

# Yehan Ma

## Ph.D. Candidate

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## EDUCATION

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- **Washington University in St. Louis** St. Louis, MO, U.S.  
*Ph.D. student in Computer Science; GPA: 3.95/4.0; Advisor: Prof. Chenyang Lu Aug. 2015 – present*
- **Harbin Institute of Technology** Harbin, China  
*M.S. in Automation; GPA: 95.2/100, Rank: 3/161; Advisor: Prof. Changhong Wang Aug. 2013 – July. 2015*
- **Harbin Institute of Technology** Harbin, China  
*B.S. in Automation; GPA: 93.2/100, Rank: 1/123 Aug. 2009 – July. 2013*

## RESEARCH INTERESTS

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*Cyber-physical systems.*  
*Networked control system.*  
*Wireless sensor network.*  
*Semi-physical simulation.*

## RESEARCH EXPERIENCE

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- **Cyber-Physical Systems Laboratory** Washington University in St. Louis  
*Research Assistant Aug. 2015 - Present*
1. **Explore the architectures of modern networked control systems** (Sep. 2018 - present)  
As WSAN, edge and cloud become pervasive, there are multiple design options of modern NCS architectures, e.g. (1) localized peer to peer control, (2) centralized remote control, and (3) cloud control system. We aim to provide a guideline of how to determine the control policy and the placement of controller to optimize control performance given the computation and communication cost.
  2. **Efficient holistic control over industrial wireless sensor-actuator networks** (Mar. 2017 - May. 2018)  
We explore efficient holistic control designs to maintain control performance while reducing the communication cost. We introduce a holistic control architecture that integrates low-power wireless bus (LWB) and two control strategies, rate adaptation and self-triggered control, specifically proposed to reduce communication cost. We design novel wireless network mechanisms to support rate adaptation and self-triggered control, respectively, in a multi-hop WSAN. We build a real-time network-in-the-loop simulator that integrates MATLAB/Simulink and a three-floor WSAN testbed to evaluate wireless control systems. (Publication:[1,6])
  3. **Holistic management for dependable wireless control system** (Mar. 2016 - Apr. 2017)  
To enhance the dependability of industrial wireless control, we propose a holistic cyber-physical management framework that employs run-time coordination between the plant control and network management. Our design includes a holistic controller that generates actuation signals to physical plants and reconfigures the WSAN. As a concrete example of holistic control, we design a holistic manager that dynamically reconfigures the number of transmissions in the WSAN based on online observations of network and control performances. (Publication:[2])
  4. **Cyber-physical case study of wireless routing and control** (Aug. 2015 - Feb. 2016)  
The control design of wireless control system (WCS) integrates extended Kalman Filter (EKF), model predictive controller (MPC), and buffered actuation to eliminate the packet loss in wireless network. In network side, we propose a flexible asymmetric routing approach tailored for WCS. Open source WCPS v3.0 (Docker): <http://wcps.cse.wustl.edu>. (Publication:[7])
- **Mitsubishi Electric Research Laboratories** Mitsubishi Electric Research Laboratories  
*Internship May. 2017 - Aug. 2017, May. 2018 - Aug. 2018*
1. **Optimal dynamic scheduling of wireless networked control systems** (May. 2018 - Aug. 2018)  
Suffering from limited bandwidth and nondeterministic link quality, in order to bridge the gap between network design and control system performance, we propose an optimal dynamic scheduling strategy that optimizes performance of multi-loop control systems by allocating network resources based on predictions of both link quality and control performance at run-time. (Publication:[4])

2. **A smart actuation architecture for wireless networked control systems** (May. 2017 - Aug. 2017)  
In order to address the safety concern of closing the control loop using wireless network, we present a smart actuation architecture, which deploys (1) a remote controller, which communicates with physical plant via wireless network, accounting for optimality, adaptation, and constraints by conducting computationally expensive operations; (2) a smart actuator, which co-locates with the physical plant, executing a local control policy and accounting for system safety in the view of network imperfections. (**Publication:[5]**)
- **Space Control and Inertial Technology Research Center** Harbin Institute of Technology  
*Research Assistant* May. 2012 - July 2015
1. **Build the analysis system for office health based on Kinect** (Jun. 2014 - Jun. 2015)  
It is my graduation project of M.S. degree, which aims at designing a product for office workers by correcting seat positions and counting common actions and their frequencies.
2. **Design and implement real-time semi-physical simulations of OTV** (Nov. 2012 - Jul. 2013)  
Real-time simulation systems of the model of orbital transfer vehicle (OTV) were designed in two ways based on xPC Target and mix-programming of LabVIEW/SIT companied with MATLAB/Simulink, respectively. Set the real-time simulation system of OTV in the spacecraft ground test system via fiber-optic reflective memory, and the test bed was driven to realize the 3 degrees of freedom translation. (**Publication:[8]**)
3. **Participate in designing the real-time control program of 3-DoF robot** (May. 2012 - Aug. 2012)  
The control program could drive the motors of robot to realize different forms of motion according to the external command, such as monotone-increasing wave, sine wave, square wave and trapezoidal wave. Satisfy the requirements of the properties such as stability, rapidity, overshoot and accuracy of the 3-degree-of-freedom robot by adjusting the control parameters of the controller and filtering of the signal.

## HONORS AND AWARDS

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<b>Fullgraf Fellowship</b>	2019,2018,2017,2016
<b>National Scholarship of China</b>	2011
<b>Gold-medal Master Thesis of HIT</b>	2015
<b>Samsung Scholarship</b>	2014
<b>First Level Graduate Student Scholarship</b>	2014,2013
<b>Excellent Graduate</b>	2013
<b>National Postgraduate Mathematic Contest in Modeling: Second Prize</b>	2014
<b>Outstanding Student</b>	2014,2011,2010
<b>People Scholarship</b>	2013,2012,2011,2010
<b>Excellent Student Leader</b>	2010
<b>88412 Scholarship</b>	2010

## PUBLICATIONS

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1. [**Submitted**] (Journal) **Yehan Ma**, Chenyang Lu and Yebin Wang, Efficient Holistic Control: Self-Awareness across Controllers and Wireless Networks, *ACM Transactions on Cyber-Physical Systems (TCPS)*, Submitted December 2018.
2. (Journal) **Yehan Ma**, Dolvara Gunatilaka, Bo Li, Humberto Gonzalez and Chenyang Lu. Holistic Cyber-Physical Management for Dependable Wireless Control Systems. *ACM Transaction on Cyber Physical Systems (TCPS)*, volume 3 (1), article No.3, January 2019.
3. (Journal) Jiayu Li, Haoran Li, **Yehan Ma**, Yang Wang, Ahmed A Abokifa, Chenyang Lu and Pratim Biswas, *Spatiotemporal Distribution of Indoor Particulate Matter Concentration with a Low-cost Sensor Network*, volume 127, pages 138 -147, January 2018.
4. (Conference) **Yehan Ma**, Jianlin Guo, Yebin Wang, Ankush Chakrabarty, Heejin Ahn, Philip Orlik and Chenyang Lu, Optimal Dynamic Scheduling of Wireless Networked Control Systems, *The 10th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2019)*. Montreal, Canada, April 16-18 2019.
5. (Conference) **Yehan Ma**, Yebin Wang, Stefano Di Cairano, Toshiaki Koike-Akino, Jianlin Guo, Philip Orlik and Chenyang Lu, A Smart Actuation Architecture for Wireless Networked Control Systems, *The 57th IEEE Conference on Decision and Control (CDC 2018)*. Miami, USA, December 17-19 2018.

6. (Conference) **Yehan Ma** and Chenyang Lu, Efficient Holistic Control over Industrial Wireless Sensor-Actuator Networks, *The 1st IEEE International Conference on Industrial Internet (ICII 18)*. Bellevue, USA, October 21-23 2018.
7. (Conference) Bo Li\*, **Yehan Ma\***, Tyler Westenbroek, Chengjie Wu, Humberto Gonzalez and Chenyang Lu. Wireless Routing and Control: a Cyber-physical Case Study. *The 7th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2016)*. Vienna, Austria, April 11-14 2016. **(co-first-author)**
8. (Conference) **Yehan Ma**, Mingxiang Ling, Changhong Wang and Qingshuang Zeng. Design and Implementation of Real-time Simulation System of OTV based on xPC Target and SIT. *The 11th World Congress on Intelligent Control and Automation (WCICA 2014)*. Shenyang, China, June 29-July 4 2014.
9. (Conference) An Zou, Hui Zhao, **Yehan Ma** and Da Li. Analysis Calculation and Testing of Rotary Inductosyn Angle Measuring Errors. *The 33rd Chinese Control Conference (CCC 2014)*. Nanjing, China, July 28-30 2014.
10. (Patent) **Yehan Ma**, A Form of Controller to Guarantee the Safety of the Infusion. *Utility-model patent of China*, patent NO.2011203182624, May. 2012

## PROFESSIONAL SERVICE ACTIVITIES

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<i>IEEE RTAS Secondary Reviewer</i>	<i>2018</i>
<i>ACM TCPS Reviewer</i>	<i>2017</i>
<i>IEEE ESL Reviewer</i>	<i>2017</i>

## TECHNIQUE SKILLS

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**Programming Languages:** *C/C++; M language; Python; SQL; Latex*

**Software:** *MATLAB; TOSSIM; VIM; LabVIEW; PostgreSQL*

**Operating System:** *Linux; Contiki OS; Mac OS X; Windows; TinyOS*