

Alessandro ZOCCA

TENURE-TRACK ASSISTANT PROFESSOR

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RESEARCH INTERESTS

Stochastic networks; rare events; operations research; complex networks; energy systems

My research is centered around the study of complex systems where randomness plays a crucial role, with a main focus on power systems affected by uncertainty. My work lies mostly in the area of applied probability, but has deep ramifications in other areas, such as pure probability, optimization, graph theory, and operations research.

My long-term goal as a researcher is to analyze the randomness emerging in these complex systems and corresponding systemic risks with rigorous mathematical tools, as well as understand how such randomness can either be mitigated or, potentially, leveraged to improve the system resilience and performances.

Broadly speaking, I am interested in stochastic dynamics on networks, especially whenever a non-trivial interplay emerges between the (evolving) network structure and the system's randomness, a setting where applied probability, learning, and optimization naturally meet.

The main focus of my current research are stochastic models instrumental to understand and quantify the impact of a high penetration of renewable energy sources in power systems. More specifically, I work on rare-event analysis, stochastic optimization, and MCMC methods for rare events, especially in relation to contingencies and blackouts.

EDUCATION

- Sep 2011 – Dec 2015 **Eindhoven University of Technology**, The Netherlands
PHD, *Mathematics*
Thesis: SPATIO-TEMPORAL DYNAMICS OF RANDOM-ACCESS NETWORKS:
AN INTERACTING PARTICLE APPROACH
Advisors: Prof. Sem Borst, Prof. Johan van Leeuwen, Prof. Francesca Nardi
- 2012 – 2013 DIPLOMA (grade 9.0/10) by the LNMB (Dutch Network for the Mathematics of Operations Research)
- 2010 – 2011 **University of Cambridge**, United Kingdom
MASTER OF ADVANCED STUDIES (PART III) in *Mathematics*, **with merit**
Essay: RANDOM SPANNING TREES
Assessor: Prof. Geoffrey Grimmett
- 2007 – 2010 **Università degli Studi di Padova**, Italy
BACHELOR in *Mathematics*, **110 cum laude**
Thesis: RANDOM FRAGMENTATION CHAINS
Supervisor: Prof. Paolo Dai Pra

ACADEMIC EMPLOYMENT

- Oct 2019 – present **Vrije Universiteit**, Amsterdam
Department of Mathematics
TENURE-TRACK ASSISTANT PROFESSOR
- Sep 2017 – Sept 2019 **California Institute of Technology**, Pasadena, CA
Computing and Mathematical Sciences Department
POSTDOCTORAL SCHOLAR
Mentors: Prof. Adam Wierman and Prof. Steven Low
- Dec 2017 – Sept 2019 **Resnick Sustainability Institute**, Pasadena, CA
AFFILIATE POSTDOCTORAL FELLOW
- Jan 2016 – Aug 2017 **Centrum Wiskunde & Informatica (CWI)**, Amsterdam
Stochastics group
POSTDOCTORAL SCHOLAR
Mentor: Prof. Bert Zwart

AWARDS AND GRANTS

- 2019 **Isaac Newton Institute CPS bursary** to attend the thematic semester “*The mathematics of energy systems*” at Isaac Newton Institute (Cambridge, UK)
- 2018 **NSF travel grant** to attend the 2018 Stochastic Networks conference (2000\$)
- 2017 **NWO Rubicon grant** for my research project “*Renewables and uncertainty in future power systems: Mathematical challenges and solutions*”

Rubicon is a highly competitive grant open for all scientific disciplines awarded by the NWO (Netherlands Organization for Scientific Research), that gives talented young researchers the chance to gain experience at a top research institution abroad.

- 2015 **Applied Probability Trust award** for the best PhD thesis in applied probability

CERTIFICATIONS

- Sep 2019 Italian **National Scientific Habilitation (ASN)** as Associate Professor (sector 01/A3 - Analysis, Probability Theory and Statistics)

LIST OF PUBLICATIONS

In reverse chronological order (see also my [Google Scholar webpage](#)):

1. J. Moriarty, J. Vogrinc, and A. Zocca, **The Skipping Sampler: A new approach to sample from complex conditional densities**, 2019. *Submitted*. [arXiv:1905.09964](#)
2. L. Guo, C. Liang, A. Zocca, S.H. Low, and A. Wierman, **Less is More: Real-time Failure Localization in Power Systems**, 2019. Accepted for publication at *2019 IEEE Conference on Decision and Control (CDC)*. [arXiv:1904.05461](#)
3. A. Zocca, **Temporal starvation in multi-channel CSMA networks: an analytical framework**, 2019. In *Queueing Systems*, Volume 91, Issue 3-4, pp. 241–263, [10.1007/s11134-019-09598-y](#)
4. F.R. Nardi, A. Zocca **Tunneling behavior of Ising and Potts models in the low-temperature regime**, 2018. To appear in *Stochastic Processes and their Applications*,

[10.1016/j.spa.2018.12.001](https://doi.org/10.1016/j.spa.2018.12.001)

5. L. Guo, C. Liang, A. Zocca, Steven H. Low, A. Wierman, **Failure Localization in Power Systems via Tree Partitions**, 2018. In *2018 IEEE Conference on Decision and Control (CDC)*, pp. 6832-6839, [10.1109/CDC.2018.8619562](https://doi.org/10.1109/CDC.2018.8619562)
6. J. Moriarty, J. Vogrinc, A. Zocca, **Frequency violations from random disturbances: an MCMC approach**, 2018. In *2018 IEEE Conference on Decision and Control (CDC)*, pp. 1598-1603, [10.1109/CDC.2018.8619304](https://doi.org/10.1109/CDC.2018.8619304)
7. A. Zocca, **Tunneling of the hard-core model on finite triangular lattices**, 2019. In *Random Structures & Algorithms*, Volume 55, Issue 1, pp. 215-246 [10.1002/rsa.20795](https://doi.org/10.1002/rsa.20795)
8. T. Nesti, A. Zocca, B. Zwart, **Emergent failures and cascades in power grids: A statistical physics perspective**. In *Physical Review Letters* 120, 258301, June 2018, [10.1103/PhysRevLett.120.258301](https://doi.org/10.1103/PhysRevLett.120.258301)
9. A. Zocca, **Low-temperature behavior of the multicomponent Widom-Rowlison model on finite square lattices**. In *Journal of Statistical Physics*, Volume 171, Issue 1, 2018, pp. 1-37, [10.1007/s10955-018-1961-9](https://doi.org/10.1007/s10955-018-1961-9)
10. A. Zocca, B. Zwart, **Optimization of stochastic lossy transport networks and applications to power grids**, 2017. Submitted. [arXiv:1712.07411](https://arxiv.org/abs/1712.07411)
11. T. Nesti, A. Zocca, B. Zwart, **Line failure probability bounds for power grids**. In *Proceedings of 2017 IEEE Power & Energy Society General Meeting*, Chicago, IL, USA, 2017, pp. 1-5, [10.1109/PESGM.2017.8274716](https://doi.org/10.1109/PESGM.2017.8274716)
12. T. Nesti, A. Zocca, B. Zwart, **Assessing safe operating regions in power grids under uncertainty** (Extended abstract). In *Proceedings of the Energy-Open conference*, University of Twente, 2017. Available at <https://energy-open.nl/>
13. A. Zocca, B. Zwart, **Minimizing heat loss in DC networks using batteries**. In *Proceedings of the 54th Allerton Conference on Communication, Control, and Computing (Allerton)*, Monticello, IL, USA, 2016, pp. 1306-1313, [10.1109/ALLERTON.2016.7852385](https://doi.org/10.1109/ALLERTON.2016.7852385)
14. F.R. Nardi, A. Zocca, S.C. Borst, **Hitting times asymptotics for hard-core interactions on grids**. In *Journal of Statistical Physics*, Volume 162, Issue 2, 2016, pp. 522-576, open-access version available at [10.1007/s10955-015-1391-x](https://doi.org/10.1007/s10955-015-1391-x)
15. B. Bellalta, A. Checco, A. Zocca and J. Barcelo, **On the interactions between multiple overlapping WLANs using channel bonding**. In *IEEE Transactions on Vehicular Technology*, Volume 65, Issue 2, 2016, pp. 796-812, [10.1109/TVT.2015.2400932](https://doi.org/10.1109/TVT.2015.2400932)
16. A. Zocca, **Spatio-temporal dynamics of random-access networks: An interacting particle approach** (PhD thesis). October 2015, available at the [TU/e repository](https://repository.tue.nl/)
17. A. Zocca, S.C. Borst and J.S.H. van Leeuwen, **Slow transitions and starvation in dense random-access networks**. In *Stochastic Models*, Volume 31, Issue 3, July 2015, pp. 361-402, [10.1080/15326349.2015.1018441](https://doi.org/10.1080/15326349.2015.1018441)
18. A. Zocca, S.C. Borst, J.S.H. van Leeuwen and F.R. Nardi, **Delay performance in random-access grid networks**. In *Performance Evaluation*, Volume 70, Issue 10, October 2013, pp. 900-915, [10.1016/j.peva.2013.08.019](https://doi.org/10.1016/j.peva.2013.08.019)
19. A. Zocca, S.C. Borst and J.S.H. van Leeuwen, **Mixing properties of CSMA networks on partite graphs**. In *Proceedings of VALUETOOLS 2012*, pp. 117-126, [10.4108/valuertools.2012.250264](https://doi.org/10.4108/valuertools.2012.250264)

BOOK CONTRIBUTIONS

B. Bellalta, A. Zocca, C. Cano, A. Checco, J. Barcelo, A. Vinel. (2014) **Throughput analysis in CSMA/CA networks using continuous time Markov networks: a tutorial.** In *Wireless Networking for Moving Objects. Protocols, Architectures, Tools, Services and Applications*, Lecture Notes in Computer Science, Vol. 8611, pp. 115-133

SERVICE

- Supervision** Daily supervisor of the PhD students L. Guo and C. Liang at Caltech
Co-supervisor for two 2019 SURF projects at Caltech
Daily supervisor of the PhD student T. Nesti at CWI (2016-2017)
Master thesis co-supervisor of T. Monni at Università di Firenze (2018)
Final bachelor projects for the minor “Finance&Risk” at TU/e (2012-2014)
Modeling assignments of “Stochastic processes” at TU/e (2014)
- Reviewer** Valuetools conference 2020 (TPC member)
Sigmetrics conference 2020
Mathematical Methods of Operations Research
Mathematics of Operations Research
IEEE Transactions on Network Science and Engineering
ACM ToMPECS
ACM-SIAM Symposium on Discrete Algorithms (SODA 2017)
IEEE Transactions on Information Theory
Journal of Statistical Mechanics: Theory and Experiment (JSTAT)
IEEE Transactions on Automatic Control
IEEE Control Systems Letters
IEEE CDC conference 2018
Sustainable Energy Grids and Networks
- Organizer** Invited sessions at INFORMS Annual Meeting (2018, 2019)
YEQT workshop “[Winter school on energy systems](#)” at Eurandom (2017)
Eindhoven Stochastic Seminar and Colloquium (2014, 2015)
“*Markov Chains and Mixing Times*” reading seminar at TU/e (2012)
- Teaching** Instructor for the course “Stochastic processes” at TU/e (2012-2014)
Tutor for the course “Calculus” at TU/e (2012-2013)
Trainer for high-school Mathematical Olympiads (2007-2010)

INVITED RESEARCH VISITS

- Jan 2019 Thematic semester “*The mathematics of energy systems*” at Isaac Newton Institute (Cambridge, UK)
- Sep 2018 DISMA at Politecnico di Torino (hosts: prof. Fagnani and prof. Como)
- Sep 2017 Università degli Studi di Firenze (host: prof. Nardi)
- Dec 2016 LAMA at Université Paris Est Créteil (host: prof. Sohier)
- Nov 2016 California Institute of Technology, Pasadena (host: prof. Wierman)
- Nov 2015 Universitat Pompeu Fabra, Barcelona (host: prof. Bellalta)
- Jul 2014 EPFL, Lausanne (host: prof. Thiran)
- May 2014 Hamilton Institute, Dublin (host: prof. Leith and prof. Duffy)

INVITED TALKS AND SEMINARS

- Jul 2019 12th Intern. Conference on Monte Carlo Methods and Applications, Sydney
Jul 2019 INFORMS Applied Probability Society Conference, Brisbane
May 2019 Talk at Resnick Fellows Seminar Day, Pasadena
Jan 2019 Workshop “*Reliability and Resiliency in Network Infrastructure*”, Santiago
Jan 2019 CUED Control Group Seminar, Cambridge
Dec 2018 IFIP WG Performance Conference 2018, Toulouse
Dec 2018 YEQT workshop 2018, Toulouse
Nov 2018 INFORMS Annual Meeting 2018, Phoenix
Oct 2018 CMI seminar at Caltech, Pasadena
Sept 2018 Seminar at DISMA, Politecnico di Torino
Jun 2018 Poster at 2018 Stochastic Networks conference, Edinburgh
Jun 2018 Poster at 2018 ACM Sigmetrics conference, Irvine
Mar 2018 Seminar at Simons Institute, Berkeley
Dec 2017 Opening conference VPSMS 2018, Verona
Oct 2017 INFORMS Annual Meeting 2017, Houston
Oct 2017 CMS seminar at Caltech, Pasadena
July 2017 INFORMS Applied Probability Society Conference, Evanston
June 2017 1st Italian Meeting on Probability and Mathematical Statistics, Torino
May 2017 Seminar at CWI “*Future Energy Systems*” workshop, Amsterdam
Apr 2017 IMA & OR Society Conference on Mathematics of Operational Research, Birmingham
Dec 2016 Seminar at Université Paris Est Créteil, Paris
Apr 2016 Workshop “*Metastability in statistical mechanics and stochastic processes*” EURANDOM, Eindhoven
Nov 2015 Seminar at Università degli Studi di Padova
July 2015 INFORMS Applied Probability Society Conference, Istanbul
Apr 2015 Seminar at Mathematical Institute of Leiden University
Oct 2014 Berlin-Padova Young Researchers Meeting, Berlin
Jul 2014 Seminar at EPFL, Lausanne
May 2014 Seminar at Hamilton Institute, Dublin
Sep 2013 IFIP WG Performance Conference 2013, Vienna
July 2013 INFORMS Applied Probability Society Conference, San José
Oct 2012 6th International VALUETOOLS Conference, Cargèse

OTHER CONFERENCES, SCHOOLS, AND WORKSHOPS ATTENDED

- 58th CDC conference, Nice, December 2019
- Future Distribution Grid R&D Workshop, Charlotte, March 2019
- 57th CDC conference, Miami, December 2018
- “*Real-Time Decision Making Boot Camp*” and “*Societal Networks*” workshops, Simons Institute at Berkeley, January and March 2018
- “*Learning, Algorithm Design and Beyond Worst-Case Analysis*” workshop, Simons Institute at Berkeley, November 2016
- Winter School “*Mathematics of the Energy Transition*”, Munich, February 2016
- Stochastic Networks conferences: June 2012 (Boston), June 2014 (Amsterdam), June 2016 (San Diego), June 2018 (Edinburgh)
- Young European Queueing Theorists (YEQT) workshops (2011-2018)
- Young European Probabilists (YEP) workshops (2012, 2014, 2015)