Optimization of a Single Flux Quantum Toggle Flip-Flop

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Single flux quantum (SFQ) toggle flip-flop (TFF) is widely used in superconductive digital electronics circuits. Specially, a program counter may be constructed based on TFF. We have re-optimized the currently used TFF and obtained a more soundly designed TFF. In this work, we used two circuit simulation tools, WRspice and Julia, as circuit optimization tools. We used XIC for a layout tool. Newly designed TFF had bias margins of ±37% and the junction global margins of ±27%. Global margin is very important in estimating a process error range allowed in fabrications. The designed circuits were fabricated by using Nb technology. The test results showed that the re-optimized TFF operated correctly on 100㎑ and had a very wide bias margin of ±63%.

keywords : flux, quantum, T flip-flop, superconductivity, digital, program counter