

MEMS Design Centre

The Centre for Micro Electro Mechanical Systems (MEMS) design was set-up at IIIT in the year 2009 as a part of Institute's response to launch MEMS activity supported under the National Program on Micro and Smart Systems (NPMASS) initiated by Aeronautical Development Agency (ADA), Govt. of India.. Under this project IIIT has been provided with three industry standard software packages namely CoventorWare, Intellisuite and COMSOL Multiphysics costing about Rs 50 lakh. These softwares are loaded on a server placed in MEMS Centre. The hardware including the server and a Vector Network Analyzer(VNA) costing Rs. 8 Lakh has been procured by the Institute(IIIT) to support the work in this center. This Center at IIIT is working in close collaboration with Centre for Applied Research in Electronics (CARE), IIT, Delhi .

The following work has been carried out in the centre:

- (i) Design, Characterization and Modeling of in-chip inductors using Mentor Graphics process design kit(PDK). The chip was got fabricated at Austria Microsystems (AMS), Austria. The Chip has been received and its characterization is under progress at CARE, IIT, Delhi.
- (ii) Design and development of SAW oscillator for temperature/gas sensor. Developed our own SPICE based SAW software tool for optimization of Inter Digitated Transducers (IDT) and SAW oscillator. Design and layout has been completed.
- (iii) Work on a Low-Voltage CMOS test chip for thermal sensor and RF applications on AMS 0.35 μ m technology sponsored by Mentor Graphics, India is in progress.

In this area, Deptt. has two funded projects: NPMASS (Govt. of India, Rs 50 Lakh 2009-2014) and Mentor Graphics (Title, A Low-Voltage CMOS Test Chip for Thermal Sensor and RF Applications using Mentor Graphics PDK, Rs 6.6 Lakh, 2011-2013)

Papers published by faculty/research scholars/student: International Journal: 2, International Conferences: 3, National Journals:1.

Faculty working: 4, Research scholars Working: 1, PG students: 3.

Annexure MEMS-1

The Centre for MEMS design was set-up at IIIT in the year 2009 as a part of Institute's response to launch MEMS activity supported under the National Program on Micro and Smart Systems (NPMASS) initiated by Aeronautical Development Agency (ADA), Govt. of India.. Under this project IIIT has been provided with three industry standard software packages namely CoventorWare, Intellisuite and COMSOL Multiphysics costing about Rs 50 lakh. These softwares are loaded on a server placed in MEMS Centre. The hardware including the server and a Vector Network Analyzer(VNA) costing Rs. 8 Lakh has been procured by the Institute(IIIT) to support the work in this center. This Center at IIIT is working in close collaboration with Centre for Applied Research in Electronics (CARE), IIT, Delhi .

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*MOS-AK/GSA India Workshop was organised by IIIT, Noida March 16-18, 2012 in association with INAE (Indian National Academy of Engineering). The MOS-AK workshop aims to encourage interaction and sharing of all information related to the compact modeling at all levels of the device and circuit characterization, modeling and simulations. No of International/National Experts Invited – 18. Also MOS-AK/GSA India Tutorial was held on March 18, 2012, total no of participants attended – 80.

Number of Publications

Publications in International Journals

1. Saxena P. K., “Modeling and simulation of HgCdTe based p⁺-n-n⁺ LWIR photodetector”, Infrared Physics & Technology 54, pp. 25–33, 2011.
2. Saxena P. K., “An Improved Photoinduced Model for Silicon Based Microcantilever” , Journal of Nanoelectronics and Optoelectronics, volume 5, Number 3, December 2010, pp. 355-359(5)

Publications in International Conferences

1. Goel P. and Bhattacharyya A. B., “DC Inductance Modeling of Coplanar Meander Inductor with Grounded Guard Ring”, ISSS-2012, Jan 4-7, 2012, Bangalore.
2. Pal V. and Dwivedi R. K., ”Dielectric properties of La modified BNT Ceramics for MEMS applications”, ISSS-2012, Jan 4-7, 2012, Bangalore

Publications in National Conferences

1. Sharma R., Goswami A., Phani A., Dwivedi R. K. and Srivastava G., “Optimization of the design parameters of a piezoelectric actuator” , COMSOL Conference 2011, Nov 4-5, Bangalore

PhD Theses Supervised

Ongoing

1. Design of highly accurate, low voltage smart temperature sensor circuit.
2. Design of CMOS-MEMS Programmable Oscillator for IC timing applications

M. Tech Theses

Completed

1. Design and Modeling of RF Spiral Inductor
2. CMOS-Compatible Micromechanical Cantilever Beam Resonator Structure for Low Frequency Filtering Applications
3. Design and Modeling of RF Inductor/Transformer
4. RF Interconnect Modeling
5. RF Inductor Modeling, Parameter Extraction and layout

M. Tech Theses

Ongoing

1. Modeling and Simulation of SAW Devices
2. Design and Analysis of MEMS based Logic Gates

B. Tech Major Projects

Completed

1. Modeling of surface acoustic wave delay line
2. Parametric extraction of Quartz crystal equivalent circuit from impedance measurements
3. Design and Modeling of SAW based temperature sensor using YZ-Lithium Niobate as substrate
4. Design and Modeling of SAW based temperature sensor using YZ-Lithium Niobate as substrate
5. Integration of SAW Device and Delay Line for the Development of Oscillator Based Temperature/Gas Sensor

6. Integration of SAW Device and Delay Line for the Development of Oscillator Based Temperature/Gas Sensor

Ongoing

1. Theoretical Modeling and Simulation of MEMS Piezoelectric Energy Harvester

Annexure MEMS - 6

10B11EC411 Semiconductor Devices (Credit 4)

Semiconductors, valence and conduction bands, Fermi level, potential barrier, doping, carrier transport phenomenon- drift and diffusion phenomena, excess charge carriers, PN junctions diode fabrication and theory, BJT Theory, energy band diagrams of different contacts, MOSFET theory and application, switching and power consideration in semiconductor devices.

13M22EC121 Microelectronic Device Technology and Design Interface (Credit 3)

Semiconductor review, MOS capacitor (2-3 terminal), MOS level 1 transistor model, Microelectronic unit processes – oxidation (Dry and wet), Impurity doping (Diffusion and Ion implantation), Lithography (optical and e-beam). Process integration: CMOS. Layout design rules, stick diagram.

10M11EC114 VLSI Circuit And System Design(Credit 3)

Overview of VLSI design methodologies, VLSI design flow, Design hierarchy, VLSI design styles, Theory of MOS transistor, Fabrication of MOSFET, MOSFET models for circuit simulation, MOS inverters: static and switching characteristics, Combinational MOS logic circuits, System specifications using HDL, Semiconductor memories.

10M22EC222 Microelectronics and MEMS Technology (Credit 3)

Silicon as mechanical material, Smart Sensors, Surface and Bulk Micromachining. Lift Off Process, Cantilever and membrane based MEMS devices. Modelling of unit processes for microelectronics: Overview of unit, Processes and of silicon as material. Oxidation, Diffusion. CVD, Implantation, Lithography, Etching, Packaging etc. Process Simulation. MEMS logic,

Analog MEMS. Interfacing for MEMS. Application case studies. Inductor modeling, Equivalent circuit, Interface circuits for smart sensors.