Robin Delabays

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Research experience

Since Aug. 2022 **Assistant professor**
Institute of Sustainable Energy, School of Engineering,
HES-SO Valais//Wallis.

Oct. 2020 – Aug. 2022 **Post-doctoral scholar**
Center for Control, Dynamical Systems, and Computation (CCDC),
University of California at Santa Barbara (UCSB).
Supervised by Prof. Francesco Bullo.

Oct. – Dec. 2020 **Visiting scholar**
Mathematics Department, University of Fribourg (Switzerland).
Invited by Prof. Christian Mazza.

Mar. – Jul. 2020
Aug. – Dec. 2018 **Post-doctoral scholar**
Institut für Automatik, ETH Zürich.
Supervised by Prof. Florian Dörfler.

Jun. 2018 – Feb. 2020 **Post-doctoral scholar**
HES-SO Valais//Wallis.
Supervised by Prof. Philippe Jacquod.

Jul. – Aug. 2019 **Visiting scholar**
Center for Nonlinear Studies, Los Alamos National Laboratory.
Supervised by Dr. Andrey Lokhov and Dr. Marc Vuffray.

Education

Sep. – Nov. 2017 **Visiting PhD student**
Institut für Automatik, ETH Zürich.
Supervised by Prof. Florian Dörfler.

Dec. 2014 – May 2018 **PhD in Mathematics** – *Loop Flows in the Kuramoto Model*
University of Geneva & HES-SO Valais//Wallis.
Supervised by Prof. Yvan Velenik and Prof. Philippe Jacquod.
[archive-ouverte.unige.ch/unige:106921]

Sep. 2014 **Master thesis**
University of Geneva.
The Topological Approach to Phase Transitions.
Supervised by Prof. David Cimasoni and Prof. Yvan Velenik.

Sep. 2012 – Sep. 2014 **Master of Science in Mathematics**
University of Geneva.
Focus in Topology and Probabilities.

Sep. 2008 – Sep. 2011 **Bachelor of Science in Mathematics**
University of Geneva.
Focus in Topology and Probabilities.

Supervision of junior researchers

Since Oct. 2023 **Jim Délitroz**
J. Délitroz is doing his PhD under my supervision, co-supervised by Prof. Dörfler (ETHZ). His work focuses on multitability of the power flow equations.

Jun. 2019 – Jul. 2020
Sep. 2022 – Dec. 2023 **Glory M. Givi**
Co-supervision of G. M. Givi during part of her PhD. Her work aims at quantifying the robustness of opinions in a group of interacting agents.

Jan. – Dec. 2019 **André Reggio**
Co-supervision of A. Reggio during his first year of PhD. His work focused on some generalization of the Kuramoto model, referred to as *Kuramoto model with Bounded Confidence*.

Teaching

Since Sep. 2022 **Professor of mathematics for engineers at HES-SO, Sion**
Classes: Analysis 1, Linear Algebra 1, Mathematics for Engineers 2, Analysis 2, Applied Mathematics, Signal Processing and Information Theory.

May 2018 **Guest lecturer at University of Geneva**
Class: Graph Spectral Theory, by Prof. Anders Karlsson.

Editorial service

Since Oct. 2024 **Journal of Physics: Complexity**
[https://iopscience.iop.org/journal/2632-072X]

Organization of conferences

Oct. 27, 2020 **CCS 2021 - Satellite Symposium**
Data-based diagnosis of networked dynamical systems covering the analysis of networks and disturbances therein relying on measurements.
Co-organizers: Laurent Pagnier (University of Arizona, Tucson) and Melvyn Tyloo (University of Geneva).
[www.delabaysrobin.site/ccs-satellite]

Feb. 2 – 5, 2020 **GeoCoW 2020**
Geometry of Complex Webs 2020: Interdisciplinary and international workshop covering a wide range of topics related to complex networks and their applications.
Co-organizers: Matthieu Jacquemet (HES-SO Valais-Wallis and University of Fribourg) and Christian Mazza (University of Fribourg).
[https://sites.google.com/view/geocow2020/home]

Grants and awards

2024 **HES-SO Free project**
TAPIS – Topology and Admittance Parameters Inference from Smart meters.

2023 **SNSF Project funding**
Existence and uniqueness of the power flows in AC electrical networks.

2020 **SNSF PostDoc.Mobility**
Multistability of the Dissipative Power Flow Equations.

2012 **Excellence Master Fellowship**
University of Geneva.

Preprints

[**Nie24**] J. Niehues, **R. Delabays**, and F. Hellmann, *Small-signal stability of power systems with voltage droop*, under preparation (2024). [arxiv.org/abs/1124.10832]

[**Kas24**] N. Kastendiek, J. Niehues, **R. Delabays**, T. Gross, and F. Hellmann, *Phase and gain stability for adaptive dynamical networks*, submitted (2024). [arxiv.org/abs/2411.10387]

[**Pag24**] L. Pagnier, **R. Delabays**, and M. Tyloo, *Nontrivial Kron reduction for power grid modeling*, submitted (2024). [arxiv.org/abs/2409.09519]

Publications in peer-reviewed journals and conference proceedings

[**Del25**] **R. Delabays**, G. De Pasquale, F. Dörfler, and Y. Zhang, *Hypergraph reconstruction from dynamics*, Nat. Commun. **16**, 2691 (2025). [doi.org/10.1038/s41467-025-57664-2], [arxiv.org/abs/2402.00078]

[**Giv24**] G. M. Givi, **R. Delabays**, M. Jacquemet, and P. Jacquod, *On the robustness of democratic electoral processes to computational propaganda*, Sci. Rep. **14**, 193 (2024). [doi.org/10.1038/s41598-023-50648-6], [arxiv.org/abs/2308.11569]

[**Del23b**] **R. Delabays**, A. Y. Lokhov, M. Tyloo, and M. Vuffray, *Locating the source of forced oscillations in transmission power grids*, Phys. Rev. X Energy **2**, 023009 (2023). [doi.org/10.1103/PRXEnergy.2.023009], [arxiv.org/abs/2211.16064]

[**Del23a**] **R. Delabays** and F. Bullo, *Semicontraction and Synchronization of Kuramoto-Sakaguchi Oscillator Networks*, IEEE Control Syst. Lett. **7**, 1566 (2023). [doi.org/10.1109/LCSYS.2023.3275169], [arxiv.org/abs/2303.10127]

[**Ngu23**] T. T. Nguyen, R. C. Budzinski, F. W. Pasini, **R. Delabays**, J. Mináč, and L. E. Muller, *Broadcasting solutions on networked systems of phase oscillators*, Chaos Solitons Fractals **168**, 113166 (2023). [doi.org/10.1016/j.chaos.2023.113166], [arxiv.org/abs/2209.05970]

[**Del22b**] **R. Delabays**, S. Jafarpour, and F. Bullo, *Mulitstability and anomanlies in oscillator models of lossy power grids*, Nat. Commun. **13**, 5238 (2022). [doi.org/10.1038/s41467-022-32931-8], [arxiv.org/abs/2202.02439]

[**Del22a**] **R. Delabays** and M. Tyloo, *Heavy-tailed distribution of the number of papers within scientific journals*, Quant. Sci. Studies **3**, 776 (2022). [doi.org/10.1162/qss_a_00201], [arxiv.org/abs/2011.05703]

[**Tyl21b**] M. Tyloo, **R. Delabays**, and P. Jacquod, *Reconstructing network structures from partial measurements*, Chaos **31**, 103117 (2021). [doi.org/10.1063/5.0058739], [arxiv.org/abs/2007.16136]

[**Del21a**] **R. Delabays**, L. Pagnier, and M. Tyloo, *Locating line and node disturbances in networks of diffusivley coupled dynamical agents*, New J. Phys. **23**, 043037 (2021). [doi.org/10.1088/1367-2630/abf54b], [arxiv.org/abs/2003.08786]

[**Tyl21a**] M. Tyloo and **R. Delabays**, *System size identification from sinusoidal probing in diffusive complex networks*, J. Phys. Complex. **2**, 025016 (2021). [doi.org/10.1088/2632-072X/abebd3], [arxiv.org/abs/2009.03824]

[**Reg20**] A. Reggio, **R. Delabays**, and P. Jacquod, *Clusterization and phase diagram of the bimodal Kuramoto model with bounded confidence*, Chaos **30**, 093134 (2020). [doi.org/10.1063/5.0020436], [arxiv.org/abs/2007.01214]

[**Del19c**] **R. Delabays**, *Dynamical equivalence between Kuramoto models with first- and higher-order coupling*, Chaos **29**, 113129 **(2019)**. [doi.org/10.1063/1.5118941], [arxiv.org/abs/1907.03699]

[**Del19b**] **R. Delabays**, M. Tyloo, and P. Jacquod, *Rate of change of frequency under line contingencies in high voltage electric power networks with uncertainties*, Chaos **29**, 103130 (2019). [doi.org/10.1063/1.5115002], [arxiv.org/abs/1906.05698]

[**Tyl19**] M. Tyloo, **R. Delabays**, and P. Jacquod, *Noise-induced desynchronization and stochastic escape from equilibrium in complex networks*, Phys. Rev. E **99**, 062213 (2019). [doi.org/10.1103/PhysRevE.99.062213], [arxiv.org/abs/1812.09497]

[**Cim19**] D. Cimasoni and **R. Delabays**, *The topological hypothesis for discrete spin models*, J. Stat. Mech. **2019** (2019). [doi.org/10.1088/1742-5468/ab0c14], [arxiv.org/abs/1811.10263]

[**Del19a**] **R. Delabays**, P. Jacquod, and F. Dörfler, *The Kuramoto Model on Oriented and Signed Graphs*, SIAM J. Appl. Dyn. Syst. **18**, 458 (2019). [doi.org/10.1137/18M1203055], [arxiv.org/abs/1807.11410]

[**Del17b**] **R. Delabays**, M. Tyloo, and P. Jacquod, *The size of the sync basin revisited*, Chaos **27**, 103109 (2017). [doi.org/10.1063/1.4986156], [http://arxiv.org/abs/1706.00344]

[**Col17**] T. Coletta, **R. Delabays**, and P. Jacquod, *Finite-size scaling in the Kuramoto model*, Phys. Rev. E **95**, 042207 (2017). [doi.org/10.1103/PhysRevE.95.042207], [arxiv.org/abs/1612.07031]

[**Del17a**] **R. Delabays**, T. Coletta, and P. Jacquod, *Multistability of phase-locking in equal-frequency Kuramoto models on planar graphs*, J. Math. Phys. **58**, 032703 (2017). [doi.org/10.1063/1.4978697], [arxiv.org/abs/1609.02359]

[**Col16a**] T. Coletta, **R. Delabays**, I. Adagideli, and P. Jacquod, *Topologically protected loop flows in high voltage AC power grids*, New J. Phys. **18**, 103042 (2016). [doi.org/10.1088/1367-2630/18/10/103042], [arxiv.org/abs/1605.07925]

[**Del16**] **R. Delabays**, T. Coletta, and P. Jacquod, *Multistability of phase-locking and topological winding numbers in locally coupled Kuramoto models on single-loop networks*, J. Math. Phys. **57**, 032701 (2016). [doi.org/10.1063/1.4943296], [arxiv.org/abs/1512.04266]

Publications in peer-reviewed conference proceedings

[**Del22c**] **R. Delabays**, L. Pagnier, and M. Tyloo, *Locating fast-varying line disturbances with the frequency mismatch*, IFAC-PapersOnLine **55**, 270 (2022). [doi.org/10.1016/j.ifacol.2022.07.271], [arxiv.org/abs/2202.08317]

[**Del21c**] **R. Delabays** and M. Tyloo, *Network Inference using Sinusoidal Probing*, IFAC-PaperOnLine **54**, 696 (2021). [doi.org/10.1016/j.ifacol.2021.06.131], [arxiv.org/abs/2002.00490]

[**Col16b**] T. Coletta, **R. Delabays**, L. Pagnier, and P. Jacquod, *Large Electric Load Fluctuations in Energy-efficient Buildings and how to Suppress them with Demand Side Management*, IEEE PES ISGT Conf. Europe (2016). [doi.org/10.1109/ISGTEurope.2016.7856328], [tinyurl.com/yd59ym5w]

Editorials

[**eDel24**] **R. Delabays**, L. Pagnier, B. Schäfer, M. Tyloo, and D. Witthaut, *Focus on monitoring and control of complex supply systems*, Journal of Physics: Complexity, **5**, 040201 (2024). [doi.org/10.1088/2632-072X/acfadd]

Softwares

[**sDel24**] **R. Delabays**, G. De Pasquale, and Y. Zhang, *THIS: Taylor-based Hypergraph Infernce using SINDy (v1.0)*, Zenodo (2024). [doi.org/10.5281/zenodo.10530470]

[**sDel22c**] **R. Delabays**, A. Y. Lokhov, M. Tyloo, and M. Vuffray, *SALO: System-Agnostic Localization of Oscillations*, GitHub (2022). [https://github.com/lanl-ansi/SALO]

[**sDel22b**] **R. Delabays**, *ADGenerator: Authors Distribution Generator (v1.1)*, Zenodo (2022). [doi.org/10.5281/zenodo.6030302]

[**sDel22a**] **R. Delabays**, *DFNSolver: Dissipative Flow Networks Solver (v1.2)*, Zenodo (2022). [doi.org/10.5281/zenodo.5899407]

Talks and posters

All slides and posters can be found on www.DelabaysRobin.site.

Feb. 5 – 9, 2024 Champéry Power Conference 2024.
Talk: *Locating the source of forced oscillations in transmission power grids.*

Dec. 13 – 15, 2023 IEEE CDC 2023, Singapore.
Talk: *Semicontraction and Synchronization of Kuramoto-Sakaguchi Oscillator Networks.*

Jul. 17 – 20, 2023 IC2S2 2023, Copenhagen, Denmark.
Poster: Heavy-tailed distribution of the number of papers within scientific journals.

Jul. 10 – 14, 2023 NetSci 2023, Vienna, Ausria.
Talk: *Locating the source of forced oscillations in transmission power grids.*

Sep. 13 – 15, 2022 SIAM Network Science Workshop 2022, Online.
Talk: *Complex networks of lossy oscillators: Multistability, anomalies, and loop flows in power grids.*

Jul. 13 – 15, 2022 Autonomous Energy Systems Workshop, NREL, Golden (CO), USA.
Poster: *Locating the source of forced oscillations: A system-agnostic approach.*

Jul. 5 – 7, 2022 NecSys22, Zurich, Switzerland.
Poster: *Locating fast-varying line disturbances with the frequency mismatch.*

Apr. 27, 2022 CNLS Seminar, Los Alamos National Laboratory (NM), USA.
Talk: *From undirected to directed diffusive networks of dynamical agents.*

Apr. 20, 2022 SFI Seminar, Santa Fe Institute (NM), USA.
Talk: *From undirected to directed diffusive networks of dynamical agents.*

Oct. 25 – 29, 2021 Conference on Complex Systems 2021, Lyon, France.
Talk: *Flow Network Problems on the n-torus with Asymmetric Couplings.*

Jul. 5 – 10, 2021 Networks 2021, Online.
Talk: *Reconstructing Network Structures from Partial Measurements.*

Jan. 11 – 15, 2021 Grid Science Conference, Online.
Poster: *Reconstructing Network Structure from Partial Measurements.*

Nov. 4 – 8, 2019 Network Dynamics in the Social, Economic, and Financial Sciences, Torino, Italy.
Talk: *Robustness of Elections Results Against External Influence.*

Sep. 23 – 26, 2019 International Workshop on Complex Systems and Networks 2019, Berlin, Germany.
Talk: *Rate of Change of Frequency under Line Contingencies.*

Feb. 3 – 8, 2019 Future Electric Power Systems, Champéry, Switzerland.
Poster: *Bounding the Desynchronization Time in Electrical Grids under Fluctuating Sources.*

Jan. 18, 2019 CCDC Seminar, UC Santa Barbara (CA), USA.
Talk: *Bounding the Destabilization Time in Networks of Coupled Noisy Oscillators.*

Jan. 7 – 11, 2019 Grid Science Conference, Santa Fe (NM), USA.
Poster: *Bounding the Desynchronization Time in Electrical Grids under Fluctuating Sources.*

Sep. 3 – 7, 2018 Dynamics Days Europe, Loughborough, United Kingdom.
Talk: *Multistability in Electric Power Grids on Meshed, Complex Networks.*

Jan. 29 – 31, 2018 661. WE-Hereaus Seminar, Bad Honnef, Germany.
Poster: *The Size of the Sync Basin Revisited.*

Sep. 3 – 8, 2017 International School on Energy Systems, Kloster Seeon, Germany.
Poster: *Topologically Protected Loop Flows in High Voltage AC Power Grids.*

Feb. 5 – 9, 2017 Future Electric Power Systems, Champéry, Switzerland.
Talk: *Loop Flows and the Number of Power Flow Solutions in Meshed Electric Power Grids.*

Jan. 8 – 13, 2017 Grid Science Conference, Santa Fe (NM), USA.
Poster: *Multistability of Phase-Locking and Vortices in Locally Coupled Kuramoto Models.*

Jun. 6 – 10, 2016 Dynamics Days, Corfu, Greece.
Talk: *Multistability of Phase-Locking and Topological Winding Numbers in Locally Coupled Kuramoto Models.*

Outreach activities

Mar. 21, 2024 Journées Culturelles de la Planta, Sion, Switzerland.
Lecture course to high school students: *Les rouages du calcul de l'empreinte énergétique.*

Sep. 12 – 15, 2023 Colloque de la Commission Romande de Mathématiques, Champéry, Switzerland.
Lecture course to high school mathematics teachers: *Graphes et réseaux électriques.*

Apr. 4 – 5, 2019 Journées Culturelles de la Planta, Sion, Switzerland.
Lecture course to high school students: *Les statistiques comme outil de manipulation... Comment tricher sans mentir ?.*

Mar. 30, 2017 Journées Culturelles de la Planta, Sion, Switzerland.
Lecture course to high school students: *La Transition Énergétique.*