High-performance Control Systems for State-of-the-art Quantum Computing

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The continuous and fast progress on quantum information science is pushing the limits of electronic control systems, which requirements are getting more and more technologically challenging.

Some of these requirements are: very good signal quality, to achieve higher gate fidelities and lower crosstalk; high scalability and low footprint, to control hundreds of qubits simultaneously; real-time FPGA-based processing, for speed and for fast feedback applications -such as qubit reset or Quantum Error Correction (QEC)-; easy-to-use programming models, to allow users to focus on quantum science and Quantum Information Processing (QIP); and state-of-the-art error mitigation techniques and benchmarking, to unleashed the full capabilities of Noisy Intermediate-Scale Quantum (NISQ) processors.

In this talk we will discuss those challenges and how they can be addressed with the technological components of a modern control system stack.

Figures

Figure 1: A modular and scalable control system hardware
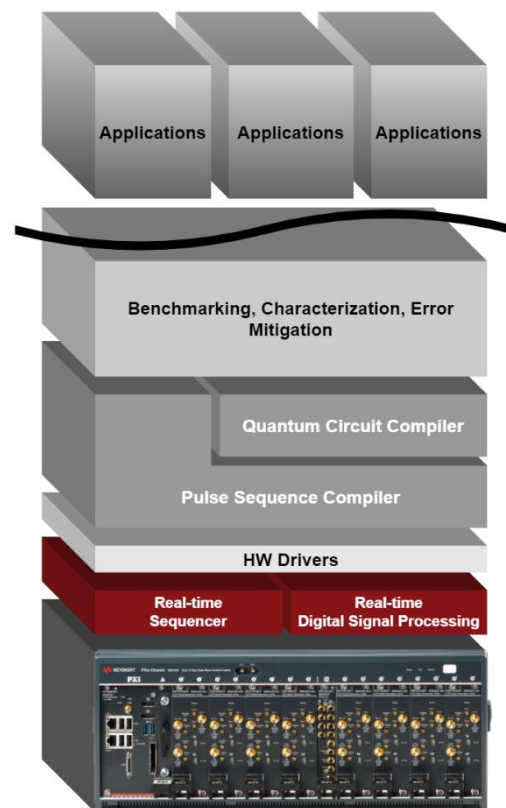
Figure 2: A full software stack solution for control systems