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Introduction to Quantum Computational Fluid Dynamics

Participant information and agenda

A realistic, hands-on introduction to quantum CFD. This practical 1.5-day workshop is for CFD practitioners, computational scientists, and technical leaders who want to understand both the promise and the current limitations of quantum computing for engineering simulation. Developed and delivered by QubitSolve's R&D team, including computational scientists with deep CFD expertise, the workshop combines concise lectures with guided QubitFlux™ exercises that connect familiar CFD concepts to hybrid quantum-classical workflows, verification outputs, cloud/HPC execution, and a quantum-hardware pathway. You will leave equipped to assess which engineering problems could plausibly benefit, on what timeline, and how your organization can prepare today.

Workshop at a Glance

Format	A full Day 1 followed by a half-day Day 2; short lectures, demonstrations, guided hands-on exercises, and use-case discussion.
Audience	CFD engineers, computational scientists, researchers, and technical leaders. No prior quantum-computing experience is required.
Class size	Designed for a small, interactive cohort of approximately 15–20 participants.
Fee	$250 per participant, including workshop materials, coffee/light breakfast on both days, lunch on Day 1, and a boxed lunch after Day 2.
Cancellation	Full refund less a $25 booking fee for cancellations received until 2 weeks before the workshop; later registrations are non-refundable but transferable.
Instructors	QubitSolve R&D team. Short bios are posted on the registration page.
Contact	workshop@qubitsolve.com.
Register	Workshop information and registration page.

Why Attend

Quantum computing is not a drop-in replacement for today's CFD solvers. This workshop is for engineers who want a grounded answer to practical questions: what would a quantum-classical CFD workflow actually look like, what can it teach us now, what must improve before it becomes useful at engineering scale, and how should an organization prepare?

- **Grounded, not hype-driven:** We make no claim of quantum advantage today. The workshop is candid about present limits and the hardware and algorithmic progress still needed.
- **Hands-on, not just lectures:** Participants run guided QubitFlux™ examples, review verification and feasibility outputs, inspect generated quantum circuits, and discuss what the outputs do and do not mean.
- **CFD-first:** Sessions begin with familiar ideas such as discretization, boundary conditions, validation, HPC execution, and engineering observables, without assuming quantum-computing expertise.
- **One quantum CFD method in depth:** Instead of a superficial survey, you work through one complete method end to end: the variational lattice Boltzmann method (LBM) implemented in QubitFlux™.
- **Transparent about the workflow:** The mathematical assumptions, hybrid decomposition, backend choices, and verification logic are discussed explicitly. Proprietary cost-function construction is described at a functional level only.

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Who Should Attend and What You Will Take Away

Good fit	By the end, participants will have
• CFD engineers and computational scientists in industry, government laboratories, and academia. • Technical managers evaluating quantum computing for engineering simulation. • Researchers exploring whether quantum computing could benefit CFD applications currently constrained by classical computing. • Quantum-curious participants who do not yet have quantum-computing experience.	• A practical vocabulary for discussing qubits, gates, circuits, measurement, noise, simulators, QPUs, and hardware roadmaps. • A guided QubitFlux™ benchmark run with verification against reference results. • A clearer algorithmic map: what is quantum, what remains classical, where nonlinear updates enter, and why observables matter. • Practice reading verification reports, feasibility outputs, backend choices, and hardware-oriented results. • A first-pass path-to-value framing for one CFD problem and possible co-design next steps.

Where Quantum CFD Stands Today

Quantum CFD is still at the small-benchmark and workflow-learning stage. Real value today is not production-scale quantum CFD, but understanding the algorithmic structure, verification discipline, hardware pathway, and co-design questions that must be addressed as quantum processors and algorithms mature. The workshop gives participants a practical way to separate credible progress from hype.

Workshop Dates and Locations

Each regional workshop follows the same 1.5-day structure.

Region	Date	Location	Venue
West	March 23–24, 2027	Las Vegas, NV	Student Union, University of Nevada, Las Vegas
Midwest	May 18–19, 2027	Dayton, OH	Digital Transformation Center, University of Dayton Research Institute
East	July 20–21, 2027	College Park, MD	Samuel Riggs IV Alumni Center, University of Maryland

How the Workshop Works

Before the workshop	Receive setup instructions, a short quantum primer, a QubitFlux™ quick-start guide, and an optional path-to-value worksheet. No quantum background is expected.
Day 1	Build vocabulary, learn how quantum CFD differs from conventional CFD, run guided QubitFlux™ examples, and connect the workflow to cloud/HPC execution.
Day 2	Explore hardware roadmaps, follow a quantum-hardware pathway, read QPU-oriented outputs, and discuss candidate applications.
After the workshop	Keep QubitFlux™ access for one month of self-paced exploration, and schedule follow-up technical discussions for promising applications or co-design opportunities.

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Participant Agenda

Agenda timing may be adjusted slightly by location. All hands-on sessions use a guided workflow, and setup instructions will be sent in advance.

Day 1 - Foundations and Hybrid Quantum-Classical CFD Workflows

Time	Session	What participants will do
8:00–9:00	**Registration, cloud access check, and light breakfast**	Check in, connect to the workshop cloud environment, and resolve setup questions.
9:00–9:30	**Welcome, introductions, and workshop goals**	Meet instructors and participants; understand the workshop roadmap, learning outcomes, and ground rules.
9:30–10:30	**Quantum computing for CFD practitioners**	Build the vocabulary needed to discuss qubits, superposition, entanglement, interference, gates, measurement, circuits, shots, noise, simulators, QPUs, and hardware readiness.
10:30–10:45	**Break**	Refresh and prepare for the CFD-to-quantum workflow session.
10:45–11:15	**From CFD workflows to hybrid quantum-classical workflows**	Map familiar CFD ingredients to a QubitFlux™ quantum CFD workflow. Learn how typical LBM settings (domain size, boundary conditions) are defined using OpenFOAM format, and what additional elements are required (parameterized circuits, optimizers, backend selections).
11:15–12:15	**Hands-on 1: first QubitFlux™ benchmark run**	Set up and run an introductory CFD benchmark, such as Couette flow, using a classical solver, circuit emulator, and statevector simulator; review verification against reference results.
12:15–1:15	**Lunch**	Informal discussion with instructors and participants.
1:15–1:45	**QubitFlux™ on AWS: cloud workflow and parallel execution**	Understand practical considerations for cloud/HPC-supported quantum-classical workflows and scalable benchmark runs.
1:45–2:30	**Hands-on 2: cloud/HPC run and noisy simulation**	Run a guided case in a parallel cloud/HPC setup, then understand why shots are necessary and how quantum noise degrades the results.
2:30–3:00	**Quantum CFD methods**	Gain a high-level overview of major quantum CFD methods under development worldwide, including where today's approaches show promise and where current hardware and algorithmic limits remain.
3:00–3:15	**Break**	Refresh before the algorithm deep dive.
3:15–4:00	**Algorithm deep dive: what is quantum, what remains classical**	Learn how QubitFlux™ implements variational quantum CFD at a practical level, including amplitude encoding of flow states, parameterized quantum circuits, variational optimization, treatment of streaming, state preparation, and readout.
4:00–4:35	**Hands-on 3: from CFD case to quantum circuits**	Inspect sample quantum circuits from the benchmark case and learn how their structure emerges from the quantum CFD algorithm.
4:35–5:00	**Day 1 discussion and Q&A**	Connect the day's lessons to participant questions and preview the hardware and co-design focus of Day 2.

Hardware access note: Day 2 is designed around a real QPU result. Live execution will be used when partner access and queue conditions permit; otherwise, participants will review a pre-executed QPU result and the associated feasibility outputs.

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Day 2 - Quantum Hardware Pathway, Co-Design, and Next Steps

Time	Session	What participants will do
8:00–8:45	Light breakfast, open lab, and troubleshooting	Resolve setup questions and review Day 1 outputs with instructors.
8:45–9:30	Use-case clinic: from CFD bottleneck to candidate observables	Frame candidate problems using goals, decision-relevant observables, validation data, workflow constraints, and path-to-value thinking.
9:30–10:30	Guest lecture: quantum hardware roadmap	Join our quantum hardware partner for a talk and Q&A covering recent hardware progress, the roadmap to fault tolerance, and practical engineering use cases. Details about the guest speaker will be provided closer to the workshop date.
10:30–10:45	Break	Refresh before the hardware pathway exercise.
10:45–11:40	Hands-on 4: quantum-hardware pathway	Follow a prepared case through a hardware-oriented workflow; inspect live or pre-executed QPU results and learn how to read feasibility outputs.
11:40–12:10	From workshop to co-design	Discuss which use cases are best suited for follow-up and what data, validation, and observables would be needed.
12:10–12:30	Closing Q&A and next steps	Confirm follow-up options, participant resources, and post-workshop technical discussions.
12:30	Workshop concludes	Pick up boxed lunch and continue informal discussion as schedules allow.

How to Prepare

What to bring	Pre-work sent before the workshop
• Laptop and power adapter. • Current browser and internet access. • Optional: one CFD bottleneck, use case, or decision-relevant observable to discuss. • **Do not bring restricted or proprietary data unless cleared for workshop use.**	About two weeks before the workshop, registered participants will receive a web link with: • QubitFlux™ quick-start guide. • Short quantum-computing primer. • Cloud-login or software-installation instructions. • Optional path-to-value worksheet.

Registration, Travel, and Participation Notes

- Travel and lodging are not included in the registration fee. Venue-specific arrival instructions, hotel suggestions, and parking/transit details will be posted on the registration page.
- All participants are expected to maintain a professional, respectful, and harassment-free environment in accordance with our event Code of Conduct.
- Hands-on exercises are guided and designed to work in a shared cloud or browser-based environment.
- The workshop is an educational and exploratory program, not a certification course.
- Participants may discuss candidate use cases at a high level. Detailed follow-up technical discussions can be scheduled after the workshop.

Ready to explore quantum CFD? Registration is limited to approximately 15–20 participants per location. Visit the workshop information and registration page. Contact workshop@qubitsolve.com with questions.