CURRICULUM VITAE

CONTACT

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ACADEMIC POSITIONS

ETH Zurich — Zurich, Switzerland
Assistant Professor, tenure track — Fall 2019–present
Department of Computer Science

Harvard University — Cambridge, U.S.A.
Postdoctoral Fellow — Spring 2018–Spring 2019
Theory of Computation Group, SEAS

UC Berkeley — Berkeley, U.S.A.
Postdoctoral Research Fellow — Fall 2017
Simons Institute for Theoretical Computer Science

EDUCATION

Yale University — New Haven, U.S.A.
Ph.D. — 2011–2017
Department of Computer Science

University of Cambridge — Cambridge, United Kingdom
BA Hons Computer Science, First Class Honors — 2008–2011
Department of Computer Science

Risskov Gymnasium, upper secondary school — Aarhus, Denmark
Highest GPA in national exams — 2005–2008

AWARDS

ICBS Frontiers of Science Award: Best paper in theoretical computer science '18-'22 — 2023
The FOCS Best Paper Award — 2022
The FOCS Machtey Award for Best Student Paper — 2017
Simons Institute Postdoctoral Research Fellowship — 2017

GRANTS

Swiss National Science Foundation Project Grant — 2021-2025
682 kCHF, grant no. 200021 204787
Title: Algorithms and complexity for high-accuracy flows and convex optimization

CURRENT GROUP

Maximilian Probst Gutenberg, postdoc — Fall 2020–present
Ming Ding, Ph.D. candidate — Fall 2020–present
Federico Soldà, Ph.D. candidate — Fall 2020–present
Simon Meierhans, Ph.D. candidate — Fall 2021–present

GROUP ALUMNI

Abdolahad Zehmankan, postdoc — Spring 2020–Fall 2020
Silvia Casacuberta, predoc intern — Summer 2020–Fall 2020

PUBLICATIONS & MANUSCRIPTS

REFEREED CONFERENCE PUBLICATIONS

A Deterministic Almost-Linear Time Algorithm for Minimum-Cost Flow
J. Brand, L. Chen, R. Kyng, Y. Liu, M. Probst, S. Sachdeva, and A. Sidford
IEEE Symposium on Foundations of Computer Science (FOCS) 2023

Maintaining Expander Decompositions via Sparse Cuts
Y. Hua, R. Kyng, M. Probst, and Z. Wu.
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2023

A Simple Framework for Finding Balanced Sparse Cuts via APSP
L. Chen, R. Kyng, M. Probst, and S. Sachdeva.
SIAM Symposium on Simplicity in Algorithms (SOSA) 2023

Maximum Flow and Minimum-Cost Flow in Almost-Linear Time
L. Chen, R. Kyng, Y. Liu, R. Peng, M. Probst, and S. Sachdeva
IEEE Symposium on Foundations of Computer Science (FOCS) 2022
Won the FOCS Best Paper Award and ICBS Best Paper 2018-2022 Award

Derandomizing Random Walks in Almost-Linear Time
R. Kyng, S. Meierhans, and M. Probst
IEEE Symposium on Foundations of Computer Science (FOCS) 2022

Scalar and Matrix Chernoff Bounds from ∞-Independence
T. Kaufman, R. Kyng, and F. Solda
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2022

Incremental SSSP for Sparse Digraphs Beyond the Hopset Barrier
R. Kyng, S. Meierhans, and M. Probst
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2022

Two-Commodity Flow is as Hard as Linear Programming
M. Ding, R. Kyng, and P. Zhang
EATCS International Colloquium on Automata,
Languages and Programming (ICALP) 2022

Hardness Results for Laplacians of Simplicial Complexes via Sparse-Linear Equation Complete Gadgets
M. Ding, R. Kyng, M. Probst, and P. Zhang
EATCS International Colloquium on Automata,
Languages and Programming (ICALP) 2022

Faster Sparse Matrix Inversion and Rank Computation in Finite Fields
S. Casacuberta and R. Kyng
Innovations in Theoretical Computer Science (ITCS) 2022

On the Oracle Complexity of Higher-Order Smooth Non-Convex Finite-Sum Optimization
N. Emmenegger, R. Kyng, and A. Zehmakan
International Conference on Artificial Intelligence and Statistics (AISTATS) 2022

Almost-linear-time Weighted ℓ_p-norm Solvers in Slightly Dense Graphs via Sparsification
D. Adil, B. Bullins, R. Kyng, and S. Sachdeva
EATCS International Colloquium on Automata,
Languages and Programming (ICALP) 2021

Packing LPs are Hard to Solve Accurately, Assuming Linear Equations are Hard
R. Kyng, D. Wang, and P. Zhang
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2020

Flows in Almost Linear Time via Adaptive Preconditioning
R. Kyng, R. Peng, S. Sachdeva, and D. Wang
ACM SIGACT Symposium on Theory of Computing (STOC) 2019

Iterative Refinement for ℓ_p-norm Regression
R. Kyng, D. Adil, R. Peng, and S. Sachdeva
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2019

A Matrix Chernoff Bound for Strongly Rayleigh Distributions and Spectral Sparsifiers from a few Random Spanning Trees
R. Kyng and Z. Song
IEEE Symposium on Foundations of Computer Science (FOCS) 2018

Solving Directed Laplacians in Nearly Linear Time through Sparse LU Factorizations
M.B. Cohen, J. Kelner, R. Kyng, J. Peebles, R. Peng, A.B. Rao, and A. Sidford
IEEE Symposium on Foundations of Computer Science (FOCS) 2018

Incomplete Nested Dissection
R. Kyng, R. Peng, R. Schwieterman, and P. Zhang
ACM SIGACT Symposium on Theory of Computing (STOC) 2018

Hardness Results for Structured Linear Systems
R. Kyng and P. Zhang
IEEE Symposium on Foundations of Computer Science (FOCS) 2017
Won the FOCS Machtey Award for Best Student Paper

Sampling Random Spanning Trees Faster than Matrix Multiplication
D. Durfee, R. Kyng, J. Peebles, A.B. Rao, and S. Sachdeva
ACM SIGACT Symposium on Theory of Computing (STOC) 2017

A Framework for Analyzing Resparsification Algorithms
R. Kyng, J. Pachocki, R. Peng, and S. Sachdeva
ACM-SIAM Symposium on Discrete Algorithms (SODA) 2017

Approximate Gaussian Elimination for Laplacians: Fast, Sparse, and Simple
R. Kyng and S. Sachdeva
IEEE Symposium on Foundations of Computer Science (FOCS) 2016
Invited to Highlights of Algorithms (HALG) 2017

Sparsified Cholesky and Multigrid Solvers for Connection Laplacians
R. Kyng, Y.T. Lee, R. Peng, S. Sachdeva, and D.A. Spielman.
ACM SIGACT Symposium on Theory of Computing (STOC) 2016

Fast, Provable Algorithms for Isotonic Regression in all ℓ_p-norms
R. Kyng, S. Sachdeva, and A. Rao
Conference and Workshop on Neural Information Processing Systems (NeurIPS) 2015

Algorithms for Lipschitz Learning on Graphs
R. Kyng, S. Sachdeva, D.A. Spielman, and A. Rao
Conference on Learning Theory (COLT) 2015

Solving SDD Linear Systems in Nearly $m \log^{1/2} n$ Time
M.B. Cohen, R. Kyng, G.L. Miller, J.W. Pachocki, R. Peng, A. Rao, and S.C. Xu
ACM SIGACT Symposium on Theory of Computing (STOC) 2015

REFEREED JOURNAL PUBLICATIONS

Four Deviations Suffice for Rank 1 Matrices
R. Kyng, K. Luh, and Z. Song
Advances in Mathematics, Volume 375, 2 December 2020

Hardness Results for Structured Linear Systems
R. Kyng and Peng Zhang
SIAM Journal on Computing, Special Section FOCS 2017 (2020)

DOCTORAL THESIS

Approximate Gaussian Elimination
R. Kyng
Doctoral thesis, Yale University Department of Computer Science, 2017

SELECTED MANUSCRIPTS

Robust and Practical Solution of Laplacian Equations by Approximate Elimination — In preparation
Y. Gao, R. Kyng, and D. Spielman.

Optimal Electrical Oblivious Routing on Expanders — Under review
C. Florescu, R. Kyng, M. Probst, and S. Sachdeva

Weighted p-norm Flows in Almost-Linear-Time and Fully Dynamic Low-Stretch Spanning Trees — Subsumed
L. Chen, R. Kyng, Y. Liu, M. Probst, and S. Sachdeva

INVITED TALKS

Georgia Tech College of Computing Seminar 2023, upcoming
Robust and Practical Solution of Laplacian Equations by Approximate Elimination

ICALP Invited Plenary Talk 2023
An Almost-Linear Time Algorithm for Maximum Flow and More

Dagstuhl Seminar on Scalable Data Structures 2023
Dynamic Spanners

DIMACS Workshop on Modern Techniques in Graph Algorithms 2023
Tutorial: Graph Algorithms via Continuous Optimization and Data Structures

Perspectives on Matrix Computations:
Theoretical Computer Science Meets Numerical Analysis 2023
BIRS Workshop
Robust and Practical Solution of Laplacian Equations by Approximate Elimination

EFPL & ETHZ Swiss Winter School
on Theoretical Computer Science 2023
Fast Graph Algorithms Using Optimization and Data Structures (four lectures)

Columbia University Theory Seminar 2022
Maximum Flow and Minimum-Cost Flow in Almost-Linear Time

Yale University Department of Computer Science Colloquium 2022
Maximum Flow and Minimum-Cost Flow in Almost-Linear Time

Bernoulli Center Workshop: Modern
Trends in Combinatorial Optimization 2022
EPFL
Maximum Flow and Minimum-Cost Flow in Almost-Linear Time

Milan Theory Workshop: Spectral and Convex Optimization
Techniques in Graph Algorithms 2022
Bocconi University
Maximum Flow and Minimum-Cost Flow in Almost-Linear Time

Algorithms and Foundations for Data Science Workshop 2022
CMU/Nanyang Technological University
Scalar and Matrix Chernoff Bounds from ℓ_∞-Independence

European Meeting on Algorithmic Challenges of Big Data 2022
University of Warwick/University of Warsaw
Almost-Linear Time Algorithms for Maximum Flow and More

TCS+ Talk 2022
Almost-Linear Time Algorithms for Maximum Flow and More

Approximation and Relaxation Workshop 2021
Hausdorff Program on Discrete Optimization
Two-Commodity Flow is as Hard as Linear Programming

INFORMS Session on Bridging Discrete and Continuous Optimization 2021
A Numerical Analysis Approach to Convex Optimization

Continuous Approaches to Discrete Optimization Workshop 2021
Hausdorff Program on Discrete Optimization
A Numerical Analysis Approach to Convex Optimization

Complexity of Matrix Computations Panel 2021
NCSU/UC Berkeley/University of Oxford/Cornell/Caltech

Laplacian solvers

Workshop on Algorithms for Large Data (WALD(O)) 2021
CMU/Google Research
Hardness Results for Structured Linear Equations and Programs

Max Planck Advanced Course on the Foundations of Computer Science (ADFOCS) 2021
Graphs, Sampling, and Iterative methods (three lectures)

SIAM Annual Meeting 2021
Two-Commodity Flow is as Hard as Linear Programming

Georgetown University Computer Science Colloquium 2021
A Numerical Analysis Approach to Convex Optimization

Hebrew University Theory Seminar 2021
A Numerical Analysis Approach to Convex Optimization

EPFL Theory Seminar 2020
A Numerical Analysis Approach to Convex Optimization

ICCOPT, Berlin 2019
Optimization on Graphs

Workshop on Fine Grained Approximation Algorithms & Complexity, Bertinoro 2019
Hardness Results for Structured Linear Systems

UT Austin Theory Seminar 2019
A Numerical Analysis Approach to Convex Optimization

Harvard Theory of Computation Seminar 2019
A Numerical Analysis Approach to Convex Optimization

Beyond Randomized Rounding and the Probabilistic Method Workshop, 2019
Geometry of Polynomials Program at the Simons Institute, UC Berkeley
A Matrix Chernoff Bound for Strongly Rayleigh Distributions
and Spectral Sparsifiers from a few Random Spanning Trees

SODA, San Diego 2019
Iterative Refinement for ℓ_p-norm Regression

Bridging Continuous and Discrete Optimization Reunion Workshop 2018
The Simons Institute, UC Berkeley
Iterative Refinement for ℓ_p-norm Regression

Caltech Theory Seminar 2018
Approximate Gaussian Elimination

Northwestern Quarterly Theory Workshop 2018
Analysis Using Matrix Martingales

FOCS, Paris 2018
A Matrix Chernoff Bound for Strongly Rayleigh Distributions
and Spectral Sparsifiers from a few Random Spanning Trees

FOCS, Paris 2018
Solving Directed Laplacians in Nearly Linear Time through Sparse LU Factorizations

Laplacians 2.0 Workshop, FOCS, Paris 2018
Analysis Using Matrix Martingales

Randomized Numerical Linear Algebra and Applications Workshop, 2018
Foundations of Data Science Program at the Simons Institute, UC Berkeley
Analysis Using Matrix Martingales

High-Performance Graph Algorithms Seminar, Dagstuhl 2018
Optimization on Graphs

Discrepancy and Integer Programming Workshop, CWI Amsterdam 2018
Matrix Approximation by Row Sampling

Graphs Across Domains Workshop, UC Berkeley 2018
Optimization on Graphs

Michael Cohen Memorial Symposium, the Simons Institute, UC Berkeley 2017
Michael Cohen and Directed Laplacians

Stanford Theory Seminar 2017
Approximate Gaussian Elimination

FOCS, Berkeley 2017
Hardness Results for Structured Linear Systems

UC Berkeley Theory Seminar 2017
Hardness Results for Structured Linear Systems

Google Research Seminar, Mountain View 2017
Hardness Results for Structured Linear Systems

Yale Department of Statistics and Data Science, YPNG Seminar 2017
Approximate Gaussian Elimination

MSR Redmond 2017
Regression, Elimination, and Sampling on Graphs

University of Copenhagen Theory Seminar 2017
Approximate Gaussian Elimination

CMU Theory Seminar 2016
Approximate Gaussian Elimination

Georgia Tech Theory Seminar 2016
Approximate Gaussian Elimination

UC Berkeley Math Dept. Seminar 2016
Approximate Gaussian Elimination

Google Research NYC 2016
Approximate Gaussian Elimination

FOCS, New Brunswick 2016
Approximate Gaussian Elimination

MIT A&C Seminar 2016
Approximate Gaussian Elimination

Aarhus University Theory Seminar 2016
Lipschitz Learning on Graphs

China Theory Week, Hong Kong 2016
Approximate Gaussian Elimination

SIAM Annual Meeting, Boston 2016
Approximate Cholesky Factorization

STOC, Boston 2016
Sparsified Cholesky and Multigrid Solvers for Connection Laplacians

IT University of Copenhagen Theory Seminar 2015
Lipschitz Learning and Isotonic Regression on Graphs

COMMUNITY INVOLVEMENT

ACADEMIC SERVICE

Program Committee, International Colloquium on Automata, Languages and Programming (ICALP) 2024, upcoming
Program Committee, Symposium on Discrete Algorithms (SODA) 2024, ongoing
Program Committee, Symposium on Simplicity in Algorithms (SOSA) 2024, ongoing
Program Committee, Symposium on Theory of Computing (STOC) 2023
Program Committee, Symposium on Discrete Algorithms (SODA) 2023
Program Committee for Track S, European Symposium on Algorithms (ESA) 2022
Program Committee, Symposium on Theory of Computing (STOC) 2022
Program Committee, Symposium on Simplicity in Algorithms (SOSA) 2022
Program Committee for Track A, European Symposium on Algorithms (ESA) 2021
Program Committee, Innovations in Theoretical Computer Science (ITCS) 2020

Journal reviews, 2023: SICOMP, JACM
Conference reviews, 2023: FOCS, STOC, SODA, SOSA
Journal reviews, 2022: Journal of Fourier Analysis and Applications, ACM Transactions on Computation Theory
Conference reviews, 2022: STOC, ICALP, FOCS, ESA, SODA, ITCS
Conference reviews, 2021: RANDOM, FOCS, SODA, ESA, SOSA
Journal reviews, 2020: JACM
Conference reviews, 2020: ITCS, STOC, FOCS, ISAAC, SODA
Journal reviews, 2019: ToC
Conference reviews, 2019: COLT, ICALP, FOCS, STOC, ITCS

RESEARCH SEMINARS AT ETH ZURICH

ETH Zurich Algorithms and Complexity Seminar Fall 2020–present
https://kyng.inf.ethz.ch/acseminar/

WORKSHOP ORGANIZING

EFPL & ETHZ Swiss Winter School on Theoretical Computer Science January 2024, upcoming

Workshop: Optimization and Algorithm Design Fall 2023, upcoming
UC Berkeley Simons Insitute Program
on Data Structures and Optimization for Fast Algorithms
https://simons.berkeley.edu/workshops/optimization-algorithm-design

INTER-DISCIPLINARY CENTERS AT ETH ZURICH

Member of the Foundations of Data Science Seminar Fall 2020–present
https://math.ethz.ch/sfs/eth-foundations-of-data-science.html

ETH SERVICE

ETH Research Commission Spring 2023
D-INFK Unterrichtskommission Spring 2020-Fall 2021

TEACHING

TEACHING AT ETH ZURICH

Algorithmen und Wahrscheinlichkeit, 252-0209-00 Spring 2023
Computer Science Bachelor, Core Course in Theoretical Computer Science
4V + 2U, 7 ECTS
519 students registered
Co-taught R. Kyng, E. Welzl, and A. Steger.
R. Kyng is teaching 15 % of lectures.

Advanced Graph Algorithms and Optimization, 263-4400-00 Spring 2023
Computer Science Master, Focus Core Course in Theoretical Computer Science
3V+3U+3A, 10 ECTS
75 students registered
Co-taught by R. Kyng (67 %), M. Probst Gutenberg (33 %).

Presenting Theoretical Computer Science, 252-4225-00 Spring 2023
Computer Science Bachelor, Seminar in Theoretical Computer Science
2S, 2 ECTS
24 students registered
Co-taught by B. Gärtner, R. Kyng, A. Steger, D. Steurer, E. Welzl
Participants are supervised by PhD students from the organizers' groups.

Algorithms, Probability, and Computing, 252-0209-00 Fall 2022
Computer Science Bachelor, Core Course in Theoretical Computer Science
4V + 2U + 1A, 8 ECTS
182 students registered
Co-taught by B. Gärtner, R. Kyng, E. Welzl, A. Steger, and D. Steurer
R. Kyng is teaching 25 % of lectures and acting as head lecturer responsible for exercises, exams, and staffing.

Advanced Graph Algorithms and Optimization Seminar, 263-4410-00 Fall 2022
Computer Science Master, Seminar in Theoretical Computer Science
2S, 2 ECTS
5 students registered
Supervised by R. Kyng's group.

Advanced Graph Algorithms and Optimization, 263-4400-00 Spring 2022
Computer Science Master, Focus Core Course in Theoretical Computer Science
3V+1U+3A, 8 ECTS
72 students registered
Taught by R. Kyng.

Presenting Theoretical Computer Science, 252-4225-00 Spring 2022
Computer Science Bachelor, Seminar in Theoretical Computer Science
2S, 2 ECTS
24 students registered
Co-taught by B. Gärtner, R. Kyng, A. Steger, D. Steurer, E. Welzl
Participants are supervised by PhD students from the organizers' groups.

Algorithms, Probability, and Computing, 252-0209-00 Fall 2021
Computer Science Bachelor, Core Course in Theoretical Computer Science
4V + 2U + 1A, 8 ECTS
206 students registered
Co-taught by B. Gärtner, M. Ghaffari, R. Kyng, and A. Steger, and D. Steurer

R. Kyng taught 20 % of lectures. The head lecturer M. Ghaffari was responsible for exercises, exams, and staffing.

Advanced Graph Algorithms and Optimization, 263-4400-00 Spring 2021
Computer Science Master, Focus Core Course in Theoretical Computer Science
3V+1U+3A, 8 ECTS
82 students registered
Co-taught by R. Kyng (67 %), M. Probst Gutenberg (33 %).

Presenting Theoretical Computer Science, 252-4225-00 Spring 2021
Computer Science Bachelor, Seminar in Theoretical Computer Science
2S, 2 ECTS
24 students registered
Co-taught by B. Gärtner, M. Ghaffari, R. Kyng, D. Steurer, E. Welzl
Participants are supervised by PhD students from the organizers' groups.

Algorithms, Probability, and Computing, 252-0209-00 Fall 2020
Computer Science Bachelor, Core Course in Theoretical Computer Science
4V + 2U + 1A, 8 ECTS
233 students registered
Co-taught by B. Gärtner, M. Ghaffari, R. Kyng, D. Steurer
R. Kyng taught 25 % of lectures. The head lecturer M. Ghaffari was responsible for exercises, exams, and staffing.

Advanced Graph Algorithms and Optimization Seminar, 263-4410-00 Fall 2020
Computer Science Master, Seminar in Theoretical Computer Science
2S, 2 ECTS
4 students registered
Supervised by R. Kyng's group.

Advanced Graph Algorithms and Optimization, 263-4400-00 Spring 2020
Computer Science Master, Focus Elective Course in Theoretical Computer Science
3G+1A, 5 ECTS credits
30 students registered
Taught by R. Kyng
R. Kyng taught lectures, and designed weekly exercises, 2 large graded homeworks, advised and graded individual student projects and reports, and conducted exams.

Presenting Theoretical Computer Science, 252-4225-00 Spring 2020
Computer Science Bachelor, Seminar in Theoretical Computer Science
Co-taught by B. Gärtner, M. Ghaffari, R. Kyng, D. Steurer, E. Welzl
2S, 2 ECTS
24 students registered
Participants are supervised by PhD students from the organizers' groups.

OTHER TEACHING

EFPL & ETHZ Swiss Winter School on Theoretical Computer Science Winter 2023
Fast Graph Algorithms Using Optimization and Data Structures (four lectures)
Taught by R. Kyng.

Max Planck Advanced Course on the Foundations of Computer Science Summer 2021
MPI ADFOCS summer school course:
Graphs, Sampling, and Iterative methods (three lectures)
Taught by R. Kyng.

Harvard Graduate Level Course AM 221: Advanced Optimization Spring 2018
Taught by R. Kyng.