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Three-axes teslameter free from the planar Hall effect

We shall present a novel 3-axes teslameter based on the first three-axes fully integrated Hall probe [1].

The integrated Hall probe consists of a sensing part, analogue electronics and digital synchronisation circuit. A horizontal Hall element measures the perpendicular component; and two vertical Hall devices [2] measure the two in-plane components of a magnetic field. The probe has a sensitive volume of 0.15mm x 0.15mm x 0.01mm, and mutual orthogonality of the three sensitive axes better than 0.5 degrees. Using spinning-current technique, the integrated electronics cancels offset, 1/f noise, and the planar Hall effect. A temperature sensor is also integrated on the chip. The chip is realized in CMOS 0.8 um technology. The probe is connected with a cable to an external electronics box.

The external electronics cancels residual offset and its temperature drift; compensates temperature influence on magnetic sensitivity; and compensates non-linearity. The compensation of temperature drifts is very efficient due to the use of the signal proportional to the real probe temperature. The teslameter may have either analogue or both analogue and digital outputs. The analogue outputs are three voltages proportional to the three components of the measured magnetic flux density, and a voltage proportional to the chip temperature. The digital output is available on a LC display and can be also transferred to a computer for further processing. The standard accuracy of the new teslameter is 0.1 percent in the measurement range +/-2T and analogue bandwidth DC to 2.5kHz; or in the range +/-0.2T and analogue bandwidth DC to 10kHz. The new teslameter has virtually no cross-talk between the channels.

[1] P Kejik, E Schurig, F Bergsma, R S Popovic: First Fully CMOS-integrated 3D Hall Probe, Transducers 05, COEX, Seoul, Korea, June 5-9, 2005

[2] R S Popovic: Hall effect devices, Second edition, IOP Publishing, Bristol 2004

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