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Digital – Analog quantum algorithms implementation

The traditional digital quantum computation paradigm is a gate-based type of quantum computation that employs only single- and two-qubits gates to implement any quantum routine or algorithm. Although there have been important improvements in the experimental realization of the quantum processors, there are still several Near Intermediate-Scale Quantum (NISQ) devices that suffer from important noise sources whenever a two-qubit gate is applied. To overcome this experimental limitation, it has been proposed the digital-analog quantum computation paradigm. The main idea of this proposal is to get advantage of the natural interaction that arises between the qubits, instead of treating it as a noise source, as the fully digital quantum computation does.

Here we will talk about the advantage of using the digital-analog paradigm against the fully digital one to implement quantum algorithms such as the quantum Fourier transform or the Harrow-Hassidim-Lloyd. We compare the outperformance of each paradigm and analyze the limitations and advantages of using the digital-analog paradigm or the fully digital one.