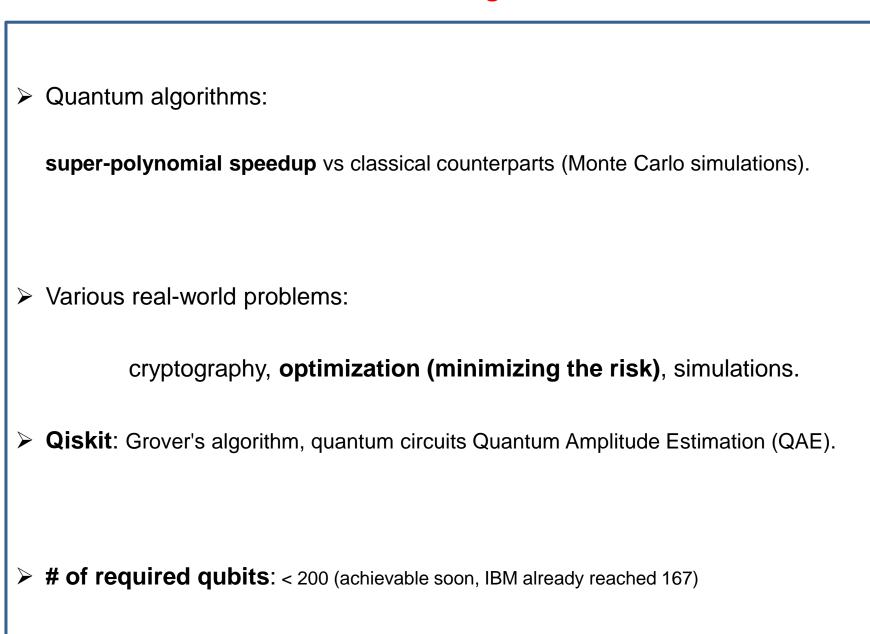# Quantum Algorithms for Business Risk Analysis

By

Gopal Mahadevan,

Ehsan Barati,

Shinibali Bhattacharyya,

Sultana Hadi

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Quantum algorithms

➤ Quantum algorithms:

super-polynomial speedup vs classical counterparts (Monte Carlo simulations).

➤ Various real-world problems:

cryptography, **optimization (minimizing the risk)**, simulations.

➤ **Qiskit**: Grover's algorithm, quantum circuits Quantum Amplitude Estimation (QAE).

➤ **# of required qubits**: < 200 (achievable soon, IBM already reached 167)

Risk analysis Implementation

- **Risk modeling**: estimates the overall likelihood of impacts that would threaten the business (probability problem).

- Define **a threshold** for a financial impact **A**, probability **P(A)**, **P_max**

- A probability P_**i** is defined for each relevant event (risk item, e.g. a change in stock market).
- An item (i^th) is also assigned a probability to trigger another item (j^th) with the transition probability P_ij.

- Each triggered risk item (e.g. by other items) generates a specific loss.

- The sum of the losses of the triggered items gives the **total loss** for a specific scenario.

Quantum modeling

- The sensitivity analysis of the risk model is considered as a **quantum program** that analyzes the impact of varying each input parameter in **three steps**:

- Implementing the risk model as a quantum algorithm,

- Implementing QAE on the outputs of the risk model,

- Search sensitive parameters with Grover's algorithm.