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QCE: A Simulator for Quantum Computer Hardware

Kristel MICHIELESEN, Hans De RAEDT  
Department of Applied Physics-Computational Physics,  
Materials Science Centre, University of Groningen,  
Nijenborgh 4, NL-9747 AG Groningen, The Netherlands  
kristel@phys.rug.nl and deraedt@phys.rug.nl  
<http://www.compphys.org>

 [Keywords](#)  
[Authors](#)



[phys@tubitak.gov.tr](mailto:phys@tubitak.gov.tr)

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**Abstract:** The Quantum Computer Emulator (QCE) described in this paper consists of a simulator of a generic, general purpose quantum computer and a graphical user interface. The latter is used to control the simulator, to define the hardware of the quantum computer and to debug and execute quantum algorithms. QCE runs in a Windows 98/NT/2000/ME/XP environment. It can be used to validate designs of physically realizable quantum processors and as an interactive educational tool to learn about quantum computers and quantum algorithms. A detailed exposition is given of the implementation of the CNOT and the Toffoli gate, the quantum Fourier transform, Grover's database search algorithm, an order finding algorithm, Shor's algorithm, a three-input adder and a number partitioning algorithm. We also review the results of simulations of an NMR-like quantum computer.

**Key Words:** Quantum computation, computer simulation, educational software

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