

New Cost Function

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1 Definition and Implementation

The old cost function is just

$$\langle \phi(\theta) | H | \phi(\theta) \rangle \quad (1)$$

The new one (I hope this is correct) is

$$\langle \hat{H} \rangle + (N - \langle \hat{n} \rangle)^2 \quad (2)$$

Extra iSWAP gates have been added:

$$[2, 3], [5, 6], [8, 0]$$

2 Performance Comparison

The following table compares performance of the VQE using an initial W state for each spin and an initial $|100100100\rangle$ state, with the number of function evaluations being the metric.

Function Evaluations		
Layers	Old	New
1	2425	2660
2	48622	31720
3	65057	???

The VQE was run multiple times for 3 layers without it converging to anywhere close to the correct value (it gets stuck around the other two values). In fact, the other layers only worked after rerunning the VQE multiple times. Possible early plateaus/local minima?