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QUANTUM COMPUTING FOR INDUSTRIAL SCIENTIFIC COMPUTING: FROM ALGORITHMS TO APPLICATIONS

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ABSTRACT

Scientific computing underpins the design and optimization of industrial products and processes, from structural and fluid simulation to materials modelling and logistics planning. As problem sizes, parameter spaces and accuracy requirements grow, classical methods face increasing computational bottlenecks. Quantum computing offers alternative paradigms that may extend what is computationally feasible, yet bridging theoretical algorithmic advances and real industrial use remains an open challenge.

This session brings together researchers from mathematics, computational science and industry to discuss how quantum and hybrid quantum-classical algorithms can be applied to scientific computing problems of industrial relevance. Its objectives are to (i) present recent mathematical developments in quantum algorithms for linear systems, partial differential equations, optimization and sampling; (ii) examine realistic use cases in sectors such as aerospace, energy, automotive and manufacturing; (iii) critically assess resource requirements, error mitigation and the prospects of near-term (NISQ) versus fault-tolerant devices; and (iv) foster academia-industry collaboration to identify problems where quantum approaches may offer a practical advantage.

Particular attention will be given to rigorous benchmarking against state-of-the-art classical solvers, data encoding and readout costs, and the integration of quantum routines into existing simulation workflows, including high-performance computing environments.

IS Topics: quantum algorithms for linear systems and PDEs; variational and hybrid quantum-classical methods; quantum optimization for industrial problems; quantum machine learning for simulation and surrogate modelling; error mitigation and resource estimation; benchmarking and quantum-HPC integration; industrial case studies.