Daan **Camps**

PhD · Computer Science · Applied Mathematics

Berkeley, California

510-388-2095 | daancamps@gmail.com | campsd.github.io | campsd | campsd

Summary

Computational mathematics postdoctoral researcher at Lawrence Berkeley National Laboratory with a broad scientific interest and a passion for problem-solving. Close to 2 years research experience in quantum information and quantum algorithms, 6+ years experience in computational mathematics, and 2+ years experience as project engineer.

Work Experience

Lawrence Berkeley National Laboratory
Berkeley, USA

Postdoctoral Researcher in Computational Mathematics
Nov. 2019 - Current

- Research project on quantum information and quantum algorithms with a focus on circuit compilation and synthesis.
- Worked on a variety of problems ranging from Hamiltonian simulation to quantum linear algebra.
- Developed `QCLAB`, `QCLAB++`, `F3C` and `F3C++`.
- Team scientist.

KU Leuven
Leuven, Belgium

Teaching Assistant
Sep. 2015 - Jun. 2019

- Guided exercise sessions for courses on numerical modeling and approximation, numerical mathematics.
- Mentor of two master student projects.

IPCOS NV
Leuven, Belgium

Project Engineer in Digital Oilfield Team
Aug. 2013 - Sep. 2015

- Deployment and maintenance of upstream production monitoring models based on real-time process data.
- Development and deployment of new data-driven pipeline leak detection models.
- Customer-oriented role: presenting on-site training sessions and providing end user support.

Education

KU Leuven (University of Leuven)
Leuven, Belgium

PhD in Computer Science and Applied Mathematics
Sep. 2015 - Sep. 2019

- Thesis: 'Pole swapping methods for the eigenvalue problem — Rational QR algorithms'.
- Research in numerical linear algebra with a strong focus on eigenvalue problems.

KU Leuven (University of Leuven)
Leuven, Belgium

M.Sc.Eng. in Mathematical Engineering
Sep. 2011 - Jun. 2013

- Thesis: 'Epileptic seizure monitoring using tensor decomposition techniques'.

KU Leuven (University of Leuven)
Leuven, Belgium

M.Sc. in Astronomy and Astrophysics
Sep. 2009 - Sep. 2011

- Thesis: 'Heschel/PACS observations of water in the carbon-rich AGB star V Hya'.

UHasselt (University of Hasselt)
Hasselt, Belgium

B.Sc. in Physics
Sep. 2006 - Jun. 2010

Skills, Competencies & Training

Programming
Matlab, Python, Fortran, C++.

Opensource projects
- `QCLAB` and `QCLAB++` software packages for quantum circuit development, analysis and simulation.
- Fast free fermion compiler `F3C` and `F3C++` for fast and scalable quantum circuit compilation for Hamiltonian simulation.

Research interests
Quantum algorithms, Quantum circuit synthesis, Numerical linear algebra, Eigenvalue problems, Tensor decomposition techniques, Computational mathematics.

Formal training
- Mathematics of Big Data: Sketching and (Multi-)Linear Algebra (MSRI Graduate Summer School, 2021)
- OpenMPI (ICTS, 2018)
- Fundamentals of Machine Learning (SOCN Graduate School, 2018)
- Low-Rank Tensor Techniques (Haussdorff School, 2016)

Language Skills

Dutch	Native
English	Fluent
French	Moderate

Preprints & Publications

2021 **An Algebraic Quantum Circuit Compression Algorithm for Hamiltonian Simulation**, Camps D., Kökcü E., Bassman L., de Jong W.A., Kemper A.F., Van Beeumen R. arXiv:2108.03283.

2021 **Algebraic Compression of Quantum Circuits for Hamiltonian Evolution**, Kökcü E., Camps D., Bassman L., Freericks J.K., de Jong W.A., Van Beeumen R., Kemper A.F. arXiv:2108.03282.

2021 **A Multishift, Multipole Rational QZ Method with Aggressive Early Deflation**, Steel T., Camps D., Meerbergen K., Vandebril R., SIAM J. Matrix Anal. Appl. 42(2), 753–774. DOI: 10.1137/19M1249631

2020 **Approximate Quantum Circuit Synthesis using Block Encodings**, Camps D., Van Beeumen R., Phys. Rev. A 102, 052411. DOI: 10.1103/PhysRevA.102.052411

2020 **Chemistry on Quantum Computers with Virtual Quantum Subspace Expansion**, Urbanek M., Camps D., Van Beeumen R., de Jong W. A., J. Chem. Theory Comput. 16(9), 5425–5431. DOI: 10.1021/acs.jctc.0c00447

2020 **Quantum Fourier Transform Revisited**, Camps D., Van Beeumen R., Yang C., Numer. Linear Algebra Appl. 28(1). DOI: 10.1002/nla.2331

2020 **On Pole-Swapping Algorithms for the Eigenvalue Problem**, Camps D., Mach T., Vandebril R., Watkins D. S., Electron. Trans. Numer. Anal. 52, 480–508. DOI: 10.1553/etna_vol52s480

2019 **Swapping 2x2 blocks in the Schur and generalized Schur form**, Camps D., Mastronardi N., Vandebril R., Van Dooren P., J. Comput. Appl. Math. 373. 112274. DOI: 10.1016/j.cam.2019.05.022

2019 **A rational QZ method**, Camps D., Meerbergen K., Vandebril R., SIAM J. Matrix Anal. Appl. 40(3), 943–972. DOI: 10.1137/18M1170480

2019 **An implicit filter for rational Krylov using core transformations**, Camps D., Meerbergen K., Vandebril R., Linear Algebra and its Applications, DOI: 10.1016/j.laa.2018.09.021

2014 **Block term decomposition for modelling epileptic seizures**, Hunyadi B., Camps D., Sorber L., Van Paesschen W., De Vos M., Van Huffel S., De Lathauwer L., EURASIP Journal on Advances in Signal Processing, DOI: 10.1186/1687-6180-2014-139

Talks

APS March Meeting — *Virtual conference*
Approximate quantum circuit synthesis using block encodings — *Mar. 2021*

SIAM Conference on Computational Science and Engineering — *Virtual conference*
Understanding the quantum Fourier transform through matrix decompositions — *Mar. 2021*

CS Area 2nd Annual Postdoc Symposium — *Berkeley, USA*
Approximate quantum circuit synthesis using block encodings — *Feb. 2021*

Berkeley Lab Seminar — *Berkeley, USA*
Pole swapping methods for the eigenvalue problem – Rational QR algorithms — *Sep. 2019*

ICIAM Conference — *Valencia, Spain*
Pole swapping methods for the eigenvalue problem – Rational QR algorithms — *Jul. 2019*

ETNA25 Conference — *Santa Margherita di Pula, Italy*
Approximate inverse-free rational Krylov methods and the link with FOM and GMRES — *May 2019*

Numerical Analysis and Scientific Computation with Applications (NASCA) Conference — *Kalamata, Greece*
A rational QZ method — *Jul. 2018*

SIAM Conference on Applied Linear Algebra — *Hong Kong*
RQZ: A rational QZ method for the generalized eigenvalue problem — *May. 2018*

NUMA Internal Seminar — *Leuven, Belgium*
Rational matrix algorithms for the generalized eigenvalue problem — Iterative and direct methods — *Oct. 2017*

Conference of the International Linear Algebra Society (ILAS) *Iowa, USA*

On the implicit restart of the rational Krylov method — Chasing algorithms for polynomial, extended and rational Krylov *Jul. 2017*

Conference of the International Linear Algebra Society (ILAS) *Leuven, Belgium*

Towards a computational efficient, implicitly restarted rational Krylov method *Jul. 2016*