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# Applications of Double Relaxation Oscillation SQUIDs to Multichannel Systems

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The Double relaxation oscillation SQUID (DROS) consists of a hysteretic dc SQUID and a reference junction, and shunted by a relaxation circuit of a resistor and an inductor. DROSs provide high flux-to-voltage transfers, usually larger than 1 $mV/\Phi_0$, and enable direct readout of the SQUID output voltage by room-temperature dc preamplifiers. By using DROS, simple flux-locked loop circuits could be used for SQUID operation.

We constructed two DROS multichannel systems and applied to biomagnetic measurements. The first system is a 40-channel planar gradiometer system, consists of integrated first-order planar pickup coils with a baseline of 40 mm. Average noise level of the 40 channels is around 1.2 $fT/cm/\sqrt{Hz}$ at 100 Hz, corresponding to a field noise of 5 $fT/\sqrt{Hz}$, operated inside a magnetically shielded room. The 40-channel system was designed to measure tangential field components and was applied to measure neuromagnetic fields.

The second one is a 37-channel magnetometer system, consists of 37 integrated magnetometers, distributed on a spherical surface and measures field component normal to the head surface. The average noise of the magnetometers is 3 $fT/\sqrt{Hz}$ at 100 Hz.

From the measured field distributions, source localization of current dipoles was done, demonstrating that the DROS could be a choice of sensor type in the future multichannel system.

keywords : SQUID, multichannel system, biomagnetic measurements