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Minimizing 1/f Noise in Magnetic Sensors with a MEMS Flux Concentrator ALAN EDELSTEIN, GREG FISCHER, JEFF PULSKAMP, U.S. Army Research Laboratory, MICHAEL PETERSEN, WILLIAM BERNARD[1], SHU FAN CHENG, Naval Research Laboratory, CATHY NORDMAN[2], U.S. ARMY RESEARCH LABORATORY TEAM, MEMS EXHANGE TEAM, NAVAL RESEARCH LABORATORY COLLABORATION, NVE COLLABORATION — The performance of magnetic sensors at frequencies on the order of 1 Hz is generally limited by $1/f$ noise and the fact that the signal is small relative to the DC background. We have developed a new device, the MEMS flux concentrator, that solves these problems. Often flux concentrators (soft magnetic materials) are placed around magnetic sensor to increase the field. In the new device, the flux concentrators are placed on MEMS flaps that are driven to oscillate in the plane of the sensor, by electrostatic comb drives, at a frequency of about 15 kHz. The two MEMS flaps are connected by Si springs so that there is an 180° out of phase normal mode. If the amplitude of the motion is 12 microns, the amplitude of the magnetic field at the position of the sensor varies by a factor of about two. At 15 kHz, the sensor is operating in a region where the 1/f noise is often reduced by several orders of magnitude. Spin valves were employed as the magnetic sensor. SOI wafers were used in the fabrication. Because the Q of the mechanical resonance is 30, only microwatts of power are required to drive the motion.

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