Mapping Open Problems in Quantum Computer Science.

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1 Universal logical operators in $\mathbf{QNC}_0$.

It's well known that there is no code that compute a full universal gate set transversally. Yet for avoiding propagation of faults a much weaker property is required. If the logical gate set can be computed at constant depth then it means that any qubit in the input feed into those gate is connected by wires to at most constant qubits at the output. That it, the lightcone's width is bounded and the probability of wire at the output to exhibits an errors, by the union bound, is at most constant times the probability to have an error at an arbitrary location. Furthermore there is a weak independence between the qubits faults, meaning for each qubit there is at most constant number of other qubits which the event they exhibit an error is depended on that qubit been faulty, combination of those two insights might point on advantage when it comes to fault tolerance implementation.

Thus brings us to raise the following question, whether there exist codes, with non-trivial distance and logical operators that can be computed in $\mathbf{QNC}_0$, we stress that the non-trivial distance is important, otherwise the 'unencoded' encoding (meaning, just take the qubits as they are) gets the required.

2 Transversal diagonal operators and error suppression.

3 Fault tolerance $\mathbf{QNC}_1$ in the absence of fresh qubits supply.

4 Solid state memory machine.

5 Mimicking PCP's oracle giving .