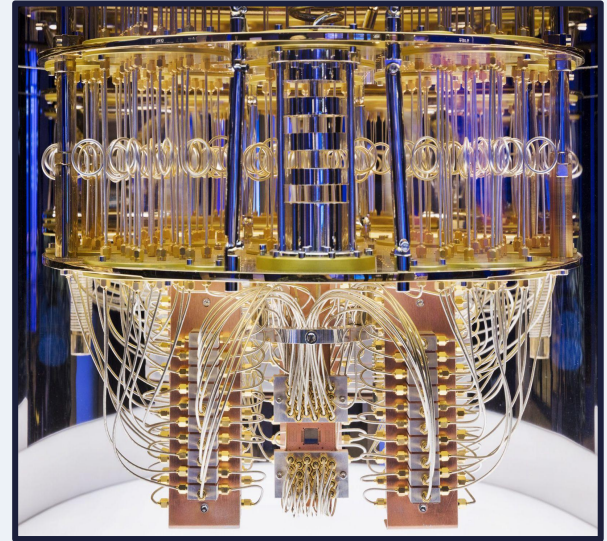


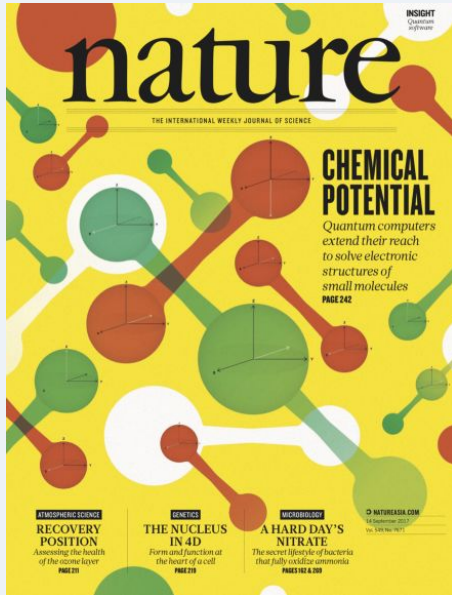
Qubits In Practice: An Educational MATLAB Approach to Quantum Algorithms

Matteo Rossi *matteo26.rossi@mail.polimi.it*



Why Quantum?

Potential to unlock previously unsolvable problems with **Quantum Computing**, cutting **computing time** from **years** to **hours**.



What's Out There Isn't Enough (Yet)

- ◆ **Limited Use** of *MATLAB Quantum Package* in the Literature
- ◆ **Material that is too Abstract:** No Resources with Theory & Documented Code
- ◆ **Black-Box:** MATLAB's Implementation of Algorithms is Hidden by Packages
- ◆ **Not Adopting** a *Hands-On* Approach

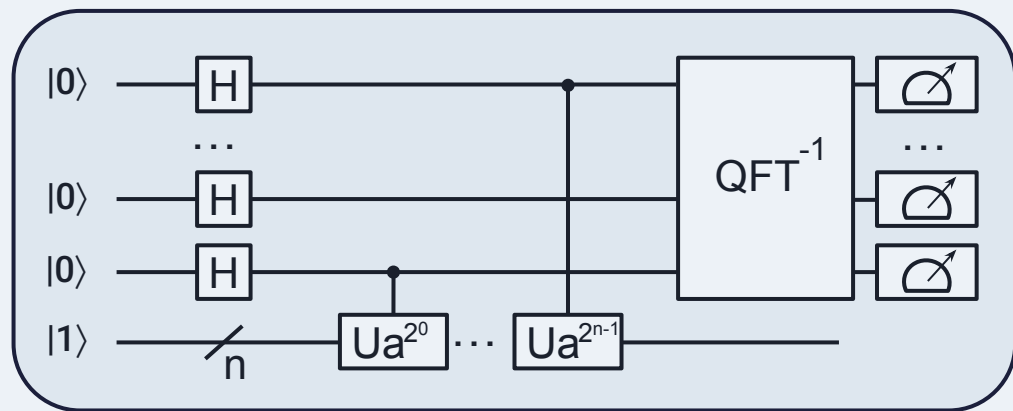
Learning By Doing: Three Educational Resources



1. Shor's Algorithm
2. Repetition Codes - Error Correction
3. QAOA

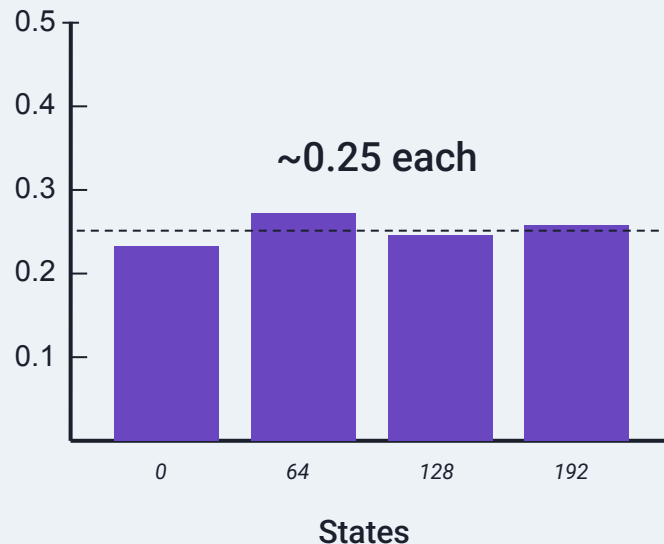
Shor's Algorithm

Factorizing Large Integers the Fast Way



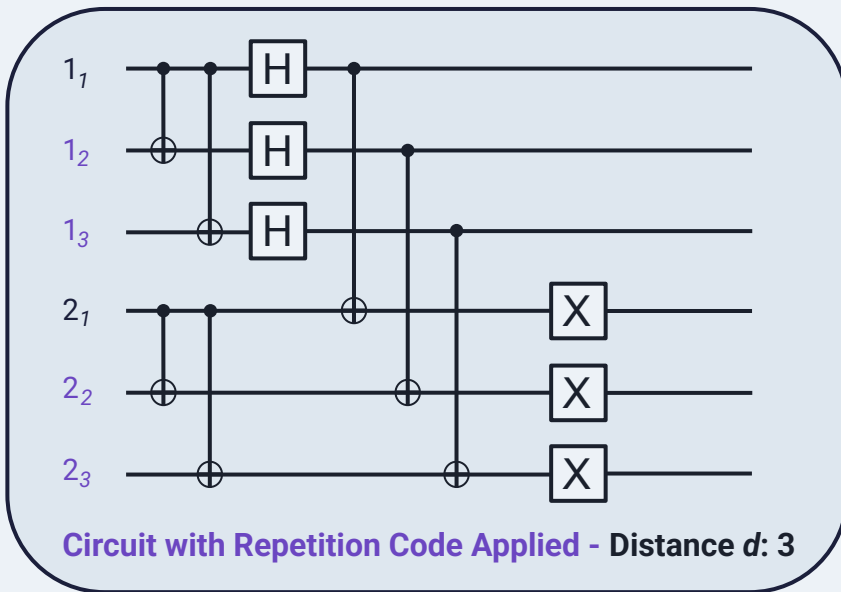
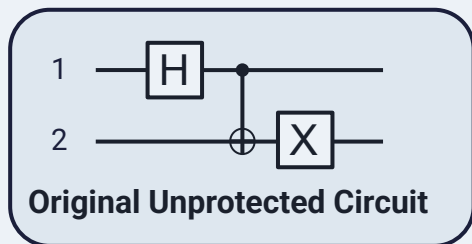
Quantum Period Finding Subroutine

Probabilities



Repetition Codes in Quantum Error Correction

Using a Code to Protect Fragile Quantum States from Bit-Flip Errors

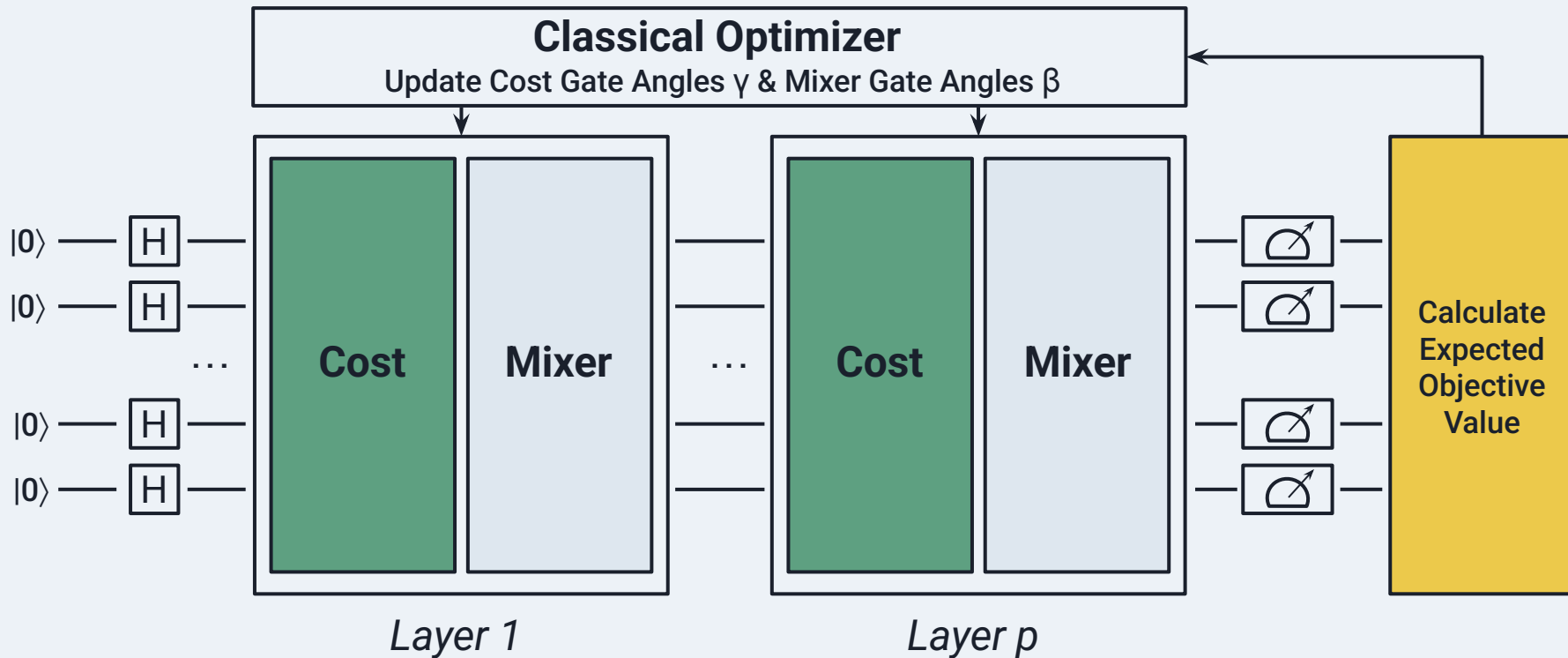


Contributions to QAOA

1. **Enhancement** of the **library** by exposing methods to interact with the tunable **parameters** of the quantum circuit
2. Implementation & Analysis of relevant **combinatorial optimization** problems:
 - ◆ **MaxCut**
 - ◆ **0/1 Multi-Knapsack**

QAOA

Quantum Approximation Optimization Algorithm



Curious? Have a Look at Them!

<https://github.com/necst/qc-with-matlab>

Thanks for your Attention!

matteo26.rossi@mail.polimi.it



GitHub
Quantum Projects