

SDPCode – Semidefinite foundations for quantum codes: convergence, bounds, and constructions

SDPCode consortium

Semidefinite programming is a key optimization method in quantum information and computation, allowing for rigorous mathematical guarantees on the solutions obtained.

SDPCode is a QuantERA consortium of five research groups in Germany, Poland, Slovenia and France. We work at the intersection of quantum information theory, semidefinite programming and algebraic methods.

Our aim is to make the semidefinite approximations of quantum optimisation problems quantitative and constructive.



Jens Eisert

FU Berlin, Germany

quantum many-body theory,
tensor networks, certification



Sevag Gharibian

Paderborn University, Germany

approximation algorithms, local Hamiltonians



Felix Huber (coordinator)

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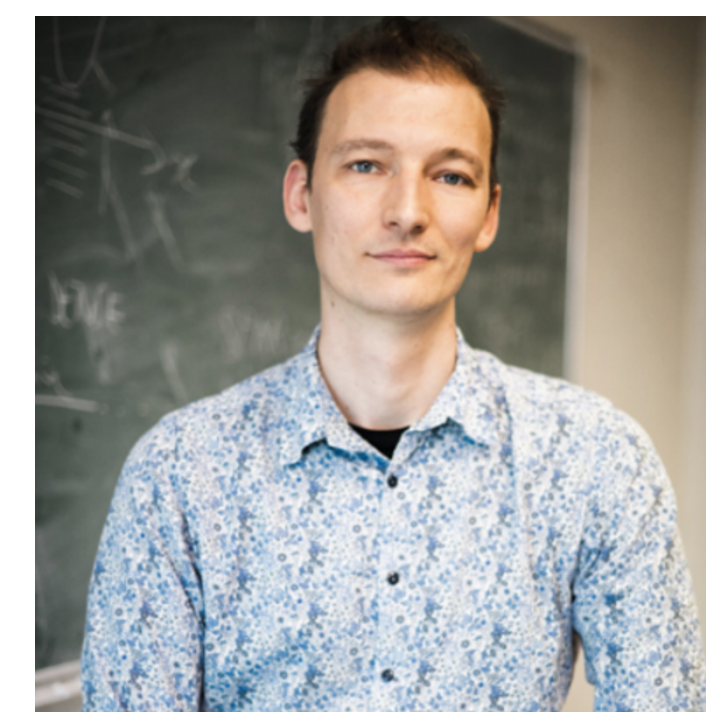
quantum error correction, coding bounds,
symmetry reduction



Igor Klep

University of Primorska, Slovenia

noncommutative optimisation, operator
theory



Victor Magron

LAAS-CNRS Toulouse, France

polynomial optimisation, sparsity exploitation,
certified numerics

WP 1: Convergence rates

How fast do SDP hierarchies converge?

We seek to establish rigorous convergence rates for widely used non-commutative semidefinite hierarchies, turning them from heuristic tools into algorithms with quantitative guarantees.

WP 2: Bounds

What are the limits of quantum error correction and magic state distillation?

We aim to derive scalable and exact bounds on the parameters of quantum error-correcting codes and magic-state distillation protocols, including new higher-order MacWilliams-type identities on codes, furthering our structural understanding of codes.

WP 3: Constructions

How can one construct quantum codes and approximate ground states with semidefinite programming methods?

Our aim is to devise constructive algorithms that turn convex relaxations into concrete quantum objects – stabilizer codes, many-body ground states, and continuous-variable codes.

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