

# INTERDISCIPLINARY INTEGRATION OF FLUID DYNAMICS AND QUANTUM COMPUTING

YUICHI KUYA<sup>\*</sup> AND HAYATO HIGUCHI<sup>†</sup>

<sup>\*</sup> Kyushu University  
744 Motooka, Nishi-ku, Fukuoka 819-0395, Japan  
kuya.yuichi.810@m.kyushu-u.ac.jp

<sup>†</sup> QunaSys Inc.  
Aqua Hakusan Building, 9th Floor, 1-13-7 Hakusan, Bunkyo-ku, Tokyo 113-0001, Japan  
higuchi@qunasys.com

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## ABSTRACT

This minisymposium focuses on the emerging interdisciplinary field of fluid dynamics and quantum computing, exploring how quantum and quantum-inspired methods can address fluid dynamics problems that are difficult to solve with current classical computational approaches. Key computational applications in fluid dynamics include computational fluid dynamics (CFD), fluid system design optimization, and data-driven analysis and modeling. Fluid dynamics problems are typically characterized by high dimensionality and strong nonlinearity, and therefore remain challenging even for the most advanced classical computing systems based on semiconductor technologies.

To address these challenges, a variety of quantum computing approaches are being explored, including gate-based quantum computing, quantum annealing, and quantum-classical hybrid machine learning. Quantum-inspired methods, such as tensor network approaches, are also being actively investigated for fluid dynamics problems. These approaches, together with recent advances in quantum hardware, have the potential to significantly improve the scaling of memory usage and computational time for certain problem classes.

Recent studies in this interdisciplinary field include the development of quantum and quantum annealing algorithms for CFD [1,2] and tensor network approaches for flow computations [3]. This minisymposium aims to facilitate interdisciplinary collaboration between fluid dynamics and quantum computing and identify promising directions for applying quantum and quantum-inspired methods to a wide range of fluid dynamics problems.

## REFERENCES

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