of Chemical Engineering, Columbia, February, 1999.
3. E. P. Gatzke. "New Propositional Logic Methods for Control and Estimation." University of Tennessee Dept. of Chemical Engineering, Knoxville, January, 1999.
2. E. P. Gatzke. "Application of Propositional Logic for Control and Estimation." DuPont Technology Exchange Forum, Wilmington, DE, October, 1999.
1. E. P. Gatzke "Fault Diagnosis Using Qualitative Knowledge." University of Delaware Dynamics and Control Seminar Series, May, 1998.

### **60+ Proposals Submitted**

37 submitted as PI. 10 funded. Approximately \$850,000 to PI. Total requested: over \$10.4 M. Funded include:

NSF Career Award. "Mixed-Integer Nonlinear Programming Approaches for Hydrogen Production Systems," \$440,000, 9/1/03-9/1/08. Edward P. Gatzke (PI).

Alexander von Humboldt Foundation two year post-doctoral fellowship for US Scientists and Scholars. "Design and Control of Power Systems Using Advanced Optimization Methods." \$80,000. 5/1/08-8/1/09. Submitted January, 2008.

ACS PRF "Improved Refining Operation Using Parallel MINLP Methods for Dynamic Modeling and Control of Nonlinear Hybrid Dynamic Systems." \$120,000. 8/16/07-8/15/10. Submitted November, 2006.

USC Collaborative Research Program. "Dynamic Optimization of Metabolic Systems." \$50,000, 8/16/02-8/15/03, Edward P. Gatzke (PI, 50%), Eberhard O. Voit,

ACS PRF proposal. "Moving Horizon Control Incorporating Safety Constraints for Complex Nonlinear Systems," \$35,000, 8/16/02-2/15/04 Edward P. Gatzke (PI),

SCUREF. "Molecular and Continuum Models for Chemical Process Systems," \$50,000 (25%, \$12,500 to Gatzke). 3/1/04-8/31/04. Edward P. Gatzke (PI). Submitted November, 2003.

USC CMAT. "High shear Granulation Studies of Nanoscale Particulates," \$15,000, 12/1/02-6/1/03, Edward P. Gatzke (PI).

USC CMAT. "Modeling and Control of an Industrial Sheet Coating Process," \$15,000, 6/16/02-9/15/02, Edward P. Gatzke (PI).

NSF "CRI: CRD Acquisition of a High-Performance Shared-Memory Computer for Biological and Medical Research in South Carolina." Jijun Tang, PI. \$461,000. 8/16/06-8/15/07. Submitted November, 2006.

ARMY Phase II STTR "Optimal Design of Compact Fuel Cell Hybrid Power Systems." \$750,00, Ralph White, IDV (PI). \$100,000 to Gatzke. 8/1/07-7/31/09. Submitted April, 2007.

ARMY STTR "Optimal Design of Compact Fuel Cell Hybrid Power Systems." \$100,00, Chris King, IDV (PI). \$20,000 to Gatzke. 7/1/06-6/30/08. Submitted April, 2006.

### **Awards, Service, and Synergistic Activities**

2008 Alexander von Humboldt Fellowship for Experienced Researchers

NSF Career Award, 9/1/03-9/1/08.

College of Engineering and Computing Young Investigator Award, 2007.

Associate editor for *Simulation* and *Automatica*.

Selected for outstanding reviewer award by *Automatica*, 2005.

Selected for Mortar Board Excellence in Teaching Award 2004.

CACHE Graduate Virtual Process Control Book Committee Chair

Developed GLOBO and GNLP, both deterministic Mixed Integer Nonlinear Programming tools

CACHE Web Seminar committee member and Collaborative Graduate Control Text group leader

Faculty advisor for

AICHe Undergraduate Student Chapter

OXE CHE Honor Society

APO Service Fraternity

USC Cycling Club

### **Students Supervised**

Doctoral Students

7. Alexis Rivera-Montalvo. Analysis and Modeling of Dynamic Biological Systems, 8/16/06 – Present. PhD Expected 8/10.
6. Timur Aleyev. Efficient Identification and Control Methods for Nonlinear Systems, 8/16/06 – Present. PhD Expected 8/09.
5. Andrew T. Stamps. Modeling, Control, and Optimization of Hydrogen Production Systems, 8/16/03 – Present. PhD Expected 8/07.
4. Katherine Schlaperjahn. Batch Process Modeling and Optimization, 8/16/02 – Present.
3. Chris Long. *Model Based Control Using Nonconvex Optimization*. 1/16/02 – 5/5/06.
2. Pradeep Polisetty. Global Optimization Techniques for Modeling, Control, and Estimation of Large Scale Systems. 1/16/02 – 8/1/06.
1. Justin Gantt. Multidimensional Modeling of Granulation Processes: A Multiscale Approach. 11/16/01 – 5/5/06.

#### South Carolina Honors Thesis

3. Trey Thompson. *Dynamic Modeling and Fault Diagnosis*. Expected Spring 2011
2. Richard Chapman. *Financial Modeling Using Deterministic Optimization Methods*. Spring 2006.
1. Katherine Rochelle. *Type I Diabetes Systems Control Modeling for Drug Delivery*. Spring 2005.

#### REU Students

7. Dominic Casali, Florida Institute of Technology. The Unscented Kalman Filter for Nonlinear State Estimation and Fault Diagnosis. NSF REU Program. Summer 2010.
6. Chad Huelsman, Ohio Dayton. Modeling and Optimization of algae production systems. NSF REU Program. Summer 2006.
5. Joshua Jackson, Tennessee Tech. Metabolic Pathway Model Identification Using Nonlinear Optimization Techniques. NSF REU Program. Summer 2006.
4. Thomas Palathra, City College, NY. Multi-Dimensional Population Balance Modeling for Enhanced Drug Delivery. NSF REU Program. Summer 2005.
3. Greg Lapp, Lafayette College. Hybrid Dynamic Modeling of an Experimental System. NSF REU Program. Summer 2004.
2. Deborah Soto, University of Puerto Rico, Mayaguez. Experiments with a High Shear Granulation System. NSF REU Program. Summer 2003.

1. Ryan Fortin, Arizona State. Dynamic Modeling and Control Using HYSYS and MATLAB. NSF REU Program. Summer 2002.

#### General Research Students, Undergraduate

16. Cale Gustafson. Low-Cost Experimental Systems. Spring 2010.
15. Geof Marsli. Parallel Optimization Methods. Spring 2010.
14. Caitlin Molloy. Numerical Optimization Methods. Fall 2007.
13. Richard Chapman. Dynamic Modeling of Economic Systems. Fall 2005.
12. Stephanie Belcher. Diabetic Patient Modeling and Control. Fall 2005.
11. Sean Dunkin. Melt Agglomeration for Granulation Systems. Spring 2004.
10. Peter Sanders. Dynamic Modeling of Fuel Cell Systems. Spring 2004.
9. Leigh Alexander. Dynamic Modeling of Diabetic Patients. Spring 2004.
8. Katherine Rochelle. Insulin Control for Diabetic Patients. Fall 2003, Spring 2003, Fall 2004.
7. Jeremy Wright. Parallel Optimization Methods. Summer-Fall 2003, Spring 2006.
6. Shameka Robinson. Kinetics of Methanol Reformer Systems. Summer-Fall 2003.
5. Jacob Hunter. Simulation and Dynamic Modeling using HYSYS and MATLAB. Spring, Summer, and Fall 2003, Spring and Fall 2004.
4. Cindi Hyman. Dynamic Modeling of a Methanol Reformer System. Fall 2002, Spring and Fall 2003, Spring 2004.
3. Justin Miles. Dynamic Modeling and Control of a Multiple Pressure Tank System. Fall 2002, Spring and Fall 2003.
2. Mary Todoro. Modeling and Analysis of Dynamic Tank System with Multiple RHP Zeros. Spring 2002.
1. Kimberly Devine. Dynamic Modeling of a Fuel Cell Reformer System. Spring 2002.

#### Other Research Supervision

6. Richard Voepel. Modeling of Algae Growth for Biodiesel Production. Summer 2007. Governor's School Summer student.

5. Aaron Clare. Modeling and Control of Diabetic Type I Patients. Summer 2005. Governor's School Summer student.
4. Adrian Scott. Optimization of a Methanol Reformer. Summer 2002. High school summer student.
3. Shiva Rai. Parallel Branch and Reduce Methods. Fall 2001. CSE graduate student.
2. Dinakar Kumagnat. Linear Programming Interfaces. Spring 1994. CSE graduate student.
1. Vahini Badagown. Optimization Using LP\_Solve and PCx. Spring 2002. CSE graduate student.