

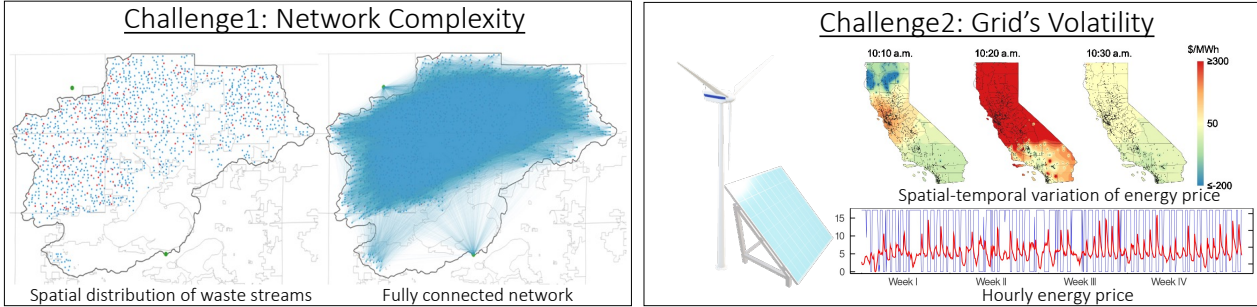
Jiaze Ma

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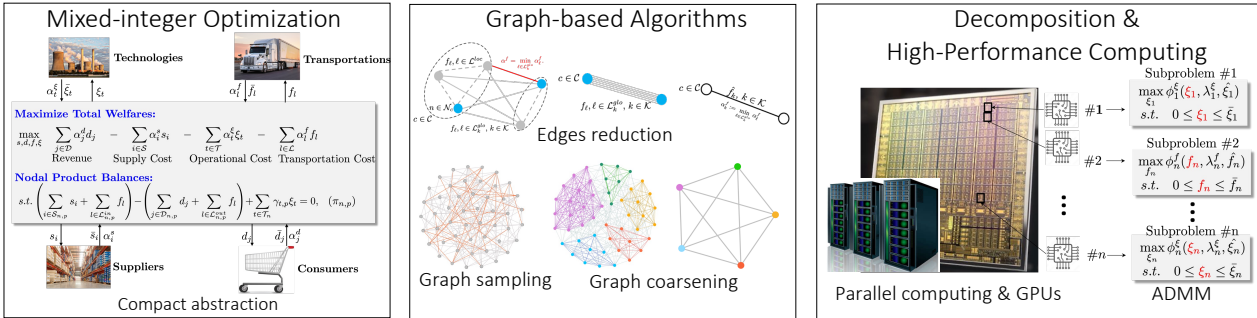
My research focuses on developing **optimization** models, theory, algorithms, and software to promote **sustainability** in the energy and environmental domains.

Motivation: waste management and energy transition need new decision-making tools



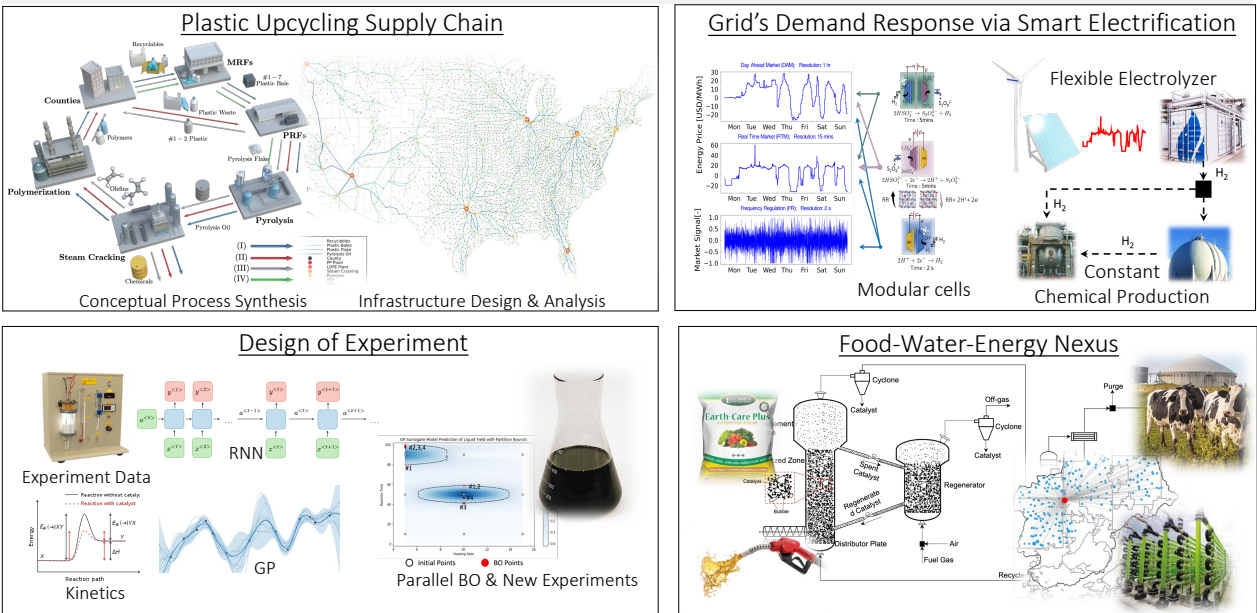
Goal: develop models, theory, algorithms for decision-makings & policy implications

Methodologies



Applications

Societal Impact: cleaner environments, circular economies, and stable energy systems



Education

University of Wisconsin-Madison

Sep.2019 - May.2024

Ph.D. Candidate in Chemical Engineering.

Minor in Computer Science

Thesis: Computational Strategies for Large-scale Supply Chain Networks

Thesis Advisor: Prof. Victor M. Zavala

China University of Petroleum

Sep.2012 - July.2019

B.S. & M.S. in Chemical Engineering.

Thesis: Industrial Cooling Water Systems Design and Optimization

Thesis Advisor: Prof. Yufei Wang & Prof. Xiao Feng

Research Interests

Large-Scale Optimization; Sustainability; Energy Systems

Research Experience

Research Assistant

2019 - 2024

University of Wisconsin-Madison, Madison, WI

Department of Chemical Engineering

Supervisor: Prof. Victor M. Zavala

- Led the study of *scalable decision-making in waste valorization*, a unified optimization framework for diverse problems.
- Develop a graph-sampling algorithm that tackles the complexity arising from the large-scale supply chain network embedded in waste valorization problems.
- Develop optimization frameworks that integrate smart electrification with manufacturing processes, offering grid flexibility and smoothing energy transition.

Research Intern

2022

Argonne National Laboratory, Lemont, IL

Mathematics and Computer Science Division

Supervisor: Dr. Kibaek Kim

- Develop a new decomposition algorithm and Julia package `ADMM_SC.jl` for solving large-scale LP/MIP problems featuring block structures
- Demonstrated the scalability of `ADMM_SC.jl` on GPUs with large-scale supply chain models

Research Intern

2018

Cornell University, Ithaca, NY

Department of Chemical Engineering

Supervisor: Prof. Fengqi You

- Develop a superstructure optimization paradigm that facilitates the automatic synthesis of chemical production processes
- Implement this paradigm for a process that recovers nutrient and energy from poultry waste

Research Assistant

2016 - 2019

China University of Petroleum, Beijing

Department of Chemical Engineering

Supervisor: Prof. Yufei Wang & Prof. Xiao Feng

- Develop computational frameworks for the optimal synthesis and operation of industrial cooling water systems
- Propose a new concept that enables the heat integration across multiple industrial zones through steam systems.

Industrial Experience

Research Engineer

2017

Sinopec & State Key Laboratory of Heavy Oil Processing, Beijing

Supervisor: Dr. Yufei Wang & Dr. Fuyu Liu

- Implement the cooling water system optimization frameworks at a Sinopec’s refinery for promoting the energy efficiency and reducing water consumption
- Collect on-site data, develop models, analyze results, propose retrofitting plans, and deliver regular progress reports to Sinopec’s managers

Teaching Experience

Optimization: Geometries, Algorithms and Applications, Instructor	Spring 2022
Process Design, Teaching Assistant	Fall 2021
Process Dynamics and Control, Teaching Assistant	Spring 2020

Mentoring Experience

Evan Erickson (undergrad)	2023
Project: Economic evaluation of the national plastic upcycling infrastructure [Link]	
Blake Lopez (PhD candidate)	2022
Project: Graph-based optimization for technology pathway analysis [Link]	
Kourtney Reed (undergrad)	2020
Project: Techno-economic analysis and life cycle assessment of solvent based plastic upcycling technologies	

Awards and Honors

Argonne Givens Associate, Argonne National Lab, US (2022)

Outstanding Graduate of Beijing City, Ministry of Education, China (2019)

Outstanding Dissertation Award, China (2019)

National Graduate Fellowship, Ministry of Education, China (2018)

Proposal Experience

Exploiting Spatio-Temporal Interdependencies Between Electrochemical Manufacturing and the Power Grid to Optimize Flexibility, Economics, and Sustainability, NSF, 2023, Funded. (Contributor)

Distributed Photosynthetic Recovery of Livestock Waste Nutrients for Sustainable Production of Fertilizers, NSF, 2021, Funded. (Contributor)

Value-added CO₂ Sequestration through a Direct Air Capture Redox Electrocatalysis Cycle Enabled by Organic CO₂ Capturing Redox Mediators, DOE, 2021, Not Funded. (Contributor)

Developing and Evaluating Sustainable N-Heterocyclic Liquid Hydrogen Carrier Technologies for Energy Storage, NSF, 2024, Submitted. (Contributor)

Journal Publications

Methodology Works (Theory, Algorithms and Software)

- [1] Ma, J. & Kim, B. (2023). **GPU Acceleration for Adaptive ADMM-based Large-scale Optimization.** (in preparation)
- [2] Ma, J. & Zavala, V. (2023). **A Graph Approach for the Solution of Supply Chain Models with Vehicle Routing Decisions.** (in preparation)
- [3] Ma, J. & Zavala, V. M. (2022). **Solution of Large-Scale Supply Chain Models using Graph Sampling & Coarsening.** *Computers & Chemical Engineering*, 163, 107832. [\[Link\]](#)
- [4] Shao, Y. Ma, J and Zavala, V. (2022). **A Spatial Superstructure Approach to the Optimal Design of Modular Processes and Supply Chains.** *Computers & Chemical Engineering* [\[Link\]](#)

Smart Electrification & Energy Systems

- [5] Ma, J., Rebarchik, M., Mavrikakis, M., Huber, G. and Zavala, V.M. (2023). **Exploiting Electricity Market Dynamics using Flexible Electrolysis Units for Retrofitting Methanol Synthesis.** *Energy & Environmental Science*, 16(5), 2346-2357 (IF:39) [\[Link\]](#)
- [6] Wang, R., Ma, J., Zavala, V.M., Jin, S. (2023). **Modular Electrochemical Synthesis with Highly Mismatched Rates Using a Fast Proton Redox Material.** (Submitted to Nature)
- [7] Lopez, B. Ma, J and Zavala, V. (2023). **Graph-Based Optimization for Technology Pathway Analysis: A Case Study in Decarbonization of University Campuses.** . *Industrial & Engineering Chemistry Research*, 2023 [\[Link\]](#)

Waste Management

- [8] Ma, J., Tominac, P., Olafasakin, O., Aguirre-Villegas, H., Wright, M.M., Benson, C.H., Huber, G.W. and Zavala, V.M., (2022). **Economic Evaluation of Infrastructures for Thermochemical Upcycling of Post-Consumer Plastic Waste.** *Green Chemistry* [\[Link\]](#)
- [9] Erickson, E., Ma, J., Tominac, P., Aguirre-Villegas, H. and Zavala, V.M., (2022). **Evaluating the Economic and Environmental Benefits of Deploying a National-Scale, Thermo-Chemical Plastic Waste Upcycling Infrastructure in the United States.** *ChemRxiv* [\[Link\]](#)
- [10] Ma, J., Tominac, P., Pfleger, B.F. and Zavala, V.M. (2021). **Infrastructures for Phosphorus Recovery from Livestock Waste Using Cyanobacteria: Transportation, Techno-Economic, and Policy Implications.** *ACS Sustainable Chemistry & Engineering*, 9(34), 11416-11426. [\[Link\]](#)
- [11] Ma, J. & You, F. (2019). **Superstructure optimization of thermal conversion based poultry litter valorization process.** *Journal of Cleaner Production*, 228, pp.1111-1121. [\[Link\]](#)
- [12] Li, H., Wu, J., Jiang, Z., Ma, J., Mavrikakis, M., Zavala, V., Huber, G. (2023). **Hydroformylation of Plastic Pyrolysis Oils: A New Route to Create Chemicals from Plastic Wastes.** *Science*, 2023 [\[Link\]](#)
- [13] Olafasakin, O., Ma, J., Zavala, V., Brown, R., Huber, G., & Wright, M. (2023). **Comparative Techno-Economic Analysis and Life Cycle Assessment of Producing High-Value Chemicals and Fuels from Waste Plastic via Conventional Pyrolysis and Thermal Oxo-Degradation.** *Energy & Fuels*. (Accepted)
- [14] Olafasakin, O. Ma, J, Bradshaw, S.L., Aguirre-Villegas, H.A., Benson, C., Huber, G.W., Zavala, V.M. and Mba Wright, M. (2022). **Techno-Economic and Life Cycle Assessment of Standalone Single-Stream Material Recovery Facilities in the United States.** *Waste Management*. 166, 368-376.

Sustainable Water Systems & Heat Integration

- [15] Ma, J. , Chang, C., Wang, Y. and Feng, X. (2018). **Multi-objective Optimization of Multi-period Interplant Heat Integration Using Steam System.** *Energy*, 159, pp.950-960. [\[Link\]](#)
- [16] Ma, J. , Wang, Y. and Feng, X. (2018). **Simultaneous Optimization of Pump and Cooler Networks in a Cooling Water System.** *Applied Thermal Engineering*, 125, pp.377-385. [\[Link\]](#)
- [17] Ma, J. , Wang, Y. and Feng, X. (2018). **Optimization of Multi-plants Cooling Water System.** *Energy*, 150, pp.797-815. [\[Link\]](#)
- [18] Ma, J. , Wang, Y. and Feng, X. (2017). **Synthesis of Cooling Water System with Air Coolers.** *Chemical Engineering Research and Design*, 131, 643-655. [\[Link\]](#)
- [19] Ma, J. , Wang, Y. and Feng, X. (2018). **Energy recovery in cooling water system by hydro turbines** *Energy*, 139, pp.329-340. [\[Link\]](#)
- [20] Ma, J. , Li, C., Liu, F., Wang, Y., Liu, T. and Feng, X. (2018). **Optimization of circulating cooling water networks considering the constraint of return water temperature** *Journal of Cleaner Production*, 199, pp.916-922. [\[Link\]](#)
- [21] Ma, J. , Irfan, H.M., Wang, Y., Feng, X. and Xu, D. (2018). **Recovering wastewater in a cooling water system with thermal membrane distillation .** *Industrial & Engineering Chemistry Research*, 57(31), pp.10491-10499. [\[Link\]](#)
- [22] Liu, F. Ma, J. Feng, X and Wang, Y (2017). **Simultaneous integrated design for heat exchanger network and cooling water system.** *Applied Thermal Engineering* 128 (2018): 1510-1519
- [23] Chang, C. Wang, Y. Ma, J. Chen, X and Feng, X (2017). **An energy hub approach for direct interplant heat integration.** *Energy* 159 (2018): 878-890

Peer Reviews

Industrial & Engineering Chemistry Research; Applied Energy; Chemical Engineering Research & Design;
Energy Conversion and Management; Chemical Engineering Research & Design; Journal of Cleaner Production;
Process Integration & Optimization for Sustainability; Engineering Report

Conference Talks

- [1] **Ma.J. et al.** (2023 Nov), *A Graph Approach for the Solution of Supply Chain Models with Vehicle Routing Decisions*, American Institute for Chemical Engineers (AIChE) Annual Meeting.
- [2] **Ma.J. et al.** (2023 Feb), *Using GPUs for Solving Large-Scale Supply Chain Models*, Texas-Wisconsin-California Control Consortium (TWCCC-2023).
- [3] **Ma.J. et al.** (2023 Nov), *Process Design and Operation for the Flexible Electrification of Methanol Synthesis*, American Institute for Chemical Engineers (AIChE) Annual Meeting. [\[Link\]](#)
- [4] **Ma.J. et al.** (2022 Oct), *Economic Evaluation of Infrastructures for Thermochemical Upcycling of Post-Consumer Plastic Waste*, INFORMS meeting. [\[Link\]](#)
- [5] **Ma.J. et al.** (2022 Nov), *Economic Evaluation of Infrastructures for Thermochemical Upcycling of Post-Consumer Plastic Waste*, American Institute for Chemical Engineers (AIChE) Annual Meeting. [\[Link\]](#)
- [6] **Ma.J. et al.** (2021, Nov), *A Network-Sampling Algorithm for the Solution of Large-Scale Supply Chain Models*, American Institute for Chemical Engineers (AIChE) Annual Meeting. [\[Link\]](#)
- [7] **Ma.J. et al.** (2017, Oct), *Design and Optimization of Cooling Water Systems*, presented at the 27th European Symposium on Computer Aided Process Engineering (ESCAPE-27).

Computer Skills

-Optimization (Julia, GAMS) -Data Analysis (Matlab, R) -Process Simulation (Aspen)

Software Products

- [1] Economic Evaluation of Infrastructures for Thermochemical Upcycling of Post-Consumer Plastic Waste [\[Link\]](#)
- [2] Exploiting Electricity Market Dynamics using Flexible Electrolysis Units for Retrofitting Methanol Synthesis [\[Link\]](#)
- [3] Solution of Large-Scale Supply Chain Models using Graph Sampling & Coarsening [\[Link\]](#)
- [4] GPU Acceleration for Adaptive ADMM-based Large-scale Supply Chain Model