

Proceedings of the 3rd Italian Conference

**SENSORS**

---

**AND**

---

**MICROSYSTEMS**

---

Genova, Italy

11 - 13 February 1998

**Editors**

---

**C. Di Natale**

---

**A. D'Amico**

*University of Rome "Tor Vergata"  
Italy*

---

UNIVERSITÄTSBIBLIOTHEK  
HANNOVER  
TECHNISCHE  
INFORMATIONSBIBLIOTHEK

**G. Sberveglieri**

*University of Brescia, Italy*

---



**World Scientific**

Singapore • New Jersey • London • Hong Kong

## CONTENT

Foreword .....	v
----------------	---

### PLENARY TALK

<i>M. Bove, M. Giugliano, M. Grattarola, S. Martinoia, G. Verreschi</i>	
Towards bio - artificial systems: Networks of neurons coupled to planar arrays of microtransducers .....	3
 <i>P.G. Morasso</i>	
Computational neuroscience and neuro-prostheses .....	9
 <i>A. Camurri</i>	
Emotional agents: Intelligent human-machine interaction in multimedia systems .....	17

### BIOSENSORS AND BIOELECTRONICS

<i>T. Panasuyk, V. Campo dall'Orto, G. Marrazza, A.El'skaya, S. Piletsky, I. Rezzano, M. Mascini</i>	
Selective films prepared by imprinting electropolymerization of metalloporphyrins .....	25
 <i>R. Fusi, A. Cagnini, M. Mascini</i>	
Development of a disposable NADH sensor for analytical applications .....	30
 <i>G. Marrazza, I. Chianella, M. Mascini</i>	
A disposable electrochemical biosensor for oligonucleotide hybridization detection .....	34
 <i>G. Palleschi, D. Compagnone, D. Moscone</i>	
Electrochemical biosensors for quality control in the food industry .....	40

## CHEMICAL SENSORS BASED ON ORGANIC MATERIALS AND CONDUCTING POLYMERS

<i>R. Raiteri, S. Martinoia, F. Molinari, G. Carlini, D. Ricci, M. Grattarola</i> Development of a new chemical sensor based on $\text{CH}_3\text{Si}(\text{OCH}_3)_3$ sol-gel coated micromachined cantilevers .....	51
<i>C. Di Natale, A. Macagnano, A. Mantini, R. Paolesse, V.I. Troitsky, T. Berzina, A. D'Amico</i> Characterization of Langmuir-Blodgett films of porphyrins as coating for QMB-based broad-selective sensors .....	56
<i>C. Di Natale, C. Giampaolo, A. D'Amico</i> The application of the Allan variance to the study of the noise properties of adsorption-desorption phenomena in chemical sensors .....	64
<i>R. Rella, P. Siciliano, G. Barbarella, G. Toscano, L. Valli</i> Heptatiophene derivative LB films for the detection of nitrogen oxide .....	71
<i>L. Prodi, F. Bolletta, M. Montalti, S. Pivari, N. Zaccheroni</i> Fluorescent chemosensors for alkaline earth metal ions .....	77
<i>F. Baldini, A. Falai, A. Flamini, A. Mencaglia</i> 2-(5-amino-3,4-dicyano-2H-pyrrol-2-ylidene)-1,1,2-tricyanoethanide immobilized on anion exchangers as optical transducer for the detection of Hg(II) in water .....	83
<i>R. Paolesse, C. Di Natale, A. Macagnano, D. Salimbeni, L. Lucarini, A. Mantini, A. D'Amico</i> Volatile organic compounds detection with metalloporphyrin thin films-based optical sensors .....	88
<i>R. Rella, P. Siciliano, F. Quaranta, L. Valli</i> Effects of nitrogen dioxide on Surface Plasmon Resonance of copper Phtalocyanine Langmuir-Blodgett films .....	92

<i>S. Cincotti, A. Chiabrera, M. Parodi, M. Storace</i> Dipolar molecular nanocircuits: a prospect for molecular electronics .....	98
<i>C. Caliendo, A. Furlani, M.V. Russo</i> Comparison of the sensitivity of Ni/Pd/Pt-organometallic polymers as sensitive membranes in Surface Acoustic Wave (SAW) humidity sensors .....	104
<i>C. Caliendo, P. Franceschini, A. Furlani, M.V. Russo</i> A novel Ni-organometallic polymer as sensitive membrane in Surface Acoustic Wave (SAW) humidity sensors .....	109
<i>M. Penza, E. Milella, V.I. Anisimkin, L. Vasanelli</i> Surface acoustic wave gases and vapours sensing using organic films .....	115

## CHEMICAL SENSORS BASED ON INORGANIC MATERIALS

<i>E. Comini, A. Cristalli, G. Faglia, G. Sberveglieri</i> Effect of UV radiation on the gas sensing properties of SNO <sub>2</sub> RGTO thin film .....	123
<i>G. Faglia, E. Comini, A. Cristalli, G. Sberveglieri, G. Cardinali, L. Dori</i> Fast temperature pulsing: a new technique to improve performances in micromachined semiconductor gas sensors .....	129
<i>V. Guidi, M.C. Carotta, M. Ferroni, G. Martinelli, L. Paglialonga, E. Comini, P. Nelli, G. Sberveglieri</i> Nanosized materials for gas-sensing applications .....	135
<i>M.C. Carotta, M.C. Casale, L. Crema, M. Ferroni, M. Merli, G. Martinelli, E. Traversa</i> Thick film microsensors for environmental monitoring applications .....	143
<i>S. Kaciulis, G. Mattogno, A. Napoli, A. Galdikas, L. Dapkus, A. Mironas, A. Šetkus</i> Effect of constituent layers on the sensitivity and selectivity of multilayer gas sensors .....	149

<i>C. Cantalini, M. Pelino, W. Wlodarski, M. Passacantando, L. Lozzi, S. Santucci</i> Preparation and electrical response of In <sub>2</sub> O <sub>3</sub> thin film gas sensors to NO <sub>2</sub> .....	155
<i>S. Capone, G. Leo, R. Rella, P. Siciliano, L. Vasanelli, M. Alvisi, L. Mirengi, A. Rizzo</i> Hafnium oxide: A new sensitive material for detection of carbon monoxide .....	159
<i>G. Neri, A. Bonavita, A. Donato, S. Patanè, A. Arena, S. Galvagno</i> Microstructural characterization of Au-doped iron oxide for CO gas sensors .....	165
<i>G. Lérondel, G. Amato, L. Boarino, A.M. Rossi</i> Porous silicon as optical gas sensor .....	171
<i>E. Scarano</i> Advanced analytical systems .....	177
<i>E. Scarano, F. R. Mignacca</i> A non-invasive specific oxygen sensor: Fundamentals and applications .....	180
<i>E. Scarano, F. R. Mignacca</i> A non-invasive specific carbon dioxide sensor: Fundamentals and applications .....	187
<i>E. Scarano, G.E. Pellegrini</i> Microbiological processes investigations by means of a non-invasive specific CO <sub>2</sub> sensor .....	192
 <b>ELECTRONIC NOSE AND MULTISENSOR SYSTEMS</b>	
<i>A. Macagnano, C. Di Natale, R. Paolesse, A. Mantini, A. D'Amico</i> Towards an electronic nose application in medicine: The skin odor analysis .....	201

<i>G. Sberveglieri, E. Comini, G. Faglia, G. Niederjaufner, M. Pardo, G.P. Benussi, G. Contarini, M. Povolo</i> Distinguishing different heat treatments of milk by an electronic nose based on ANN .....	205
--	-----

<i>A. Campitelli, W. Wlodarski</i> Electronic tongue based on a shear horizontal acoustic wave sensor array .....	211
--	-----

## **CHEMFET**

<i>L. Campanella, G. Favero, F. Occhionero, M. Tomassetti</i> New potentiometric and ChemFET devices based on Benzylidenephenylnitrone selective membrane for free radicals analysis .....	219
---	-----

<i>G. Massobrio, L. Lorenzelli, S. Martinoia</i> Temperature effects on the ISFET behaviour: Modelling and computer simulations .....	225
--	-----

<i>L. Lorenzelli, S. Martinoia, G. Massobrio, M. Grattarola</i> An ISFET based sensor for carbon dioxide detection in solution .....	231
---	-----

## **FIBER OPTICS SENSORS**

<i>R. Falciai, A.G. Mignani, A. Vannini</i> Optical fiber long period gratings for refractometry .....	239
---	-----

<i>A.G. Mignani, S. Romano, F. Fusi, L. Ciaccheri</i> Radiation dosimetry in radiotherapy: A model for an extrinsic optical fiber sensor .....	243
---	-----

<i>L. Sirleto, G.C Righini, L. Ciaccheri, F. Simoni</i> Fibre optic sensing device based on polymer dispersed liquid crystals .....	247
--	-----

## IR AND OPTICAL SENSORS

<i>R. Ramponi, M. Marangoni, R. Osellame</i> Nonlinear optical waveguide sensor for refractometry of liquids in the near-IR .....	255
<i>C. Corsi, M. Inguscio</i> High sensitivity diode laser gas sensor for environmental, industrial and medical applications .....	261
<i>M. De Rosa, C. Corsi, G. Modugno, F. D'Amato, M. Inguscio</i> Real-time sensor for the HCl detection at the ppb level .....	269
<i>R. Benedetti, C. Corsi, M. Rosa-Clot</i> Diode laser based sensor for O <sub>2</sub> under high temperature and high pressure conditions .....	275
<i>L. Capineri, V. Ferrari, F. Naldoni, L. Masotti, D. Marioli, A. Taroni</i> Array of pyroelectric transducers in thick-film technology .....	281
<i>G.C. Righini, M. Nieri, M.A. Forastiere, J. Zheng</i> Grating microstructures for optical waveguide sensors .....	287
<i>L. Ciancaglioni, L. Colace, G. Masini, M.C. Rossi, S. Salvatori, L. Schirone, F. Galluzzi</i> Differential image sensor .....	293

## PHYSICAL SENSORS

<i>G. De Cicco, B. Morten, D. Dalmonago, M. Prudenziati</i> Pyroelectric phenomena in PZT-based thick-films .....	301
<i>C. Ferrero, C. Marinari, E. Martino, S. Merlo</i> Metrology of torque: State of the art and short-term development at the CNR-IMGC within the frame of European standardization .....	306

<i>A.S. Fiorillo</i> Piezopolymers and biosensors .....	312
<i>R. Carotenuto, N. Lamberti, A. Iula, M. Pappalardo</i> A new double rotor linear motor for low-voltage and large displacements applications .....	318
<i>G. Villosio, M. Cisternino, C. Malvicino, M. Palazzetti</i> Strumentation and methodology for the thermal comfort of seats .....	324
<i>D. Rossini, F. De Cristofaro, S. De Marino, C. Malvicino, M. Palazzetti</i> Hot wire anemometer for sections of wide surface flow .....	330

## MICROMECHANICS AND TECHNOLOGIES

<i>U. Mastromatteo, M. Foroni, B. Vigna, P. Ferrari, P. Montanini, M. Ferrera, F. Villa, A. Manfredi</i> Realisation of polysilicon microstructures for accelerometers and gyroscopes .....	339
<i>A. Mazzoldi, C. Degl'innocenti, M. Michelucci, M. Pachetti, D. De Rossi</i> All polymer actuators for microsystems .....	345
<i>G. Di Francia, V. La Ferrara, L. Quercia, F. De Filippo, L. Lancellotti, P. Maddalena, D. Ninno, C. Baratto, E. Comini, G. Faglia</i> Porous silicon sensors: A review on their fabrication and applications .....	351
<i>S. Brida, L. Ferrario, F. Giacomozzi, P. Gregori, V. Guarnieri, B. Margesin, F. Merz, G. Verzellesi, M. Zen</i> Feasibility study on fabrication of piezoresistive pressure sensors using silicon micromachining technology .....	357



**ELECTRONICS FOR SENSORS***G. Ferri*

A low-voltage CMOS operational transconductance amplifier  
for capacitive sensor applications ..... 365

*G. Ferri*

The use of a 1.2 V-supply CMOS amplifier as a front end for  
integrated sensor applications ..... 370

*G. Ferri, P. de Laurentiis*

A 1.4 V 28 $\mu$ W CMOS oscillator as a capacitive sensor interface ..... 376

*M. Faccio, A. Tammaro, C. Cantalini, S. Santucci*

Design of a CMOS heater support for thin film gas sensors ..... 381

*G. Ferri, M. Faccio, A. D'Amico*

Parametric variations and sensitivity in ladder networks recall  
Fibonacci numbers ..... 387