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
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Final year PhD candidate looking for postdoctoral research positions in modelling, control, and optimization of process systems. Interested in sustainable processes, food production, carbon capture, and energy generation, as well as methods to deal with process uncertainty.

Education

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

PhD, Process Systems Engineering

- Supervisor: Luis Ricardez-Sandoval
- Topics: Moving horizon estimation (MHE), model predictive control (MPC), real-time optimization (RTO), post-combustion carbon capture (PCC), recirculating aquaculture systems (RAS)

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

MSc, Process Systems Engineering (Merit)

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

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

Research exchange

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

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

BASc, Chemical Engineering (Honours)

- Minor in sustainable energy.

Publications

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

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

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

Active projects

Patrón, G and Ricardez-Sandoval, L. A fast modifier adaptation approach for real-time optimization.

- The traditional modifier adaptation scheme to account for structural model uncertainty is adapted to become more computationally efficient through a simplified gradient estimation step. This results in faster control action with only modest performance deterioration with respect to the full algorithm.

Patrón, G and Ricardez-Sandoval, L. Economic Model Predictive Control of a Recirculating Aquaculture System.

- The recirculating aquaculture system (RAS) is treated as a batch process. An economic model predictive controller (EMPC) is developed for RAS, which uses a mechanistic model that considers fish growth, oxygenation, and waste accumulation. The batch length and optimal control actions are found subject to various temperatures and their potential fluctuations.

Patrón, G and Ricardez-Sandoval, L. Robust real-time economic optimization and parameter estimation of post-combustion carbon capture under uncertainty.

- Uses a novel estimation algorithm to compute uncertain physical property and disturbance parameters for a post-combustion carbon capture pilot plant. Economic uncertainty is considered through a multi-scenario optimization approach jointly with parametric uncertainty, which is quantified using a novel algorithm.

Conference presentations

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

Patrón, G 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 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
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, final year design project: Design of a Chemical Looping Combustion Model for Reducing Carbon Footprint *2021*
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) - *Graduate Student Member* *2022–*
Canadian Society for Chemical Engineering (CSChE) - *Graduate Student Member* *2022–*
International Federation of Automatic Control (IFAC) - *Affiliate Member* *2022–*

Professional service

Peer reviewer for:
The 13th IFAC Symposium on Dynamics and Control of Process Systems, including Biosystems (DYCOPS) in Busan, Republic of Korea, June 14-17, 2022. *2022*

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.

References available upon request