Quanscient and Haiqu Announce Breakthrough Algorithm for Scalable Computational Fluid Simulations on Quantum Computers

This advancement in quantum algorithms could help accelerate some of the most computationally intensive simulations used in engineering today.

HELSINKI, FINLAND, April 2, 2026 /EINPresswire.com/ -- Researchers from Quanscient, a leader in cloud-based multiphysics simulation technology and quantum algorithms, and Haiqu, a leading developer of quantum middleware, today announced a new algorithm that can significantly advance the use of quantum computing in real-world engineering applications. The teams conducted a 15-step nonlinear fluid benchmark with an obstacle, making this the most physically complex, publicly documented variant of a Quantum Lattice Boltzmann Method (QLBM) hardware demonstration to date.

Developed and tested on IBMs largest-available quantum computer, the IBM Heron R3, the algorithm reduces the number of qubits required to run complex simulations in computational fluid dynamics (CFD) on quantum computers, demonstrating a viable path toward future industrial-scale solutions.

CFD is widely used to model how air, water, and other fluids behave around objects, such as airflow over an aircraft wing. It plays a critical role in product development and testing across industries, including aerospace, automotive, and energy. However, these simulations are extremely demanding for even today's most powerful supercomputers, often taking days or even weeks to complete, if possible at all.

The new algorithm addresses one of the key challenges in applying quantum computing to CFD: high resource requirements. By significantly reducing the number of qubits and computational operations needed, this approach makes it more practical to run complex simulations on quantum computers. It demonstrates a more efficient path toward using quantum systems for real-world applications, and ultimately could help companies design better products and optimize complex systems more quickly.

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“This is an interesting and timely contribution to quantum CFD,” said Oleksandr Kyriienko, Professor and Chair in Quantum Technologies at the University of Sheffield. “It proposes a more flexible quantum LBM framework while keeping the core algorithm efficient, and it strengthens the case with applications ranging from linear acoustics to IBM-QPU-assisted nonlinear flow simulations. We need more works like this to achieve industrially relevant quantum solutions."

“This is one of the most realistic CFD simulations ever executed on a quantum computer. It is an important signal that quantum CFD research is moving toward simulating how fluids interact with real-world shapes and obstacles on quantum hardware,” Mykola Maksymenko, CTO of Haiqu. “This is the direction that any industrially meaningful workflow would have to take to reach commercial viability.”

“CFD is one of the most computationally difficult branches of simulation with some of the largest impact on the world’s biggest sectors,” said Valtteri Lahtinen, Chief Scientist of Quanscient. “Quantum computers offer a future path to simulations that are far more complex than what classical computers can handle, which may allow for the design of more efficient vehicles and aircraft, better energy systems and more. Our work with Haiqu is a critical step toward making this a reality.”

Researchers from Quanscient and Haiqu developed and tested a novel One-Step Simplified LBM (OSSLBM) based on a quantum Lattice Boltzmann Method (QLBM) algorithm, which is a powerful generalization of an important classical CFD technique. Their approach allowed them to run a nonlinear fluid‑flow simulation with an obstacle, such as fluid moving around a solid object, over multiple steps on IBM quantum hardware. Haiqu’s algorithmic and runtime layer was critical to making this possible, reducing circuit depth, improving and developing new key algorithmic subroutines, and applying targeted error‑reduction techniques that allowed the quantum system to execute a multi‑step, complex workflow that would otherwise be out of reach for today’s devices.

The researchers believe their work represents a new algorithmic framework that reshapes how fluid simulations are performed on quantum computers, turning a complicated sequence of calculations into a simpler, more efficient process designed for quantum hardware. The hybrid quantum-classical OSSLBM can be executed on current hardware, outlining a practical path for moving beyond simple linear demonstrations toward more realistic, engineering‑relevant quantum fluid simulations as quantum systems continue to mature.

To learn more about the research, find the paper on arXiv here:
https://arxiv.org/pdf/2603.02127

About Quanscient
Quanscient is the first cloud-and-quantum-powered multiphysics simulation software provider with the goal of transforming R&D with accurate digital prototypes. Quanscient was founded by Juha Riippi, Alexandre Halbach, Asser Lähdemäki, and Valtteri Lahtinen in 2021, and Andrew Tweedie joined as the fifth founder in 2024. Quanscient's international team consists of 40 professionals from 15 nationalities.
quanscient.com

About Haiqu
Haiqu is an emerging leader in quantum software that supports the notion that near-term, commercially viable quantum applications are achievable with the right software, even on current hardware. Haiqu's hardware-agnostic software can run applications with up to 100x more operations on current devices compared to competitors. Headquartered in New York City in the United States, Haiqu's expert team members are based all over the world, including the US, Canada, Ukraine, UK, EU, and Singapore, contributing to the company's mission to make quantum computing practical as soon as possible.
haiqu.ai

Taylor White
HKA, Inc. Marketing Communications
+1 714-426-0444
email us here
