

Operation of Mixer Comprising a Series-connected Distributed Superconductor-Insulator-Superconductor Junction Array

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Abstract — Mixers comprising series-connected distributed Superconductor-Insulator-Superconductor tunnel junctions (SDJ) are analyzed. Compared to mixers consisting of parallel-connected distributed junctions (PDJ), SDJ mixers offer wider instantaneous bandwidth and higher dynamic range as well as easier magnetic field tuning. However, SDJ mixers are more complex in operation and in design as well. The reason lies in the fact that the large-signal nonlinear equations containing $3N$ unknowns, with N the junction number, are difficult to be solved. We propose a fixed-point iterative method to solve the nonlinear equations. This method is verified to be effective and efficient and a case study is done to clarify the uniqueness of SDJ mixers in operation.

Keywords (Index Terms) — Large signal problem, Fixed-point iteration, SIS mixer, Series-connected distributed junctions