Gonzalo E. Constante Flores

Ph.D. in Electrical and Computer Engineering

Davidson School of Chemical Engineering
Purdue University
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Google scholar

Education

The Ohio State University

Ph.D. in Electrical and Computer Enginering — *Jul 2018 – Dec 2022*
Advisor: Antonio J. Conejo
Thesis: *Scheduling of Power Units via Relaxation and Decomposition*

M.Sc. in Electrical and Computer Enginering — *Aug 2016 – Jul 2018*
Advisor: Mahesh S. Illindala
Thesis: *Conservation Voltage Reduction of Active Distribution Systems with Networked Microgrids*

Escuela Politécnica Nacional, Quito, Ecuador

Diploma in Electrical Enginering (*Honors*) — *Sep 2008 – Oct 2014*
Advisor: Jesús Játiva
Final project: *Harmonic power flow using MATLAB* (*Spanish*)

Appointments

Purdue University

Postdoctoral Research Scholar — *Jan 2023 – present*
Advisor: Can Li
Research projects: *Machine learning for mixed-integer and global optimization.*

Argonne National Laboratory

Research Aide — *May 2019 – Aug 2019*
Superisor: Dongbo Zhao
Research project: *Integration of plug-in electric vehicles in power systems.*

Escuela Politécnica Nacional, Quito, Ecuador

Instructor in the Department of Electrical Energy — *Jun 2014 – Jul 2016*
Responsibilities: *Teaching undergraduate courses, laboratory practices, and seminars.*

Research interests

- Analysis, planning, and operation of sustainable electric power systems
- Decomposition techniques of mathematical programming applied to energy systems
- Complementarity modeling in energy systems and energy markets
- Data-driven and machine-learning-aided optimization for operation of energy systems

Honors & Awards

Presidential Fellowship — *2022*
The Ohio State University

Outstanding Reviewer — *2019*
IEEE Transactions on Power Delivery

Fulbright Scholarship — *Jul 2016 – May 2018*
Fulbright Commission in Ecuador

Knowledge Generation Program Award — *2014*
Vice Presidency of Ecuador

Research experience

Graduate Research Associate
The Ohio State University, Columbus, OH, USA *Aug 2019 – present*

- Develop a unit commitment model with AC network constraints based on a second-order conic relaxation of the power flow equations and an algorithm to achieve an AC feasible solution.
- Design an algorithm based on Benders decomposition to address the AC network-constrained unit commitment problem of large-scale power systems.
- Propose a risk-aware network-constrained unit commitment model and an algorithm based on decomposition techniques to address the solution of large-scale power grids.
- Formulate a unit commitment model considering the optimal behavior of the natural-gas market and a solution method for large-scale systems based on an outer approximation algorithm.
- Devise a solution method for the corrective security-constrained unit commitment problem for large-scale power systems using a hybrid decomposition and a Kron-based network reduction technique.

Research Aide
Argonne National Laboratory, Lemont, IL, USA *May 2019 – Aug 2019*

- Develop a tool to visualize and analyze the behavior of distribution networks based on a component-based aggregate load model.
- Investigate the physical feasibility of engaging plug-in electric vehicles to support a power grid with increasing renewable energy.

Graduate Research Associate
The Ohio State University, Columbus, OH, USA *Aug 2016 – May 2019*

- Develop analytic and algorithmic tools to analyze and mitigate the impact of cyberattacks on the power grid.
- Formulate a model of monitoring-control attacks with goals in the state estimation and/or the optimal power flow considering AC-based models.
- Assess the vulnerability of the state estimator in power grids and characterize vulnerable meters based on sensitivity analysis.
- Analyze the operation of networked microgrids in active distribution networks in the context of Volt/Var optimization.

Journal Publications

[J12] **G. Constante-Flores**, A. J. Conejo, "Security-Constrained Unit Commitment: A Decomposition Approach Embodying Kron reduction", *European Journal of Operational Research*, July 2023.

[J11] Xuan Liu, A. J. Conejo, **G. Constante-Flores**, "Stochastic Unit Commitment: Model Reduction via Learning", *Current Sustainable/Renewable Energy Reports*, July 2023.

[J10] **G. Constante-Flores**, A. J. Conejo, R. Lima, "Stochastic Unit Commitment with Weekly Energy Storage: a Hybrid Decomposition Approach," *International Journal of Electrical Power & Energy Systems*, vol.145, 2022.

[J9] **G. Constante-Flores**, A. J. Conejo, S. Constante-Flores, "Solving certain complementarity problems in power markets via convex programming," *TOP*, 2022.

[J8] **G. Constante-Flores**, A. J. Conejo, J.K. Wang, "Stealthy Monitoring Control Attacks to Disrupt Power System Operations," *Electric Power Systems Research*, vol. 203, 2022.

[J7] **G. Constante-Flores**, A. J. Conejo, Feng Qiu, "AC Network-Constrained Unit Commitment via Relaxation and Decomposition," *IEEE Transactions on Power Systems*, vol. 37, 2022.

[J6] **G. Constante-Flores**, A. J. Conejo, Feng Qiu, "AC Network-Constrained Unit Commitment via Conic Relaxation and Convex Programming," *International Journal of Electrical Power & Energy Systems*, vol. 134, 2022.

[J5] **G. Constante-Flores**, A. J. Conejo, and J.K. Wang, "Sensitivity-Based Vulnerability Assessment of State Estimation," *Journal of Modern Power Systems and Clean Energy*, 2021.

[J4] A. J. Conejo, S. Chen, and **G. Constante**, "Operations and Long-Term Expansion Planning of Natural-Gas and Power Systems: A Market Perspective," *Proceedings of the IEEE*, 2020.

[J3] J.K. Wang, **G. Constante**, C. Moya, and J. Hong, "A Semantic Analysis Framework for Protecting the Power Grid Against Monitoring-Control Attacks," *IET Cyber-Physical Systems: Theory & Applications*, 2020.

[J2] **G. Constante**, J. Abillama, M. Illindala, "Conservation Voltage Reduction of Networked Microgrids", *IET Generation, Transmission, & Distribution*, 2019.

[J1] **G. Constante**, M. Illindala, "Data-Driven Probabilistic Power Flow Analysis for a Distribution System With Renewable Energy Sources Using Monte Carlo Simulation," *IEEE Transactions on Industry Applications*, vol. 55, no. 1, Jan. 2019.

Submitted for Publication

[S2] **G. Constante-Flores**, A. Conejo, F. Qiu, "Daily Scheduling of Generating Units With Natural-Gas Market Constraints", *European Journal of Operational Research*, In review.

[S1] R. Lima, **G. Constante-Flores**, A. Conejo, O. Knio, "An effective hybrid decomposition approach to solve the network-constrained stochastic unit commitment problem in large scale power systems", *EURO Journal on Computational Optimization*, In review.

Conference Papers

[C6] **G. E. Constante**, C. Moya, and J.K. Wang, "Semantic-Based Detection Architectures Against Monitoring-Control Attacks in Power Grids", *in 2019 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids* (*SmartGridComm*), 2019.

[C5] C. Staiger, B. Sim, **G. E. Constante**, J.K. Wang, "Predicting the Impact of Increasing Plug-in Electric Vehicle Loading on Bulk Transmission Systems", *in 2019 IEEE Power Energy Society General Meeting* (*PESGM*), 2019.

[C4] **G. E. Constante**, J.K. Wang, "Hierarchical Mechanism of Voltage Instability with Active Distribution Networks", *in 2018 Clemson University Power Conference*, Clemson, SC, Sept. 4-7th, 2018.

[C3] **G. E. Constante**, M. Illindala, "Data-driven probabilistic power flow analysis for a distribution system with Renewable Energy sources using Monte Carlo Simulation", *IEEE/IAS 53rd Industrial and Commercial Power Systems Technical Conference* (*I&CPS*), Niagara Falls, ON, May 7-11th, 2017.

[C2] F. Quilumba, **G. E. Constante**, J. Játiva, Wei-Jen Lee, "Distributed energy resources placement in distribution networks considering proximity to voltage collapse", *2015 IEEE Industry Applications Society Annual Meeting*, Dallas, TX, Oct. 18-22nd, 2015.

[C1] **G. E. Constante**, G. Cabrera, F. Quilumba, J. Játiva, Wei-Jen Lee, "A harmonic power flow program aimed at analyzing distortion effects caused by industrial customers", *2015 IEEE Industry Applications Society Annual Meeting*, Dallas, TX, Oct. 18-22nd, 2015.

Teaching

Undergraduate Courses Instructor
Escuela Politécnica Nacional *Oct 2014 – Jul 2016*
- IEE573 Electrical and Communication Installations
- Seminar on Power Quality
- Seminar on Introduction to Power Systems

Undergraduate Courses Instructor
Escuela Politécnica Nacional *Jan 2014 – Aug 2014*
- IEE7B2 Electric Power Systems Laboratory
- IEE6O2 Introduction to Electric Power Systems Laboratory
- IEE8S3 Protective Relaying Laboratory
- IEE584 Electric Machinery Laboratory

Conference presentations

Clemson University Power Systems Conference, Clemson, SC *Sep 2018*
Title: "*Hierarchical Mechanism of Voltage Instability with Active Distribution Networks*"

Transportation Electrification Conference and Expo (ITEC), Long Beach, CA *Jun 2018*
Title: "*Visualizing the impact of PEV on power distribution grids*"

IEEE/IAS 53rd I&CPS Technical Conference, Niagara Falls, ON *May 2017*
Title: "*Data-driven probabilistic power flow analysis for a distribution system with Renewable Energy sources using Monte Carlo Simulation*"

2015 IEEE Industry Applications Society Annual Meeting, Dallas, TX *Oct 2015*
Title: "*A harmonic power flow program aimed at analyzing distortion effects caused by industrial customers*"

Invited Talks

IEEE PES General Meeting 2022 *July 2022*
Panel: Managing Uncertainty in Grid Operations, "*A Grid that is Risk Aware for Clean Electricity*"

IEEE PES General Meeting 2022 *July 2022*
Panel: Frontier of Power System Optimization and Simulation, "*AC Network-Constrained Unit Commitment via Relaxation and Decomposition*"

INFORMS/ENRE Online Scientific Event Series, "AC Unit Commitment" *Mar 2021*

Professional activities

Society Memberships

Institute for Electrical and Electronics Engineers (IEEE) *2014 – present*
Graduate Student Member: Power and Energy Society, Industry Applications Society

Technical Papers Review

Journals: IEEE Transactions on Industry Applications, IEEE Transactions on Power Delivery, IEEE Control Systems Letters, IEEE Power Engineering Letters, Applied Energy, International Journal of Power & Energy Systems, IEEE Transactions on Sustainable Energy, Optimization and Engineering

Conferences: IEEE PES General Meeting, Clemson University Power Systems Conference, Power Systems Computation Conference

Skills

Julia/JuMP, MATLAB/Simulink, GAMS, DIgSILENT PowerFactory