

Quantum circuits: from structure to software

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Abstract:

Quantum circuits are a de facto assembly language for quantum software. Programs are described as list of primitive operations, or gates, which are run in sequence on a quantum computer to perform a computation. Just like with classical software, there is more than one way to write a program to do the same job, and so it's important to find programs that do that job as quickly and cheaply as possible.

Looking at quantum circuits just as lists of gates doesn't tell us a whole lot about what computation is being performed, or how it might be optimised. However, if we "break open" quantum gates, we see a rich graphical/algebraic structure inside called the ZX-calculus. This can be used not only for making quantum circuits more efficient, but also for performing other critical tasks like bug-checking. In this talk, I will give a brief overview of these techniques, and how they can be used with an open source software library called PyZX.