

QIUGANG (JAY) LU

PO Box 43121, Lubbock, TX, 79409-3121 **Mobile:** (806)742-3552 **Email:** jay.lu@ttu.edu

EDUCATION

- University of British Columbia (UBC)** 2013.09 – 2018.01
Ph.D. in Department of Chemical and Biological Engineering Vancouver, Canada
- Dissertation: *Adaptive Model-Predictive Control and Its Applications in Paper-Making Processes*
 - Advisors: Prof. R. Bhushan Gopaluni and Prof. Philip D. Loewen
- Harbin Institute of Technology (HIT)** 2011.08 – 2013.07
M.Sc. in Department of Control Science and Engineering Harbin, China
- Advisor: Prof. Lixian Zhang
- Harbin Institute of Technology** 2007.09 – 2011.07
B.Eng. in Department of Control Science and Engineering Harbin, China

PROFESSIONAL EXPERIENCE

- Texas Tech University**, Lubbock, TX 2020.08 – Present
Visiting Assistant Professor in Department of Chemical Engineering
- University of Wisconsin – Madison**, Madison, WI 2019.06 – 2020.08
Postdoctoral Research Associate in Department Chemical & Biological Engineering
- Principal investigator: Professor Victor M. Zavala
 - Spatial-temporal image data analytics and modeling with dimensionality reduction methods
 - Data-driven model-predictive control with reduced-order dynamic systems
- General Motors of Canada Company**, Toronto, Canada 2018.01 – 2019.03
Vehicle Health Management (VHM) Engineer in Canadian Technical Centre
- VHM algorithm development with signal processing and first principles
 - Validation and refinement of VHM algorithms using machine learning techniques
 - Driver behavior monitoring using classifications to identify lane changes with vehicle signals
- Massachusetts Institute of Technology**, Cambridge, MA 2017.03 – 2017.09
Visiting Ph.D. Student in Department of Chemical Engineering
- Advisor: Professor Richard Braatz
 - Sparse and locality preserving latent variable methods for fault detection
 - Multivariate statistics and Bayesian statistics for process monitoring
 - Information-theoretic fault diagnosis
- University of British Columbia**, Vancouver, Canada 2013.09 – 2018.01
Ph.D. Student in Department Chemical & Biological Engineering
- Control performance monitoring for spatially distributed processes
 - Model quality monitoring and assessment for model-predictive control
 - Closed-loop identification and optimal input design
 - Linear and nonlinear model-predictive control for mechanical pulping processes
- Harbin Institute of Technology**, Harbin, China 2011.08 – 2013.07
M.Sc. Student in Department of Control Science and Engineering
- H_∞ control approach for switched LPV systems
 - Control design for networked switched (LPV) systems with imperfect communications

HONORS AND AWARDS

- John Grace Graduate Scholarship, UBC 2017.02
- Research Activity Travel Fund (IEEE Control Decision Conference), UBC 2016.12
- Self-directed Research Abroad Award with MIT, UBC 2016.10

- Vanier Canada Graduate Scholarship, Government of Canada 2015.06
- Best Presenter Award, PACWEST Conference 2015.06
- Four Year Fellowship, UBC 2014.09
- Best Provincial Graduate Student Award, Heilongjiang Province 2013.04

TEACHING EXPERIENCE

Texas Tech University, Lubbock, TX August 2020 – Present

Instructor in Department of Chemical Engineering

- CHE 4353 Process Control
- CHE 4232 Unit Operations Lab (jointly with other instructors)

University of British Columbia, Vancouver, Canada 2014 – 2015

Teaching Assistant in Department of Chemical & Biological Engineering

- CHBE 356 Process Dynamics and Control Spring 2015
- CHBE 244 Thermodynamics I Spring 2014

PATENTS

- [P1] **Qiugang Lu**, R.B. Gopaluni, M. Forbes, P.D. Loewen, J. Backstrom and G. Dumont. "Model-plant mismatch detection using model parameter data clustering for paper machines or other systems." US20180081328A1, publication on March 22, 2018.
- [P2] **Qiugang Lu**, L.D. Rippon, R.B. Gopaluni, M. Forbes, P.D. Loewen, J. Backstrom and G. Dumont. "Closed-loop model parameter identification techniques for industrial model-based process controllers." EP3296821A2, publication on March 21, 2018.
- [P3] **Qiugang Lu**, R.B. Gopaluni, M. Forbes, P.D. Loewen, J. Backstrom and G. Dumont. "Model-plant mismatch detection with support vector machine for cross-directional process behavior monitoring." EP3296823A2, publication on March 21, 2018.
- [P4] **Qiugang Lu**, R.B. Gopaluni, M. Forbes, P.D. Loewen, J. Backstrom and G. Dumont. "Optimal closed-loop input design for identification of flat-sheet process models." US20170261963A1, publication on September 14, 2017.

JOURNAL PUBLICATIONS

- [J1] **Qiugang Lu**, R.B. Gopaluni, M.G. Forbes, P.D. Loewen, J.U. Backstrom, and G.A. Dumont. "Support vector machine approach for model-plant mismatch detection." *Computers & Chemical Engineering*, 106660, 2020.
- [J2] **Qiugang Lu**, B. Jiang, and E. Harinath. "Fault diagnosis in industrial processes by maximizing pairwise Kullback-Leibler divergence." *IEEE Transactions on Control Systems Technology*, accepted, DOI: 10.1109/TCST.2019.2950403, 2019.
- [J3] **Qiugang Lu**, P.D. Loewen, R.B. Gopaluni, M.G. Forbes, J.U. Backstrom, G.A. Dumont, and M.S. Davies. "Identification of symmetric noncausal processes." *Automatica*, 103: 515-530, 2019.
- [J4] B. Jiang, Y. Luo, and **Qiugang Lu**. "Maximized mutual information analysis based on stochastic representation for process monitoring." *IEEE Transactions on Industrial Informatics*, 15(3): 1579-1587, 2019.
- [J5] L. Rippon, **Qiugang Lu**, R.B. Gopaluni, M.G. Forbes, P.D. Loewen, and J.U. Backstrom. "Machine direction adaptive control on a paper machine." *Industrial & Engineering Chemistry Research*, 58(26), 11452-11473, 2019.
- [J6] H. Tian, **Qiugang Lu**, R.B. Gopaluni, V.M. Zavala, and J.A. Olson. "An economic MPC framework for mechanical pulping processes." *Control Engineering Practice*, 85: 100-109, 2019.

- [J7] **Qiugang Lu**, B. Jiang, R.B. Gopaluni, P.D. Loewen, R.D. Braatz. "Locality preserving discriminative canonical variate analysis for fault diagnosis." *Computers & Chemical Engineering*, 117(2): 309-319, 2018.
- [J8] **Qiugang Lu**, B. Jiang, R.B. Gopaluni, P.D. Loewen, R.D. Braatz. "Sparse canonical variate analysis approach for process monitoring." *Journal of Process Control*, 70(1): 90-102, 2018.
- [J9] **Qiugang Lu**, M. Forbes, R.B. Gopaluni, P.D. Loewen, J.U. Backstrom, G.A. Dumont. "Performance assessment of cross-directional control for paper machines." *IEEE Transactions on Control Systems Technology*, 25(1): 208-221, 2017.
- [J10] **Qiugang Lu**, L. Zhang, H.R. Karimi, and Y. Shi. " H_∞ control for asynchronously switched linear parameter-varying systems with mode-dependent average dwell time." *IET Control Theory & Applications*, 7(5): 673-683, 2013.
- [J11] **Qiugang Lu**, L. Zhang, P. Shi, and H.R. Karimi. "Control design for a hypersonic aircraft using a switched linear parameter-varying system approach." *Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering*, 227(5): 85-95, 2013.
- [J12] J. Qiu, H. Tian, **Qiugang Lu**, and H. Gao. "Nonsynchronized robust filtering design for continuous-time T-S fuzzy affine dynamic systems based on piecewise Lyapunov functions." *IEEE Transactions on Cybernetics*, 43(6): 1755-1766, 2013.
- [J13] **Qiugang Lu**, H.R. Karimi, and K.G. Robbersmyr. "A data-based approach for modeling and analysis of vehicle collision by LPV-ARMAX models." *Journal of Applied Mathematics*, 1(1): 1-9, 2013.
- [J14] **Qiugang Lu**, L. Zhang, M. Basin, and H. Tian. "Analysis and synthesis for networked control systems with uncertain rate of packet losses." *Journal of the Franklin Institute*, 349(7): 2500-2514, 2012.

JOURNAL PAPERS UNDER REVIEW

- [J15] **Qiugang Lu**, R.B. Gopaluni, M. Forbes, P.D. Loewen, J. Backstrom and G. Dumont. "Model-plant mismatch detection for cross-directional processes." Under review, 2020.
- [J16] **Qiugang Lu**, and V.M. Zavala. "Image-Based Model Predictive Control via Dynamic Mode Decomposition." Under review, 2020.
- [J17] S. Shin, **Qiugang Lu**, and V.M. Zavala. "Unifying Theorems for Subspace Identification and Dynamic Mode Decomposition." Under review, 2020.

CONFERENCE PUBLICATIONS

- [C1] **Qiugang Lu**, S. Shin, and V.M. Zavala. "Characterizing the predictive accuracy of dynamic mode decomposition for data-driven control." In *21st IFAC World Congress*, Berlin, Germany, July 12-17, 2020.
- [C2] Y. Tsai, **Qiugang Lu**, L. Rippon, C.S. Lim, A. Tulsyan, and B. Gopaluni. "Knowledge extraction using process data analytics: A tutorial." In *10th IFAC International Symposium on Advanced Control of Chemical Processes*, Shenyang, China, 2018.
- [C3] **Qiugang Lu**, L. Rippon, R.B. Gopaluni, M.G. Forbes, P.D. Loewen, J. Backstrom, and G.A. Dumont. "Noncausal modeling and closed-loop optimal input design for cross-directional processes of paper machines." In *American Control Conference*, Seattle, WA, 2017.
- [C4] **Qiugang Lu**, R.B. Gopaluni, M.G. Forbes, P.D. Loewen, J. Backstrom, and G.A. Dumont. "Model-plant mismatch detection with support vector machines." In *IFAC World Congress*, Toulouse, France, 2017.
- [C5] H. Tian, **Qiugang Lu**, R.B. Gopaluni, V. Zavala. "Multiobjective economic model predictive control of mechanical pulping processes." In *IEEE 55th Conference on Decision and Control (CDC)*, Las Vegas, NV, 2016.

- [C6] **Qiugang Lu**, L. Rippon, R.B. Gopaluni, M.G. Forbes, P.D. Loewen, J. Backstrom, and G.A. Dumont. "Cross-directional controller performance monitoring for paper machines." In *American Control Conference*, Chicago, IL, 2015.
- [C7] M. Yousefi, **Qiugang Lu**, R.B. Gopaluni, P.D. Loewen, M.G. Forbes, G.A. Dumont, J. Backstrom. "Detecting model-plant mismatch without external excitation." In *American Control Conference*, Chicago, IL, 2015.
- [C8] H. Tian, **Qiugang Lu**, R.B. Gopaluni, V. Zavala. "Economic nonlinear model predictive control for mechanical pulping processes." In *American Control Conference*, Boston, MA, 2016.
- [C9] **Qiugang Lu**, L. Zhang, Q. Zhang, and H.R. Karimi. "Stability analysis and controller design for a class of T-S fuzzy Markov jump system with uncertain expectation of packet dropouts." In *American Control Conference*, Washington, DC, 2013.

BOOKS

- [B1] L. Zhang, Y. Zhu, P. Shi, and **Qiugang Lu**. *Time-Dependent Switched Discrete-Time Linear Systems: Control and Filtering*. Springer International Publishing, 2016.

PRESENTATIONS

- "Characterizing the predictive accuracy of dynamic mode decomposition for data-driven control." In 2020 IFAC World Congress, Berlin, Germany, July 12-17, 2020.
- "MPC with dynamic mode decomposition." In 2020 TWCCC, February 24-25, 2020.
- "Learning to control: leveraging industrial data assets." Michigan Tech University, March 26, 2019.
- "Detecting model-plant mismatch without external excitation." In 2015 American Control Conference, Chicago, IL, July 1-3, 2015.
- "Performance monitoring for the cross-directional process of paper machines." Best Presenter Award. In 2015 PCAWEST Conference, Whistler, BC, June 13, 2015.
- "An adaptive control strategy for the paper machine." Pulp and Paper Center 30th Anniversary Open House, UBC, 2016.

PROFESSIONAL ACTIVITIES

- **Reviewer of Academic Journals** 2011.08 – Present
IEEE Transactions on Automatic Control, Automatica, IEEE Transactions on Industrial Informatics, IEEE Transactions on Cybernetics, Journal of the Franklin Institute (**outstanding reviewer award 2017**), Journal of Process Control, Neurocomputing, Circuits, Systems & Signal Processing (CSSP), IET Control Theory & Applications, International Journal of Robust and Nonlinear Control, Journal of Dynamic Systems, Measurement and Control, Nonlinear Analysis: Hybrid Systems
- **Reviewer of International Conferences** 2014.06 – Present
 - IFAC Symposium on System Identification, American Control Conference, IFAC World Congress, International Symposium on Advanced Control of Industrial Processes (AdCONIP), IEEE Canadian Conference on Electrical and Computer Engineering, IEEE Multi-conference on Systems and Control, Asia Control Conference
- **Service and Activities in Academia** 2010 – Present
 - Chair of Nonlinear MPC Session, the 55th IEEE CDC, 2016
 - Coordinator and Volunteer, the 9th IEEE International Symposium on ADCHEM, 2015

LEADERSHIPS

- Vice President, Thunderbird Residence Association, UBC
- UBC Graduate Student Seminar, Volunteer