A multichannel Double Relaxation Oscillation SQUID magnetometer system for Magnetoencephalogram

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We developed a new type SQUID magnetometer system to measure biomagnetic signals, magnetoencephalogram(MEG) etc. A new type SQUID, which is Double Relaxation Oscillation SQUID(DROS), was utilized in the magnetometer as main point. DROS consists of two SQUIDs(signal SQUID and reference SQUID) in series, and a relaxation circuit of an inductor and a resistor. Specially we used single reference junction instead of the reference SQUID. The magnetometer, in which DROS is coupled to a pickup coil of 12 × 18 mm^2, was fabricated using four level processes based on hysteretic $Nb/AlO_x/Nb$ junctions technology. Since DROS magnetometer has about 10 times lager flux–to-voltage transfer coefficient than dc SQUID, we can use simple flux-locked loop electronics for SQUID operation The measured average magnetic field noise of the magnetometer was about 3 $fT/\sqrt{Hz}$ at 100 Hz inside a magnetically shielded room, and therefore was sufficiently low for MEG measurements. Using these magnetometers, we constructed a 37-channel SQUID system for simultaneous measurements of MEG. The system consists of 37 signal magnetometers, distributed on a semispherical surface for a human head and 11 reference channels were installed to pickup background noises. Also External feedback was used to eliminate the magnetic coupling with the adjacent channels. In this paper, we described a system operation characteristics and measured a biomagnetic signals.