High-Performance dc SQUID Sensors and Electronics

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Abstract—We introduce a new family of low-noise, robust, and easy-to-use dc SQUID sensors for a wide range of applications. In combination with our high-performance dc SQUID read-out electronics and a state-of-the-art packaging and wiring of the sensors, we obtain complete solutions for established measurement tasks as well as for new application concepts. For the readout of transition-edge sensors (TESs), series arrays of 16 gradiometric SQUIDs are fabricated which can be mounted directly on a Cu block at the cold stage of a mK cryostat without degradation in noise. Integrated two-stage sensors consisting of a single front-end SQUID with a double-transformer input coupling read out by a 16-SQUID series array are developed for applications requiring a high input inductance of up to 1.8 µH and an ultra-low current noise down to 180 fA/Hz1/2 at 4.2 K. Single-stage SQUIDs with additional positive feedback (APF) and bias current feedback (BCF) were implemented for applications with relaxed demands on the SQUID noise. For magnetic sensing field applications (e.g. monitoring of environmental interferences), integrated miniature multiloop magnetometers were designed with maximized field resolution. For a 3 mm × 3 mm chip size, a noise level below 4 fT/Hz1/2 is obtained at 4.2 K. In this paper, we report about latest developments of our SQUID sensors, SQUID electronics, and sensor packaging.

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