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Number-Theoretic Methods in Quantum Compiling

Quantum compiling is concerned with the representation of general unitary operations by circuits built from some chosen set of quantum gates. The circuit representation of a unitary U is exact if the product of the gates composing the circuit is equal to U. The representation is approximate up to $\epsilon > 0$ if this product is at distance ϵ of U in the operator norm. In the last few years, the field of quantum compiling was rejuvenated by the introduction of methods from algebraic number theory. In particular, such number-theoretic methods were used to provide an optimal solution to the problem of approximating single-qubit unitaries using Clifford+T circuits. In this talk, I will present an efficient algorithm for the optimal approximation of single-qubit unitaries using Clifford+T circuits and discuss open problems in the field of quantum compiling.