Control Systems at Infleqtion

Ryan Jones
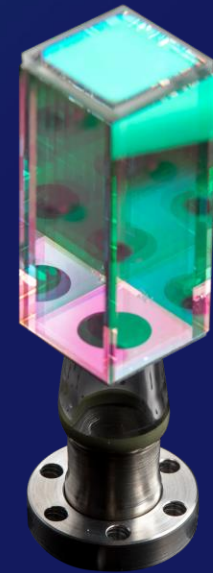Lead Electrical Engineer – Quantum
Computing

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About Infleqtion

Infleqtion (f.k.a. ColdQuanta) is a global quantum technology company.

Some areas where we use quantum control include:

- Neutral-atom quantum computing
- Quantum information platforms and networking
- Quantum devices (clocks, sensing)

Scalable and Distributed Hardware

o High-speed backplanes instead of point-to-point cabling

o Temperature-controlled chassis that fit in a server rack

o High-speed interconnects to (almost any!) control peripheral

Source: xilinx.com

Source: vadatech.com

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RF Control

- Laser intensity servos
  - Gated and offloaded from processor for better bandwidth
- Useful DDS features ported to RFSoC
  - RAM-mode
  - Fast amplitude/frequency/phase shift-keying
- Scalable multitone synthesis

Other Hardware Peripherals

- Many other hardware peripherals
  - Cameras
  - Electromagnetic field control
  - Microwave
- Prefer flexible HDL interfaces to DAC controlled interfaces

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Some thoughts on QICK software approach

- We 🤍 open-source!
- `tProcessor` assembly approach is simple and powerful
  - Please avoid the temptation to roll out a DSL in the future
- It would be fantastic to see efforts to synchronize / distribute control and memory across multiple boards
- Flexible interfaces to other (non-QICK) peripherals
- Please consider an API to run a real-time kernel
  - This could include an ABI (C/Rust/LLVM) to the `tProcessor` from the ARM R5 processor
  - More sophisticated control flows than are reasonable from `tProcessor` assembly without Python overhead

Questions?

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