Optimization of a Low-Tc dc SQUID Amplifier with Tightly Coupled Input Coils

J. Pleikies, O. Usenko, G. Frossati, and J. Flokstra

Abstract — We optimized the design and operation of a low-Tc direct current superconducting quantum interference device (dc SQUID) with an integrated coupling coil of 1.5 μH inductance taking into account typical effects observed for similar devices. Numerical simulations were performed on a model including the capacitance of the Josephson junctions, thermal noise of the integrated shunt- and damping- resistors as well as a complex frequency dependent impedance of the SQUID loop originating from the integrated coils. The experimentally and numerically determined characteristics and sensitivity are in good agreement. A minimum additional coupled energy resolution of 700 ħ and 250 ħ was measured at a temperature of 4.2 K and 1.5 K, respectively.

Index Terms — Circuit simulation, Current sensors, Josephson device noise, SQUIDs.

Manuscript received August 19, 2008.
This work was supported in part by Stichting Technische Wetenschappen (STW).
J. Pleikies, and J. Flokstra are with the Low Temperature division at the Faculty of Science and Technology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands (phone: +31-53-489-3125; fax: +31-53-489-1099; e-mail: j.pleikies@tnw.utwente.nl).
O. Usenko, and G. Frossati are with the Kamerlingh Onnes Laboratory of the Leiden University, P.O. Box 9504, 2300 RA Leiden, The Netherlands (e-mail: usenko@physics.leidenuniv.nl).