Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Resource requirements for a fault-tolerant quantum Fourier transform HAYATO GOTO, SATOSHI NAKAMURA, MAMIKO KUJIRAOKA, KOUICHI ICHIMURA, Toshiba Corporation — The quantum Fourier transform (QFT) is a basic subroutine for most quantum algorithms providing an exponential speedup over classical ones. We investigate resource requirements for a fault-tolerant QFT. To implement single-qubit rotations for a QFT in a fault-tolerant manner, we examine three types of approaches: ancilla-free gate synthesis, ancilla-assisted gate synthesis, and state distillation. While the gate synthesis approximates single-qubit rotations with basic quantum operations, the state distillation enables to perform specific single-qubit rotations required for the QFT exactly. It is unknown, however, which approach is better for the QFT. We estimated the resource requirement for a QFT in each case, where the resource is measured by the total number of the $\pi/8$ gates denoted by T, which is called the T count. Contrary to the initial expectation, the total T count for the state distillation is considerably larger than those for the ancilla-free and ancilla-assisted gate synthesis. Thus, we conclude that the ancilla-assisted gate synthesis is the best for a fault-tolerant QFT so far.

Hayato Goto
Toshiba Corporation

Date submitted: 13 Nov 2014 Electronic form version 1.4