Nilanjan Roy Chowdhury

Postdoctoral Fellow
Faculty of Electrical Engineering,
Technion Israel Institute of Technology,
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Research Interests

My general research interests include distributed control, nonlinear & adaptive control, optimal control with applications to {power, social} networks, {cyber − physical, multi − agent} systems. My current research involves

1. Control & optimization of grid-connected storage systems,
2. Cyber-physical & cyber-secure control systems,
3. Convergence analysis of cooperative algorithms,
4. Opinion dynamics in social systems.

Academic Employment

Postdoctoral Fellow February 2019- Present
- Faculty of Electrical Engineering, Technion, Israel.
- Research topic: Control, monitoring & optimization of power grids.
- Supervisor: Prof. Yoash Levron.
- Co-supervisor: Prof. Juri Belikov & Dr. Dimitry Baimel.

Postdoctoral Research Scholar August 2017- August 2018
- Electrical & Computer Engineering, North Carolina State University, USA.
- Research topic: Security of cyber-physical systems.
- Adviser: Prof. Aranya Chakrabortty.

Visiting Researcher October 2015- December 2015
- Research Center for Automatic Control of Nancy, France.
- Research topic: Continuous opinion and discrete actions in opinion dynamics.
- Adviser: Prof. Irinel-Constantin Morărescu & Prof. Samuel Martin.

Education

Ph.D in Systems and Control Engineering July 2012-May 2017
- Indian Institute of Technology, Bombay. CPI: 8.1/10
- Thesis title: Consensus analysis for dynamic graphs: variants and applications.
- Adviser: Prof. Srikant Sukumar.

M.E in Control System Engineering August 2010-June 2012
- Jadavpur University. CGPA: 9.05/10
- Dissertation topic: Observer-based fault detection for nonlinear systems .
- Adviser: Prof. Smita Sadhu (Ghosh).

B.Tech in Electrical Engineering August 2005-June 2009
- Meghnad Saha Institute of Technology. CGPA: 8.28/10.
- B.Tech Project: Stability analysis of a multi-machine system by numerical solution of swing equation using point-by-point method.

Publications

Journal Publications

1. N. Zargari, R. Ofir, N. Roy Chowdhury, J. Belikov, Y. Levron, *An optimal control method for storage systems with ramp constraints, based on an updated trimming process*, IEEE Transactions on Control System Technology (to appear).**(I.F- 5.485)**
2. N. Roy Chowdhury, R. Ofir, N. Zargari, D. Baimel, J. Belikov, Y. Levron, *Optimal control of lossy energy storage systems with nonlinear efficiency based on dynamic programming and Pontryagin's minimum principle*, IEEE Transactions on Energy Conversion, volume- 36, no.-1 pp. 524 – 533, March 2021. **(I.F- 4.312)**
3. N. Roy Chowdhury, J. Belikov, Y. Levron, D. Baimel, *Observer-based detection and identification of sensor attacks in networked CPSs*, Automatica, volume 121, pp. 109166, November 2020. **(I.F- 5.944)**
4. N. Roy Chowdhury, S. Srikant, D. Chatterjee, *A new condition for asymptotic consensus over switching graphs*, Automatica, vol. 97, pp. 18 – 26, 2018. **(I.F- 5.944)**
5. N. Roy Chowdhury, S. Srikant, M. Maghenem, A. Loría, *On the estimation of the consensus rate of convergence in graphs with persistent interconnections*, International Journal of Control, vol. 91, no. 1, pp. 132 – 144, 2018. **(I.F- 2.888)**
6. N. Roy Chowdhury, S. Srikant, N. Balachandran, *Persistence based convergence rate analysis of consensus protocols for dynamic graph networks*, European Journal of Control, vol. 29, pp. 33 – 43, 2016. **(I.F- 2.395)**
7. D. Baimel, N. Roy Chowdhury, J. Belikov, Y. Levron *A new type of bridge fault current limiter with reduced power losses for transient stability improvement of DFIG wind farm*, Electric Power System Research, vol. 197, pp. 107293, August 2021. **(I.F- 3.414)**
8. R. Machlev, N. Roy Chowdhury, J. Belikov, Y. Levron, *Distributed storage placement policy for minimizing frequency deviations: a combinatorial optimization approach based on the cross-entropy method*, International Journal of Electrical Power & Energy Systems, vol. 134, pp. 107322, January 2022. **(I.F- 4.63)**
9. R. Machlev, N. Zargari, N. Roy Chowdhury, J. Belikov, Y. Levron, *A review of optimal control methods for energy storage systems: energy trading, energy balancing and electric vehicles*, Journal of Energy Storage, vol. 32, pp. 101787, December 2020. **(I.F- 6.583)**
10. A. Fahima, G.B. Yosef, R. Machlev, S. Shapira, N. Roy Chowdhury, J. Belikov, A. Orda, Y. Levron, *Applications of game theory to design and operation of modern power systems: a comprehensive review*, Energies, vol. 13(15), pp. 3982 – 4016, 2020. **(I.F- 3.004)**
11. V. Skiparev, R. Machlev, N. Roy Chowdhury, Y. Levron, E. Petlenkov, J. Belikov, *Virtual inertia control methods in islanded microgrids*, early access, Energies, vol. 14, pp. 1562, March 2021. **(I.F- 3.004)**

Journal Under review

1. N. Roy Chowdhury, D. Baimel, J. Belikov, Y. Levron, *A generalized control paradigm for storage systems: optimal energy management and stability certificates*, submitted to IEEE Transactions on Control System Technology, 2020.
2. V. Kaparin, A. Simha, N. Roy Chowdhury, U. Kotta, Y. Levron, J. Belikov, *Extended Observer Form for Nonlinear Continuous-time Systems with Disturbance*, submitted to IFAC Journal of Systems and Control, 2022.

3. N. Roy Chowdhury, D. Baimel, J. Belikov, Y. Levron, *Optimal energy management of power grids with multiple storage systems*, submitted to Power engineering letters, 2022.
4. N. Roy Chowdhury, Y. Beck, J. Belikov, Y. Levron, D. Baimel, *The role storage degradation in energy management problems: an optimal control perspective*, submitted to IEEE CSS e-letter.

Conference Proceedings

1. N. Roy Chowdhury, D. Baimel, J. Belikov, Y. Levron, *Construction of nonlinear feedback strategies for energy storage systems: a stochastic dynamic programming approach*, in the proceedings of PowerTech, pp. $1-6$, June 2021.
2. D. Baimel, N. Roy Chowdhury, J. Belikov, Y. Levron *A new type of bridge fault current limiter with reduced power losses for transient stability improvement of DFIG wind farm*, in the proceedings of IPST 2021.
3. N. Roy Chowdhury, N. Negi, A. Chakrabortty, *A new cyber-secure countermeasure for LTI systems under DoS attacks*, in the proceedings of the 27^{th} Mediterranean Conference on Control and Automation (MED), pp. $304-309$, $1-4^{th}$ July 2019.
4. S. A Kumar, N. Roy Chowdhury, S. Srikant, J. Raísch, *Consensus analysis of systems with time-varying interactions: an event-triggered approach*, in the proceedings of 20^{th} IFAC World Congress, pp. $9349-9354$, $9-14^{th}$ July 2017.
5. N. Roy Chowdhury, I.-C. Morărescu, S. Martin, S. Srikant, *Continuous opinions and discrete actions in social networks: a multi-agent system approach*, in the proceedings of 55^{th} Conference of Decision and Control (CDC), pp. $1739-1744$, $12-14^{th}$ December 2016.
6. N. Roy Chowdhury, S. Srikant, *Consensus analysis of double integrator agents with persistence interaction graphs*, in the proceedings of Australian Control Conference (AUCC), pp. $120-125$, $05-06^{th}$ November 2015.
7. N. Roy Chowdhury, S. Srikant, *A comparative study of persistence based convergence rate estimates to consensus*, in the proceedings of 1^{st} Conference on Modelling, Identification and Control of Nonlinear Systems (MICNON), pp. $534-539$, $24-26^{th}$ June 2015.
8. N. Roy Chowdhury, S. Srikant, *Persistence based analysis of consensus protocols for dynamic graph networks*, in the proceedings of 13^{th} European Control Conference (ECC), pp. $886-891$, $24-27^{th}$ June 2014.

Conference Under review

1. N. Roy Chowdhury, Y. Beck, J. Belikov, Y. Levron, D. Baimel, *The role storage degradation in energy management problems: an optimal control perspective*, submitted to IEEE CDC, Cancun, Mexico, 2022.

Working papers

1. N. Roy Chowdhury, J. Belikov, Y. Levron, *A new finite-time sub-optimal controller for storage systems*, in preparation.
2. S. Arun Kumar, N. Roy Chowdhury, S. Srikant, J. Raísch, *Limited information synchronization of networked linear systems*, in preparation.

3. N. Roy Chowdhury, *Convergence of formations over persistent graphs*, in preparation.
4. N. Roy Chowdhury, *Persistence based consensus analysis against DoS attacks*, in preparation.

Talks and presentations

1. *A comparative study of persistence based convergence rate estimates to consensus*, MICNON, Saint-Petersburg, Russia, June 2015.
2. *Persistence based consensus analysis for dynamic graphs*, CRAN, Nancy, France, December 2015.
3. *Consensus analysis of double integrator agents with persistent interaction graphs*, RACEM-2015 (Poster presentation) Mumbai, India.
4. *Consensus over dynamic graphs*, 42^{nd} SIAM Southeastern Atlantic Sectional Conference, UNC Chapel Hill, North Carolina, March 2018.
5. *Persistence based consensus analysis over dynamic graphs*, Chalmers University of Technology, June 2018. (Skype presentation).
6. *A new cyber-secure countermeasure for LTI systems under DoS attacks*, MED, Akko, Israel, July 2019.
7. *Construction of nonlinear feedback strategies for energy storage systems*, PowerTech, Madrid, Spain 2021. (Virtual)

Relevant Courses

- **Graduate coursework:** Modeling and identification of dynamical systems, System theory, Introduction to probability and random processes, Multivariable control system, Control of nonlinear dynamical systems, Adaptive control theory, Optimal control systems, Differential geometric methods in control, Variable structure and sliding mode control, Advance feedback control,
- **Postgraduate courses:** Modeling of dynamical systems, Control system engineering, Digital control system, Optimal and robust control.
- **Other courses:** Decentralized control of complex systems, Real analysis, Foundation of Optimization, Linear Programming, Game theory.

Teaching Experience

Teaching Assistant
Indian Institute of Technology July 2012-May 2017

- Linear and Non-linear Systems, Mathematical Structures for Systems and Control, Adaptive Control Theory, Systems Theory, Signal and Feedback systems, Theory of Output Regulation, Systems and Control Engineering Laboratory.

Professional Experience

Summer intern May 2008-July 2008
Micro-pro Private Ltd.

- Developed a 89c51 microcontroller based ON/OFF temperature controller.

Honors and awards

- Postdoctoral scholarship at Technion, Israel, (2019 – present)
- Postdoctoral scholarship (sponsored by: NSF) at NCSU (2017 – 2018).
- Institute fellowship during Ph.D program (2012 – 2017) in IIT Bombay.
- MHRD fellowship during M.E program (2010 – 2012) in Jadavpur University.
- Merit position during M.E program (2010 – 2012) in Jadavpur University.
- National Scholarship in Secondary Examination.

Technical Skills

- Programming languages: C, MATLAB, SIMULINK .
- Document preparation packages: LaTeX, LyX, Microsoft office.
- Operating system: Windows.

Professional Service

Session chair

- Invited Session Co-Chair in MICNON-2015.

Reviewer

- **Journal:** IEEE Transaction on Automatic Control, IEEE Transaction on control system technology, IEEE Transaction on Power System, International Journal of Robust and Nonlinear Control, International Journal of Control, IEEE Transactions on Cybernetics.
- **Conference:** IEEE Conference on Decision and Control, American Control Conference, Mediterranean Conference on Control and Automation, Indian Control Conference, IFAC World Congress, IFAC Workshop on Adaptive and Learning Control Systems.

References

- Dr. Srikant Sukumar, Associate Professor,
  Systems and Control Engineering, IIT Bombay,
  Email: srikant@sc.iitb.ac.in, Tel: $+91-22-2576-7832$.
- Dr. Yoash Levron, Associate Professor,
  The Viterbi Faculty of Electrical Engineering,
  Technion−Israel Institute of Technology, Israel,
  Email: yoashl@ee.technion.ac.il, Tel: $+972-4-829-5923$.
- Dr. Juri Belikov, Assistant Professor,
  Department of Software Science,
  Tallinn University of Technology, Estonia,
  Email: juri.belikov@taltech.ee, Tel: $+372-620-2116$

Date 26^{th} April 2022.

Place Haifa, Israel.