ABSTRACT

Title：Harmonics Detection Circuit for Giant Magnetoresistive Triaxial Magnetic Sensor

Pages：77

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Modern triaxial magnetic sensors mostly consist of three uniaxial sensors, for which their sensitivity axes are mutually orthogonal. The vector signals detected by the sensors arc strongly affected by magnetic field gradient due to their structure. Giant magnetoresistance (GMR) sensors are regarded as an important role in magnetic field sensing applications because of small size, low power consumption, high sensitivity, large frequency bandwidth, and relatively low cost. This research demonstrated a driving circuit for a triaxial magnetic sensor fabricated by two dual full-bridge GMR sensors and a fluxguide. The dual full-bridge GMR sensor were assembled by a pair of single full-bridge GMR sensors(#l, #2, #3, #4 : single ; #1#3 ,#2#4 : dual), and the sensitivity axes of two dual full-bridge GMR sensors are orthogonal to each other. A fluxguide was placed at the center of two dual full-bridge GMR sensors, and the Z-axis magnetic field would be deflected by means of fluxguide, so we can measure the magnitude of Z-axis magnetic field by #1#3 or #2#4. The result show the sensitivities of triaxial GMR sensor are : 1177 V/T(#1#3), 1147 V/T (#2#4), 485 V/T(Z#1#3), 471 V/T(Z#2#4). A single full-bridge GMR sensor with compensation coil was also operated with the proposed driving circuit to compare the compensated sensor's sensitivity, noise, hysteresis and linearity with the uncompsated one's.

GMR sensor has some disadvantages like 1/f noise and hysteresis. These disadvantages could be reduced through AC magnetic modulation technique. After modulation, the sensed signal would have two dominant components: response to modulation magnetic field (at relatively high frequency) and response lo external

magnetic field (at relatively frequency low). The GMR driving circuit has two major parts: excitation (for modulation) and demodulation. By using FPGA lo implement the digital circuit, the driving circuit was simplified significantly.