Abstract: The goal of near-term quantum computing is to utilize noisy quantum devices to gain tangible performance over classical computers in useful applications. However, it remains a great research challenge to achieve this goal. High-level optimizations in the quantum toolchain can provide an accelerated pathway to useful near-term quantum computing applications. In particular, strategically exposing physical technology details to the quantum software stack can lead to orders-of-magnitude savings in machine resources. At the same time, there is a pressing need for automated verification to control the added complexity as we break traditional abstractions. In the first half of this talk, I will describe a compilation method to improve the efficiency of quantum computing systems by compiling directly to analog control pulses. Then, I will talk about an effort in the IBM Qiskit compiler to verify the heavy optimizations performed in the quantum compilation process.

Short bio: Yunong Shi is a Ph.D candidate at the University of Chicago. His research interests include quantum compiler optimization/verification, novel qubit architectures, quantum control system design, and fault-tolerant quantum computing. In 2019, He spent a year at IBM T.J. Watson research center as the QISE-NET fellow, developing new quantum compilation/verification methods for the Qiskit quantum compiler and designing protocols for bosonic qubit codes. In 2017, he was the W.J Cody fellow at Argonne national lab, using formal verification methods to facilitate the migration of large numerical software to new supercomputing architectures. He is also a contributor to the ScaffCC quantum compiler developed at UChicago.