

The design and analysis of tri-axis GMR sensors with fluxguide

Student : Chia-Yi Chiang

Advisors : Dr. Jen-Tzong Jeng

Institute of Graduate Institute of Mechanical and precision Engineering
National Kaohsiung University of Applied Sciences

Abstract

Keyword: GMR sensor, tri-axis magnetometer, electronic compass

In this study, a 3-dimensional (3D) magnetometer comprising three in-plane GMR sensors and a fluxguide was investigated. The anti-ferromagnetic coupled GMR sensors, which are form NVE, have high sensitivity, small size, low power consumption, but their outputs are hysteretic and non-linear. The problems of hysteresis and nonlinear is solved using three GMR sensor with AC magnetic modulation coils and feedback. The fluxguide's material is Ni-Zn ferrite, which can deflect the magnetic flux to generate the field components in the sensing directions of in-plane GMR sensors. The fluxguide can converge and deflects flux line as well as enhance the sensitivity, which are also verified by magnetostatic numerical simulation. The sensing axes of the magnetometer comprising in-plane GMR sensors and a fluxguide are not orthogonal each other, which can be corrected by using the voltage to field transfer matrix to achieve orthogonality. Further linearization and reduction in hysteresis are possible using the magnetic feedback technique through the modulation coils. The developed tri-axis GMR magnetometer can detect the magnitude and direction of geomagnetic field and hence is suitable for applications in electronic compass and angle sensors.