

# Rahul K. Gupta

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## RESEARCH INTERESTS

- Optimal operation of energy storage systems, electricity networks and multi-energy systems; control and coordination of energy systems; model predictive control of distributed energy resources;
- Integrated planning of energy storage, electricity networks and multi-energy systems; stochastic and robust optimization of energy systems under uncertainty; hosting capacity analysis;
- Data-driven estimation and control; distributed optimization; market-based framework for flexibility in energy system.

## EDUCATION

- **Ph.D. in Electrical Engineering**, 09/2018 - 01/2023  
École Polytechnique Fédérale de Lausanne (EPFL), Switzerland  
Thesis title: “Methods for Grid-aware Operation and Planning of Active Distribution Networks”.  
([Access Link](#))  
Thesis directors: Prof. Mario Paolone (EPFL), Prof. Fabrizio Sossan (HES-SO Wallis, Switzerland).
- **M.Sc. in Electrical Engineering** 09/2016 - 07/2018  
Smart Grids Science and Technology Orientation,  
École Polytechnique Fédérale de Lausanne, Switzerland
- **B.Tech in Electrical Engineering** 07/2010 - 06/2014  
National Institute of Technology, Rourkela, India

## EXPERIENCE

- **SNSF Postdoctoral Fellow, Georgia Institute of Technology, Atlanta, USA** 10/2023 - present  
(*Supervisor: Prof. Daniel K. Molzahn*)
- **Postdoctoral Researcher, EPFL, Switzerland** 02/2023 - 09/2023  
(*Supervisor: Prof. Mario Paolone*)
- **Doctoral Researcher, EPFL, Switzerland** 09/2018 - 01/2023
- **Visiting Doctoral Researcher, ParisTech MINES, Nice, France** 09/2019 - 01/2020
- **Intern, ABB Corporate Research Centre, Baden, Switzerland** 08/2017 - 01/2018
- **Research Engineer, National University of Singapore, Singapore** 01/2015 - 07/2016

## HONORS AND AWARDS

1. **Swiss National Science Foundation Postdoc Mobility Grant** for postdoctoral stay at Georgia Tech.
2. **EPFL PhD Thesis Distinction in Electrical Engineering 2023** (awarded to the 8% best Ph.D. theses of each EPFL Doctoral Program).
3. Finalist in the **Grid Edge Technologies Dissertation Prize Challenge 2023** and nominated for the **ABB Award 2024, EPFL** for my Ph.D. thesis.
4. **Zanelli: Technologie et Développement Durable Prize 2018** for the best master project in the field of sustainable development: environment, economy, or society, EPFL, Switzerland.
5. **J.N. Tata Endowment Award** and **K. C. Mahindra Scholarship** for supporting master studies at EPFL.

6. **Ashim Choudhury Memorial Gold Medal** for overall academic topper among all the undergraduate Electrical Engineering Students of the 2014 batch, NIT Rourkela.
7. **University Silver Medal** for academic topper among Students of 2014 batch, NIT Rourkela, India.
8. **Sugat Kishore Mall Memorial Award** for the best graduate in the 2014 batch of electrical engineering, NIT Rourkela, India.
9. **DAAD WISE-2013 Scholarship** (Deutscher Akademischer Austausch Dienst), (German Academic Exchange Service) for an internship at the University of Bremen, Germany.

## INVOLVEMENT IN RESEARCH PROJECTS

### Synthetic Networks & Hosting Capacity Analysis for USA

Oct. 2023 - Sept. 2025

(funded by Swiss National Science Foundation - CHF 121,400)

- Developing algorithms for realistic synthetic networks for power distribution networks in the USA using publicly available datasets (street maps, population density, primary substation locations, etc.).
- Photovoltaic hosting capacity analysis of power distribution network using synthetic networks. Optimal planning of battery energy storage for increasing hosting capacity.

### MESH4U (funded by European Union's Horizon 2020 and ERA-Net Smart Energy Systems) 2022 - 2023

- Experimental validation of a grid-aware dispatching framework by utilizing the flexibility from electric vehicle charging stations (EVCS). Forecasting EVCS demand. [Final Report](#).

### SWEET PATHFINDER (funding agency: Swiss Federal Office of Energy's "SWEET" program) 2020 - 2023

- Modeling and control of multi-energy systems. Experimental validation of a multi-grid dispatch framework on real medium and low voltage distribution grid at EPFL consisting of fuel-cell, electrolyser, PV plants and battery energy storage systems.

### REEL Demonstrator (funding agency: SFOE's "SCCER-FURIES" program)

2019 - 2022

- Validation of OPF-based real-time control algorithm on a real-life medium voltage distribution network in Aigle, Switzerland, hosting 2.5MWh/1.5MW battery storage capacity, 3.2MWp photovoltaic, 3.4 MVA hydro and 2.8MW base demand. [Final Report](#).
- Development of software for the operation of the battery energy storage system for real-time control.

### Joint Activity Scenario and Modeling (funding agency: SFOE, Innosuisse)

2017 - 2022

- Assessment of photovoltaic generation hosting capacity for the power distribution networks of Switzerland. Providing a set of robust scenarios to realize the Swiss Energy Strategy 2050. [Final Report](#).
- Calculation of the cost-optimal placement of energy storage systems for different levels of photovoltaic generation.

## PUBLICATIONS

(The citations can be found on [Google Scholar](#).)

### Journal Articles (Under revision)

- [R<sub>1</sub>] **Rahul Gupta**, Paolo Attilio Pegoraro, Ognjen Stanojev, Ali Abur, Carlo Muscas, Gabriela Hug, and Mario Paolone. Learning power flow models and constraints from time-synchronised measurements: A review. *[under review in Proc. of the IEEE.]*, 2024
- [R<sub>2</sub>] **Rahul Gupta** and Daniel K. Molzahn. Improving fairness in photovoltaic curtailments via daily topology reconfiguration for voltage control in power distribution networks. *[under review]*, 2024. [Preprint Link](#).
- [R<sub>3</sub>] Taheri Babak, **Rahul Gupta**, and Daniel K Molzahn. Optimized lindistflow for high-fidelity power flow modeling of distribution networks. *[under review]*, 2024. [Preprint Link](#).
- [R<sub>4</sub>] **Rahul Gupta**, Sherif Fahmy, Max Chevron, Enea Figini, and Mario Paolone. Grid-aware scheduling and control of electric vehicle charging stations for dispatching active distribution networks: Theory and experimental validation. *[under review]*, 2024. [Preprint Link](#).

## Journal Articles (published)

- [J<sub>1</sub>] Matthieu Jacobs, **Rahul Gupta**, and Mario Paolone. Week-ahead dispatching of active distribution networks using hybrid energy storage systems. *Sustainable Energy, Grids and Networks*, 39:101500, 2024. [Publisher Link](#).
- [J<sub>2</sub>] **Rahul Gupta**. Quantifying uncertainty on the power-flow sensitivity coefficients from uncertain branches parameters and noisy grid-state measurements. *IEEE Transactions on Instrumentation and Measurement*, 2023. [Publisher Link](#).
- [J<sub>3</sub>] **Rahul Gupta** and Fabrizio Sossan. Optimal sizing and siting of energy storage systems considering curtailable photovoltaic generation in power distribution networks. *Applied Energy*, 339, 2023. [Publisher Link](#).
- [J<sub>4</sub>] **Rahul Gupta**, Antonio Zecchino, Ji-Hyun Yi, and Mario Paolone. Reliable dispatch of active distribution networks via a two-layer grid-aware model predictive control. *IEEE Open Access Journal of Power and Energy*, 2022. [Publisher Link](#).
- [J<sub>5</sub>] **Rahul Gupta**, Sherif Fahmy, and Mario Paolone. Coordinated day-ahead dispatch of multiple power distribution grids hosting stochastic resources: An admm-based framework. *Electric Power Systems Research*, 212:108555, 2022. [Publisher Link](#).
- [J<sub>6</sub>] **Rahul Gupta**, Fabrizio Sossan, and Mario Paolone. Model-less robust voltage control in active distribution networks using sensitivity coefficients estimated from measurements. *Electric Power Systems Research*, 212:108547, 2022. [Publisher Link](#).
- [J<sub>7</sub>] Francesco Gerini, Yihui Zuo, **Rahul Gupta**, Antonio Zecchino, Zhao Yuan, Elena Vagnoni, Rachid Cherkaoui, and Mario Paolone. Optimal grid-forming control of battery energy storage systems providing multiple services: Modeling and experimental validation. *Electric Power Systems Research*, 212:108567, 2022. [Publisher Link](#).
- [J<sub>8</sub>] **Rahul Gupta**, Fabrizio Sossan, Jean-Yves Le Boudec, and Mario Paolone. Compound admittance matrix estimation of three-phase untransposed power distribution grids using synchrophasor measurements. *IEEE Transactions on Instrumentation and Measurement*, 70:1–13, 2021. [Publisher Link](#).
- [J<sub>9</sub>] **Rahul Gupta**, Fabrizio Sossan, and Mario Paolone. Countrywide pv hosting capacity and energy storage requirements for distribution networks: The case of switzerland. *Applied Energy*, 281:116010, 2021. [Publisher Link](#).
- [J<sub>10</sub>] **Rahul Gupta**, Fabrizio Sossan, and Mario Paolone. Grid-aware distributed model predictive control of heterogeneous resources in a distribution network: Theory and experimental validation. *IEEE Transactions on Energy Conversion*, 36(2):1392–1402, 2020. [Publisher Link](#).
- [J<sub>11</sub>] Sherif Fahmy, **Rahul Gupta**, and Mario Paolone. Grid-aware distributed control of electric vehicle charging stations in active distribution grids. *Electric Power Systems Research*, 189:106697, 2020. [Publisher Link](#).
- [J<sub>12</sub>] Fabrizio Sossan, Enrica Scolari, **Rahul Gupta**, and Mario Paolone. Solar irradiance estimations for modeling the variability of photovoltaic generation and assessing violations of grid constraints: A comparison between satellite and pyranometers measurements with load flow simulations. *Journal of Renewable and Sustainable Energy*, 11(5):056103, 2019. [Publisher Link](#).

## Conference Papers (under review)

- [D<sub>1</sub>] **Rahul Gupta** and Daniel K Molzahn. Analysis of fairness-promoting optimization schemes of photovoltaic curtailments for voltage regulation in power distribution networks. *[under review]*, 2024. [Preprint Link](#).
- [D<sub>2</sub>] **Rahul Gupta** and Daniel K Molzahn. Optimizing phase allocation in unbalanced power distribution networks using a linearized distflow formulation. *[under review]*, 2024.

## Conference Papers (published)

- [C<sub>1</sub>] Richard Asiamah, **Rahul Gupta**, Rabab Haider, and Daniel. Molzahn. Performance assessment of data sampling strategies for neural network-based voltage approximations. *56th North American Power Symposium (NAPS 2024)*, October 13-15, 2024, 2024. [Publisher Link](#).
- [C<sub>2</sub>] Samuel Talkington, **Rahul Gupta**, Richard Asiamah, Paprapee Buason, and Daniel K Molzahn. Strategic electric distribution network sensing via spectral bandits. *To appear in the 63rd IEEE Conference on Decision and Control (CDC)*, December 16-19, 2024, Milano, Italy, 2024. [Preprint Link](#).
- [C<sub>3</sub>] **Rahul Gupta**, Paprapee Buason, and Daniel K Molzahn. Fairness-aware photovoltaic generation limits for voltage regulation in power distribution networks using conservative linear approximations. *8th Texas Power and Energy Conference (TPEC)*, February 12-13, 2024, 2024. [Publisher Link](#).
- [C<sub>4</sub>] Robin Henry and **Rahul Gupta**. Measurement-based/model-less estimation of voltage sensitivity coefficients by feedforward and lstm neural networks in power distribution grids. *8th Texas Power and Energy Conference (TPEC)*, February 12-13, 2024, 2024. [Publisher Link](#).
- [C<sub>5</sub>] **Rahul Gupta** and Mario Paolone. Experimental validation of model-less robust voltage control using measurement-based estimated voltage sensitivity coefficients. *IEEE Belgrade PowerTech*, June 25-29, 2023, pages 1–8, 2023. [Publisher Link](#).
- [C<sub>6</sub>] **Rahul Gupta**, Sherif Fahmy, and Mario Paolone. Coordinated day-ahead dispatch of multiple power distribution grids hosting stochastic resources: An admm-based framework. In *2022 Power Systems Computation Conference (PSCC)*, Porto, Portugal. [Publisher Link](#).
- [C<sub>7</sub>] **Rahul Gupta**, Fabrizio Sossan, and Mario Paolone. Model-less robust voltage control in active distribution networks using sensitivity coefficients estimated from measurements. In *2022 Power Systems Computation Conference (PSCC)*, Porto, Portugal. [Publisher Link](#).
- [C<sub>8</sub>] Francesco Gerini, Yihui Zuo, **Rahul Gupta**, Antonio Zecchino, Zhao Yuan, Elena Vagnoni, Rachid Cherkaoui, and Mario Paolone. Optimal grid-forming control of battery energy storage systems providing multiple services: Modeling and experimental validation. In *2022 Power Systems Computation Conference (PSCC)*, Porto, Portugal. [Publisher Link](#).
- [C<sub>9</sub>] **Rahul Gupta**, Vladimir Sovljanski, Fabrizio Sossan, and Mario Paolone. Performance comparison of alternating direction optimization methods for linear-opf based real-time predictive control. In *2021 IEEE Madrid PowerTech*, pages 1–6. IEEE, 2021. [Publisher Link](#).
- [C<sub>10</sub>] Sherif Fahmy, **Rahul Gupta**, and Mario Paolone. Grid-aware distributed control of electric vehicle charging stations in active distribution grids. In *2020 Power Systems Computation Conference (PSCC)*, Porto, Portugal. [Publisher Link](#).
- [C<sub>11</sub>] **Rahul Gupta**, Fabrizio Sossan, and Mario Paolone. Performance assessment of linearized opf-based distributed real-time predictive control. In *2019 IEEE Milan PowerTech*, pages 1–6. IEEE, 2019. [Publisher Link](#).
- [C<sub>12</sub>] **Rahul Gupta**, Fabrizio Sossan, Enrica Scolari, Emil Namor, Luca Fabietti, Colin Jones, and Mario Paolone. An admm-based coordination and control strategy for pv and storage to dispatch stochastic prosumers: Theory and experimental validation. In *2018 Power Systems Computation Conference (PSCC)*, pages 1–7. IEEE, 2018. [Publisher Link](#).

## PRESENTATIONS

### Invited presentations

1. Invited presentation on a session titled Power Systems Optimization Under Uncertainty, *Informa Annual Meeting 2024*, Oct. 20-24, 2024, Seattle, WA, USA.
2. Panel session on Learning Power Flow Models from Synchronized Measurements at *International Conference on Smart Grid Synchronized Measurements & Analytics (SGSMA) 2024*, Washington DC, USA.
3. *Joint US-European Workshop on Flexible Electric Grid Critical Infrastructure for Resilient Society*, Temple University Conference Center, April 21-22, 2023, Philadelphia, PA, USA.

4. *The 7th Purple Mountain Forum Panel Session - Advanced Optimization and Control Methods toward a Carbon Neutral Energy Internet, Nanjing China (Virtual):* Grid-Aware Model Predictive Control of Distributed Energy Resources in a Distribution Network Theory and Experimental Validation, Gupta, R., 2022.

## Conference (Oral)

1. *8th Texas Power and Energy Conference, College Station, Texas, USA:* Measurement-based/model-less estimation of voltage sensitivity co-efficients by feedforward and lstm neural networks in power distribution grids, February 12-13, 2024, 2024.
2. *8th Texas Power and Energy Conference, College Station, Texas, USA:* Fairness-aware photovoltaic generation limits for voltage regulation in power distribution networks using conservative linear approximations, February 12-13, 2024, 2024.
3. *15<sup>th</sup> PowerTech Conference, Belgrade, Serbia:* Experimental validation of model-less robust voltage control using measurement-based estimated voltage sensitivity coefficients, June 2023.
4. *XXII PSCC, Porto, Portugal:* Coordinated Day-ahead Dispatch of Multiple Power Distribution Grids hosting Stochastic Resources: An ADMM-based Framework, June 2022.
5. *XXII PSCC, Porto, Portugal:* Model-less Robust Voltage Control in Active Distribution Networks using Sensitivity Coefficients Estimated from Measurements, June 2022.
6. *14<sup>th</sup> PowerTech Conference, Madrid, Spain:* Performance Comparison of Alternating Direction Optimization Methods for Linear-OPF based Real-time Predictive Control, June 2021.
7. *13<sup>th</sup> PowerTech Conference, Milan, Italy:* Performance assessment of linearized opf-based distributed real-time predictive control, June 2019.
8. *XX PSCC, Dublin, Ireland:* An admm-based coordination and control strategy for pv and storage to dispatch stochastic prosumers: Theory and experimental validation, July 2018.

## Poster presentations

1. *PATHFNDR Workshop, Bern, Switzerland:* Coordinated Day-ahead Dispatch of Multiple Power Distribution Grids hosting Stochastic Resources, Gupta, R., Paolone, M., 2022.
2. *PATHFNDR Workshop, Bern, Switzerland:* Model Predictive Control of Multi-Energy Systems in a Microgrid, Gupta, R., Fernando, S., Paolone, M., 2022.
3. *SCCER-FURIES Annual Conference, EPFL, Lausanne, Switzerland:* Linearized-OPF based Distributed Real-time Predictive Control of Distribution Networks, Gupta, R., Sossan, F., Paolone, M. 2019.
4. *SCCER-FURIES Annual Conference, EPFL, Lausanne, Switzerland:* Optimal Planning of Energy Storage Systems in Electrical Distribution Grids using Receding Horizon Control Strategies, Gupta, R., 2018.

## TEACHING ACTIVITIES

- Teaching Assistant, Smart Grids Technologies (EE-472), EPFL Spring 2022
- Teaching Assistant, Smart Grids Technologies (EE-472), EPFL Spring 2021
- Teaching Assistant, Smart Grids Technologies (EE-472), EPFL Spring 2020

My role was to prepare teaching material for the course, supervising the lab exercises, evaluating the laboratory reports, and preparing and grading exams.

## SUPERVISED STUDENT PROJECTS

During my PhD and postdoctoral period, I supervised sixteen student projects on various topics ranging from distributed optimization algorithms, forecasting, synthetic networks, optimal planning, etc.

1. *Synthetic Transmission Network Generation for the Case of Georgia, USA*, Susannah Gordon, Bachelor Project, Georgia Tech, Fall 2024.
2. *ML-based Realistic Synthetic Network Generation for the Power Distribution Networks in USA*, Yuhao Chen, Bachelor Project, Georgia Tech, Spring 2024.
3. *Realistic Synthetic Network Generation for the Power Distribution Networks in USA*, Susannah Gordon, Bachelor Project, Georgia Tech, Spring 2024.
4. *Grid-aware Optimal Planning of Multi-energy System in Power Distribution Grids*, Master Semester Project, EPFL, Jennifer Abou-Najm, Spring 2023.
5. *ML-based Power Consumption Forecasting of an EPFL Building*, Corentin Jaire, Kelyan Hangard, Jennifer Abou-Najm, CS433 Machine Learning, EPFL, Project, Fall 2022.
6. *Model Predictive Control of Multi-Energy Systems in a Microgrid*, Master Thesis Project, Mr. Sooria Fernando, EPFL, Spring 2022.
7. *Day-ahead Grid-aware Dispatcher for Active Distribution Networks Embedding Stochastic Electric Vehicle Charging Stations*, Master Thesis Project, Mr. Max Chevron, Spring 2021.
8. *Optimal Planning of Electric Vehicle Charging Stations and Photovoltaic Generation in a Distribution Network*, Master Thesis Project, Mr. Vladimir Sovljanski, Fall 2021.
9. *Generating Realistic Low Voltage Distribution Networks using Representative Geographical and Socio-economic Information for Switzerland*, Bachelor Project, Mr. Kristoffer Berglund, KTH, Spring 2021.
10. *Detection of Medium and High Voltage poles using Convolutional Neural Network*, Bachelor Project, Mr. Louis Drame, EPFL, Spring 2021.
11. *Modeling of a PEM Electrolyzer for Model Predictive Control*, Bachelor Project, Keske Cem, EPFL, Spring 2021.
12. *Solar Irradiance Forecast using Sky-Camera Images*, Ms. Maissara Beliazi, Mr. Ahmed Achiche, Bachelor Project, EPFL, Spring 2021.
13. *Solar Irradiance Forecast using Time-series Forecasting*, Mr. Aziz Ben, Bachelor Project, EPFL, Spring 2021.
14. *Generating Realistic Power Distribution Network for Switzerland*, Master Semester Project, EPFL, Fall 2020.
15. *Data-driven Estimation of Voltage Sensitivity Coefficients in Power Distribution Grids*, Master Thesis Project, Mr. Robin Henry, The University of Edinburgh, Fall 2020.
16. *State Estimation of Power Grids: Analysis of Available Methods and Effects of Parameter Inaccuracies*, Master Thesis Project, Mr. Bruno Gabriele, University of Genova, Spring 2019.
17. *Performance Comparison of Different Distributed Algorithms for Grid Aware Predictive Control*, Master Semester Project, Mr. Vladimir Sovljanski, EPFL, Fall 2018.

## SERVICE TO THE PROFESSION

I regularly act as a reviewer for the top international journals and international conferences. Some are listed below:

- IEEE PES Transactions on Power Systems, 2020-present
- IEEE PES Transactions on Sustainable Energy 2019-present
- IEEE PES Transactions on Smart Grid 2021-present

- IEEE Transactions on Circuits and Systems-I 2022-present
- IEEE Transactions on Instrumentation and Measurement 2022-present
- Elsevier Electric Power Systems Research 2019-present
- Elsevier Sustainable Energy, Grids and Networks Journal 2018-present
- Elsevier Energy for Sustainable Development 2021-present
- IEEE Powertech Conference 2019-present
- Power Systems Computation Conference 2020-present
- IEEE International Conference on Smart Energy Systems and Technologies 2020-present
- IEEE Power and Energy General Meeting 2023-present.

## REFEREES

- Prof. Daniel Molzahn (Current Postdoc supervisor and Ph.D. Evaluation Committee member),  
Assistant Professor, Electrical and Computer Engineering, Georgia Tech, Atlanta, USA,  
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- Prof. Mario Paolone (Ph.D. Thesis advisor),  
Head of Distributed Electrical Systems Laboratory, EPFL, Switzerland,  
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- Prof. Fabrizio Sossan (Ph.D. Thesis Co-advisor),  
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