Roland Schwan

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Date of birth: 7 October 1997 | Nationalities/Permits: Austrian, German, Swiss C-Permit

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Summary

- PhD in Electrical Engineering with experience in algorithms and numerical software for control, motion systems, and robotics.
- Developed high-performance state-of-the-art open-source mathematical programming solvers with 10k+ downloads per month, used both in academia and industry (robotics, finance, maritime industry, etc.).

Experience

Postdoctoral Researcher, Dartmouth College – Hanover, NH, USA — June 2026 – Present

Research Assistant, EPFL – Lausanne, Switzerland — Oct 2020 – Apr 2026

- Advisors: Colin N. Jones and Daniel Kuhn
- Teaching Assistant:
  - Model Predictive Control / Automatic Control Laboratory / Prof. Colin Jones (2021-Present)
  - Control Systems / Automatic Control Laboratory / Prof. Colin Jones (2020-Present)
  - Advanced Machine Learning / Learning Algorithms and Systems Laboratory / Prof. Aude Billard (2020/2021)

Researcher, NCCR Automation – Switzerland — Oct 2020 – Apr 2026

- The NCCR (National Centre of Competence in Research) Automation is a Swiss research initiative focused on laying the foundations of dependable automation systems and implementing the resulting solutions in practice to demonstrate their social relevance.

Visiting Researcher, University of Oxford – Oxford, U.K. — Aug 2024 – Sep 2024

- Advisor: Paul Goulart
- Developed warm starting methods for Interior-Point methods.

Avionics / GNC Engineer, ARIS – Zurich, Switzerland — Jun 2018 – Sep 2019

- Controller design of a sounding rocket's air braking system and software design of the rocket's avionics firmware.
- 2nd Place at the Spaceport America Cup competition in New Mexico, USA (10K COTS category).

Teaching Assistant, ETH Zurich – Zurich, Switzerland — Feb 2018 – Jun 2019

- Computer Science I / Programming Methodology / Dr. Malte Schwerhoff (2019)
- Networks and Circuits I / High Voltage Laboratory / Prof. Christian Franck (2018/2019)
- PPS "Bits on Air" / Communication Theory Group / Prof. Helmut Bölcskei (2018)

Education

École Polytechnique Fédérale de Lausanne (EPFL), PhD Electrical Engineering — Oct 2020 – Mar 2026

- Thesis: Numerical Methods for Optimization and Control: From Verification to GPU-Acceleration
- Thesis Advisors: Colin N. Jones and Daniel Kuhn

Imperial College London, MSc Control Systems, *Distinction* — Oct 2019 – Sep 2020

- Thesis: Data-Driven Economic Model Predictive Control
- Thesis Advisor: David Angeli

ETH Zurich, BSc in Electrical Engineering and Information Technology — Sep 2016 – Sep 2019

Software

socu, Python toolbox to solve structured sparse linear systems for MPC problems on GPU [4]

- Custom CUDA kernels to solve linear systems arising in multi-stage problems (e.g. MPC) efficiently, reducing the time complexity from $\mathcal{O}(Nn^3)$ to $\mathcal{O}(\log(N)n^3)$. More than 100x faster for long horizon problems compared to solving with a sparse CPU solver (QDLDL) and more than 2x faster than NVIDIA's cuDSS library.
- Open Source: github.com/PREDICT-EPFL/socu

laOPT, C++ toolbox to model and solve non-linear optimal control problems in real-time [6]

- laOPT allows modeling and solving non-linear optimization problem with an emphasis on optimal control problems. It uses C++ meta-programming to achieve minimal overhead at run time. Gradients and Hessians are automatically calculated using automatic differentiation, but can be manually overwritten for maximal performance or library integrations like Pinocchio. It interfaces IPOPT and implements an SQP solver with interfaces to QP solvers like PIQP, HPIPM, OSQP, and more.

PIQP, Proximal Interior-Point Quadratic Programming solver [5], [7], [10]

- A QP solver to solve dense and sparse quadratic problems using a proximal interior-point method. It is designed for embedded applications with an emphasis on real-time capability and no dynamic memory allocations during re-solves. It's implemented in C/C++ with Eigen support and interfaces to Python, Matlab/Octave, and R.
- 10k+ downloads per month.
- Open Source: github.com/PREDICT-EPFL/piqp

EVANQP, EPFL verifier for approximate neural networks and QPs [3]

- Framework to verify Approximate Neural Networks and parametric QPs. Starting with a stable but expensive control policy (e.g. MPC), we can learn an approximation (e.g. NN) of it. EVANQP then finds the worst-case approximation error between the two policies and can prove stability in a given domain. The toolbox is implemented in Python and allows problems to be directly formulated in CVXPY for parametric QPs and in PyTorch for NNs.
- Open Source: github.com/PREDICT-EPFL/evanqp

Languages

- German (native)
- English (C1)
- French (B2)

Software Tools

- Programming Languages: C, C++, CUDA, Python, Matlab, Julia
- Libraries: Eigen, Numpy, SciPy, PyTorch, Jax, BLAS, OpenMP/MPI, CasADi, ROS2

Publications

Journal Papers

[1] Y. Jiang, K. Fedorová, **R. Schwan**, J. Oravec, and C. N. Jones, “Distributed real-time cooperative model predictive control,” *IEEE Transactions on Automatic Control*, pp. 1–8, 2026

[2] W. Jongeneel and **R. Schwan**, “On continuation and convex lyapunov functions,” *IEEE Transactions on Automatic Control*, vol. 69, no. 10, pp. 6895–6906, 2024

[3] **R. Schwan**, C. N. Jones, and D. Kuhn, “Stability verification of neural network controllers using mixed-integer programming,” *IEEE Transactions on Automatic Control*, vol. 68, no. 12, pp. 7514–7529, 2023

Preprints

[4] **R. Schwan**, D. Kuhn, and C. N. Jones, *GPU-accelerated Cholesky factorization of block tridiagonal matrices*, 2026. eprint: `arXiv:2601.03754`

[5] F. Song, **R. Schwan**, Y. Chen, and C. N. Jones, *Parallel KKT solver in PIQP for multistage optimization*, 2025. eprint: `arXiv:2511.00946`

Conference Papers

[6] J. Waibel*, **R. Schwan***, and C. N. Jones, "LaOPT: A native C++ optimal control toolbox for high-performance implementations, and application to racing," in *IEEE Conference on Control Technology and Applications (CCTA)*, 2026

[7] **R. Schwan**, D. Kuhn, and C. N. Jones, "Exploiting multistage optimization structure in proximal solvers," in *IEEE Conference on Decision and Control (CDC)*, 2025, pp. 4677–4683

[8] G. Stomberg*, **R. Schwan***, A. Grillo, C. N. Jones, and T. Faulwasser, "Cooperative distributed model predictive control for embedded systems: Experiments with hovercraft formations," in *International Conference on Robotics and Automation (ICRA)*, 2025, pp. 11 377–11 383

[9] **R. Schwan**, N. Schmid, E. Chassaing, K. Samaha, and C. Jones, "On identifying the non-linear dynamics of a hovercraft using an end-to-end deep learning approach," in *IFAC Symposium on System Identification*, vol. 58, 2024, pp. 289–294

[10] **R. Schwan**, Y. Jiang, D. Kuhn, and C. N. Jones, "PIQP: A proximal interior-point quadratic programming solver," in *IEEE Conference on Decision and Control (CDC)*, 2023, pp. 1088–1093

[11] T. X. Nghiem, J. Drgoňa, C. Jones, Z. Nagy, **R. Schwan**, B. Dey, A. Chakrabarty, S. Di Cairano, J. A. Paulson, A. Carron, M. N. Zeilinger, W. Shaw Cortez, and D. L. Vrabie, "Physics-informed machine learning for modeling and control of dynamical systems," in *American Control Conference (ACC)*, 2023, pp. 3735–3750

[12] R. Linsen, P. Listov, A. de Lajarte, **R. Schwan**, and C. N. Jones, "Optimal thrust vector control of an electric small-scale rocket prototype," in *International Conference on Robotics and Automation (ICRA)*, 2022, pp. 1996–2002

[*] Equal contribution