Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Classical Emulation of a Two-Qubit Quantum Computer with Analog Electronics[1] BRIAN LA COUR, COREY OSTROVE, GRANVILLE OTT, MICHAEL STARKEY, GARY WILSON, Applied Research Laboratories, The University of Texas at Austin — Abstract: The Hilbert space mathematical structure of a gate-based quantum computer may be reproduced by mapping the computational basis states to corresponding functions in the space of complex exponentials and identifying an inner product between any two such functions. The span of these complex basis exponentials may then identified with the finite-dimensional Hilbert space of a gate-based quantum computer. By using classical analog electronic components, such as four-quadrant multipliers and operational amplifiers, voltage signals representing arbitrary four-dimensional quantum states, along with the equivalent gate and measurement operations of a quantum computer have been physically realized through the corresponding circuitry. The fidelity of the emulation is measured using both a direct evaluation of the signal as well as through an emulation of quantum state tomography to infer the quantum state. We demonstrate that for both state synthesis and gate operations, our quantum emulation device is capable of achieving over 99% fidelity.

[1]This work was supported by the Office of Naval Research under Grant No. N00014-14-1-0323.

Brian La Cour
Applied Research Laboratories, The University of Texas at Austin

Date submitted: 06 Nov 2015 Electronic form version 1.4