

# YU LUO

GSK | Date modified: January 18, 2023

## EDUCATION AND TRAINING

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<b>University of Delaware, College of Engineering</b> Postdoctoral Researcher, Chemical Engineering	01/2021
<b>Columbia University, Graduate School of Arts and Sciences</b> Doctor of Philosophy, Chemical Engineering	02/2017
<b>Columbia University, Fu Foundation School of Engineering and Applied Science</b> Master of Science, Chemical Engineering <b>Full GPA</b>	05/2012
<b>National University of Singapore, Faculty of Engineering</b> Bachelor of Engineering, Chemical Engineering <b>First Class Honors</b>	06/2011

## TECHNICAL STRENGTHS

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<b>Language</b>	Python, R, MATLAB, JavaScript, SQL, Lisp, HTML, L <sup>A</sup> T <sub>E</sub> X
<b>Software</b>	SIMCA, Simulink, COMSOL, NetLogo, Aspen HYSYS
<b>Creative</b>	Photoshop, Illustrator, graphic design, portrait painting, musical composition

## EXPERIENCE

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<b>GSK, Biopharm Drug Substance Process Development</b> <i>Investigator, Associate Fellow, Chemometrics &amp; Process Modeling Expert</i>	02/2021–Present <i>King of Prussia, PA</i>
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- **Managers:** Dr. Sameer Talwar and Dr. Diana Ritz
- Led a matrix team to industrialize and expand the value-added applications of Raman spectroscopy
- Demonstrated Raman-based glucose control in a 1000-L bioreactor for the first time
- Developed a hybrid growth model and cell density forecast tool for a commercial manufacturing process
- Improved process productivity systematically and substantially using designs of dynamic experiments
- Developed chemometric and dynamic models for process analytics, optimization, and control
- Created designs of dynamic experiments for the optimization of time-varying feeding strategies
- Automated the workflow of developing Raman models
- Created, validated, and maintained Raman models for multiple assets
- Expanded the capability of Raman-based process control to lower-than-typical setpoints
- Analyzed omics data algorithmically to understand cell's metabolic responses to external stimuli
- Supervised junior scientists to develop chemometric and dynamic process models

<b>University of Delaware, Chemical and Biomolecular Engineering</b> <i>Postdoctoral Researcher</i>	06/2017–01/2021 <i>Newark, DE</i>
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- **Advisors:** Prof. Babatunde A. Ogunnaike and Prof. Kelvin H. Lee
- Specialized in modeling and control of different biological processes using systems engineering techniques
- Developed a hybrid mAb glycosylation model in close collaboration with Janssen (J&J Pharmaceuticals)
- Designed and implemented a model-based mAb glycosylation control system (CMU/JHU collaboration)
- Developed a cell signaling model for optimal control-based cancer treatment (UVA collaboration)
- Developed a kinetics-based, data-driven COVID-19 model for optimal control-based rational mitigation
- Supervised an undergraduate project on modeling cell culture dynamics and parameter estimation
- Presented research at invited seminars and at CCE, ACS, GRC, CSBC, and AIChE conferences

- **Advisors:** Prof. Venkat Venkatasubramanian and Prof. Garud Iyengar (Operations Research)
- Specialized in managing systemic risk and modeling social dynamics via systems engineering and AI
- Developed a control-theoretic opinion dynamics model, validated via human-subject experiments
- Developed an optimal control-based framework for improving multi-stakeholder decision-making
- Developed an open data-driven, early-warning system to predict and prevent mining accidents
- Developed an income distribution model using statistical mechanics and population game theory
- Developed systemic financial risk models with executives from Prudential Finance and PNC Bank
- Developed an agent-based model to understand high-frequency trading and its market impact
- Identified vulnerabilities in financial networks using process hazard analysis techniques
- Led multiple interdisciplinary research projects and supervised graduate and undergraduate teams
- Received extensive training in computer science and operations research

## PUBLICATIONS

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12. Yu Luo, Johanna Vappiani, Keegan Orzechowski, Pramthesh Patel, Daniel Sevin, and Juan Aon. Metabolic rewiring revealed by cell-specific rate analyses from nontargeted exometabolomics during simultaneous consumption of glucose and lactic acid in a CHO fed-batch process. *Journal of Biotechnology*, 359:161–175, 2022
11. Yu Luo, Varghese Kurian, and Babatunde A. Ogunnaike. Bioprocess systems analysis, modeling, estimation, and control. *Current Opinion in Chemical Engineering*, 33:100705, 2021
10. Yu Luo, Robert J. Lovelett, J. Vincent Price, Devesh Radhakrishnan, Kristopher Barnhouse, Ping Hu, Eugene Schaefer, John Cunningham, Kelvin H. Lee, Raghunath B. Shivappa, and Babatunde A. Ogunnaike. Modeling the effect of amino acids and copper on monoclonal antibody productivity and glycosylation: A modular approach. *Biotechnology Journal*, 16(2):2000261, 2021
9. Evan Wells, Liqing Song, Madison Greer, Yu Luo, Varghese Kurian, Babatunde A. Ogunnaike, and Anne S. Robinson. Media supplementation for targeted manipulation of monoclonal antibody galactosylation and fucosylation. *Biotechnology and Bioengineering*, 117(11):3310–3321, July 2020
8. Venkat Venkatasubramanian and Yu Luo. How much income inequality is fair? Nash bargaining solution and its connection to entropy. In Anindya Chakrabarti, Lukas Pichl, and Taisei Kaizoji, editors, *Network Theory and Agent-Based Modeling in Economics and Finance*, pages 159–174. Springer, Singapore, December 2019
7. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. A one-third advice rule based on a control-theoretic opinion dynamics model. *IEEE Transactions on Computational Social Systems*, 6(3):576–581, June 2019
6. Venkat Venkatasubramanian, Yu Luo, and Zhizun Zhang. Control of complex sociotechnical systems: importance of causal models and game theory. *Computers & Chemical Engineering*, 123:1–11, April 2019
5. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. Social influence makes self-interested crowds smarter: an optimal control perspective. *IEEE Transactions on Computational Social Systems*, 5(1):200–209, March 2018
4. Garud Iyengar, Yu Luo, Shivaram Rajgopal, Venkat Venkatasubramanian, and Zhizun Zhang. Towards a financial statement based approach to modeling systemic risk in insurance and banking. *Columbia Business School Research Paper*, 17(177), July 2017. Available at SSRN. **Featured by the “SSRN Top Ten List” in Banking and Insurance, Risk Management and Analysis in Financial Institutions, Risk Management, and Financial Crises categories**

3. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. Soft regulation with crowd recommendation: coordinating self-interested agents in sociotechnical systems under imperfect information. *PLoS ONE*, 11(3):e0150343, March 2016
2. Venkat Venkatasubramanian, Yu Luo, and Jay Sethuraman. How much inequality in income is fair? A microeconomic game theoretic perspective. *Physica A: Statistical Mechanics and its Applications*, 435:120–138, October 2015. **Featured by the “ScienceDirect Top 25 List of Most Downloaded Articles”**
1. Richard Bookstaber, Paul Glasserman, Garud Iyengar, Yu Luo, Venkat Venkatasubramanian, and Zhizun Zhang. Process systems engineering as a modeling paradigm for analyzing systemic risk in financial networks. *The Journal of Investing*, 24(2):147–162, May 2015

## PRESENTATIONS

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29. Yu Luo, Duane Stanton, Rachel Sharp, Kelsey Morgan, and Alexis Parrillo. How to win “20 questions” in process development using a design of dynamic experiments. In *IFPAC 2023*, North Bethesda, MD, June 2022. Oral presentation
28. Yu Luo. What does the cell say? How to be a better “listener” and “motivate” cells to work harder through advanced data analytics and modeling approaches. In *GSK BPD Science Symposium (Internal)*, King of Prussia, PA, November 2021. Oral presentation
27. Yu Luo. Model-based control of biological processes: systems engineering in biomanufacturing. In *Chemical Engineering Future Faculty Seminar Series*, Santa Barbara, CA, December 2020. Oral presentation
26. Yu Luo, Varghese Kurian, Janine Buonato, Matthew J. Lazzara, and Babatunde A. Ogunnaike. Model-based approach for multivariate signaling regulation of epithelial-mesenchymal transition in pancreas cancer cells. In *AIChE Annual Meeting*, San Francisco, CA, November 2020. Oral presentation
25. Yu Luo. Model-based control of biological processes: systems engineering in biomanufacturing and cancer treatment. In *AIChE Annual Meeting*, San Francisco, CA, November 2020. Poster presentation
24. Yu Luo. Model-based control of biological processes: systems engineering in biomanufacturing and cancer treatment. GSK, King of Prussia, PA, October 2020. Invited seminar
23. Yu Luo, Varghese Kurian, Janine Buonato, Matthew J. Lazzara, and Babatunde A. Ogunnaike. Model-based approach for multivariate signaling regulation of epithelial-mesenchymal transition in pancreas cancer cells. In *CSBC Annual Investigators Meeting*, Bethesda, MD, September 2020. Poster presentation
22. Yu Luo, Devesh Radhakrishnan, Evan Wells, Deepto Banerjee, Liqing Song, Varghese Kurian, Anne S. Robinson, and Babatunde A. Ogunnaike. Control of glycosylation and titer in fed-batch monoclonal antibody production. In *Cell Culture Engineering XVII*, Tucson, AZ, April 2020. Poster presentation (rescheduled due to COVID-19)
21. Yu Luo, Devesh Radhakrishnan, Evan Wells, Deepto Banerjee, Liqing Song, Varghese Kurian, Anne S. Robinson, and Babatunde A. Ogunnaike. Control of glycosylation and titer in fed-batch monoclonal antibody production. In *ACS National Meeting & Expo*, Philadelphia, PA, March 2020. Oral presentation (rescheduled due to COVID-19)
20. Yu Luo. Smart biomanufacturing and smarter crowds: a process systems engineering + artificial intelligence approach. Purdue University, West Lafayette, IN, January 2020. Invited seminar
19. Yu Luo. Smart biomanufacturing and smarter crowds: a process systems engineering + artificial intelligence approach. Clemson University, Clemson, SC, January 2020. Invited seminar

18. Yu Luo, Devesh Radhakrishnan, Anne S. Robinson, and Babatunde A. Ogunnaike. Control of glycosylation and titer in fed-batch monoclonal antibody production. In *AIChE Annual Meeting*, Orlando, FL, November 2019. Oral presentation
17. Yu Luo. Systems approach to advanced decision-making in chemical engineering, biomanufacturing, and society. In *AIChE Annual Meeting*, Orlando, FL, November 2019. Poster presentation
16. Yu Luo. Systems and advanced decisions: from biomanufacturing to opinion dynamics applications. Imperial College London, London, U.K., June 2019. Invited seminar
15. Yu Luo. Systems and advanced decisions: from biomanufacturing to opinion dynamics applications. Clarkson University, Potsdam, NY, June 2019. Invited seminar
14. Yu Luo, J. Vincent Price, Robert J. Lovelett, Devesh Radhakrishnan, Kristopher Barnthouse, Eugene Schaefer, John Cunningham, Ping Hu, Kelvin H. Lee, and Babatunde A. Ogunnaike. Multiscale modeling of antibody production and glycosylation for improved upstream process design. In *ACS National Meeting & Expo*, Orlando, FL, April 2019. Oral presentation
13. Yu Luo. Systems and advanced decisions: from biomanufacturing to opinion dynamics applications. Stevens Institute of Technology, Hoboken, NJ, March 2019. Invited seminar
12. Yu Luo. Systems and advanced decisions: from biomanufacturing to opinion dynamics applications. University of Waterloo, Waterloo, ON, Canada, March 2019. Invited seminar
11. Yu Luo, J. Vincent Price, Robert J. Lovelett, Devesh Radhakrishnan, Kristopher Barnthouse, Eugene Schaefer, John Cunningham, Ping Hu, Kelvin H. Lee, and Babatunde A. Ogunnaike. Multiscale modeling of antibody production and glycosylation for improved upstream process design. In *Biotherapeutics and Vaccines Development (Gordon Research Conference)*, Galveston, TX, January 2019. Poster presentation
10. Yu Luo, J. Vincent Price, Robert J. Lovelett, Devesh Radhakrishnan, Kristopher Barnthouse, Eugene Schaefer, John Cunningham, Ping Hu, Kelvin H. Lee, Raghunath B. Shivappa, and Babatunde A. Ogunnaike. Multiscale modeling of monoclonal antibody (mAb) production and glycosylation in a Chinese hamster ovary (CHO) cell culture process. In *AIChE Annual Meeting*, Pittsburgh, PA, October 2018. Oral presentation
9. Yu Luo. Process systems engineering and artificial intelligence for advanced manufacturing: including applications to biopharmaceuticals. In *AIChE Annual Meeting*, Pittsburgh, PA, October 2018. Poster presentation
8. Yu Luo, J. Vincent Price, Robert J. Lovelett, Devesh Radhakrishnan, Kristopher Barnthouse, Eugene Schaefer, John Cunningham, Ping Hu, Kelvin H. Lee, Raghunath B. Shivappa, and Babatunde A. Ogunnaike. Multiscale modeling of monoclonal antibody (mAb) production and glycosylation in a CHO cell culture process. In *AMBIC Semiannual Meeting*, Fremont, CA, June 2018. Poster presentation
7. Yu Luo, J. Vincent Price, Robert J. Lovelett, Devesh Radhakrishnan, Kristopher Barnthouse, Eugene Schaefer, John Cunningham, Ping Hu, Kelvin H. Lee, Raghunath B. Shivappa, and Babatunde A. Ogunnaike. Multiscale modeling of monoclonal antibody (mAb) production and glycosylation in a CHO cell culture process. In *Cell Culture Engineering XVI*, Tampa, FL, May 2018. Poster presentation
6. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. Control with soft feedback in social systems: mathematical principles, empirical evidence, and applications. In *AIChE Annual Meeting*, Minneapolis, MN, November 2017. Oral presentation
5. Yu Luo, Ashutosh Nanda, Shivaram Rajgopal, Vinay Ramesh, Zhizun Zhang, Catherine Zhao, and Venkat Venkatasubramanian. A data-driven early warning system for mining accidents. In

*Global Congress on Process Safety*, San Antonio, TX, March 2017. Oral presentation

4. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. The control of self-interested agents: learning from nature's wisdom of crowds. In *AIChE Annual Meeting*, San Francisco, CA, November 2016. Oral presentation. **Finalist and travel grant recipient for the AIChE CAST Division Director's Student Presentation Award**
3. Yu Luo, Richard Bookstaber, Paul Glasserman, Garud Iyengar, Zhizun Zhang, and Venkat Venkatasubramanian. Process systems engineering beyond chemical plants: signed digraph as a modeling tool for analyzing systemic risk in financial networks. In *AIChE Annual Meeting*, San Francisco, CA, November 2016. Oral presentation
2. Yu Luo. Process systems engineering beyond chemical plants. In *AIChE Annual Meeting*, San Francisco, CA, November 2016. Poster presentation
1. Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian. Soft regulation: coordinating distributed self-interested agents in sociotechnical systems. In *AIChE Annual Meeting*, Atlanta, GA, November 2014. Oral presentation

## TEACHING

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<b>Managing Systemic Risk in Complex Systems (Graduate)</b> Student Lecturer	Spring 2016 Columbia University
<b>Managing Systemic Risk in Complex Systems (Graduate)</b> Student Lecturer	Fall 2015 Columbia University
<b>Molecular Phenomena (Undergraduate)</b> Teaching Assistant	Spring 2012 Columbia University
<b>Thermodynamics (Undergraduate)</b> Teaching Assistant	Fall 2011 Columbia University

## PROFESSIONAL SERVICE

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<b>Various Research Journals and Conferences</b> <i>Reviewer</i>	12/2012–Present
<ul style="list-style-type: none"><li>· <i>Computers and Chemical Engineering</i>. <b>Recognized as an outstanding reviewer</b></li><li>· <i>Biotechnology and Bioengineering</i></li><li>· <i>IEEE Conference on Decision and Control</i></li><li>· <i>The Canadian Journal of Chemical Engineering</i></li><li>· <i>AIChE Journal</i></li><li>· <i>Scientific Reports</i></li><li>· <i>Frontiers Physiology</i></li><li>· <i>Metabolic Engineering Communications</i></li><li>· <i>Biotechnology Journal</i></li><li>· <i>Chemical Engineering Research and Design</i></li></ul>	
<b>AIChE</b> <i>Member, Session Chair</i>	11/2014–Present
<ul style="list-style-type: none"><li>· Served as session chair for the Pharmaceutical Discovery, Development, and Manufacturing Forum</li></ul>	
<b>Columbia University, Center for the Management of Systemic Risk</b> <i>Webmaster, Event Assistant, Graphic Designer</i>	12/2012–05/2017
<ul style="list-style-type: none"><li>· Designed print media, assisted organizing three university-level symposia</li></ul>	