

Voltage Biased SQUID Bootstrap Circuit: Circuit Model and Numerical Simulation

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Abstract - The SQUID Bootstrap Circuit (SBC) for direct-coupled readout of SQUID signals in voltage bias mode was recently demonstrated. In addition to the conventional dc SQUID, the SBC incorporates a shunt resistor R_s , and two coils coupled to the SQUID via mutual inductances M_1 and M_2 . In this paper, basic equations of SBC are formulated based on its equivalent circuit model. The expression of equivalent flux noise from the preamplifier is also given. The effect of the three adjustable parameters (M_1 , M_2 and R_s) on the characteristics of SBC and the preamplifier noise suppression are numerically simulated. The SBC combines current and voltage feedbacks in one circuit, allowing for an effective suppression of the preamplifier voltage noise through increased flux-current transfer coefficient and dynamic resistance. In contrast to other direct-coupled schemes, it offers not only a good noise performance, but also tolerance to a wide range of adjustable parameters.

Index Terms - Noise Suppression, Numerical Simulation, SQUID Bootstrap Circuit, SQUID Direct Readout.

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