Day 1 (Poster B)

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Title: Error Suppression in Continuous-time Quantum Computing

Abstract:
In the quantum optimisation setting, we build on [Young et al., PRA 88, 062314, 2013] with logical qubits in multiple copies of the Ising spin system, linked together to increase the logical system's robustness to error. We introduce several refinements that improve the scheme significantly. First we note that only one copy needs to be correct by the end of computation, since solution quality can be checked efficiently. Second, we find that ferromagnetic links do not help in the "one correct copy" situation, but anti-ferromagnetic links do help sometimes. Third, we developed a protocol based on local field and coupling strengths in the problem Hamiltonian, to decide whether logical qubits should be connected anti-ferromagnetically, or left disconnected. Numerical simulations show that three qubit copies connected in a loop (triangle) perform better than two or more copies connected in a chain. In logical systems which contain frustration, the anti-ferromagnetic links inhibit the propagation of errors. We have tested our method on small instances of spin glasses from [Callison et al., NJP 21, 123022, 2019] and similar small Max2SAT instances, and we find improved error tolerance for three or more copies in configurations that include frustration.