Gabriel David Patrón

Citizenship: Canadian, Colombian
Languages: English, Spanish
Modelling environments: Aspen Plus/HYSYS, GAMS, gPROMS, MATLAB, Python (Pyomo)

Department of Chemical Engineering, University of Waterloo
E6-3104, 259 Phillip St, Waterloo, ON, CA, N2L 3W8
g2patron@uwaterloo.ca

Vision: Postdoctoral fellow in modelling, control, and optimization of process systems. Interests in sustainable processes, food production, carbon capture, and energy generation, as well as methods to deal with process uncertainty.

Academic Positions

Department of Chemical Engineering, University of Waterloo, CA *2023–*

Postdoctoral fellow

- Supervisor: Luis Ricardez-Sandoval
- Research topics:
  - Chemical looping combustion/gasification
  - Gross error detection in real-time optimization
  - Recirculating aquaculture systems
  - Data-driven online economic optimization

Education

University of Waterloo, Department of Chemical Engineering, Waterloo, CA *2018–2023*

PhD, Process Systems Engineering

- Supervisor: Luis Ricardez-Sandoval
- Thesis: New approaches for the real-time optimization of process systems under uncertainty.
  - Passed with minor corrections.
  - Examiners: Prof. Hector Budman (Waterloo, Chemical Engineering), Prof. Alexander Penlidis (Waterloo, Chemical Engineering), Prof. Houra Mahmoudzadeh (Waterloo, Management Sciences), Prof. Prashant Mhaskar (McMaster, Chemical Engineering).

Imperial College London, Department of Chemical Engineering, London, UK *2017–2018*

MSc, Process Systems Engineering

- Supervisor: Amparo Galindo
- *Thesis: An Application of Residual Entropy Scaling to Calculate and Predict Viscosity Using the SAFT-γ Mie Equation of State.*

National University of Singapore, Department of Chemical and Biomolecular Engineering, Singapore, SG *2016*

Research exchange

- *Supervisors: Ning YAN, Jiaguang ZHANG (now at the University of Lincoln, UK)*
  - *Thesis: Formic Acid-Mediated Pyrolysis of Woody Biomass.*

University of Toronto, Department of Chemical Engineering and Applied Chemistry, Toronto, CA *2013–2017*

BASc, Chemical Engineering

- Minor in sustainable energy.

Peer-Reviewed Publications

Patrón, G.D., Ricardez-Sandoval, L., 2024. Bootstrapped gross error detection for efficient and fault-tolerant real-time optimization. (Accepted). In press: American Controls Conference.

Patrón, G.D., Ricardez-Sandoval, L., 2024. Economically optimal operation of recirculating aquaculture systems under uncertainty. Computers and Electronics in Agriculture 220, 108856.

Patrón, G.D., Toffolo, K., Ricardez-Sandoval, L., 2024. Economic model predictive control for packed bed chemical looping combustion. Chemical Engineering and Processing – Process Intensification 198, 109731.

Patrón, G.D., Ricardez-Sandoval, L., 2023. Economic Model Predictive Control of a Recirculating Aquaculture System. IFAC-PapersOnLine 56(2); 6156–6161.

Patrón, G.D., Ricardez-Sandoval, L., 2023. Robust real-time optimization and parameter estimation of post-combustion CO_2 capture under economic uncertainty. Chemical Engineering Science 281, 119124.

Patrón, G.D., Ricardez-Sandoval, L., 2023. Directional modifier adaptation based on input selection for real-time optimization. Computers & Chemical Engineering 177, 108351.

Patrón, G.D., Ricardez-Sandoval, L., 2022. Low-Variance Parameter Estimation Approach for Real-Time Optimization of Noisy Process Systems. Industrial & Engineering Chemistry Research 61(45), 16780–16798.

Patrón, G.D., Ricardez-Sandoval, L., 2022. An integrated real-time optimization, control, and estimation scheme for post-combustion CO_2 capture. Applied Energy 308, 118302.

Patrón, G.D., Ricardez-Sandoval, L., 2020. A robust nonlinear model predictive controller for a post-combustion CO_2 capture absorber unit. Fuel 265, 116932.

Patrón, G.D., Ricardez-Sandoval, L., 2020. Real-Time Optimization and Nonlinear Model Predictive Control for a Post-Combustion Carbon Capture Absorber. IFAC-PapersOnLine 53(2), 11595–11600.

Manuscripts under review

Patrón, G.D. and Ricardez-Sandoval, L. Efficient carbon capture through online control and optimization.

- Chapter for the Encyclopedia of Systems of Systems and Control Engineering (Elsevier). Describes current state-of-the-art for carbon capture technologies including post-combustion, pre-combustion, and oxy-fuel combustion. An emphasis is place on carbon capture control and optimization topics such as advanced control, variable pairings, process constraints, and economic optimization objectives.

Conference presentations

Patrón, G.D. and Ricardez-Sandoval, L. (2023). Robust real-time optimization for the long-term economical and sustainable operation of post-combustion carbon capture under uncertainty. 11th International Freiberg Conference, Poster 25.

Patrón, G.D. and Ricardez-Sandoval, L. (2023). Economic Model Predictive Control of a Recirculating Aquaculture System. 22nd IFAC world congress, WeB16.4.

Patrón, G.D. and Ricardez-Sandoval, L. (2022). Partial Modifier Adaptation for Economic Optimization of Process Systems Under Frequent Disturbances and Structural Model Uncertainty. AICHE annual meeting 2022, 434d.

Patrón, G.D. and Ricardez-Sandoval, L. (2022). Parameter Estimation for Real-Time Optimization Under Model Uncertainty and Measurement Noise. AICHE annual meeting 2022, 434g.

Patrón, G.D. and Ricardez-Sandoval, L. (2020). Towards an integrated approach for real-time economic optimization, state estimation, and control for a post-combustion carbon capture absorber section. AICHE annual meeting 2020, 596c.

Patrón, G.D. and Ricardez-Sandoval, L. (2020). Real-Time Optimization and Nonlinear Model Predictive Control for a Post-Combustion Carbon Capture Absorber. 21st IFAC world congress, VI161-09.9.

Awards and grants

Doctoral Thesis Completion Award 2022
University of Waterloo

Faculty of Engineering Domestic Doctoral Student Award 2018–2022
University of Waterloo

Graduate Research Studentship 2018–2022
University of Waterloo

Dean's List 2013–2017
University of Toronto

Centre for International Experience Award 2016
University of Toronto

Cross-Disciplinary Program Summer Grant 2016
University of Toronto

University of Toronto Entrance Scholarship 2013

University of Toronto

Teaching and mentoring

Undergraduate teaching assistantship 2019, 2020
University of Waterloo, CHE420: Introduction to Process Control with Prof. Hector Budman

Undergraduate student supervision
University of Waterloo, undergraduate thesis, Zhen Ye: *2022*
Modifier adaptation for real-time optimization of the Williams-Otto CSTR.
University of Waterloo, final year design project: *2021*
Design of a Chemical Looping Combustion Model for Reducing Carbon Footprint.
University of Waterloo, final year design project:
Modelling and Optimization of Chemical Looping Combustion (CLC) Process. *2020*

Professional membership

American Institute of Chemical Engineers (AIChE): *Post-doctoral Researcher Member* *2022–*
Canadian Society for Chemical Engineering (CSChE): *Postdoctoral Fellow Member* *2022–*
International Federation of Automatic Control (IFAC): *Affiliate Member* *2022–*

Academic service

Journal reviewer: *AIChE Journal, Applied Intelligence, The Canadian Journal of Chemical Engineering, Industrial & Engineering Chemistry Research, Journal of Process Control*
Conference reviewer: *American Controls Conference (ACC), Dynamics and Control of Process Systems (DYCOPS)*

Industrial experience

EllisDon Corporation *2015*
M.E.I.T. Intern, New Oakville Trafalgar Memorial Hospital
- Worked with specialty teams - Mechanical, Electrical, and Information Technology - during the commissioning of the project.
- Performed calibration, testing, and troubleshooting for hospital communications and emergency systems - to meet strict hospital regulations and standards.
- Identified system deficiencies and liaised with subcontractors to find solutions.
- Modified drawings for hoarding permit applications using Autodesk.

EllisDon Corporation *2014*
Estimating Intern
- Was a part of the proposal team that formed an estimate for and won the Eglinton Light Rail Transit (ELRT) Project.
- Management of several project-specific tender packages, including assessment of requirements based on specifications, qualification process, management of quotes, quantity takeoffs, and estimates.