Quantum Scientific Machine Learning for Multiphysics simulations

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The natural and socioeconomic world is fundamentally governed by conservation laws and rates of change; these systems are mostly modelled by differential equations (DEs). Solving intricate DEs can be computationally challenging due to their scale and complexity. As such, recently novel methodological approaches and computational paradigms have been explored to target them efficiently and accurately. In our work, we combine the efforts made by the classical machine learning community towards Scientific Machine Learning (SciML), i.e. using machine learning to solve and optimize systems governed by DEs, and the recent developments in the field of Quantum Machine Learning (QML), to form Quantum Scientific Machine Learning (QSciML). In the talk we will focus specifically on the advancements of variational quantum algorithms in this direction, including the Differentiable Quantum Circuits paradigm, and present results of their applications in various types of physics and engineering problems towards industrial-scale relevant applications.