

**THIRD INTERNATIONAL WORKSHOP ON DEVELOPMENT IN MICROELECTRONICS:
ROLE OF VLSI IN MEMS, CENTRAL ROAD RESEARCH INSTITUTE
(CRRI), NEW DELHI (INDIA), DEC. 4-6, 2002**

PARTICIPATING COUNTRIES: 9 MEMBER COUNTRIES OF THE NAM S&T CENTRE

NUMBER OF RESOURCE PERSONS: 11

NUMBER OF PARTICIPANTS: 21

The sensors based on micro-electromechanical systems (MEMS) have been dominating the advances in microelectronics since the last decade and are markedly becoming relevant in our day-to-day lives. Recent developments in the field of MEMS based micro-sensors using physical, chemical and biological sensing elements have shown great promise for the realization of smart sensors and their numerous applications. Compatibility of signal conditioning and processing circuitry fabrication technology with MEMS based micro-sensors has enhanced the process of integration. However, the design of appropriate modules and the interfaces has been a challenging task in the present scenario. In addition to this, the miniaturization of semiconductor based circuit technology is approaching its physical limits, hindering further development of faster and more efficient systems.

In this context as a follow up of the 2nd International Workshop on Microelectronics, which was organized by the NAM S&T Center jointly with the Asian Institute of Technology in Bangkok and Da Nang University in Vietnam in November 2001, the 3rd International Workshop on 'Development in Microelectronics: Role of VLSI in MEMS' was held in the premises of Central Road Research Institute at New Delhi, India during December 4-6, 2002. This workshop was organized by the NAM S&T Centre jointly with the Asian Institute of Technology (AIT), Bangkok, Central Electronics Engineering Research Institute (CEERI), Pilani of the Indian Council of Scientific & Industrial Research (CSIR), to review the status of microelectronics in the world, familiarize the participants with the limitations and latest trends of VLSI based MEMS technology and consider the latest development in the upcoming field of Nano-technology.

Scientists from nine member countries of the NAM S&T Centre attended the workshop. These included Colombia (Dr. Jose. E. Garcia, Director, International Centre of Physics, National University of Colombia, Bogota); Egypt (Dr. Hamed Elsimary, Electronics Research Centre, Cairo); India (Prof. Dinesh Chandra, JSS Academy of Technical Education, NOIDA); Indonesia (Dr. Totok M. S. Soegandi, Director, Research Center for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Bandung); Mauritius (Prof. H. C.

S. Rughooputh, Dean of Faculty, Chair of Electronics and Communications Engineering, University of Mauritius); Myanmar (Ms. Aye Aye Thinn from Mandalay Technological University); Sri Lanka (Mrs. K. N. D. Moonasinghe, Arthur C. Clarke Institute for Modern Technologies, Katubedda); Syria (Prof. Dr. Eng. Nadim Shahine, Medical & Electronic Consulting Unit, Damascus University); and Vietnam (Dr. Tran Xuan Hong, Vice President, National Centre for Technological Progress (NCTP) and Director, Centre for Information and Microelectronics Technology (CIMT), Hanoi). Besides them, the country report was received from Mr. Abdul Kareem I. Ali of Iraq, who could not attend the workshop.

The speakers in the workshop comprised ten eminent scientists, respectively, Prof. Cor Claeys, Director, Inter-University Microelectronics Centre, Katholieke University, Leuven, Belgium; Prof. Dr. H. Gesch, University of Applied Sciences, Landshut, Germany; Dr. Shamim Ahmad, Director, Central Electronics Engineering Research Institute (CEERI), Pilani, India; Dr. R. P. Bajpai, Director, Central Scientific Instruments Organisation, Chandigarh, India; Prof. A. B. Bhattacharyya, Distinguished Professor, Indian Institute of Technology, New Delhi, India; Dr. D. N. Singh, Semiconductor Complex Limited, Mohali, India; Dr. A. R. Upadhyaya, Aeronautical Development Agency, Bangalore, India; Dr. J. Dutta, Institute of Technology, Lausanne, Switzerland; Dr. Itti Rittaporn, National Electronics and Computer Technology Centre (NECTEC), Thailand; and Prof. Nitin Afzulpurkar, Asian Institute of Technology, Pathumthani, Thailand. Prof. Huynh Ngoc Phien, Dean, School of Advanced Technologies, Asian Institute of Technology (AIT), Pathumthani, Thailand also participated in the workshop.

The inaugural session was attended by, among others, H. E. Dr. Mohsen Al-Khayer, Ambassador of the Syrian Arab Republic, H.E. Mr. Jose Eloy Valdes, Ambassador of Cuba and Dr Helmut Lüders, Counsellor (Science, Technology & Environment) of the Federal Republic of Germany. Hon'ble Dr. R. Chidambaram, Principal Scientific Adviser to the Government of India and Chairman, TIFAC, inaugurated the Workshop. In his brief inaugural address, he highlighted the importance of cooperation between the developed and developing countries so as to facilitate widespread research in the field of Microelectronics and enable the transfer of cutting edge technology from the developed to the developing countries. Pointing out that packaging of micro-sensors has been a challenging task in the present scenario, he stressed on the need to ensure compliance and reliability testing and stated that the need of the hour is technology foresight as there is a plethora of technologies available in the market and for sustained development one needs to choose the best available technology as per necessities.

Dr. Shamim Ahmad, Director, CEERI, Pilani, India gave the plenary address. He informed the participants about the various initiatives taken by CSIR for the development of MEMS based technology. Giving a broad outline of the development work being carried out on a number of micro-sensors such as

embedded μ -heater gas sensor, ion sensitive FET, micro filament sensors, micro cantilevers etc., he talked about the recent developments and future industrial applications (micro-valves, micro-nozzles etc.) for Micro Total Analysis. He named various micro-sensors, such as pressure sensors, acoustic sensors, poly-silicon load sensors, RF switches, infrared detectors etc., which have been successfully developed at CEERI, Pilani

The Workshop was divided into five sessions over a period of two days. The first four sessions comprised of talks by the specialist faculty on various topics. Prof. Cor Claeys talked about the technological challenges, roadmap for future global research in VLSI technology for MEMS based micro-sensors and the recent developments and challenges faced by designers in the field of scaling, lithography and use of thin dielectrics. Dr. A. R. Upadhyya apprised the participants of the Indian national programme on smart materials. Prof. Gesch spoke about the economic significance of MEMS and Micro-system Technology (MST) and gave a forecast of future developments in MEMS by pointing out the necessary thrust and problem areas for the future. He also addressed some specific questions on large-scale integration on boards and the electrical behaviour of dense board components with high pin counts. Dr. D. N. Singh mentioned about the work being carried out at SCL, India on the development of VLSI compatible MEMS technology. Dr. Rittaporn made an interesting and informative presentation on the VLSI fabrication facilities available in Thailand. Dr. Bajpai talked about bio-molecular electronics as a future alternative to CMOS technology and related research being carried out at CSIO, Chandigarh, India. This Centre had developed a number system akin to the binary system used by computers today, which has been successfully used to perform simple mathematical operations like addition, subtraction, division and multiplication by using DNA sequencing. Dr. Dutta briefed the participants about the latest development in the field of nano-particles, especially clusters. He pointed out that since the next decade would see wide application of nano-technology, the study and understanding of cluster growth was of paramount importance as control of size, shape and homogeneity is necessary for developing efficient nano-systems. Self-Assembly of clusters was an interesting approach for assembling nanostructures. Prof. A. B. Bhattacharyya dealt primarily with the design of low power VLSI interface design for sensors. Dr. Afzulpurkar focused on the need to develop industry-oriented curriculum at postgraduate levels with emphasis on research.

The status of microelectronic industry, the existing infrastructure for R&D and fabrication of VLSI based MEMS systems and the difficulties faced in developing world class research and fabrication facilities by participating member countries were discussed at length in the Country Status Reports presented by the respective participants.

Prof. V.S. Ramamurthy, Secretary to the Government of India, Department of Science and Technology chaired the valedictory session. The participants sought enhancing research cooperation, sharing of research facilities and making VLSI technology economically viable so that these technologies can be used for improving the economic condition of the people in the developing as well as developed countries. A need was indicated for organizing 'Hands On' workshops in the area of Microelectronics with multidisciplinary efforts to develop the activities in this area, training of trainers, distance education and producing marketable products.