Sensors and Materials, Vol. 6, No. 3 (1994) 139-157
MYU Tokyo

S & M 0161

Application of General-Purpose Device Simulator to Analysis of Integrated Silicon Microsensors

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(Received August 19, 1993; accepted October 23, 1993)

Key words: silicon microsensor, integrated circuit, numerical simulation

Based on suitable generalizations of the semiconductor-device transport model, a number of features have been successively added to a general-purpose, multidimensional analysis code. Some of these features allow for the simulation of classes of integrated microsensors at an acceptable computational cost. They are reviewed in this paper along with a few examples in which simulations of optical, thermal, and mechanical sensors are carried out for realistic cases.

1. Introduction

In recent years, the development of CAD tools has played a key role in fostering the progress of IC technology, keeping the cost of the prototyping/debugging operation for processes and circuits within affordable limits. On the other hand, as integrated circuits become smaller, cheaper and faster, new applications are devised and new needs come into play; for instance, when the application requires interaction with an external, nonelectrical system, the problem of signal transduction arises. In order to exploit the advantages of IC technology, signal transducers must be fast, small, and cheap. For this reason, extensive effort has been devoted to investigating some properties of semiconductor materials that make them suitable for constructing "on-board" physical sensors, with the aim of making the transducer itself a part of the integrated circuit.

This paper deals with numerical-modeling techniques suitable for the simulation of a few