

LI WANG

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EDUCATION

Georgia Institute of Technology, Atlanta, GA August 2014 - May 2018 (expected)
Doctor of Philosophy in Department of Electrical & Computer Engineering GPA: 4.00/4.00

Clemson University, Clemson, SC July 2012 — May 2014
Master of Science in Department of Electrical & Computer Engineering GPA: 4.00/4.00

Huazhong University of Sci. & Tech., Wuhan, China July 2008 — June 2012
Bachelor of Science (with honor) in Department of Mechanical Engineering GPA: 91.60/100 Ranking: 1/54

RESEARCH EXPERIENCE

Graduate Research Assistant, Georgia Institute of Technology August 2014 - Present
Topic: Safe Learning and Control of Multi-robot Systems (Video Link 1, 2, 3) *Advisor: Magnus Egerstedt*

- Developed safety control certificates to ensure safe aggressive maneuvers of multi-quadrotor and mobile robot swarms.
- Designed online safe learning algorithm for quadrotor dynamics using recursive Gaussian Process with safety guarantees.
- Implemented safety certificates on teams of quadrotors and robots with Robot Operating System (ROS) (C++, Python).
- Integrated a multi-robot test-bed with multiple quadrotors, mobile robots, joystick/Iphone, and motion capture system
- Programmed stable hovering and trajectory tracking of quadrotors with Extended Kalman Filter and sensor fusion.

Graduate Research Assistant, Clemson University May 2013 - May 2014
Topic: Online Control, Estimation and Sensor Fusion of Bioreactor *Advisor: Richard Groff*

- Developed and implemented nonlinear adaptive state estimator for online tracking of oxygen uptake rate in bioreactor.
- Designed and implemented a Kalman filter and particle filter for bioreactor sensing data filtering and fusion
- Implemented bioreactor real-time control and data acquisition with xPC-target, OPC, UDP and serial communication

Undergraduate Research Group Leader, HUST March 2011 - June 2012
Topic: Geometric error modelling and compensation for multi-axis machine tools *Advisor: Fangyu Peng*

- Used CAD/CAM software for machine tools and parts modeling and tool cutting path generation and optimization
- Modeled kinematics of multi-axis machine tools with geometric error and developed tool path post-processing algorithms

WORK EXPERIENCE

Summer Research Intern, Siemens Corporate Technology May 2017 - August 2017
Project: Planning and Scheduling of Flexible Manufacturing Systems *Advisor: Ulrich Muenz*

- Developed graph-based Model Predictive Control planning and scheduling algorithm for flexible manufacturing systems.
- Implemented the MPC graph-based planner in C++ and interfaced with Siemens Tecnomatix plant simulator.

Summer Research Intern, OFS Fitel LLC June 2014 - August 2014
Project: Software Development for Plasma-based Optical Fiber Manufacturing Process *Advisor: David Braganza*

- Worked on hardware&software integration for Siemens PLC, HMI, RF power circuit, and other periphery devices.
- Developed software for manufacturing recipe optimization and automation in multi-programming language environment

Summer Research Intern, DEPUH Robotic Education Technology June 2011 - August 2011
Project: Educational reconfigurable mechatronical platform (Video Link) *Advisor: Kevin Rong*

- Developed a modular mechatronic platform with mechatronic transmission, micro-controller and Labview interface

Lab Teaching Assistant, Georgia Tech, Clemson University July 2012 - August 2015
Courses: Mechatronic System, Electronics Lab *Advisors: Allen Robinson, John Wagner*

- Taught signal acquisition/processing with transistor circuit, PLC programming, Labview sampling, and CNC operation

SOFTWARE AND HARDWARE SKILLS

Programming Tools: Python, C and C++, Matlab&Simulink, ROS (in Ubuntu Linux), PLC, Labview

System&Controls: Linear/nonlinear/optimal/networked control, regular/cascaded PID control, LQR control

Machine Learning: Gaussian Process, Hidden Markov Model, PCA, Expectation-Maximization, KNN/Q learner

Signal Processing: Complementary/Kalman/Extended-Kalman/Particle Filtering, SVD, Convex optimizations

Robotic Hardware: Crazyflie Quadrotor, AR Drone, Segway/Khepera III/Magellan Pro Robots, GRIST bots

Robotic Software: ROS, MQTT, Player/Stage, Vrep simulator, Rviz, Optitrack/Vicon Motion Capture System

Robotics: Quadrotor dynamics, manipulator forward/inverse kinematics, path planning (PRM, A*)

Sensors&Hardware: x-PC Target, Servo/step motor, Laser range sensor, Accelerometer, Analog IO, Gas sensor

CAD/CAM: Solidworks(3 yrs), AutoCAD(3 yrs), UG(3 yrs), Inventor(2 yrs), Mastercam(1 yr)

Engineering Skills: Siemens PLC, CNC, Micro-Controller, Oscilloscope, Signal generator, 3D printing, Laser cutter

SELECTED HONORS

- Best Multi-Robot Paper Award:** Best Multi-Robot Systems Paper Award at top Robotics conference ICRA 2017
- Jenny H. Krauss Fellowship:** Awarded to top Georgia Tech graduate students with excellent academic record
- Top winner of BlueCompetition:** A worldwide competition sponsored by BlueSens Gas Sensor GmbH(Germany)
- Chinese National Scholarship:** Awarded to top 2% college students by the Chinese Ministry of Education
- China National Innovation Grants:** Awarded to teams of undergraduates with innovative research projects

MEDIA COVERAGE

- D1. *IEEE spectrum*, “Swarms of Robots Manage to Not Run Into Each Other”, Web link
- D2. *Engadget*, “Virtual ‘top hats’ ensure swarming drones won’t crash”, Web link
- D3. *Robohub*, “The Robotarium: A remotely accessible swarm robotics research testbed”, Web link
- D4. *Digital trends*, “This swarm of drones uses virtual force fields to avoid crashing into each other”, Web link

SERVICE

Tour Organizer, showed live robotic demos (quadrotor swarm and mobile robot swarm experiments) during 2014-2017 to

- Industrial visitors from: BMW, United Technologies Research Center, Siemens Corporate Technology, Littler Mendelson, Denso Corporation, Texas Instrument, Marvel Studios, Walmart, Samsung Electronics, Ford Motor, etc.
- Academical visitors from: NASA, ONR, 2016 Robotics Roadmap, the Ray Foundation, Cristo Rey High School, CMU, UCLA, University of Maryland, University of Tennessee at Chattanooga, 2016/2017 Robotics Open House, Clayton State University, AIAA Technical Committee, George Walton Academy, Tuskegee university, etc.

Session Co-Chair, IFAC Conference on Analysis and Design of Hybrid Systems, Atlanta, 2015.

PUBLICATIONS

A. Master’s Thesis

- A1. “Design and Implementation of a Real-time Adaptive Oxygen Transfer Rate Estimator”, Clemson University, 2014

B. Peer-reviewed Journal Papers

- B1. **L. Wang**, A. Ames, and M. Egerstedt, “Super-Ellipsoidal Barrier Certificates for Safe Maneuvers in Teams of Quadrotors”, *IEEE Transactions on Robotics (T-RO)*, under review.
- B2. **L. Wang**, A. Ames, and M. Egerstedt, “Safety Barrier Certificates for Collisions-Free Multi-robot Systems”, *IEEE Transactions on Robotics (T-RO)*, vol. 33, no. 3, pp. 661-674, 2017.
- B3. F. Peng, J. Ma, **L. Wang**, R. Yan and B. Li, “Post-processing Algorithm Based on Total Differential Method for Multi-axis Machine Tools with Arbitrary Configuration”, *Chinese Journal of Mechanical Engineering*, vol. 48, no. 13, pp. 121-127, 2012.

C. Peer-reviewed Conference Papers

- C1. **L. Wang**, E. A. Theodorou, and M. Egerstedt, “Safe Learning of Quadrotor Dynamics Using Barrier Certificates”, *IEEE International Conference on Robotics and Automation (ICRA)*, 2018, under review.
- C2. **L. Wang**, A. Ames, and M. Egerstedt, “Safe Certificate-Based Maneuvers for Teams of Quadrotors Using Differential Flatness”, *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 3293-3298, 2017.
- C3. D. Pickem, P. Glotfelter, **L. Wang**, M. Mote, A. Ames, E. Feron, and M. Egerstedt, “The Robotarium: A Remotely Accessible Swarm Robotics Research Testbed”, *IEEE International Conference on Robotics and Automation (ICRA)*, **Best Multi-Robot Systems Paper Award, Best Conference Paper Finalist**, pp. 1699-1706, 2017.
- C4. **L. Wang**, D. Han, and M. Egerstedt, “Permissive Barrier Certificates for Safe Stabilization Using Sum-of-squares”, *2018 American Control Conference (ACC)*, under review.
- C5. **L. Wang**, A. Ames, and M. Egerstedt, “Multi-objective Compositions for Collision-free Connectivity Maintenance in Teams of Mobile Robots”, *2016 Decisions and Control Conference (CDC)*, pp. 2659-2664, Dec. 2016.
- C6. **L. Wang**, A. Ames, and M. Egerstedt, “Safety Barrier Certificates for Heterogeneous Multi-robot System”, *2016 American Control Conference (ACC)*, pp. 5213-5218, July 2016.
- C7. U. Borrmann, **L. Wang**, A. Ames, and M. Egerstedt, “Control Barrier Certificates for Safe Swarm Behavior”, *2015 IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)*, Oct. 2015.
- C8. **L. Wang**, M. E. Pepper, A. Padmakumar, T. C. Burg, S. W. Harcum, and R. E. Groff, “A Real-time Adaptive Oxygen Transfer Rate Estimator for Metabolism Tracking in Escherichia coli Cultures”, *IEEE Engineering in Medicine and Biology Conference*, pp. 6191-6194, 2014
- C9. M. E. Pepper, **L. Wang**, A. Padmakumar, T. C. Burg, S. W. Harcum, and R. E. Groff, “A CMI(Cell Metabolic Indicator)-based Controller for Achieving High Growth Rate E.coli Cultures”, *IEEE Engineering in Medicine and Biology Conference*, pp. 2911-2915, 2014