Bin Hu

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Dept. of Engineering Technology
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Professional Experience

University of Houston, Houston, Texas, USA

Assistant Professor, Department of Engineering Technology, September 2022 - present

Old Dominion University, Norfolk, Virginia, USA

Assistant Professor, Department of Engineering Technology, July 2019 - May 2022

Education

Ph.D. in Electrical Engineering, University of Notre Dame (ND), USA, 2016

M.S. in Control Science and Engineering, Zhejiang University (ZJU), China, 2010

B.S. in Electrical Engineering and Automation, Hefei University of Technology, China, 2007

Research Interests

Resilient CPS

- Developing **resilient control, communication and optimization algorithms** for Cyber-Physical Systems to address cybersecurity issues under different malicious attacks, e.g., jamming, deception, or spoofing attacks.
- Designing **secure, portable and customizable smart embedded systems** that integrate LiDAR and Camera for CPS applications, such as mobile robots and drones.
- Developing **secure and safe human-machine interaction** via multi-disciplinary tools from human factors, machine learning and control theories.

AI-Human Safety & Security

- Safe AI-human collaboration system
- Learning based optimal AI-human collaboration algorithms
- Secure and cognizant AI-human system

Big Data & Machine Learning based Control and Optimization

- Data-driven controller design based on PLS and convolutional neural network structure.
- Data-based Model Predictive Control and optimization method that ensures optimal economic profits for complex industrial processes
- Data based Fault detection and diagnosis using machine learning methods

Vehicular Networked Control Systems

- State-dependent channel models for Vehicle to Vehicle (V2V) communication
- Distributed control and optimization strategies to ensure safety and efficiency for vehicular networked control systems
- Optimal Co-design framework for communication and control strategies for networked control systems

Awarded Funds

External Funding

2. Contributed as a Co-PI to the NSF project: *"CHS: Small: AI-Human Collaboration in Autonomous Vehicles for Safety and Security"*, **NSF (IIS Core), $500,000**, 2020 - 2023. (my share: **$166,667**)

1. Contributed as a PI to the project: *"Design An Embedded Portable Platform of LiDAR and Peripherals for Unmanned Aerial Systems"*, ONR Rapid Solutions Learning-Projects (RSLP), **$42,000**, 2018-2019.

Intramural Funding

2. Contributed as a faculty mentor to the project: *Resilient LiDAR Systems Against Malicious Attacks*, ODU Undergraduate Research Program in Cybersecurity, **$3,250**, 2019 September - 2019 December.

1. Contributed as a faculty mentor to the project: *Robust Networked Drone Systems Against Jamming Attacks*, ODU Undergraduate Research Program in Cybersecurity, **$3,250**, 2020 January - 2020 May.

Pending Funding

1. Solo PI to the NSF project: *"CRII: CPS: Distributed Safe Autonomy for Vehicular Networked Control Systems Under Uncertain Dynamic Environments"*, **NSF CISE CRII, $172,716**, 2022 - 2024. (pending)

Peer-Reviewed Journal Publications

23. **Hu, B.** and Tamba, T. A, "Optimal Transmission Power and Controller Design for Networked Control Systems Under State-Dependent Markovian Channels", *IEEE Transactions on Automatic Control*, in press, 2022.

22. Li, Z.C., **Hu, B.** and Yang, Z.Y, "Co-design of Distributed Event-Triggered Controller for String Stability of Vehicle Platooning Under Periodic Jamming attacks", *IEEE Transactions on Vehicular Technology* (**IF = 5.978**), vol. 70, no.12, pp. 13115–13128, 2021.

21. J. Chen, S. Mishler and **B. Hu**, "Automation Error Type and Methods of Communicating Automation Reliability Affect Trust and Performance: An Empirical Study in the Cyber Domain", *IEEE Transactions on Human-Machine Systems* (**Regular Paper**, **IF=3.37**), vol. 51, no. 5, pp. 463-473, 2021.

20. **Hu, B.** "Stochastic Stability Analysis for Vehicular Networked Systems with State-dependent Bursty Fading Channels: A Self-Triggered Approach", *Automatica* (**Regular Paper**, **IF=7.78**), vol. 123, no. 1, 2021.

19. **Hu, B.**, "Event-based Adaptive Power Control in Vehicular Networked Systems with Bursty State-dependent Fading Channels", *IEEE Transactions on Circuits and Systems II: Express Briefs* (**IF=3.25**), vol. 67, no. 3, pp. 506-510, 2019.

18. **Hu, B.**, Y.B. Wang, P. Orlik, T. Koike-Akino and J.L. Guo, "Co-design of Safe and Efficient Networked Control Systems in Factory Automation with State-dependent Fading Channels", *Automatica* (**Regular Paper**, **IF=7.78**), vol. 105, no. 7, pp. 334-346, 2019.

17. **Hu, B.** and T. Tua, "Optimal Co-design of Industrial Networked Control Systems with State-dependent Correlated Fading Channels", *International Journal of Robust and Nonlinear Control* (**IF=3.953**), vol. 29, no.13, pp. 4472-4493, 2019.

16. Li, Z.C. and **Hu, B.**, "String Stability Analysis for Vehicle Platooning under Unreliable Communication Links with Event-Triggered Strategy", *IEEE Transactions on Vehicular Technology* (**IF = 5.978**), vol. 68, no. 3, pp. 2152-2164, 2019.

15. Wu, B., **Hu, B.**, and Lin, H., "Learning-Based Optimal Task Allocation for Human-Robot Collaboration with Linear Temporal Logic Constraints", *IEEE Transactions on Automation Science and Engineering* (**IF=5.224**), conditionally accepted, 2018.

14. Chen, J., Mishler, S., **Hu, B.**, Li, N.H. and Proctor, R.W., "The Description-Experience Gap in the Effect of Warning Reliability on User Trust and Performance in a Phishing Detection Context.", *International Journal of Human-Computer Studies* (**IF=2.3**), vol. 119, no. 11, pp. 35-47, 2018.

13. **Hu, B.** and Chen, J., "Optimal Task Allocation for Human-Machine Collaborative Manufacturing Systems", *IEEE Robotics and Automation Letters (RA-L)* (**IF=3.608**), vol. 2, no. 4, pp. 1933-1940, 2017.

12. **Hu, B.** and Lemmon, M.D., "Distributed Switching Control to Achieve Almost Sure Safety for Leader-follower Vehicular Networked Systems. ", *IEEE Transactions on Automatic Control* (**Full Paper, IF=6.2**), vol. 60, no. 12, pp. 3195-3209, 2015.

11. Fei, Z.S., Liu, K.L., **Hu, B.** and Liang, J., "An Efficient Latent Variable Optimization Approach With Stochastic Constraints for Complex Industrial Process.", *Chinese Journal of Chemical Engineering*, vol. 23, no. 10, pp. 1670-1678, 2015.

10. Chi, Q. H., Zhao, Z., **Hu, B.**, Lv, Y., and Liang, J., "Multi-loop Nonlinear Internal Model Controller Design Based On A Dynamic Fuzzy Partial Least Squares Model. ", *Chemical Engineering Research and Design* (**IF=3.073**), vol. 91, no. 12, pp. 2559-2568, 2013.

9. **Hu, B.**, Z. Zhao and J. Liang. "Multi-loop Nonlinear Internal Model Controller Design Under Nonlinear Dynamic PLS Framework Using ARX-Neural Network Model." *Journal of Process Control* (**IF=3.316**), 22(1):207–217, 2012.

8. Fei, Z.S., **B. Hu**, L.B. Ye and J. Liang. "ARX-NNPLS Model Based Optimization Strategy and Its Application in Polymer Grade Transition Process." *Chinese Journal of Chemical Engineering*, 20(5): 971–979, 2012.

7. Zhao, Z., **B. Hu** and J. Liang. "Multi-loop Adaptive Internal Model Control based on a Dynamic Partial Least Squares Model." *Journal of Zhejiang University SCIENCE A*, 12(3): 190–200, 2011.

6. Duan, B., J. Liang, Z.S., Fei, M. Yang and **B. Hu**. "Nonlinear Semi-parametric Modeling Method Based on GA-ANN." *Journal of Zhejiang University-Engineering Science*, 45(6):977-983, 2011.

5. **Hu, B.**, P.Y. Zheng and J. Liang. "Multi-loop Internal Model Controller Design based on a Dynamic PLS Framework." *Chinese Journal of Chemical Engineering*, 18(2): 277–285, 2010.

4. Yang, M., **B. Hu**, Z.S. Fei, P.Y. Zheng and J. Liang. "Soft-sensing Research on the Gas Phase Ethylene Polymerization in Fuidized Bed Reactor based on DPCA-RBF Network." *Chinese Journal of Scientific Instrument*, 31(3): 481–487, 2010.

3. Fei, Z.S, **B. Hu**, L.B., Ye, P.Y., Zheng and J. Liang. "Optimal Grade Transition of Polymerization Process with Path Constraints." *Journal of Chemical Industry and Engineering (China)*, (4):893-900, 2010.

2. Liu, Y.M., L.B., Ye, P.Y., Zheng, X.R., Shi, **B. Hu** and J. Liang. "Multiscale Classification and its Application to Process Monitoring." *Journal of Zhejiang University Science C*, 11(6): 425-434, 2010.

1. Liu, Y.M., J. Liang, **B. Hu** and X.R., Shi. "A Multivariable Statistical Process Monitoring Method Based on Multiscale Analysis." *Journal of the Chemical Industry and Engineering (China)*, 60(4):952-958, 2009.

Peer-Reviewed Conference Proceedings

26. Wang, C., **Hu, B.** and Wu, H.Y, "Energy Minimization for Federated Asynchronous Learning on Battery-Powered Mobile Devices via Application Co-running. " *The 2022 IEEE International Conference on Distributed Computing Systems (ICDCS)*, Bologna, Italy. (**Acceptance Rate: 19.9%**)

25. Tamba, Tua A., and **Hu, B.**. "Reachability Estimates of Piecewise Deterministic Markov Processes." *In 2022 13th Asian Control Conference (ASCC)*, pp. 2327-2331. IEEE, 2022.

24. Garcia, K. R., Xiao, Y., Mishler, S., Wang, C., **Hu, B.**, and Chen, J. (2021, November). Human Perception of AI Capabilities in Identifying Malicious Roadway Signs. *In TMS Proceedings 2021.* PubPub.

23. Mishler, S., Garcia, K., Fuller-Jakaitis, E., Wang, C., **Hu, B.**, Still, J., and Chen, J. "Predicting a malicious stop sign: Knowledge, exposure, trust in AI." To appear in *Proceedings of the Human Factors and Ergonomics Society 65th International Annual Meeting*. Washington DC: HFES. 2021.

22. Garcia, K., Xiao, Y., Mishler, S., Wang, C., **Hu, B.**, and Chen, J. "Human perception of AI capabilities in identifying malicious roadway signs", *In The 2021 American Psychological Association's Conference on Technology, Mind & Societ*. Nov. 3-5, 2021, Virtual.

21. **B. Hu** and T. Tamba, "Optimal Networked Control Systems with State-dependent Markov Channels", *In The 2021 American Control Conference, Louisiana, New Orleans, US, May 26-28, 2021*.

20. T. Tamba and **B. Hu**, "On A Notion of Stochastic Zeroing Barrier Function", *In The 2021 American Control Conference, Louisiana, New Orleans, US, May 26-28, 2021*.

19. T. Tamba, **B. Hu**, and Y. Nazaruddin, "On Event-Triggered Implementation of Moving Target Defense Control", *2020 International Federation of Automatic Control (IFAC-V 2020)*, Germany, July 11-17, 2020.

18. T. Tamba, **B. Hu**, and Y. Nazaruddin, "An Actuator Intrusion Detection Mechanism for Event-Triggered Moving Target Defense Control", *2019 IEEE 6th Asian Conference on Defense Technology (ACDT 2019)*, Bali, Indonesia, November 13-15, 2019.

17. **Hu, B.**, S. Hsiung and M. Kersey, "Design a Portable Sensing Platform with a Lidar and TI ARM M4 Controller", *2019 ASEE Annual Conference & Exposition (ASEE 2019)*, Tampa, Florida, June, 2019.

16. Chen, J., S. Mishler and **B. Hu**, "Conveying Automation Reliability and Automation Error Type An Empirical Study in the Cyber Domain", *Proceedings of the Human Factors and Ergonomics Society 62nd International Annual Meeting (HFES 2018)*. Philadelphia, US, October, 2018.

15. Tamba, T.A., Nazaruddi,n Y.Y., and **B. Hu**, "Resilient Control Under Denial-of-Service via Dynamic Event Triggering," *The 2017 Asian Control Conference (ASCC 2017)*, Gold Coast, December 17-20, 2017.

14. Samiei, A., **B. Hu**, S.Y., Zhao and L. Sun, "A Decision-Making Framework for Resilient Multi-Agents Unmanned Aircraft Systems in Risky Communication Scenarios," *AIAA Science and Technology Forum and Exposition*, Kissimmee, Florida, January, 2018.

13. **Hu, B.** and J. Chen, "Optimal Task Allocation for Human-Machine Collaborative Manufacturing Systems", *The 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2017)*, Vancouver, Canada, September 24-28, 2017.

12. Sun, L., **B. Hu** and S.Y. Zhao. "An Event-Triggering-Based Approach for Three-Dimensional Local-Level Frame Formation Control of Leader-Follower UAVs," *The 2017 International Conference on Unmanned Aircraft Systems, ICUAS'17*, June, 2017.

11. Sabic, E., Chen, J., Mishler, S., **Hu, B.** "Recognition of Car Warnings: An Analysis of Various Alert Types," *Proceedings of 2017 ACM Conference Extended Abstracts on Human Factors in Computing Systems (**CHI 17**)*. (**38.7% acceptance rate**)

10. Wu, B., **B. Hu** and H. Lin. "Toward Efficient Manufacturing Systems: A Trust Based Human Robot Collaboration," The 2017 *American Control Conference*, May 24-26, Seattle, WA, USA.

9. Mishler, S., Chen, J., Sabic, E., **Hu, B.**, Li, N., and Proctor, R. W. "Description-Experience Gap: The Role of Feedback and Description in Human Trust in Automation," *The 8th International Conference on Applied Human Factors and Ergonomics (AHFE 2017)*, Los Angeles, CA, USA, July 17-21, 2017.

8. Sun, L. and **B. Hu**. "Event-triggering in Three-dimensional Leader-follower Formation Control for Unmanned Aerial Vehicles." *The ASME 2016 Dynamic Systems and Control Conference (DSCC)*, October, 2016.

7. **Hu, B.** and M.D. Lemmon. "Event triggering in Vehicular Networked Systems with Limited Bandwidth and Deep Fading." In: *Proceedings of the 53rd IEEE Annual Conference on Decision and Control (CDC 14)*, December, 2014. (**Invited Paper**)

6. **Hu, B.** and M.D. Lemmon. "Distributed Switched Supervisory Control to Achieve Almost Sure Safety for a Class of Interconnected Networked Systems." In: *Proceedings of the 11th International Conference on Control & Automation (ICCA 14)*, June, 2014.

5. **Hu, B.** and M.D. Lemmon. "Distributed Switching Control to Achieve Resilience to Deep Fades in Leader-follower Nonholonomic Systems." In: *Proceedings of the 3rd ACM International Conference on High Confidence Networked Systems (HiCoNS 14)*, April, 2014.

4. **Hu, B.** and M.D. Lemmon. "Using Channel State Feedback to Achieve Resilience to Deep Fades in Wireless Networked Control Systems." In: *Proceedings of the 2nd ACM International Conference on High Confidence Networked Systems (HiCoNS 13)*, April, 2013.

3. Li, L.C., **B. Hu** and M.D. Lemmon. "Resilient Event Triggered Systems with Limited Communication." In: *Proceedings of the 51st IEEE Annual Conference on Decision and Control (CDC 12)*, December, 2012. (**Invited Paper**)

2. **Hu, B.**, Z.S. Fei, Z. Zhao and J. Liang. "Multi-loop Nonlinear IMC Strategy Design Under PLS framework Using ARX-Neural Network Model." In: *Proceedings of 8th World Congress on Intelligent Control and Automation (WCICA 10)*, July, 2010.

1. Shi, X.R., J. Liang, L.B. Ye and **B. Hu.** "A Method of Fault Diagnosis based on PCA and Bayes Classification." In: *Proceedings of 8th World Congress on Intelligent Control and Automation (WCICA 10)*, July, 2010.

Presentations/Invited Talks

8. **Hu, B.**, "Toward Safe and Secure Vehicular Networked Systems", *Department of Cyber Security Engineering, Invited Talk, George Mason University*, March, 2021.

7. **Hu, B.**, "Resilient Vehicular Networked Control System: Cybersecurity and Safety", *Department of Electrical and Computer Engineering, Invited Talk, Old Dominion University*, January, 2021.

6. **Hu, B.**, "Resilient Vehicular Networked Control System: Theories and Applications", *Department of Electrical and Computer Engineering, Graduate Seminar, Old Dominion University*, 2019.

5. **Hu, B.**, "Resilient Vehicular Networked Control System", *Department of Engineering Technology, Old Dominion University*, 2017.

4. **Hu, B.**, "Resilient Vehicular Networked Systems: Theories and Applications", *Klipsch School of Electrical & Computer Engineering, New Mexico State University*, Seminar, 2016.

3. **Hu, B.**, "Event triggering in Vehicular Networked Systems with Limited Bandwidth and Deep Fading.", In: *Proceedings of the 53rd IEEE Annual Conference on Decision and Control (CDC 14)*, December, 2014.

2. **Hu, B.**, "Resilient Event Triggered Systems with Limited Communication", In: *the* 1^{st} *Midwest Workshop on Control and Game Theory*, University of Illinois at Urbana-Champaign, April 2012.

1. **Hu, B.**, "Resilient Leader Follower Formation Control for Nonholonomic Systems Using Channel State Feedback", In: *the* 2^{nd} *Midwest Workshop on Control and Game Theory*, University of Notre Dame, April 2013.

Papers under Revision or Submitted

1. **B. Hu** and T. Tamba, "Co-design of Optimal Transmission Power and Controller for Networked Control Systems Under State-dependent Markovian Channels", submitted to *IEEE Transactions on Automatic Control*, 2020.

Teaching/Advising Experience

Old Dominion University, Norfolk, Virginia

Instructor, EET 110, Electrical Circuits I, Spring '18, Spring '19, Spring '20

Instructor, EET 120, Logic Circuits and Microprocessors, Fall 18', Fall 19'

Instructor, EET 125, Logic Circuits and Microprocessors Lab, Fall 18'

Instructor, EET 200, Electrical Circuits II, Fall 18', Fall 19', Fall 20'

Instructor, EET 205, Electrical Circuits Lab, Fall 17', Fall 18', Fall 20'

Instructor, EET 225, Electronics Laboratory, Spring 19'.

Instructor, EET 305, Advanced Technical Analysis, Fall 17', Spring 18', Spring 19'.

Instructor, EET 330, Linear Electronics, Spring 18', Summer 18', Spring 19', Summer 19', Summer 20'

Instructor, EET 335, Linear Electronics Lab, Summer 18', Summer 19'.

Instructor, EET 365W, Electrical Power and Machinery Laboratory, Fall 17'.

Instructor, ENGT 434, Introduction to Senior Project, Spring 20'

Advisor, Undergraduate Senior Project, Fall 18', Spring 19', Fall 19', Spring 20', Fall 20'.

New Mexico State University, Las Cruces, New Mexico

Guest Instructor, EE 501: Research Topics in ECE

University of Notre Dame, Notre Dame, Indiana

Teaching Assistant, EE 47012: Audio Technology, Fall 13'

Lab Teaching Assistant, EE 20222: Introduction to Electrical Engineering, Fall 10'.

Dissertation and Thesis

Ph.D. Dissertation: "Stochastic Safety and Efficiency for Vehicular Networked Systems: Theories and Applications". Department of Electrical Engineering, The University of Notre Dame.

Advisor: Dr. Michael D. Lemmon.

Thesis Committee Members: Dr. Vijay Gupta, Dr. Panos Antsaklis, and Dr. Hai Lin

Contributed Funding Contracts

1. Contributed as a Ph.D. student (**Team Leader**) to the proposal: Michael Lemmon (PI), Hai Lin and J. Nicholas Laneman, "Resilient Wireless Sensor Actuator Networks", CPS: Synergy, NSF-CNS $1,192,000, 2012-2015, awarded.

Supervised Students

Undergraduate Students

10. Victor Ortiz, EET program (ODU), advised, graduated in December 2018.
Senior Project: "Facial Detection on a Raspberry Pi 3 Robotic Neck"

9. Matthew Kersey, EET program (ODU), co-advised, graduated in May 2019.
Group Senior Project: "Design an Embedded Portable Platform of Lidar and Peripherals for Unmanned Aerial Systems", funded by 2019 RSLP ONR project at ODU.

8. Bryan Holland, EET program (ODU), co-advised, graduated in May 2019.
Group Senior Project: "Design an Embedded Portable Platform of Lidar and Peripherals for Unmanned Aerial Systems", funded by 2019 RSLP ONR project at ODU.

7. Thomas Sexton, EET program (ODU), advised, graduated in May 2019.
Group Senior Project: "Design an Embedded Portable Platform of Lidar and Peripherals for Unmanned Aerial Systems", funded by 2019 RSLP ONR project at ODU.

6. Zachariah Garvin, EET program (ODU), advised, graduates in May 2019.
Group Senior Project: "Design an Embedded Portable Platform of Lidar and Peripherals for Unmanned Aerial Systems", funded by 2019 RSLP ONR project at ODU.

5. Teresa Trinh, MET program (ODU), co-advised, graduates in May 2019.
Group Senior Project: "Design an Embedded Portable Platform of Lidar and Peripherals for Unmanned Aerial Systems", funded by 2019 RSLP ONR project at ODU.

4. Andrew Vecerkauskas, EET program (ODU), advised, graduated in May 2020. Senior Project: "Robotic Operation Systems and LiDAR Vulnerabilities", funded by 2019 undergraduate cybersecurity research program at ODU.

3. Jeremy Sklute, EET program (ODU), advised, graduated in 2020. Senior Project: "Redesign of Wireless light system used by Monarch athletic bands in performance(s)"

2. Joshua Smith, EET program (ODU), advised, graduated in 2021. Senior Project: "LiDAR Implementation with Turtlebot", funded by NSF project.

1. Kristof Siska, EET program (ODU), advised, to be graduated in 2023.

Awards

"Department Fellowship" award, University of Notre Dame, 2010.

"Second Prize Scholarship" award, Zhejiang Univeristy, 2009.

"Excellent Undergraduate Thesis" award , Hefei University of Technology, 2007.

"First Class Excellent Academic Scholarship" award (top 3%), Hefei University of Technology, 2006.

Professional Service

Reviewer

Journals

IEEE Transactions on Automatic Control
Automatica
Robotics
Journal of Intelligent & Robotic Systems
IEEE Transactions on Automation Science and Engineering
Journal of Process Control

Journal of Intelligent and Robotic Systems
IEEE Transactions on Cognitive Communications and Networking
IEEE Transactions on Intelligent Transportation System
IEEE Transactions on Vehicular Technology
IEEE Transactions on Circuits and Systems II: Express Briefs

Conferences

IEEE American Control Conference (ACC)
IEEE Conference on Decision and Control (CDC)
IEEE International Conference on Control & Automation (ICCA)

Membership

IEEE, IEEE Robotics and Automation Society, IEEE Control Systems Society.

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