Gustav Nilsson
Postdoctoral Scientist

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Academic Employment

September 2021 - Present	Postdoctoral Scientist, Urban Transport Systems Laboratory (LUTS), École Polytechnique Fédérale de Lausanne (EPFL), Switzerland. Host: Prof. Nikolas Geroliminis
May 2019 - August 2021	Postdoctoral Fellow, School of Electrical and Computer Engineering, Georgia Institute of Technology, USA. Host: Prof. Sam Coogan.
September 2013 - April 2019	Ph.D. student, Lund University, Sweden.

Education

Ph.D. in Automatic Control, Lund University, Sept 2013 – Feb 2019.

Supervisor: Giacomo Como.

Co-supervisor: Anders Rantzer.

M.Sc. in Engineering Physics, Lund University, Sept 2008 – Aug 2013.

Specialized in Mathematics and Automatic Control.

Research Interests

Modeling, control, and robustness analysis of dynamical flow networks with applications in transportation networks. Non-linear control. Game theory.

Internships

October 2017 - March 2018: Mitsubishi Electric Research Laboratories, Cambridge, MA. Host: Uros Kalabic

Publications

Peer-Reviewed Journal Papers

[J4] **G. Nilsson** and G. Como. Jan. 2022. "Generalized Proportional Allocation Policies for Robust Control of Dynamical Flow Networks". *IEEE Transactions on Automatic Control* 67.1, pp. 32–47. DOI: 10.1109/TAC.2020.3046026.

[J3] G. Como and **G. Nilsson**. Aug. 2021. "On the well-posedness of deterministic queuing networks with feedback control". *Transportation Research Part B: Methodological* 150, pp. 323–335. ISSN: 0191-2615. DOI: https://doi.org/10.1016/j.trb.2021.06.010.

[J2] M. Srinivasan, M. Abate, **G. Nilsson**, and S. Coogan. Apr. 2021. "Extent-compatible control barrier functions". *Systems & Control Letters* 150, p. 104895. ISSN: 0167-6911. DOI: 10.1016/j.sysconle.2021.104895.

[J1] **G. Nilsson** and G. Como. Apr. 2020. "A Micro-Simulation Study of the Generalized Proportional Allocation Traffic Signal Control". *IEEE Transactions on Intelligent Transportation Systems* 21.4, pp. 1705–1715. DOI: 10.1109/TITS.2019.2957718.

Peer-Reviewed Conference Publications

[C14] C. Santoyo, **G. Nilsson**, and S. Coogan. Dec. 2021. "Sensitivity of Electric Vehicle Charging Facility Occupancy to Users' Impatience". *2021 60th IEEE Conference on Decision and Control (CDC)*, pp. 2862–2867. DOI: 10.1109/CDC45484.2021.9682824.

[C13] M. E. Cao, **G. Nilsson**, and S. Coogan. Aug. 2021. "On the Impact of the Capacity Drop Phenomenon for Freeway Traffic Flow Control". *2021 IEEE Conference on Control Technology and Applications (CCTA)*, pp. 1037–1042. DOI: 10.1109/CCTA48906.2021.9658952.

[C12] Q. Wei, **G. Nilsson**, and S. Coogan. May 2021. "Scheduling of Urban Air Mobility Services with Limited Landing Capacity and Uncertain Travel Times". *2021 American Control Conference (ACC)*, pp. 1681–1686. DOI: 10.23919/ACC50511.2021.9482700.

[C11] **G. Nilsson** and S. Coogan. May 2021. "Strong Integral Input-to-State Stability in Dynamical Flow Networks". *2021 American Control Conference (ACC)*, pp. 4836–4841. DOI: 10.23919/ACC50511.2021.9483432.

[C10] A. Jaafer, **G. Nilsson**, and G. Como. Sept. 2020. "Data Augmentation of IMU Signals and Evaluation via a Semi-Supervised Classification of Driving Behavior". *2020 IEEE 23rd International Conference on Intelligent Transportation Systems (ITSC)*. DOI: 10.1109/ITSC45102.2020.9294496.

[C9] C. Santoyo, **G. Nilsson**, and S. Coogan. July 2020. "Multi-Level Electric Vehicle Charging Facilities with Limited Resources". Vol. 53. 2. 21th IFAC World Congress, pp. 15428–15433. DOI: 10.1016/j.ifacol.2020.12.2364.

[C8] **G. Nilsson** and G. Como. July 2020. "On Robustness of the Generalized Proportional Controller for Traffic Signal Control". *2020 American Control Conference (ACC)*, pp. 1191–1196. DOI: 10.23919/ACC45564.2020.9147471.

[C7] R. Stalberg, **G. Nilsson**, and G. Como. June 2019. "On Robustness of Equilibria in Dynamical Transportation Networks". *2019 18th European Control Conference (ECC)*, pp. 2209–2214. DOI: 10.23919/ECC.2019.8796234.

[C6] **G. Nilsson**, P. Grover, and U. Kalabić. Dec. 2018. "Assignment and Control of Two- Tiered Vehicle Traffic". *2018 IEEE Conference on Decision and Control (CDC)*, pp. 1023–1028. DOI: 10.1109/CDC.2018.8619411.

[C5] C. Rosdahl, **G. Nilsson**, and G. Como. Aug. 2018. "On Distributed Optimal Control of Traffic Flows in Transportation Networks". *2018 IEEE Conference on Control Technology and Applications (CCTA)*, pp. 903–908. DOI: 10.1109/CCTA.2018.8511601.

[C4] **G. Nilsson** and G. Como. June 2018. "Evaluation of Decentralized Feedback Traffic Light Control with Dynamic Cycle Length". *15th IFAC Symposium on Control in Transportation Systems CTS 2018*, pp. 464–469. DOI: 10.1016/j.ifacol.2018.07.076.

[C3] **G. Nilsson** and G. Como. July 2017. "On Generalized Proportional Allocation Policies for Traffic Signal Control". *20th IFAC World Congress*, pp. 9643–9648. DOI: 10.1016/j.ifacol.2017.08.1728.

[C2] **G. Nilsson**, P. Hosseini, G. Como, and K. Savla. Dec. 2015. "Entropy-like Lyapunov functions for the stability analysis of adaptive traffic signal controls". *2015 54th IEEE Conference on Decision and Control (CDC)*, pp. 2193–2198. DOI: 10.1109/CDC.2015.7402532.

[C1] **G. Nilsson**, G. Como, and E. Lovisari. Dec. 2014. "On resilience of multicommodity dynamical flow networks". *53rd IEEE Conference on Decision and Control*, pp. 5125–5130. DOI: 10.1109/CDC.2014.7040190.

Under Review

[PP4] C. Santoyo, **G. Nilsson**, and S. Coogan. Nov. 2021. "Sensitivity to User Mischaracterizations in Electric Vehicle Charging". Under review. URL: https://arxiv.org/abs/2111.08542.

[PP3] **G. Nilsson** and S. Coogan. Nov. 2021. "The Strong Integral Input-to-State Stability Property in Dynamical Flow Networks". Under review. URL: https://arxiv.org/abs/2111.09727.

[PP2] Q. Wei, **G. Nilsson**, and S. Coogan. July 2021. "Capacity-Constrained Urban Air Mobility Scheduling". Under revision. URL: https://arxiv.org/abs/2107.02900.

[PP1] C. Santoyo, **G. Nilsson**, and S. Coogan. Sept. 2020. "Resource Aware Pricing for Electric Vehicle Charging". Under review. URL: https://arxiv.org/abs/2009.10771.

Patents

[P1] U. Kalabić, **G. Nilsson**, and P. Grover. Feb. 2021. "System and Method for Asymmetric Traffic Control". US Patent 10,922,966.

Thesis

1. PhD thesis: "On robust distributed control of transportation networks", 2019.

   Supervisors: Giacomo Como and Anders Rantzer.

2. Master's thesis: "A multi-commodity dynamical model for traffic networks", 2013.

   Supervisors: Giacomo Como and Enrico Lovisari.

Longer Research Visits

September 2019: Dipartimento di Scienze Matematiche "Giuseppe Luigi Lagrange", Politecnico di Torino

October – November 2018: Dipartimento di Scienze Matematiche "Giuseppe Luigi Lagrange", Politecnico di Torino

July 2018: Dipartimento di Scienze Matematiche "Giuseppe Luigi Lagrange", Politecnico di Torino

October and December 2016: Dipartimento di Scienze Matematiche "Giuseppe Luigi Lagrange", Politecnico di Torino

September – October 2015: Institute for Pure & Applied Mathematics, UCLA

May 2014: Grenoble Traffic Lab, INRIA Grenoble – Rhone-Alpes.

Program Committee Member

FORUM-ISTS2020 – International Program Committee

Reviewer

Reviewer for IEEE Transactions on Automatic Control, IEEE Transactions on Control of Network Systems, IEEE Transactions on Intelligent Transportation Systems, Automatica, IEEE Control Systems Letters (L-CSS), IEEE Transactions on Vehicular Technology, IEEE Transactions on Network Science and Engineering, IEEE Transactions on Intelligent Vehicles, Transportation Research Part C: Emerging Technologies, EURO Journal on Transportation and Logistics, IEEE Conference on Decision and Control (2015, 2016, 2017, 2018, 2019, 2021), American Control Conference (2017, 2020, 2021, 2022), IFAC World Congress (2017), IFAC Symposium on Control in Transportation Systems (2018, 2021), European Control Conference (2019,

2021, 2022), IFAC Workshop on Distributed Estimation and Control in Networked Systems (2019), IEEE Conference on Control Technology and Applications (2020), IEEE International Conference on Intelligent Transportation Systems (2020).

Seminars

Ecole Polytechnique Fédérale de Lausanne (EPFL), (Lausanne, Switzerland), April 14, 2021.

DISMA Politecnico di Torino (Turin, Italy), October 3, 2019.

Georgia Institute of Technology (Atlanta, USA), February 1, 2019.

DISMA Politecnico di Torino (Turin, Italy), July 4, 2018.

Institute of Institute for Pure and Applied Mathematics, UCLA (Los Angeles), September 22, 2015.

Other Professional Activities

17–18 October 2019: TU Delft Mechanical Engineering Talent Event 2019 (by invitation).

Teaching Experience

Georgia Tech:

Nonlinear Control – Fill-in lecturer.

Network Dynamics – Organizer of a summer reading group for graduate students.

During my Ph.D. studies at Lund University:

Network Dynamics – Teaching assistant three times and involved in the development of the course. Lecturer for part of the course spring 2019.

Physiological Models and Computations – Teaching assistant and involved in the development of the course.

Automatic Control, Basic Course – Teaching assistant four times.

Automatic Control, Basic Course in China – Lecturer for one third of the course and teaching assistant.

During my M.Sc. studies at Lund University:

Calculus in One Variable – Teaching assistant one time.

Calculus in Several Variables – Teaching assistant two times.

Linear Algebra – Teaching assistant three times.

Supervision

Master's Thesis

1. Amani Jaafer, "Data-driven system for learning driver behaviors from IMU data", 2019, co-supervisor.
2. Rasmus Stålberg, "On Robustness of Equilibria in Transportation Networks", 2018, co-supervisor.
3. Simon Paulsson, "Tuning Feedback-Based Traffic Signal Controls", 2018, co-supervisor.
4. Christian Rosdahl, "Distributed Control of Dynamic Flows in Traffic Networks", 2017, co-supervisor.
5. Joakim Guth, "On Distributed Maximization of Influence in Social Networks", 2017, co-supervisor.

Pedagogical Training

Over five weeks of pedagogical courses including:

Introduction to teaching and learning in higher education.

Communicating science.

Media Coverage

October 2019 "Trafikljus som kortar pendlingen". *Traffic lights that shortens the commute time.* Newspaper Tidningen Kollega.

11 April 2019 "Ny teknik kan minska bilköerna: 'Man får vänta kortare vid varje trafikljus'" *New technology can shorten traffic queues: 'One has to wait shorter at each traffic signal'* TV4 Nyhetsmorgon, national televised morning show.

10 April 2019 "Forskare: Så kan världens bilköer kortas" *Researcher: So can the traffic queues in the world be shorted* Article from the Swedish News Agency TT, that appeared in several national and regional newspapers.

10 April 2019 "Nytt sätt att styra trafikljus kan korta bilköer" *New method for controlling traffic signals can shorten traffic queues* Swedish Radio, interviewed in their national news broadcast (Ekot)

Miscellaneous

Languages: **Swedish** native; **English** fluent; **German** basic; **Italian** beginner; **French** beginner..

Programming Languages: MATLAB, C, Python, Java, PHP, SQL, LaTeX.