

Junction Parameters and Uniformity Analysis of Over-damped Josephson Junction Array

Kyu-Tae Kim^{*}, Kyu Won Lee^{*}, Doo Woo Nam^{*}
Ralf Behr⁺, Franz Mueller⁺, Juergen Niemeyer⁺

^{}Division of Electromagnetic Metrology, KRISS, Yuseong 305-340, Korea*

⁺Quantum Electronics Dept., PTB, Braunschweig, 38116, Germany.

Over-damped Josephson junctions are essential for many important applications, for example RSFQ (Rapid Single Flux Quantum) digital circuit, next generation voltage standard so called programmable Josephson voltage standard (PJVS). The damping to the junction can be provided by external shunt to the SIS (Superconductor/Insulator/Superconductor) junction or intrinsic conductivity of the junction itself as in SNS or SINIS junctions. Contrary to the SIS junctions, analysis of the junction parameters and circuit uniformity are not so easy. We have developed the simulation model to investigate and analyze the properties of the various over-damped junctions. We observed several interesting properties. The effect of the external shunt to the SIS junctions and the optimal range of shunt inductance and McCumber parameters for the PJVS was found. Chaotic instability of SINIS junctions at low frequency was also observed. Margins of tolerable range of I_c spread and microwave non-uniformity were calculated. Our simulation model was also used to analyze our experimental observations on well-operating SINIS Josephson junction array for PJVS which was recently fabricated with PTB standard process. This analysis demonstrates how we can analyze the properties of over-damped Josephson junction array with the help of the simulation tool.

This work was supported in part by the KRISS and the Center for Applied Superconductivity Technology of the 21st Century Frontier R&D Program, both funded by the Ministry of Science and Technology, Republic of Korea..

keywords : Over-damped Josephson junction, SINIS, junction array, simulation, I_c spread, RSFQ