


Alisa Rupenyan-Vasileva

Data-driven Automation and Optimization

Rieter Endowed Professor, Zurich University for Applied Sciences, Centre for AI

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Education

- 2009 **PhD, Physical Sciences, Vrije Universiteit Amsterdam, Amsterdam.**
Thesis: Time-resolved laser spectroscopy for studying protein photoreactions
Supervisor: Prof. Dr. Marloes Groot
- 2005 **Master of Science, Laser Physics and Optics, Sofia University, Sofia.**
Thesis: Raman Spectroscopy studies of polymers C2E2C2
Supervisor: Prof. Dr. Georgi Georgiev
- 2003 **Bachelor of Science, Engineering Physics, Sofia University, Sofia.**
Bachelor thesis completed in exchange semester at University Paris XIII, Laboratoire de Physique de Lasers

Research Interests

Autonomous machines, Decision-making in industrial settings, Learning-based optimization and control, Predictive control for machining applications

Research Experience

- September 2023 – Present **Zurich University of Applied Sciences - Centre for AI.**
Rieter Endowed Professor, Group leader for Industrial AI - research projects in neuro-symbolic learning, robot-based manufacturing optimization)
- August 2020 – August 2023 **ETH Zurich - Automatic Control Laboratory.**
Senior scientist, Leader of Advanced manufacturing within NCCR Automation - several interconnected and collaborative PhD and postdoctoral research projects in data-driven optimization and control)
- Feb 2018 – August 2023 **Inspire AG - technology transfer unit at ETH Zurich.**
Group leader, Advanced Control and Automation (group associated with the Automated Control Lab at ETH Zurich, Prof. John Lygeros). Lead PI of Innosuisse funded-projects in the field of automation and learning-based control in collaboration with industry partners.
- March 2011 – Sept 2013 **Laboratory for Physical Chemistry, ETH Zurich.**
Postdoctoral fellow (individual grant), Following electrons on the electronic time scale: attosecond imaging of charge transfer
- Jan 2010 – Dec 2010 **Van't Hoff Institute for Molecular Chemistry, University of Amsterdam.**
Postdoctoral researcher, Supervisor: Prof. Dr. Sander Woutersen, 2D mid-IR spectroscopy of proteins
- Feb 2005 – Dec 2009 **Biophysics group, Vrije Universiteit Amsterdam.**
Doctoral student, Ultrafast spectroscopy of protein photoreactions Supervisor: Prof. Dr. Marloes Groot

Technology leadership experience

- June 2022 – present **ObvioTec AG (swiss medtech startup) .**
Advisory board member
- January 2021 – present **Innosuisse (Federal Swiss Innovation Agency) .**
Innovation expert, Engineering and ICT
 - Evaluation and advisory function for various types of innovation projects between industrial and academic partners, and for innovation platforms bringing together stakeholders from academy, industry, and policy institutions

Jan 2014 – **Qualysense AG (swiss agri-tech startup)** .

Aug 2017 Lead scientist, Head of application development. Machine learning-based methods for automated high-speed grain sorting.

Research funding, Fellowships & Grants

2023-2026 Recipient of **Innosuisse grant** Robot-enhanced active control for thermal spray coating

2022-2024 Recipient of **Innosuisse grant** Multi-axis path generation and intelligent control for 3D-printing

2020-2024 **NCCR Automation**: Lead PI for the Advanced manufacturing research projects (2 co-supervised PhD projects)

2020-2022 Recipient of **Innosuisse grant** Data-driven adaptive control for high-end motion systems

2019-2021 Recipient of **Innosuisse grant** Data-driven insights for smart grinding

2019-2022 Co-Recipient of **Innosuisse grant** Adaptive control tracker In-Situ Verification

2011-2013 Recipient of **ETH Zurich postdoctoral fellowship grant**

Teaching Experience

2022–present **Lead lecturer and organiser, AI in Manufacturing Course (inspire).**

2018–present **Co-supervisor of multiple (>15) bachelor and master-level research projects at D-ITET ETH Zurich.**

2011–2013 **Supervisor of bachelor and master-level research projects at D-CHAB ETH Zurich.**

2006-2008 **TA Structure of matter (Quantum mechanics / Atomic physics), VU Amsterdam.**

2006-2008 **TA Practicum Analytical Chemistry, VU Amsterdam.**

Academic Experience

(Co-)Supervision

Xavier Guidetti, PhD student, ETH Zurich/inspire. Data-driven process control, December 2019 - present (co-supervising with prof. J. Lygeros)

Samuel Balula, PhD student, ETH Zurich/inspire. Merging data-driven and first principles modeling for real-time control of industrial processes, June 2018 - present (co-supervising with prof. J. Lygeros)

Mahdi Nobar, PhD student, FHNW / ETH Zurich (NCCR Automation). Intelligent Control Framework for Robotic Systems, September 2021 - present (co-supervising with prof. J. Lygeros and with prof. J. Keller at FHNW)

Riccardo Zulliani, PhD student, ETH Zurich (NCCR Automation). Advanced control for additive manufacturing, November 2022 - present (co-supervising with prof. J. Lygeros)

MSc projects at ETHZ

Timo Roth, Hierarchical MPC with jointly optimized controller parameters for path following, 2020

Eugenio Chisari, Deep reinforcement learning for autonomous racing, 2019/2020

Christopher Koenig, Adaptive tuning with Bayesian optimization 2019

Tianwei Lan, Deep reinforcement learning for industrial applications, 2019

Ruben Zwicker, Efficient Bayesian optimization for turning, 2019

Sven Schmid, Measurement and modeling of grinding wheel wear and grinding quality, 2019

Ramadaas Krishnadaas, Online Learning in Contouring Control Using Bayesian Linear Regression, 2021

Riccardo Zulliani, Uncertainty-aware repetitive predictive control, 2022

>15 semester projects (MSc level) and BSc projects (BSc thesis) in the field of advanced control systems combined with machine learning

Review

IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Vehicular Technology, European Control Conference, IEEE Conference on Decision and Control, IEEE ICRA, IROS, IECON, CIRP Journal of Manufacturing Technology, MDPI Applied Science Journal, IEEE Access, IEEE Robotics and Automation Letters, IEEE Transaction on Robotics

Review of proposals and grants

Swiss Innovation Agency (Innosuisse) innovation expert in ICT since January 2021

Expert Evaluator at the European Commission, (Horizon 2020, Horizon Europe, MSCA postdoctoral projects)

Seminar organization

Co-organizer of **Colloquium on Production Technology** (ETH Zurich, IWF) for industrial manufacturing research
Organizer and lead lecturer for **AI in manufacturing** - graduate level course for researchers at inspire

Conference organization

Industry chair for 7th IEEE Conference on Control Technology and Applications, 2023 - Barbados

Publications

Full list of publications available at google scholar, last five years publications listed below.

Honors and awards

2020 Finalist Best paper IEEE IROS (co-author)

2011 ETH individual postdoctoral research grant (ETH fellow)

2000-2004 Scholarship for excellence, Sofia University, Physics Department

Selected recent invited talks and conference presentations

2022, Webinar on Artificial intelligence in advanced manufacturing processes, JMT - Transfer learning and optimization applied to turning processes

2022, Innovation Booster Photonics - AI in Photonics, Automated laser beam alignment through Bayesian Optimization, FHNW Brugg

2021, ICRA, Safe and efficient model-free adaptive control via Bayesian optimization

Languages

Bulgarian (mother tongue), English (fluent), French (professional proficiency), German (intermediate B1-B2)

Interests and activities

Member of IEEE (CSS, RAS, IES), IFAC Industry (executive committee member), member of Swiss informatics; Industry chair for IEEE CCTA 2023

Publications and Patents (last five years)

Patents

2020 Christian Bobst Markus Maier, Alisa Rupenyan. Method for autonomous optimization of a grinding process. *EU patent EP3736648A1*, 2020.

Book chapters

2020 Markus Maier, Alisa Rupenyan, Stephan Scholze, and Konrad Wegener. Einrichten von schleifmaschinen auf der basis der bayesschen optimierung. In Hans-Werner Hoffmeister and Berend Denkena, editors, *Jahrbuch Schleifen, Honen, Läppen und Polieren*. Vulkan-Verlag GmbH, 2020.

Journal Articles

2023 Xavier Guidetti, Efe C Balta, Yannick Nagel, Hang Yin, Alisa Rupenyan, and John Lygeros. Stress flow guided non-planar print trajectory optimization for additive manufacturing of anisotropic polymers. *Additive Manufacturing*, page 103628. Elsevier, 2023.

2022 Mohammad H Mamduhi, Efe C Balta, Alisa Rupenyan, and John Lygeros. Information-operation technology integration in industrial cyberphysical systems. *Computer*, volume 55, pages 115–118. IEEE, 2022.

2022 Markus Maier, Hannes Kunstmann, Ruben Zwicker, Alisa Rupenyan, and Konrad Wegener. Autonomous and data-efficient optimization of turning processes using expert knowledge and transfer learning. *Journal of Materials Processing Technology*, volume 303, page 117540, 2022.

2022 Dominic Liao-McPherson, Efe C Balta, Alisa Rupenyan, and John Lygeros. On robustness in optimization-based constrained iterative learning control. *IEEE Control Systems Letters*. IEEE, 2022.

2022 Christopher Koenig, Mohammad Khosravi, Markus Maier, Roy S Smith, John Lygeros, and Alisa Rupenyan. Safety-aware cascade controller tuning using constrained bayesian optimization. *IEEE Transactions on Industrial Electronics (accepted)*, 2022. <https://arxiv.org/abs/2010.15211>.

- 2022 Xavier Guidetti, Alisa Rupenyan, Ehsan Fallahi Sichani, Majid Nabavi, and John Lygeros. Spraying parameters selection based on predicted equipment status: A study on measured voltage. *Journal of Thermal Spray Technology*, pages 1–9. Springer US, 2022.
- 2021 M. Khosravi, V. Behrunani, P. Myszkowski, R. S. Smith, A. Rupenyan, and J. Lygeros. Performance-driven cascade controller tuning with bayesian optimization. *IEEE Transactions on Industrial Electronics*, pages 1–1, 2021. DOI: <https://doi.org/10.1109/TIE.2021.3050356>.
- 2020 Markus Maier, Alisa Rupenyan, Christian Bobst, and Konrad Wegener. Self-optimizing grinding machines using gaussian process models and constrained bayesian optimization. *The International Journal of Advanced Manufacturing Technology*, volume 108, pages 528–552, 2020. DOI: <https://doi.org/10.1007/s00170-020-05369-9>.
- 2020 Thomas Gittler, Stephan Scholze, Alisa Rupenyan, and Konrad Wegener. Machine tool component health identification with unsupervised learning. *Journal of Manufacturing and Materials Processing*, volume 4, page 86, 2020. DOI: <https://doi.org/10.3390/jmmp4030086>.
- 2019 M. Maier, R. Zwicker, M. Akbari, A. Rupenyan, and K. Wegener. Bayesian optimization for autonomous process set-up in turning. *CIRP Journal of Manufacturing Science and Technology*, volume 26, pages 81–87, 2019. DOI: <https://doi.org/10.1016/j.cirpj.2019.04.005>.
- 2017 P.R. Armstrong, F. Dell’Endice, E.B. Maghirang, and A. Rupenyan. Discriminating oat and groat kernels from other grains using near-infrared spectroscopy. *Cereal Chemistry*, volume 94, pages 458–463, 2017. DOI: <https://doi.org/10.1094/CCHEM-06-16-0162-R>.
- 2016 A. Rupenyan, N. Sansonne, and F. Dell’Endice. Machine vision combined with near-infrared spectroscopy to guarantee food safety. *Cereal Foods World*, volume 61, pages 140–142, 2016. DOI: <https://doi.org/10.1094/CFW-61-4-0140>.
- 2015 Kraus PM, Tolstikhin OI, Baykusheva D, Rupenyan A, Schneider J, Bisgaard CZ, Morishita T, Jensen F, Madsen LB, and Wörner HJ. Observation of laser-induced electronic structure in oriented polyatomic molecules. *Nature communications*, 05 2015. DOI: <https://doi.org/10.1038/ncomms8039>.
- 2015 Kraus PM, Mignolet B, Baykusheva D, Rupenyan A, Horny L, Penka EF, Grassi G, Tolstikhin OI, Schneider J, Jensen F, Madsen LB, Bandrauk AD, Remacle F, and Wörner HJ. Measurement and laser control of attosecond charge migration in ionized iodoacetylene. *Science (New York, N.Y.)*, 11 2015. DOI: <https://doi.org/10.1126/science.aab2160>.
- 2015 P.M. Kraus, B. Mignolet, D. Baykusheva, A. Rupenyan, L. Horn, E.F. Penka, O.I. Tolstikhin, J. Schneider, F. Jensen, L.B. Madsen, A.D. Bandrauk, F. Remacle, and H.J. Wörner. Attosecond charge migration and its laser control. *Journal of Physics: Conference Series*, volume 635, 2015.
- 2015 Huerta-Viga A, Amirjalayer S, Domingos SR, Meuzelaar H, Rupenyan A, and Woutersen S. The structure of salt bridges between Arg(+) and Glu(-) in peptides investigated with 2d-ir spectroscopy: Evidence for two distinct hydrogen-bond geometries. *The Journal of chemical physics*, 06 2015. DOI: <https://doi.org/10.1063/1.4921064>.
- 2013 A. Rupenyan, P.M. Kraus, J. Schneider, and H.J. Wörner. High-harmonic spectroscopy of isoelectronic molecules: Wavelength scaling of electronic-structure and multielectron effects. *Physical Review A - Atomic, Molecular, and Optical Physics*, volume 87, 2013.
- 2012 Kraus PM, Rupenyan A, and Wörner HJ. High-harmonic spectroscopy of oriented OCS molecules: emission of even and odd harmonics. *Physical review letters*, 12 2012. DOI: <https://doi.org/10.1103/physrevlett.109.233903>.
- 2012 P.M. Kraus, J. Schneider, A. Rupenyan, and H.J. Wörner. High-harmonic spectroscopy of oriented polyatomic molecules: Toward probing attosecond charge migration. *Laser Science, LS 2012*, 2012.
- 2012 Rupenyan A, Bertrand JB, Villeneuve DM, and Wörner HJ. All-optical measurement of high-harmonic amplitudes and phases in aligned molecules. *Physical review letters*, 01 2012. DOI: <https://doi.org/10.1103/physrevlett.108.033903>.
- 2011 Toh KC, Stojkovic EA, Rupenyan AB, van Stokkum IH, Salumbides M, Groot ML, Moffat K, and Kennis JT. Primary reactions of bacteriophytochrome observed with ultrafast mid-infrared spectroscopy. *The journal of physical chemistry. A*, 04 2011. DOI: <https://doi.org/10.1021/jp106891x>.

- 2011 Rupenyan AB, Vreede J, van Stokkum IH, Hospes M, Kennis JT, Hellingwerf KJ, and Groot ML. Proline 68 enhances photoisomerization yield in photoactive yellow protein. *The journal of physical chemistry. B*, 05 2011. DOI: <https://doi.org/10.1021/jp112113s>.
- 2009 Rupenyan A, van Stokkum IH, Arents JC, van Grondelle R, Hellingwerf KJ, and Groot ML. Reaction pathways of photoexcited retinal in proteorhodopsin studied by pump-dump-probe spectroscopy. *The journal of physical chemistry. B*, 12 2009. DOI: <https://doi.org/10.1021/jp9065289>.
- 2009 Rupenyan A, Commandeur J, and Groot ML. Co photodissociation dynamics in cytochrome p450bm3 studied by subpicosecond visible and mid-infrared spectroscopy. *Biochemistry*, 07 2009. DOI: <https://doi.org/10.1021/bi900351m>.
- 2008 Rupenyan A, van Stokkum IH, Arents JC, van Grondelle R, Hellingwerf K, and Groot ML. Characterization of the primary photochemistry of proteorhodopsin with femtosecond spectroscopy. *Biophysical journal*, 05 2008. DOI: <https://doi.org/10.1529/biophysj.107.121376>.

Submitted publications

- 2023 Baris Kavas, Efe C. Balta, Michael Tucker, Alisa Rupenyan, John Lygeros, and Markus Bambach. Layer-to-layer closed-loop feedback control application for inter-layer temperature stabilization in laser powder bed fusion. *Additive Manufacturing*, page 103628. Elsevier, 2023.
- 2022 Samuel Balula, Dominic Liao-McPherson, Alisa Rupenyan, and John Lygeros. Data-driven reference trajectory optimization for precision motion systems. *arXiv preprint arXiv:2205.15694*, 2022.
- 2022 Efe C Balta, Mohammad H Mamduhi, John Lygeros, and Alisa Rupenyan. Controller-aware dynamic network management for industry 4.0. *arXiv preprint arXiv:2205.14449*, 2022.

Conference Proceedings

- 2022 Riccardo Zuliani, Efe C Balta, Alisa Rupenyan, and John Lygeros. Batch model predictive control for selective laser melting. *IEEE ECC 2022 (accepted)*, 2022. <https://arxiv.org/abs/2111.08363>.
- 2022 Dominic Liao-McPherson, Efe C Balta, Ryan Wüest, Alisa Rupenyan, and John Lygeros. In-layer thermal control of a multi-layer selective laser melting process. *IEEE ECC 2022 (accepted)*, 2022. <https://arxiv.org/abs/2111.00890>.
- 2021 Alisa Rupenyan, Mohammad Khosravi, and John Lygeros. Performance-based trajectory optimization for path following control using bayesian optimization. In *2021 60th IEEE Conference on Decision and Control (CDC)*, pages 2116–2121, 2021.
- 2021 Christopher Koenig, Mateo Turchetta, John Lygeros, Alisa Rupenyan, and Krause Andreas. Safe and efficient model-free adaptive control via bayesian optimization. *International Conference for Robotics ans Automation (ICRA) 2021*, 2021. <https://arxiv.org/abs/2101.07825>.
- 2021 Xavier Guidetti, Alisa Rupenyan, Lutz Fassel, Majid Nabavi, and John Lygeros. Plasma spray process parameters configuration using sample-efficient batch bayesian optimization. In *2021 IEEE 17th International Conference on Automation Science and Engineering (CASE)*, pages 31–38, 2021.
- 2021 Eugenio Chisari, Alexander Liniger, Alisa Rupenyan, and John Lygeros. Learning from simulation, racing in reality. *International Conference for Robotics ans Automation (ICRA) 2021*, 2021. <https://arxiv.org/abs/2011.13332>.
- 2020 José L Vázquez, Marius Brühlmeier, Alexander Liniger, Alisa Rupenyan, and John Lygeros. Optimization-based hierarchical motion planning for autonomous racing. *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 2397–2403, 2020. DOI:10.1109/IROS45743.2020.9341731.
- 2020 Markus Maier, Alisa Rupenyan, Mansur Akbari, Ruben Zwicker, and Konrad Wegener. Turning: Autonomous process set-up through bayesian optimization and gaussian process models. In *13th CIRP Conference on Intelligent Computation in Manufacturing Engineering, CIRP ICME 19*, volume 88, pages 306–311, 2020. <https://doi.org/10.3929/ethz-b-000386017>.
- 2020 Mohammad Khosravi, Varsha Behrunani, Roy S Smith, Alisa Rupenyan, and John Lygeros. Cascade control: Data-driven tuning approach based on bayesian optimization. *accepted in IFAC World congress*, 2020. <https://arxiv.org/abs/2005.03970>.

- 2020 Eugenio Chisari, Alexander Liniger, Alisa Rupenyan, and John Lygeros. Learning from simulation, racing in reality. *3rd Robot Learning Workshop, NeurIPS*, 2020.
- 2020 Samuel Balula, Alex Liniger, Alisa Rupenyan, and John Lygeros. Reference design for closed loop system optimization. *IEEE Xplore European Control Conference*, 2020. <https://ieeexplore.ieee.org/document/9143667>.
- 2019 A. Liniger, L. Varano, A. Rupenyan, and J. Lygeros. Real-time predictive control for precision machining. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pages 7746–7751, 2019. DOI: <https://doi.org/10.1109/CDC40024.2019.9029533>.
- Efe C. Balta, Kira Barton, Dawn M. Tilbury, and Alisa Rupenyan.