

Synthesis Flow for Cell-Based Adiabatic Quantum-Flux-Parametron Structural Circuit Generation with HDL Backend Verification

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Abstract—Adiabatic quantum-flux-parametron (AQFP) is a very energy-efficient superconductor logic. In AQFP logic, dynamic energy dissipation can be drastically reduced due to adiabatic switching operations using ac excitation currents. During the past few years, AQFP logic family has been investigated and implemented. Experimental results prove the robustness of building large-scale integrated AQFP circuits. In this paper, an AQFP VLSI design flow is introduced and detailed with a 16-bit decoder as example circuit. By including logic synthesis and automatic routing tools, this AQFP VLSI design flow is capable of converting a high-level described system into physical fabrication. Analysis suggests that a reduction of more than 40% in circuit area and much higher design efficiency can be obtained, comparing to a previous manual design.

Keywords (Index Terms)— Superconducting integrated circuits, Josephson integrated circuits, HDL, AQFP logic, logic synthesis, EDA tools.

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