

Işık İlber Sirmatel

assistant professor of automatic control

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Research Interests

automatic control, mathematical optimization, model predictive control

Education

- 01.2020 **Ph.D., electrical engineering**, *Doctoral Program in Electrical Engineering, École Polytechnique Fédérale de Lausanne (EPFL)*
Thesis: Optimization-based control, estimation, and identification of urban road transport systems. Advisor: Prof. Nikolas Geroliminis
- 06.2014 **M.Sc., mechanical engineering**, *Department of Mechanical and Process Engineering, Eidgenössische Technische Hochschule Zürich (ETH Zürich)*
Thesis: Adaptive model predictive control of constrained multiple-input multiple-output systems and its application to the quad tank system. Advisor: Prof. Manfred Morari
- 02.2012 **B.Sc., control engineering**, *Control and Automation Engineering Department, Faculty of Electrical and Electronics Engineering, Istanbul Technical University*
- 06.2010 **B.Sc., mechanical engineering**, *Mechanical Engineering Department, Faculty of Mechanical Engineering, Istanbul Technical University*

Research Experience

- 2026-ongoing **Assistant professor**, *Control and Automation Engineering Department, Faculty of Electrical and Electronics Engineering, Istanbul Technical University*
- 2021-2026 **Assistant professor**, *Department of Electrical and Electronics Engineering, Faculty of Engineering, Trakya University*
- 2020-2021 **Postdoctoral researcher**, *Urban Transport Systems Laboratory, Civil Engineering Institute, School of Architecture, Civil and Environmental Engineering, École Polytechnique Fédérale de Lausanne (EPFL)*
Topic: Nonlinear model predictive control of city-scale road traffic networks
- 2015-2020 **Doctoral researcher**, *Urban Transport Systems Laboratory, Civil Engineering Institute, School of Architecture, Civil and Environmental Engineering, École Polytechnique Fédérale de Lausanne (EPFL)*
Topic: Dynamic optimization-based methods for control of intelligent transportation systems
- 11.2016– **Visiting researcher**, *University of Southern California*
02.2017 Topic: Feedback control of freeway systems with variable speed limits
Advisor: Prof. Petros Ioannou
- 04.2013– **Research intern**, *ABB Corporate Research Center, Germany*
09.2013 Topic: Advanced self-tuning controllers for motion control solutions

Research Projects

- 2023-2026 **Modeling, Estimation, and Control of Mixed Urban and Freeway Road Traffic Networks (Role: Principal Investigator) (2232-B)**
Sponsor: Scientific and Technological Research Council of Türkiye (TÜBİTAK)
- 2020-2021 **Mobility of the Future (National Centre of Competence in Research, Dependable Ubiquitous Automation) (Role: Researcher)**
Sponsor: Swiss National Science Foundation (SNF)
- 2015-2020 **METAFERW - Modeling and controlling traffic congestion and propagation in large-scale urban multimodal networks (Role: Researcher)**
Sponsor: European Research Council (ERC)
- 2016 **Modeling, demand calibration, and control of bus transport systems - A case study in the city of Fribourg (Role: Researcher)**
Sponsor: Fribourg Public Transportation Company (TPF)

Skills

- language Turkish, English, German
- software MATLAB, [CasADi](#), [YALMIP](#), Mathematica, $\text{\LaTeX}$

Honors and Awards

- 2010 Ranked 1st/160 at graduation

*B.Sc., mechanical engineering
Istanbul Technical University*

Academic Services - Review

Control Engineering Practice
IEEE Control Systems Letters
IEEE Intelligent Transportation Systems Magazine
IEEE Transactions on Control Systems Technology
IEEE Transactions on Industrial Informatics
IEEE Transactions on Intelligent Transportation Systems
IEEE/CAA Journal of Automatica Sinica
Nonlinear Dynamics
Scientific Reports
Systems and Control Letters
Transportation Research Part B: Methodological
Transportation Research Part C: Emerging Technologies
Transportmetrica A: Transport Science

Publications

- 12) I. I. Sirmatel, "Robust nonlinear model predictive control of large-scale urban road networks," *IEEE Transactions on Intelligent Transportation Systems (under review)*, 2026

- 11) I. I. Sirmatel, "Parameter estimation and model validation for macroscopic fundamental diagram-based dynamical models of urban road traffic networks," (*under preparation; to be submitted to IEEE Transactions on Intelligent Transportation Systems*), 2026
- 10) C. V. Beojone, P. Zhu, I. I. Sirmatel, and N. Geroliminis, "A hierarchical control framework for vehicle repositioning in ride-hailing systems," *Transportation Research Part C: Emerging Technologies*, vol. 168, p. 104 717, 2024. DOI: 10.1016/j.trc.2024.104717
- 9) P. Zhu, I. I. Sirmatel, G. Ferrari-Trecate, and N. Geroliminis, "A coverage control-based idle vehicle rebalancing approach for autonomous mobility-on-demand systems," *IEEE Transactions on Control Systems Technology*, vol. 32, no. 5, pp. 1839–1853, 2024. DOI: 10.1109/TCST.2024.3375765
- 8) I. I. Sirmatel and M. Yildirimoglu, "Nonlinear model predictive control of large-scale urban road networks via average speed control," *Transportation Research Part C: Emerging Technologies*, vol. 156, p. 104 338, 2023. DOI: 10.1016/j.trc.2023.104338
- 7) I. I. Sirmatel, D. Tsitsokas, A. Kouvelas, and N. Geroliminis, "Modeling, estimation, and control in large-scale urban road networks with remaining travel distance dynamics," *Transportation Research Part C: Emerging Technologies*, 2021. DOI: 10.1016/j.trc.2021.103157
- 6) I. I. Sirmatel and N. Geroliminis, "Stabilization of city-scale road traffic networks via macroscopic fundamental diagram-based model predictive perimeter control," *Control Engineering Practice*, vol. 109, 2021. DOI: 10.1016/j.conengprac.2021.104750
- 5) Y. Ren, Z. Hou, I. I. Sirmatel, and N. Geroliminis, "Data driven model free adaptive iterative learning perimeter control for large-scale urban road networks," *Transportation Research Part C: Emerging Technologies*, vol. 115, p. 102 618, 2020. DOI: 10.1016/j.trc.2020.102618
- 4) I. I. Sirmatel and N. Geroliminis, "Nonlinear moving horizon estimation for large-scale urban road networks," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 12, pp. 4983–4994, 2019. DOI: 10.1109/TITS.2019.2946324
- 3) M. Yildirimoglu, I. I. Sirmatel, and N. Geroliminis, "Hierarchical control of heterogeneous large-scale urban road networks via path assignment and regional route guidance," *Transportation Research Part B: Methodological*, vol. 118, pp. 106–123, 2018. DOI: 10.1016/j.trb.2018.10.007
- 2) I. I. Sirmatel and N. Geroliminis, "Mixed logical dynamical modeling and hybrid model predictive control of public transport operations," *Transportation Research Part B: Methodological*, vol. 114, pp. 325–345, 2018. DOI: 10.1016/j.trb.2018.06.009
- 1) I. I. Sirmatel and N. Geroliminis, "Economic model predictive control of large-scale urban road networks via perimeter control and regional route guidance," *IEEE Transactions on Intelligent Transportation Systems*, vol. 19, no. 4, pp. 1112–1121, 2018. DOI: 10.1109/TITS.2017.2716541