

## Accurate 3D Capacitance Evaluation in Integrated Capacitive Humidity Sensors

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We describe progress made towards the accurate 3-D modelling of integrated capacitive humidity microsensors fabricated using industrial CMOS technology. The designs are based on microelectrodes coated with a moisture-absorbing polyimide layer. A new dedicated software package, semiconductor sensor device simulation (SESES), has been developed for this purpose. It solves the 3-D Poisson equation over the full sensor structure, subject to appropriate boundary conditions, using the finite-element method. The solution determines the induced surface charge on the electrodes and hence the exact capacitance, which can then be used for 'dielectric modelling', namely, to assess the accuracy of various models of dielectric behaviour in the polyimide, from a comparison with experimental results. We also describe progress made in the optimization of sensor design, particularly in improving the sensitivity to humidity. We outline how SESES can also be used for the careful study of reliability considerations, such as the effects of embedded charges. Our results are relevant to integrated microsensors in general, i.e., any application involving capacitance measurements.

### 1. Introduction

Capacitive humidity sensors, whose designs typically consist of parallel or inter-

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