MAGNETORESISTIVE SENSORS AS A PRECISION TOOL IN BIOMEDICAL APPLICATIONS

Susana Cardoso de Freitas

INESC-MN and Instituto Superior Técnico / Universidade de Lisboa, Portugal
e-mail: scardoso@inesc-mn.pt

Magnetic field sensors, namely, magnetoresistive (MR) sensors have presently a mature level of implementation in the market. In the past 10 years, the biomedical area has motivated many research on highly sensitive sensors with pico-Tesla detectivities using MR sensors, which offer very good spatial resolution and low cost at room temperature. Such a solution can have a high impact towards competing technologies as SQUIDS or other hybrid devices, as highlighted in a recent roadmap from the IEEE society [1].

Although the technologies are compatible with massive integration of sensors for industry areas such as automobile applications, or current sensor, there are still challenges for using MR sensors in biomedical applications. In this talk, we discuss geometry and operation parameters of MR sensors where the advantages over other sensors (eg. magnetic flux sensors) are canceled by the intrinsic noise characteristics, therefore limiting the minimum field detection. The MR sensor optimization strategies towards high performing devices are discussed, including on-chip magnetic flux concentrators, frequency modulation and packed architectures. Several examples of device architectures will be described and commented in the framework of a candidate for the next generation of integrated devices for biomedical precision instrumentation and lab-on-chip applications.

[1] Chao Zheng, et.al., "Magnetoresistive Sensor Development Roadmap (Non-Recording Applications)", IEEE Trans.Magn. 55 (4), pp. 1-30 (2019)