

# Design Considerations of Op-Amp-Based Integrated Sensors: Magneto-Operational Amplifiers as an Example

Kazusuke Maenaka

Department of Electronics, Himeji Institute of Technology,  
Shosha 2167, Himeji 671-22, Japan

(Received October 28, 1992; accepted February 15, 1993)

**Key words:** integrated sensor, intelligent sensor, magnetic sensor, operational amplifier, bipolar IC

The design of a new class of integrated sensors is presented, which allows realization of a variety of different signal processing functions on the same chip. The principle employs a feedback amplifier system based on the operational amplifier, where the feedback elements define the required transfer function. An example of this integration is illustrated for magnetic sensing. This integrated magnetic sensor (called MOP: magneto-operational amplifier) is fabricated using standard bipolar IC technology, and characterized by connecting various feedback elements. The experiments show that the MOP achieves linear, nonlinear and time domain operations, and is thus useful for many applications. The concept presented here can be easily extended to a variety of other sensors.

## 1. Introduction

A variety of different integrated sensors have been reported to date.<sup>(1,2)</sup> Examples include integrated magnetic sensors (so-called Hall-ICs<sup>(3)</sup>) and integrated pressure sensors.<sup>(4)</sup> These sensors, however, have fixed sensitivities and other fixed functions. Thus, a customer has no option but to choose a suitable device among those commercially available, for the desired purpose, and is unable to further adjust the characteristics or output function of the device. Contrary to this scenario is the operational amplifier (op-amp), which is widely used in electronic circuits.<sup>(5)</sup> The op-amp achieves many analog functions (such as amplification and oscillation) with ar-