

ARASH RAHNAMA

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PROFESSIONAL PROFILE

- Nine years of experience in electrical and computer engineering —specialization in cyber-physical systems, control and design of multi-layer intelligent systems and machine learning.
- Extensive experience and knowledge with statistical and predictive modeling, firm background in mathematics, numerical analysis and optimization methods:
 - Statistics: Probability, Detection, Hypothesis Testing, Statistical Estimation (Method of Moments, Maximum Likelihood Estimation, Bayesian Estimation), Regression (General Linear, Ridge, LASSO, LOWESS, Nonlinear, Logistic).
 - Data Mining:
 - * Classification (Supervised and Unsupervised):
Nearest-Neighborhood, Linear/Quadratic Discriminant Analysis, Principal Component Analysis (PCA), Multi-Dimensional Scaling (MDS), Isomap, Naïve Bayesian, Artificial Neural Networks (ANN), Stacked Denoising Auto-Encoder (SDAE), Support Vector Machines (SVM), Tree Based Methods (Bagging, Boosting, Random Forest), Clustering (Hierarchical and Normal), K-Means.
 - * Model Assessment and Methods of Model Selection:
Cross-Validation, Bootstrap, Jackknife, Plug-in Principle, Structural Risk Minimization.
 - Optimization and Mathematical Programming: Linear/Quadratic/Mixed Integer/Nonlinear Programming, Convex Programming, Newton's Methods (Steepest Descent, Quasi-Newton), The Simplex Method, Genetic Algorithms, Penalty and Barrier Methods, The Ellipsoid Method, The Prime-Dual Interior-Point Method.
- Strong programming skills with languages such as C++, Python, MATLAB/Simulink and R:
 - Knowledgeable about Algorithm Designs, Data Structures and Graph Theory.
 - Experienced in Object-Oriented Programming (OOP).
- Experienced in Real-Time Learning-Based Control of Large-Scale Networked Systems.
- Knowledge on Verification and Synthesis Methods: Temporal Logic and Model Checking, Abstraction and Bisimulation, Automata (Finite, Timed, Hybrid), Supervisory Control (DES, Timed Language).

EDUCATION

University of Notre Dame, Notre Dame, IN <i>Doctor of Philosophy in Electrical Engineering</i> Specialization in Systems and Control Theory	<i>Aug 2013 - Present</i>
University of Notre Dame, Notre Dame, IN <i>Master of Science in Electrical Engineering</i>	<i>Aug 2013 - May 2015</i> <i>3.53/4.00</i>
Texas Tech University, Lubbock, TX <i>Bachelor of Science in Electrical Engineering</i> Minor in Mathematics Magna Cum Laude, Member of Honors College	<i>Aug 2008 - May 2012</i> <i>3.80/4.00</i> <i>4.00/4.00</i>

RESEARCH EXPERIENCE

Graduate Research Assistant

University of Notre Dame

Aug 2013 - Present

Funded by NSF and General Motors Research

- Control and Design of Cyber-Physical Embedded Systems
- Estimation and Control of Large-Scale Computational Networked Systems
- Non-Model Based Optimization Methods for Design of Nonlinear Systems
- Learning-Based Adaptive Control of Intelligent Reconfigurable Systems
- Statistics, Data Analysis, Data Mining and Machine Learning
- Applied Mathematics, Numerical Analysis and Optimization

EMPLOYMENT EXPERIENCE

X-FAB Semiconductor Foundries

Electrical Engineer Intern/Marketing Department

Jan 2012 - May 2012

Lubbock, TX

- Researched the technology, structure, operations, and manufacturing process of GaN LED Micro Displays and GaN Power Transistors.
- Analyzed and determined the market size, applications, and future of GaN based products.
- Proposed profit-based manufacturing processes for future investment in the area.

X-FAB Semiconductor Foundries

Electrical Engineer Intern

Nov 2011 - Jan 2012

Lubbock, TX

- Monitored the Phasor Management Unit (PMU) of an SEL-421 protective relay connected to a wind turbine, powering the foundry, for transient voltage spikes, current and frequency swings.
- Wrote a software to mine and perform statistical analysis on the data received from the PMU in real-time (Data Mining and Data Analysis).

X-FAB Semiconductor Foundries

Electrical Engineer Intern

Aug 2011 - Oct 2011

Lubbock, TX

- Modeled X-Fab's electric power system from their 15kV switchgear to 120/208V panels and motors.
- Performed short circuit, load flow and protective device coordination analysis using SKM (Arc Flash Evaluation).
- Calculated fault current, breaker switching time.
- Modeled a single-line for the main electrical room using SKM.

PUBLICATIONS

Peer-Reviewed Journal Publications:

- **Rahnama, A.**, Xia, M., and Antsaklis, P. J. (2017). Passivity-Based Design for Event-Triggered Networked Control Systems, *IEEE Transactions on Automatic Control*.

Peer-Reviewed Journal Submissions:

- **Rahnama, A.**, Xia, M., and Antsaklis, P. J. (Under Review). A *QSR-Dissipativity* Based Design for Event-Triggered Networked Systems, *IEEE Transactions on Automatic Control*.
- Xia, M., **Rahnama, A.**, and Antsaklis, P. J. (Under Review). Control Design Using Passivity for Stability and Performance, *IEEE Transactions on Automatic Control*.

Peer-Reviewed Published Paper (Invited Session):

- **Rahnama, A.**, Xia, M., and Antsaklis, P. J. (2016). A *QSR-Dissipativity* and Passivity based Analysis of Event-Triggered Networked Control Systems, *IEEE Conference on Control and Decision (CDC)*.

- Yan, Y., Xia, M., **Rahnama, A.**, and Antsaklis, P. J. (Under Review). A Passivity-Based Self-Triggered Strategy for Cyber-Physical Systems under Denial-of-Service Attack, *IEEE Conference on Control and Decision (CDC)*.

Peer-Reviewed Conference Publications:

- **Rahnama, A.**, Xia, M., and Antsaklis, P. J. (2016). Passivation and Performance Optimization Using an Extremum Seeking Co-Simulation Framework with Application to Adaptive Cruise Control Systems, *American Control Conference (ACC)*.
- Xia, M., **Rahnama, A.**, and Antsaklis, P. J. (2016). Performance Optimization Based on Passivation of Systems with Applications to Systems with Input/output Delay, *American Control Conference (ACC)*.
- Xia, M., **Rahnama, A.**, and Antsaklis, P. J. (2015). On Guaranteeing Passivity and Performance with a Human Controller, *Mediterranean Conference on Control and Automation (MED)*.
- Santosh, P., **Rahnama, A.**, Tovar, M., and Bayne, S. (2012). Power Quality Analysis of a Sensitive Load Using a Phasor Measurement Unit, *IEEE Conference on Green Technologies*.

Peer-Reviewed Research Reports:

- **Rahnama, A.**, Xia, M., Antsaklis, P. J. (2016). A Passivity-Based Design for Stability and Robustness in Event-Triggered Networked Control Systems with Communication Delays, Signal Quantizations and Packet Dropouts, *the Cornell University Library*. <https://arxiv.org/abs/1704.00592>
- **Rahnama, A.**, Xia, M., Antsaklis, P. J. (2016). *QSR-Dissipativity* and Passivity Analysis of Event-Triggered Networked Control Cyber-Physical Systems, *the Cornell University Library*. <https://arxiv.org/abs/1607.00553>
- **Rahnama, A.**, Xia, M., Wang, S., Antsaklis, P. J. (2015). An Extremum-Seeking Co-Simulation Based Framework for Passivation Theory and its Application in Adaptive Cruise Control Systems, *the Cornell University Library*. <https://arxiv.org/abs/1607.03958>
- Xia, M., **Rahnama, A.**, S. Wang, Antsaklis, P. J. (2015). Passivation Theory and its Application to Automotive Systems, *Interdisciplinary Studies in Intelligent Systems at the University of Notre Dame*. <http://nd.edu/~isis/techreports/isis-2015-001.pdf>

PROJECTS

Line-Following Smart Robots

Spring 2010

Designed and manufactured an autonomous smart line-following robotic car using Digilent BASYS2 FPGA board and Xilinx ISE (VHDL). Additional to reading the course, the robotic car, could be controlled by an ultrasonic remote, and was capable of detecting and filtering the signals coming from blinking LED beacons in daylight to interpret the direction of future turns.

Robotic Smart MIDI Glockenspiel

Fall 2010

Designed and built an autonomous robotic glockenspiel with a graphical user interface (GUI), equipped with a microcontroller (Arduino) capable of reading MIDI files, and playing music —The framework controlled the solenoids connected to the glockenspiel by manipulating pulse-width signals sent to them (the electric board was designed and implemented on a PCB board).

Wideband Signal Generator

Spring 2011

Designed and manufactured a wide-range comb generator —From the initial stage to the final design on a PCB board.

2D Game Development

Spring 2008

Designed, programmed and implemented 2D games using C++ and Pascal.

DATA ANALYTIC SKILLS AND TECHNICAL STRENGTHS

Programming Languages	C/C++, MATLAB/Simulink, Python, CarSim, SKM, Labview
Statistical Computing	R
Digital Design Languages	Verilog, VHDL (FPGAs, Microcontrollers)
Circuit Design Programs	PSpice, EagleCAD, OrCAD Capture/Cadence (PCB Design)
Software and Tools	LaTeX, Mathematica, Excel

CONFERENCE PRESENTATIONS

- IEEE Conference on Decision and Control, 2016, Las Vegas, NV
- American Control Conference, 2016, Boston, MA
- IEEE Conference on Green Technologies, 2012, Tulsa, OK

TEACHING EXPERIENCE

University of Notre Dame Aug 2013 - May 2017
Teaching Assistant Notre Dame, IN

- Mathematical Programming
Taught classes, and graded assignments
- Advanced Linear Systems
Conducted tutoring sessions, and graded assignments
- Electronics
Conducted discussions, laboratory and tutoring sessions, held office hours, and graded assignments, lab reports and examinations, and helped with related administrative tasks.
- Power Systems
Conducted discussions, tutoring sessions, and graded assignments

Texas Tech University Jan 2011 - May 2011
Teaching Assistant Lubbock, TX

- Linear Systems
Conducted discussion, tutoring sessions, graded assignments, helped with related administrative tasks.

ACADEMIC ACHIEVEMENTS

The Notebaert Professional Development Award	<i>Fall 2016</i>
Recipient of University of Notre Dame Research Fellow	<i>Aug 2013 - May 2014</i>
Recipient of Texas Tech Travis Simpson Scholarship	<i>Aug 2011 - May 2012</i>
Recipient of Texas Tech Travis Simpson Scholarship	<i>Aug 2010 - May 2011</i>
Texas Tech Honors Student	<i>Jan 2009 - May 2012</i>
Texas Tech President's Honors List	<i>Spring 2009 and Spring 2010</i>
Texas Tech College of Engineering Dean's Honors List	<i>Fall 2008, 2009, 2010, 2011, 2012</i>

RELEVANT COURSES

Core Courses

- Cyber-Physical Systems: Verification
- Mathematical Programming
- Static and Dynamic Game Theory
- Hybrid Dynamical Systems

- Optimal Control
- Advanced Control Systems
- Advanced Linear Systems
- Advanced Digital Communication
- Advanced Digital Signal Processing
- Computer Algorithms
- Data Structure

Related Courses

- Statistical Methods in Data Mining and Prediction
- Statistics in the Computer era
- Estimation and Detection
- Probability and Random Processes
- Set Theory
- Modern Optics for Engineering
- Higher Mathematics for Engineers and Scientists
- Advanced Programming in C/C++

REFERENCES

Dr. Panos J. Antsaklis

University of Notre Dame, Advisor

Email: antsaklis.1@nd.edu

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Dr. Hai Lin

University of Notre Dame, Committee Member

Email: hlin1@nd.edu

Phone: 574-631-3177

Dr. Vijay Gupta

University of Notre Dame, Committee Member

Email: vgupta2@nd.edu

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Dr. Meng Xia

The MathWorks, Researcher/Co-Worker

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Marcus Borhani

X-Fab Semiconductor Foundries, Manager

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