Huan Xu

Contact Information

Graduate Student
Mechanical and Civil Engineering
California Institute of Technology
1200 E. California Blvd.
MC104-44
Pasadena, CA 91125 USA

Mobile: +1-951-534-4615
Office: +1-626-395-3391
E-mail: mumu@caltech.edu

Research Interests

Systematic analysis, design, and verification of networked, information-based systems, including formal specification and automated synthesis of software-enabled control protocols, distributed sense and control systems, perception-driven planning, sensing and estimation with imperfect information.

Education

California Institute of Technology, Pasadena, CA

Ph.D., Mechanical and Civil Engineering, expected June 2013

- Thesis Topic: *Design, Specification, and Synthesis of Control Protocols for Aircraft Electric Power Systems*
- Adviser: Professor Richard M. Murray
- Area of Study: Control and Dynamical Systems, Computing and Mathematical Sciences

M.S., Mechanical and Civil Engineering, June 2008

- Adviser: Professor Nadia Lapusta
- Area of Study: Fracture mechanics, Computational mechanics of earthquakes

Harvard University, Cambridge, MA

S.B., Mechanical and Materials Sciences and Engineering, June 2007

- Thesis Topic: *Design of an Air Pollution Monitoring System for Developing Countries*
- Thesis Adviser: Professor Matt Welsh
- Undergraduate Adviser: Professor James R. Rice

Submitted Journal Publications

[1] Specification and Design for Aircraft Electric Power Systems. H. Xu, U. Topcu, and R. M. Murray. *IEEE Transactions on Industrial Informatics*. 2013. To be submitted.

[2] A Contract-Based Methodology for Aircraft Electric Power System Design. P. Nuzzo, H. Xu, N. Ozay, R. M. Murray, A. Sangiovanni-Vincentelli, et al. *AIAA Journal of Aerospace Computing, Information, and Communication*. 2013. To be submitted.

Submitted Conference Publications

[3] A Domain-Specific Language for Aircraft Electric Power Systems. H. Xu, N. Ozay, and R. M. Murray. In: *International Conference on Hybrid Systems: Computation and Control*, 2013. Workshop on Design, Modeling and Evaluation of Cyber Physical Systems. To be submitted.

[4] From Formal Specifications to Software Models and Hardware Implementation of Reactive Protocols: An Aircraft Electric Power Testbed. R. Rogersten, N. Ozay, U. Topcu, H. Xu, and R. M. Murray. In: *International Conference on Hybrid Systems: Computation and Control*, 2013. Accepted.

Conference Publications

[5] A Case Study on Reactive Protocols for Aircraft Electric Power Distribution H. Xu, U. Topcu, and R. M. Murray. In: *IEEE Conference on Decision and Control*, 2012. Accepted.

[6] TuLiP: A Software Toolbox for Receding Horizon Temporal Logic Planning. T. Wongpiromsarn, U. Topcu, N. Ozay, H. Xu and R. M. Murray. In: *International Conference on Hybrid Systems: Computation and Control*, 2011.

[7] Load-shedding Probabilities of Power Systems with Renewable Power Generation and Energy Storage. H. Xu, U. Topcu, S. Low, C. Clarke, and K. M. Chandy. In: *Allerton Conference on Communication, Control, and Computing*, 2010.

[8] A Simple Optimal Power Flow Model with Energy Storage. H. Xu, U. Topcu, S. Low, and K. M. Chandy. In: *IEEE Conference on Decision and Control*, 2010.

[9] The Effect of Pre-Stress Assumptions on Dip-Slip Fault Nucleation. H. Xu, Z. Fang, G. Xu, and D.D. Oglesby In: *American Geophysical Union Conference*, 2006.

Invited Workshops and Posters

[10] Engineering Resilient Space Systems: Leveraging Novel System Engineering Techniques and Software Architectures. Workshop hosted by Keck Institute for Space Studies and NASA Jet Propulsion Laboratory, July 2012.

[11] Foundations for Innovation in Cyber-Physical Systems. Workshop hosted by NIST, March 2012.

[12] Celebrating Women in Computing (Southern California). Invited talk. April 2012

[13] Southern California Smart Grid Symposium. Load-Shedding Probabilities with Hybrid Power Generation and Energy Storage. USC, October 2010, Poster.

[14] An Optimal Power Flow Network with Energy Storage. H. Xu, U. Topcu, S. Low, and K. M. Chandy. In: *2nd International Conference on Computational Sustainability*, MIT, June 2010, Poster.

Student Advising

Robert Rogersten Caltech Summer Undergraduate Fellowship Program (SURF). Undergraduate student in Electrical Engineering from KTH, Royal Institute of Technology. Developed an aircraft electric power system testbed as part of Multi-Scale Systems Center (MuSyC) program. 2012.

Quentin Maillet. Undergraduate student in engineering from Mines ParisTech. Researching optimal sensor placement in electric power systems for observability. 2012-2013

Teaching Experience

California Institute of Technology, Pasadena, CA

Teaching Assistant **March 2011 to March 2012**

- Head TA ME 96: Mechanical Engineering Laboratory
  - Spring 2011, Spring 2012
  - Responsible for supervision of controls and dynamical systems-related laboratory experiments. Students design and implement double oscillator, inverted pendulum.
- CNS 107 Writing About Scientific Research
  - Winter 2013
  - Responsible for grading and editing student-written chapters on scientific research, to be published in a book on science for a general audience.

Harvard University, Cambridge, MA

Teaching Fellow **Spring 2007**

- ES 123: Introduction to Fluid Mechanics and Transport Processes
  - Responsible for weekly 1-hour section, office hours, grading, and review sessions.

University of California, Riverside, Riverside, CA

Undergraduate Researcher **Summer 2006**

- Advisor: Professor David Oglesby
  - Created and studied earthquake simulations of fault nucleation along dip-slip faults.

Professional Experience

Sikorsky Aircraft/United Technologies Research Center, Stratford, CT

Intern **November 2010 to February 2011**

- Investigated the use of formal methods in the development of next-generation helicopter the S-97 Raider.
- Introduced software verification and synthesis tools into design process for vehicle management systems.

Service

- Contributor to open-source software project TuLiP, a collection of Python-based code for automatic synthesis of correct-by-construction embedded control software.
- President of SOPS (Society of Professional Students), the graduate student association for departments of mechanical engineering, civil engineering, applied mechanics, and aeronautics/aerospace. Duties included facilitating faculty-student interactions through seminars and mentorship programs, coordinating social events, encouraging divesity/minority outreach, maintaining annual budget and organizing department banquet. June 2009 - June 2011.

Application Areas

Autonomous and Unmanned Vehicles, more-electric technologies in aerial vehicles and smartgrid, distributed, networked, and sustainable energy systems, cyber-physical systems.

Awards

National Science Foundation: Graduate Research Fellowship 2007

Skills

- C, C++, Python, Fortran, Java, Matlab, Mathematica, ABAQUS, Spin, NuSMV, UPPAAL, SysML, Modelica, Simulink, and others

References Available to Contact

Dr. Richard M. Murray (e-mail: murray@cds.caltech.edu; phone: +1-626-395-6460)

- Professor, Thomas E. and Doris Everhart Professor of Control and Dynamical Systems and Bioengineering, California Institute of Technology
- ◇ Control and Dynamical Systems 107-81, 1200 E. California Blvd., Pasadena, CA 91125
- ⋆ *Graduate adviser*

Dr. Alberto Sangiovanni-Vincentelli (e-mail: alberto@eecs.berkeley.edu; phone: +1-510-642-4882)

- Edgar L. and Harold H. Buttner Chair of EECS, Electrical Engineering and Computer Science, University of California, Berkeley
- ◇ 253 Cory Hall MC 1770, Berkeley CA 94720
- ⋆ *Collaborator on research projects.*

Richard A. Poisson (e-mail: richard.poisson@utas.utc.com; phone: +1-860-654-9217)
- Technical Fellow, Advanced Architectures Engine and Control Systems, United Technologies Aerospace Systems (formerly Hamilton Sundstrand)
- ◇ 1 Hamilton Road, Windsor Locks, CT 06096
- ⋆ *Industry collaborator*

Dr. K. Mani Chandy (e-mail: mani@cs.caltech.edu; phone: +1-626-395-6559)
- Professor, Simon Ramo Professor and Professor of Computer Science, California Institute of Technology
- ◇ Computer Science MC305-16, 1200 E. California Blvd., Pasadena, CA 91125
- ⋆ *Thesis committee member*

Dr. Monica Kohler (e-mail: kohler@caltech.edu; phone: +1-626-395-4142)
- Senior Research Fellow, Mechanical and Civil Engineering, California Institute of Technology
- ◇ MC104-44, 1200 E. California Blvd., Pasadena, CA 91125
- ⋆ *Taught ME 72, the lab course for which I was a teaching assistant.*