

Machine Learning based Automated Calibration & Characterisation for Quantum Devices

Anurag Saha Roy

Roman Razilov, Paweł Nalezyty, Julian Treutler,
Faiçal Jouini, Satya Bade, Deepak Khurana,
Alastair Marshall, Shai Machnes

Qruise GmbH, Saarbruecken, Germany

anurag@qruise.com

Be it research teams developing next-generation QPUs or quantum hardware manufacturers fabricating production devices or HPC centres operating full stack cloud accessible platforms, automated calibration is necessary for the optimal operation of quantum computers. While most solutions focus on rapidly tuning 1 and 2Q gates under some ideal conditions, they ignore the in-depth characterisation and the flexibility & robustness of the automation framework. The day to day operation of current generation QPUs often involves many non-ideal situations – caused by fluctuations in the environment, the control or the QPU itself; eventually resulting in sub-optimal device performance or more commonly, errors in the bring-up process. QruiseOS offers an in-depth characterisation routine and an accurate digital twin that is key to debugging and identifying the reasons for such failures. We present a flexible automation framework that allows selective execution of specific experiments, multi-stage workflows, looping of individual or groups of tasks, adaptive error handling, fully parallelised execution, etc all accessible either programmatically or through a GUI. We discuss results and our learnings from deployments on various QPUs integrating with different control stack OEMs.