

# Matthew C. Ruschmann

## Curriculum Vitae

**Contact** 107 N Roosevelt Ave Apt. 1  
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**Interests** Robust control, fault detection, fault diagnosis, system identification, nonlinear control, convex optimization, receding horizon control, linear matrix inequalities, Markov processes, discrete event systems, perturbation analysis, simulation.

## Education

*Ph.D. Electrical Engineering,* May 2009  
Binghamton University; Binghamton, NY  
Thesis: *Robustness and Reliability of Assets Allocation in Air Operations*  
Adviser: Prof. N. Eva Wu  
Committee: Prof. M. Fowler, Prof. V. Nikulin, and Prof. S. Zacks  
GPA: 3.85/4.0

*M.S. Electrical Engineering,* December 2006  
Binghamton University; Binghamton, NY  
Thesis: *Receding Horizon Control of Air Operation Resource Allocation*  
GPA: 3.88/4.0

*B.S. Electrical Engineering, Minor in Mathematics,* December 2004  
Clarkson University; Potsdam, NY  
Radio-frequency interference and countermeasures in radio controlled vehicles:

- Reverse engineered RC toy cars to modify transmitters and receivers for an RF battle.

Designed and compared analog and digital PID controllers to power a DC motor.

## Employment History and Accomplishments

05/2009-present *Post-doctoral Research Scientist*  
Research Foundation of SUNY, Binghamton University; Binghamton, NY  
Fault diagnosis, prognosis and reliable flight envelope assessment of the NASA GTM aircraft:

- Developed a probing algorithm for health monitoring of nonlinear systems,
- Designed stuck actuator fault models, and estimated parameters with an extended Kalman filter,
- Developed online system identification routines using block least squares.

Convex regression for system identification of a GDP growth model in economics.

05/2006-05/2009 *Graduate Research Assistant*  
Research Foundation of SUNY, Binghamton University; Binghamton, NY  
Fault-tolerant control of dataset restoration policies for maximum availability in a redundant database:

- Method for optimizing dataset renewal/overhaul policies under faulty observations and decisions,
- Designed a dataset renewal policy, and optimized the policy by deriving performance gradients.

Robustness analysis and control of two-port systems:

- Stability analysis using mu-analysis and linear matrix inequalities.

Summer 2006 & 2008 *On-site Summer Research Contractor*  
Air Force Research Laboratory; Rome, NY  
Robust resource allocation in a discrete-state, probabilistic air operation model:

- Implemented robust receding horizon for an uncertain bilinear system with control constraints,
- Simulated the resulting hybrid system in Matlab and Simulink using Stateflow and SimEvents,
- Evaluated performance with uncertain observations by designing state estimators and detectors.

09/2005-present *Entrepreneur, Webmaster, and Content Creator*  
Superpositioned.com - Electronics Projects and News in the Frequency Domain

- Conducted multiple hobby electronics projects, and documented them in the blog,
- Door knob buzzer, penny powered LED, galvanic skin response sensor, and EKG,

- General Ruby on Rails web development and site maintenance tasks.

01/2005-08/2005 *High Speed Data Services Representative, Tier 3*

Time Warner Cable, Binghamton Division;

Vestal, NY

- Provided troubleshooting for high-speed data and IP telephony from the call center,
- Decided to assign a field technician if the issues could not be resolved from the call center.

06/2000-01/2005 *Fast Food Attendant*

Wendy's, WendBing Corp;

Vestal, NY

03/2000-07/2003 *Typesetter and Assistant to the Executive Editor*

Sampling Publishing;

Potsdam, NY

- Layout and design of academic journals and textbooks using LaTeX and Adobe Illustrator,
- Assisted in daily communications.

## Professional Associations

2010-present Member, *American Institute of Aeronautics and Astronautics (AIAA)*.

2006-present Member, *Institute of Electrical and Electronics Engineers (IEEE)*.

2002-present Member, *Eta Kappa Nu (HKN)*, honor society for electrical engineers.

## Honors

2009 *Excellence in Research Award*; Awarded by the the electrical and computer engineering department to a single post-graduate for dedication and excellence in their research.

1999-2000 *The Clarkson School*; Selective program for inspired high school seniors to begin their collegiate experience a year early.

## Journal Publications

- N.E. Wu, M.C. Ruschmann, and K. Huang, "Probing the NASA Generic Transport Aircraft in Real-Time for Health Monitoring," Accepted for publication in *IEEE Transactions on Control System Technology* on July 26, 2010.
- N.E. Wu and M.C. Ruschmann, "Fault-Tolerant Control of a Hidden Markov Process with Application to Resource Allocation in an Air Operation," Accepted for publication in *Journal of Systems Engineering and Electronics* on July 15, 2010.
- N.E. Wu, M.C. Ruschmann, and M. Linderman, "Fault-Tolerant Control of a Distributed Database System," *Journal of Control Science and Engineering*, vol. 2008, no. 1, 2008.
- N.E. Wu, Y. Guo, K. Huang, M. Ruschmann, and M. Fowler, "Fault-Tolerant Tasking and Guidance of an Airborne Location Sensor Network," *International Journal of Control Automation and Systems*, vol. 6, no. 3, p. 351, 2008.

## Conference Publications

- M. Ruschmann, N. Wu, and J. Shin, "Actuator Fault Diagnosis Using Two-Stage Extended Kalman Filters," in *Proceedings of the 2010 Guidance, Navigation, and Control Conference*, 2010.
- M. Ruschmann, J. Huang, and N. Wu, "Pulse-Compression Probing of Small Signal Characteristics for Nonlinear Systems in Dynamic Operating Conditions," in *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010.
- M. Ruschmann and N. Wu, "Online Estimation of Linear State-Space Parameters of the Generic Transport Model for a Set of Structural Damage Scenarios," in *Proceedings of the 49th IEEE Conference on Decision and Control*, 2010.
- M. Ruschmann and N. Wu, "Perturbation Analysis for Optimal Update Intervals of Data Sets," in *Proceedings of the 2008 American Control Conference*, pp. 4318–4323, 2008.
- M. Ruschmann and N. Wu, "Optimal control of a database with reduced & full state models," in *Proceedings of the 46th IEEE Conference on Decision and Control*, pp. 2663–2668, 2007.

- N. Wu and M. Ruschmann, "Loop Closure for Enhanced Win Percentage in an Air Operation," in *Proceedings of the 2007 American Control Conference*, pp. 1097–1102, 2007.

### **Submitted Papers**

- M. Ruschmann and N. Wu, "Optimal Dataset Availability in a Distributed Database," submitted to *Discrete Event Dynamic Systems* on October 31, 2008; resubmitted on July 16, 2010.
- M. Ruschmann, J. Huang, and N. Wu, "Pulse-Compression Probing of Small Signal Characteristics for Nonlinear Systems in Dynamic Operating Conditions," submitted to *IEEE Transactions on Aerospace and Electronic Systems*, on June 24, 2010.

### **Unpublished Work**

- M. Ruschmann, "Rockwell Software's Arena and Mathworks' Simulink SimEvents, A Comparison," SSIE 520: Modeling and Simulation, Spring 2008. Final Class Project.

### **Technical Skills**

#### *Engineering Software*

Matlab, Simulink, SimEvents, Arena, LabVIEW, SPICE, VisSim, Maple, Minitab.

#### *Programming Languages*

C/C++/C#, Assembly, PHP, SQL, Ruby, Python.

#### *Miscellaneous Software*

Microsoft Office, LaTeX, Adobe Photoshop, Adobe InDesign, Linux/Unix, Mac OSX, Windows.

**Hobbies** Cycling, kayaking, sailing, Nordic skiing, and cooking.

### **References and Availability**

References available upon request.

Available for employment December, 2010

Binghamton University, July 30, 2010, download at <http://matthew.ruschmann.net/>