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Hall Devices for Multidimensional Sensing of Magnetic Field

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This paper is a review of different structures based on Hall devices designed for two- and three-dimensional sensing of magnetic fields. The devices are fabricated by either bipolar or complementary metal-oxide-semiconductor (CMOS) technology. The majority of these structures is a variation of the basic cell known as the vertical Hall device. We also show that these structures can be integrated on a single chip together with signal processing circuitry, or even combined together with micromachining techniques to enhance sensor performance.

1. Introduction

Magnetic field sensors are usually designed and optimized to sense one component of a magnetic field. However, there are applications where the simultaneous detection of more than one component of the magnetic field vector is required. The examples include angle detectors, slope detectors, proximity switches, and detectors for determining the position of valve openings. Sometimes a specific application demands knowledge of the absolute value of the magnetic flux density, while in other cases, the spatial resolution of the sensor is of prime importance. Whatever the primary objective might be, multidimensional sensing of magnetic fields still remains a challenging task.

The magnetic field sensors designed for multidimensional sensing are either based on transistor action or on Hall devices. In this paper, we will focus strictly on