RUDIYANTO (RUDI) GUNAWAN

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Work:
Department of Chemical Engineering
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EDUCATION:

2003 **Ph.D. Chemical Engineering,** University of Illinois Urbana-Champaign
Thesis title: *Modeling and Control of Transient Enhanced Diffusion of Boron in Silicon*
Thesis advisers: Professors Richard D. Braatz and Edmund G. Seebauer

2000 **M.S. Chemical Engineering,** University of Illinois Urbana-Champaign
Thesis title: *Dimensionality Reduction and Robustness Analysis of Large Scale Systems*
Thesis adviser: Professor Richard D. Braatz

1998 **B.S. Chemical Engineering & Mathematics,** University of Wisconsin - Madison
Graduated with Highest Distinction,
Dean's Honor List 1994 – 1998

EXPERIENCE:

Postdoctoral Fellow, *University of California Santa Barbara* 9/2003 – present

- Performed research in the field of systems biology with Professor Francis J. Doyle III.
- Research goal: to understand the underlying design principles of cellular robustness.
- Specific research interests: reverse-engineering of cellular networks, analysis of discrete stochastic gene networks, and phase behavior analysis of biological oscillatory systems.
- Specific applications: circadian rhythm, cell cycle, genetic toggle switch, caspase-activated apoptosis, and enzymatic futile cycle.
- Co-developed the sensitivity analysis toolbox BioSens, as part of open-source computational biology software Bio-SPICE funded by DARPA BioComp.
- Participated in the model development of staphylococcal enterotoxin B response which represents a collaborative work among UCSB, UC Berkeley, UCLA, Walter Reed, Thomas Jefferson U, Indiana U, KGI, NYU, and SRI.
- Mentored four graduate and one undergraduate students in the area of systems biology.

Research Assistant, *University of Illinois at Urbana-Champaign* 8/1998 – 8/2003

- Performed research in various areas of control systems theory and applications.
- Specific research interests: robust control theory, optimal control, model reduction, experiment design, model identification, and particulate system dynamics.
- Specific applications: large scale systems, time delay systems, batch crystallization, and microelectronics processing (transient enhanced diffusion of boron in silicon).
- Developed a software package, Particle Solver, based on the finite volume method for simulating general particulate system dynamics.

Lecturer, *University of Illinois at Urbana-Champaign* 8/2000 – 12/2000

- Responsible for lecture, exam preparation and grading, laboratory experiments and report grading of "Open-ended Experimental Design" course for M.S. students.
- The course is designed to teach how to bring processes from design to production efficiently.
- Techniques covered in the course include data analysis, process modeling and simulation, design of experiments, parameter estimation, and process optimization.
- Crystallization processes were used as the primary examples to illustrate the ideas.

Teaching Assistant, *University of Illinois at Urbana-Champaign* 8/1999 – 5/2000

- Led a weekly discussion section, prepared solutions for homework and exams, and responsible for homework and exams grading of "Chemical Rate Processes and Reactor Design" course for senior undergraduates.
- Instructed laboratory sections and graded laboratory reports and exams of "Open-ended Experimental Design" course for senior undergraduates.

SCHOLARSHIP AND GRANT

- Hotaling Scholarship 8/1997
- UIUC Graduate Student Travel Grant 10/2002

PROFESSIONAL ACTIVITIES

- Reviewer for many journals, and was nominated by an associate editor for "Outstanding Reviewer" (Automatica) in 2004
- Member, American Institute of Chemical Engineers
- Member, IEEE

PUBLICATIONS

Patent:

1. "Methods for controlling dopant concentration and activation in semiconductor structures" with E. G. Seebauer, R. D. Braatz and M. Y. L. Jung, patent filed 8/2005.

Book Chapter:

1. R. Gunawan, K. Gadkar, and F. J. Doyle III. Methods to identify cellular architecture and dynamics from experimental data. In Z. Szallasi, V. Periwal, and J. Stelling (Eds.), System Modeling in Cellular Biology, MIT Press, 2005. in press

Journal Articles:

1. R. Gunawan and F. J. Doyle III. Design of robust genetic switches. 2005. in preparation
2. R. Gunawan and F. J. Doyle III. Entrainment of circadian rhythm: continuum vs. discrete models. 2005. in preparation
3. R. Gunawan and F. J. Doyle III. Isochron-based phase response analysis of circadian rhythms. *Biophys. J.*, 2005. submitted
4. R. D. Braatz, R. C. Alkire, E. G. Seebauer, E. Rusli, R. Gunawan, T. O. Drews, X. Li, and Y. He. Perspectives on the dynamics and control of multiscale systems. *J. Process Control*, 2005. in press
5. K. Gadkar, R. Gunawan, and F. J. Doyle III. Iterative approach to model identification of biological networks. *BMC Bioinformatics*, 6:155-174, 2005.

6. R. Gunawan, Y. Cao, L. Petzold, and F. J. Doyle III. Sensitivity analysis of discrete stochastic system. *Biophys. J.*, 88:2530-2540, 2005.
7. M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. Pair diffusion and kick-out: Contributions to diffusion of boron in silicon. *AIChE J.*, 50:3248-3256, 2004.
8. R. Gunawan, I. Fusman, and R. D. Braatz. High resolution algorithms for multidimensional population balance equations. *AIChE J.*, 50:2738-2749, 2004.
9. M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. Effect of near-surface band bending on dopant profiles in ion-implanted silicon. *J. Appl. Phys.*, 95:1134-1140, 2004.
10. M. Fujiwara, J. C. Pirkle Jr., T. Togkalidou, D. L. Ma, R. Gunawan, and R. D. Braatz. A holistic approach to materials process design. *J. Materials Edu.*, 24:65-70, 2004.
11. M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. A simplified picture for transient enhanced diffusion of boron in silicon. *J. Electrochem. Soc.*, 151:G1-G7, 2004.
12. R. Gunawan, M. Y. L. Jung, R. D. Braatz, and E. G. Seebauer. Optimal control of rapid thermal annealing in a semiconductor process. *J. Process Control*, 14:423-430, 2004.
13. K. Dev, M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. Mechanism for coupling between properties of interfaces and bulk semiconductors. *Phys. Rev. B.*, 68:195311-195316, 2003.
14. M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. Ramp-rate effects on transient enhanced diffusion and dopant activation. *J. Electrochem. Soc.*, 150:G838-G842, 2003.
15. R. Gunawan, M. Y. L. Jung, R. D. Braatz, and E. G. Seebauer. Parameter sensitivity analysis applied to modeling transient enhanced diffusion and activation of boron in silicon. *J. Electrochem. Soc.*, 150:G758-G765, 2003.
16. R. Gunawan, M. Y. L. Jung, R. D. Braatz, and E. G. Seebauer. Maximum *a posteriori* estimation of transient enhanced diffusion kinetics. *AIChE J.*, 49:2114-2123, 2003.
17. R. Gunawan, D. L. Ma, M. Fujiwara, and R. D. Braatz. Identification of kinetic parameters in a multidimensional crystallization process. *Int. J. Modern Phys. B*, 16:367-374, 2002.
18. R. Gunawan, E. L. Russell, and R. D. Braatz. Comparison of theoretical and computational characteristics of dimensionality reduction methods for large scale uncertain systems. *J. Process Control*, 11:543-552, 2001.

Peer-reviewed Conference Proceedings:

1. R. Gunawan and F. J. Doyle III. Phase sensitivity analysis of a circadian gene network. In *Proc. of the 44th IEEE Conf. on Decision & Control and European Control Conf.*, December 2005.
2. R. Gunawan, M. Y. L. Jung, E. G. Seebauer, and R. D. Braatz. Optimal control of transient enhanced diffusion. In *Proc. of the IFAC Symp. on Advanced Control of Chemical Processes*, pp. 603-608, 2003.
3. R. Gunawan, M. Y. L. Jung, R. D. Braatz and E. G. Seebauer. Systems analysis applied to modeling dopant activation and TED in rapid thermal annealing. In *Proc. of the 10th IEEE Intl. Conf. on Advanced Thermal Processing of Semiconductors*, pp. 107-110, 2002.
4. R. Gunawan, E. L. Russell, and R. D. Braatz. Robustness analysis of multivariable systems with time delays. In *Proc. of European Control Conf.*, pp. 1882-1887, 2001.

5. M. Y. L. Jung, R. Gunawan, R. D. Braatz, and E. G. Seebauer. New physics for modeling transient enhanced diffusion in RTP. In *Rapid Thermal & Other Short-Time Processing Technologies*, vol. 2000-9, pp. 15-20, 2000.

Conference Presentations:

1. R. Gunawan, D. L. Ma, M. Fujiwara, and R. D. Braatz. Identification of kinetic parameters in a multidimensional crystallization process. *Int. Conf. on Materials for Advanced Technologies*, Symposium D: Crystallization and Interfacial Processes, Singapore, 2001.
2. R. Gunawan, M. Y. L. Jung, E. G. Seebauer, and R. D. Braatz. Maximum *a posteriori* estimation of transient enhanced diffusion kinetics. *AIChE Annual Meeting*, Indianapolis, IN, 2002.
3. R. Gunawan, M. Y. L. Jung, E. G. Seebauer, and R. D. Braatz. Optimal control of transient enhanced diffusion. *AIChE Annual Meeting*, Indianapolis, IN, 2002.
4. R. Gunawan, M. Y. L. Jung, R. D. Braatz, and E. G. Seebauer. Systems analysis applied to modeling transient enhanced diffusion. *AIChE Annual Meeting*, Indianapolis, IN, 2002.
5. R. Gunawan, I. Fusman, and R. D. Braatz. High resolution algorithms for multidimensional population balance equations with nucleation and size-dependent growth. In *AIChE Annual Meeting*, San Francisco, CA, 2003.
6. R. Gunawan, Y. Cao, L. Petzold, and F. J. Doyle III. Stochastic sensitivity analysis of cellular processes. In *Intl. Conf. of Molecular Systems Biology*, Lake Tahoe, CA, 2004.
7. R. Gunawan, Y. Cao, L. Petzold, and F. J. Doyle III. Stochastic sensitivity analysis of discrete stochastic biological systems. In *AIChE Annual Meeting*, Austin, TX, 2004.
8. R. Gunawan and F. J. Doyle III. Isochron-based phase sensitivity analysis of biological oscillatory systems. In *AIChE Annual Meeting*, Cincinnati, OH, 2005.
9. R. Gunawan, S. R. Taylor, and F. J. Doyle III. Sensitivity analysis in biological modeling: an application in the model development of staphylococcal enterotoxin B response. In *AIChE Annual Meeting*, Cincinnati, OH, 2005.

REFERENCES

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