Design of GMI micro-magnetic sensor and its application for geomagnetic navigation jiang

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Abstract: Magnetic field sensors with high sensitivity and rapid response are required for geomagnetic navigation. Giant magneto-impedance (GMI) magnetic sensors show great potential as the next generation of magnetic sensors for low magnetic field detection due to their high sensitivity, quick response, low power consumption and easy miniaturization. In this paper, design of GMI micro-magnetic sensor based on the GMI effects of amorphous alloys and its application for geomagnetic navigation are presented, which includes sensing elements, sensor construction and working principle, geomagnetic navigation with this sensor and navigation methods. According to the theory of GMI effect, Co-based amorphous ribbons are selected as the preferred sensing elements for GMI magnetic sensor since they have good soft magnetic properties. Preliminary investigation on GMI sensing elements using the Co-based amorphous ribbons without any post-treatment suggests a potential GMI effect with an impedance variation about 28.6°;'0 and the magnetic field sensitivity about 1.04% IOe at 38 MHz. In addition, as a crucial application for geomagnetic navigation, the geomagnetic navigation system with three GMI micro-magnetic sensors is presented, geomagnetic navigation correlative theory is described and GMI magnetic sensor navigation methods are given. These show that high precision GMI magnetic sensors, accurate geomagnetic database and proper navigation methods can achieve precise geomagnetic navigation.

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