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WELCOME FROM THE GENERAL CHAIR

It is a great privilege and honor to be invited to serve as the General Chair (Publications) in the 7th International Conference on *Microelectronics, Circuits and Systems* (Micro2020) to be held during July 25-26, 2020 using online platform in India. Since the COVID-19 pandemic has been impacting us all, we have attempted to organize Micro2020 entirely online so that contactless event may be hold to ensure safety of our life.

The Micro conferences had outstanding scientists serving as past Chairman, General Chair, and I wish to thank them all for the great legacy that has significantly improved the quality of the conference. On behalf of the entire team Micro2020, I would like to welcome all the participants, speakers, delegates in the Micro2020. This conference is committed to provide the scientific community an appropriate platform for presenting the most recent developments and the state of the art not only in the domain of microelectronics, devices, circuits, VLSI and optoelectronics, but also in all other correlated multidisciplinary fields. The Micro2020 will feature presentation of outstanding contributory papers received from various premier institutes in India including Indian Institute of Technology, National Institute of Technology, State and Central Universities, and also from overseas such as United Kingdom, Poland, Serbia, Italy, Ethiopia, and Bangladesh. Although we received a total of 71 submissions, the number of accepted papers has been restricted to only 50 on the basis of reviewers' comments in order to allow good quality paper presentation in the conference, and publication of abstracts in the proceedings. Most importantly, the conference will include deliberations by renowned speakers from different countries including Japan, Poland, Bangladesh, etc. covering the theme of the conference and beyond. Furthermore, you will be happy to learn that extended version of some good quality papers presented in the Micro2020 will be published in Microsystem Technologies, Springer, and other reputed journals subject to completion of further peer-review process as per journal guidelines.

It is again my great honor and pleasure to extend a hearty welcome to everyone attending the Micro2020 and helping to celebrate our 7th year.

Abhijit Biswas
Professor
General Chair (Publication), Micro2020

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July 25, 2020
A message at the
7th International Conference on Microelectronics, Circuits and Systems (Micro 2020),
July 25 – 26, 2020, Delhi, India

Good Morning, Ladies and Gentlemen:
Heartiest greetings and welcome to Micro 2020 conference in historic Delhi, India. Hope you are doing well against the Covid-19 pandemic of this year, by maintaining "social distancing" and "lock down".
For those of you who don't know me, I am Hillol Ray, with the U.S. Environmental Protection Agency (EPA) in Dallas, Texas. It's a great pleasure and unique opportunity for me to connect with you this morning, from half-way around the world. Let me begin by expressing my sincere thanks and appreciations to Professor Dulal Acharjee, and the Organizing Committee of the 7th International Conference Micro 2020. My appreciations and thanks also go to you, the distinguished Speakers, Researchers, Engineers, Designers, Developers, and Scientists, from India and abroad. This event will provide us with an opportunity to network, exchange and share our knowledge, while we attend this Conference of today and tomorrow.
Upon review of the Conference Agenda, I found several significant sessions of special interest to me, such as: Bio-Based Materials and biofuels, Bio and Medical Electronics, Sensors and Applications, and Quantum Information Systems and Devices. These specific areas are intertwined with the fields of Environmental Engineering. The microelectronic wireless nitrate sensors are widely used in agriculture and environmental applications, to study the ions (such as Nitrate). On the other hand, the most common and popular nanomaterials, such as Titania, Carbon nanotubes, and silver nanomaterials have significant applications in environmental remediation, and particularly in water purification. The Research and Development (R and D) Division of EPA continues to explore the benefits through these emerging innovations.
Well, without any further adieu, I like to conclude by wishing all of you and the Conference a great success. Have a pleasant stay and enjoy the historic Delhi and the surroundings.

Hillol Ray

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Invited Talk:

RF-MEMS: An Itinerary through High-Performance Radio Frequency/Millimeter-Wave Passives for the Internet of Things (IoT) and 5G Scenarios

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RF-MEMS, i.e. MicroElectroMechanical-Systems for Radio Frequency applications, have been around for about two decades. Across fluctuating expectations on their market employment, RF-MEMS consolidated as a valuable technology to develop high-performance and widely reconfigurable passive components, like ohmic/capacitive micro-relays, variable capacitors/inductors, as well as complex devices, like tunable filters, high-order switching matrices, reconfigurable phase shifters, programmable step attenuators, impedance matching tuners, and so on.
In recent years, the first successful exploitations of RF-MEMS technology in the consumer electronics market segment, and in particular in mobile handsets and smartphones, started to appear on the landscape.

The target of this presentation is to provide an overview on the tangled scenario of RF-MEMS devices, focusing on some significant examples of low-complexity and high-complexity design concepts, developed and prototyped at Fondazione Bruno Kessler (FBK), in Italy. Subsequently, an overview on future applications of RF-MEMS technology in the large market scenarios of 5G and of the Internet of Things (IoT) is developed.

Invited Talk:

Non-linear Inference of Electric Vehicles using Hybrid Fuzzified-PID Controller

Rashmi Bhardwaj

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ABSTRACT:

The talk intends to deliver a structure of speed-control for electric DC motor widely being used in the electric rechargeable-battery vehicles. Electric vehicles are the need of the hour due to increasing environmental concerns and the dependency on fuels and oils. So as to promote this hybrid and electric vehicle technology and ensure its sustenance, the Ministry of Heavy Industry and Public Enterprises in the Gazette of India on March 13, 2015 approved the Scheme for Faster adoption and manufacture of (Hybrid &) Electric Vehicle in India referred as FAMEIndia under National Electric Mobility Mission (NEMM). This scheme intends to encourage the hybrid/electric motor driven vehicles in the market and also its manufacturing for the betterment of eco-system to be implemented over a period of six years till 2020. Electricbattery driven vehicle is sourced on the restricted electrical-energy delivered by the battery in circuit. Major contribution of this work is to propose control-strategy through Fuzzified-PID controller so that the performances of the electric vehicle is comparable to that of an internal combustion-engine vehicle. Feedback is the foundation of PID control. The target or the set point is compared with the resultant of the process. Then, correction is computed and applied for the difference identified. This procedure is carried on till the time recalculation is required. PID refers to the combined computation of proportional-integral-derivative. Controllers, in general do not apply all three mathematical functions. Maximum processes were being handled through the proportional-integral-terms. However, addition of derivative control for fine control plus to avoid overshoot are required. Following models: PID controller, hybrid Fuzzified-reasoning PID controllers for linear surfaces and non-linear control surfaces using n-D Lookup-Table data have been designed for a comparative study. It has been observed that hybrid model designed for non-linear control-surfaces provided better speed response and have zero steady state error. The simulation of these models is carried out using SIMULINK under varying state conditions.

Keywords: Electric-motor, Fuzzified-PID Controller, Lookup-Table, SIMULINK

Data Aware near Subthreshold 10T SRAM cell for ultra low power Wireless Sensor application

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ABSTRACT:

In the present era high performance computing is the most important feature for Artificial Intelligent and IoT applications. For edge devices low power dissipation at high performance computing capability is the highest priority constraint. The most effective way to reduce power dissipation is to scale down the power supply voltage. At lower supply voltage reliability of the memory cell also the major concern for VLSI designer. In this paper, data driven Multi-Threshold based 10T static random access memory (SRAM) cell designed with ultra-low leakage power and improved read and write stability at low supply voltage is proposed. With the utilization of differential-data-dependent power supply mechanism and high threshold cross-coupled inverters, the energy efficiency of the proposed cell increased. By the use of low threshold voltage transistors in the read buffer circuit, we observed a reduction in the read access time and enhance the reliability at low supply voltage. In the proposed cell a single bitline is used to read and write operation. The percentage reduction in leakage power of the proposed 10T cell is 25%, 48%, 51% when compared with the conventional 6T, differential data-aware power supply (D2AP) 8T, and threshold voltage techniques based Vth_9T respectively at 300mV supply voltage. The proposed cell also achieves Read SNM of 4X and 1.33X higher as compared to Vth_9T and data-dependent power supply (D2P) 11T respectively at the same time conventional 6T and (D2AP) 8T are unstable. It is found that the proposed cell has better WSNM and HSNM compared to all considered cells.

Keywords:

Static random access memory (SRAM), Ultra-low power, Static noise margin (SNM), Multi-Threshold

Design of 4-6 GHz Wideband Single-Ended to Differential-Ended LNA for IEEE 802.11ax Wireless Applications

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ABSTRACT:

With the emergence of internet-of-things (IoT), many devices process data through the IEEE 802.11 wireless networks. To satisfy the increased data processing the wireless fidelity (Wi-Fi) networks must have sufficient capacity. IEEE 802.11ax is formulated to provide higher data processing capabilities for IoT applications. The IEEE 802.11ax receiver operating at 5GHz must be able to withstand interference from nearby IoT applications. Hence, the low-noise amplifier (LNA) employed in such receivers must have high input-referred third-order intercept point (IIP3). This paper aims to present a wideband LNA operating at 5GHz with high IIP3 for modern IoT transceivers using IEEE 802.11ax protocol. The LNA is designed and implemented in UMC 65nm CMOS technology using Cadence virtuoso design tool. The proposed LNA can provide a maximum gain of 17.64dB while consuming 8.18mW of power from a 1.2V supply. It can be noted that the minimum noise figure (NF) measured is 3.67dB and the corresponding IIP3 is 9.44dBm at 5GHz.

Keywords: LNA, CMOS, UMC, IIP3, Low-power.

Gate length Optimization of AlGaN/GaN HEMT for Low Noise Application

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ABSTRACT:

In this research article a detailed study of noise parameters such as minimum noise figure (NF_{min}), noise resistance (R_n) and optimum reflection coefficient (Γ_{opt}) for AlGaN/GaN based HEMT have been done. The radio frequency (RF) and DC parameters of AlGaN/GaN based HEMT have been done also. AlGaN/GaN based HEMT having gate length 250 nm and 500 nm have been studied and simulated for obtaining DC, RF and noise parameters. The gate length has been reduced to 250 nm to improve the current gain cutoff frequency. The length of the gate is an important device parameter that has far reaching effects on the characteristics of the device. The noise parameters such as NF_{min}, R_n and Γ_{OPT} for AlGaN/GaN HEMT having gate length 250 nm gives better result than the AlGaN/GaN HEMT having gate length 500 nm. Further, the variation of current gain and unilateral power gain with that of changing gate length has been studied. Downscaling of gate imparts effects on device characteristics. It affects the current gain cutoff frequency, maximum oscillation frequency, threshold voltage, saturation current and transconductance. These are the several parameters whose variation with the changing gate length has been studied. Better noise performance of a device is one of the key factors that determine its utilization. Possible fabrications steps for AlGaN/GaN HEMT with the help of schematic are shown in this paper. All the device parameters are simulated and verified on the Silvaco TCAD tool. We simulated the fabricated AlGaN/GaN based HEMT device using Silvaco Atlas simulator to calibrate our TCAD tool.

Keywords: AlGaN/GaN HEMT; Unilateral power gain; current gain; Maximum oscillation frequency, Minimum noise figure; Noise resistance; Optimum reflection coefficient.

Unidirectional Voltage Converter for Battery Electric Vehicle Ultrafast Charger

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ABSTRACT :

This article proposes the use of a frequency converter used in AC motor drives to build a fast charging battery converter for electric vehicles (EV). The possibility of using semiconductor integrated modules with two-level inverters and diode rectifiers for the construction of high power voltage DC/DC converters has been demonstrated. The DC voltage of the EV battery during charging is obtained by rectifying the three-phase voltage of the PWM inverter. A 600V DC microgrid was used to power the inverter. Simulation tests of the DC/DC converter model were carried out. The results of simulation tests were verified experimentally on a laboratory stand.

Keywords: common mode voltage, DC microgrid, drive frequency converter, fast and ultrafast EV battery charging, power integrated circuit, power voltage source.

Improved Structure of Piezoelectric MEMS Vibration Energy Harvester for Multi-mode Operation

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ABSTRACT:

Conventional linear Piezoelectric Energy Harvester (PEH) has the disadvantage of high frequency, narrow bandwidth and low output generation. In this paper we propose an optimal design concept to overcome the disadvantages based on optimal geometry and optimal segmentation of piezoelectric layer at strain nodes of higher vibration modes. The trapezoidal shape of the PEH provides more uniform strain distribution while segmentation avoids the charge cancellation at strain nodes to increase the generated output voltage for low frequency operation. The harvester is designed for vibration mode 3 with segmentation at 2 strain nodes. The simulation results shows that there is two resonant peak for fundamental and mode 3 operation thereby enabling multi-frequency operation to widen the operating frequency range. The parallel connection of the PZT segments to a common load resistance yielded 5.8 V at 0.5g acceleration input for optimal load of 20kΩ showing a performance improvement of 41.5% in fundamental mode while 133.3% improvement in mode 3 compared to non-segmented continuous trapezoidal PEH.

Keywords: Wireless sensor network (WSN), Internet of Things (IoT), Piezoelectric Vibration Energy Harvester, Micro Energy Harvester, Strain Nodes, Segmentation, Multimode energy harvester.

Design and analysis of ultra-low power memory architecture with MTCMOS asymmetrical ground-gated 7T SRAM cell

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ABSTRACT:

Memory is basic and essential component for all VLSI systems. As nano-scale complementary metal oxide semiconductor (nano-CMOS) technology is growing VLSI designers are facing new challenges for fast, low power and high robust Memory design. According to the recent trends at nanometer and beyond technology node, leakage power dissipation and noise margin are the challenging cell parameters for memory design engineers. In this paper, an effective MTCMOS asymmetrical SRAM cell is proposed for the designing of memory architecture with least leakage power dissipation and high data stability. Circuit parameters of asymmetrical 7T SRAM cell such as propagation delay, leakage power dissipation and stability are evaluated and compared with ground-gated 6T SRAM cell for designing ultra-low power memory architecture. Pre and post layout simulations of asymmetrical ground-gated 7T (Asym7T) SRAM cell and 4×4 memory array architecture are done to get real results. Post layout simulation results are degraded as compared to pre layout simulation results due to inclusion of parasitics. FF corner simulation of Asym7T SRAM cell has delay reduced up to 4.01× as compared to standard simulation of Asym7T SRAM cell. Asym7T SRAM cell has less leakage current up to 99.9 % as compared to standard ground-gated 6T SRAM cell. Asym7T SRAM cell has enhanced write, read and hold SNM up to 67.45 %, 52.18 % and 46.56 % as compared to ground-gated standard 6T SRAM cell. 4×4 memory architecture along with peripheral circuitry such as Asym7T SRAM cells array , decoder and sense amplifiers are designed and simulated. The simulation results are obtained at 1.2 V supply voltage using Cadence EDA tool with 180 nm GPDK technology file.

Keywords: SRAM, MTCMOS, static noise margin, leakage current, write assist circuitry.

A Highly Reliable and Radiation-Hardened Majority PFET-Based 10T SRAM cell

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ABSTRACT:

The major design metric for designing a basic SRAM cell include high value of RSNM, low power consumption and higher reliability. Whereas a radiation tolerant SRAM cell includes the design metric of soft error robustness. In this paper, we propose a Quad-node 10 transistor (10T) soft error robust SRAM cell that is more robust than the Quatro 10T cell. The NMOS access transistors of the Quatro 10T cell are replaced by the PMOS access transistors in the proposed 10T cell. The benefit of using PMOS access transistors is due to its high radiation tolerance. The leakage currents in PMOS access transistors are not affected by the radiation bombardment. Whereas they increase rapidly in NMOS transistors. In hold operation, both the cells consume same amount of power as the access transistors are cutoff. We also have smaller gate leakages in the case of PMOS access transistors than NMOS access transistors. In the case of hold operation, both the Quatro and proposed cells are able to recover 1→0 single event transients (SET). For 0→1 single event transients (SET) in hold operation, proposed cell shows an increment of 3μA in current margin. This improves the hold failure probability of the proposed cell. The increment in current margin is obtained by compromising the increment in the value of read access time by 2.04%. Rest of the design matrices such as Read Static Noise Margin (RSNM), Hold power, Write Static Noise Margin (WSNM) and Cell Area remains same.

Keywords: Current Margin, Hold power, Quatro 10T, Read Static Noise Margin (RSNM), SET (Single Event Transient), Soft error robustness, Write Static Noise Margin (WSNM).

A Cost-Effective Design Approach for Tracking and Monitoring Suspected COVID-19 Patient in Quarantine

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ABSTRACT:

Coronavirus disease (COVID-19) is a contagious one. So to prevent the spread of COVID-19 social-distancing, quarantine and frequent hand-washing are essential for all people around the globe. Governments, healthcare units, universities, schools and business houses are taking steps to slow down the spread of new COVID-19 cases. Some researchers and organizations are already developed several mobile applications for this purpose. In this paper a cost-effective design has been proposed to observe the movement of home-quarantined people and the people who are in quarantine centres identified by the government and to monitor the health condition of suspected COVID-19 patient. Proposed system can be used to slow down the community transmission of this virus. Also it will help the local authority and hospital authority to monitor the quarantined people. The cost of proposed system is less than Rupees two thousand so it is cost effective and also it is reusable.

Keywords: Coronavirus (COVID-19), Quarantine, Tracking, Detection, Arduino UNO, Pulse Sensor, GPS, GSM, Voice Frequency Detector, Body Temperature Sensor.

Zinc Oxide Nanoparticles Production Using *Catharanthus Roseus* Leaf Extract and their Characterization for Practical Utilization

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Abstract:

Zinc Oxide (ZnO) nanoparticles (NPs) have been successfully synthesized through green synthesis route using *Catharanthus roseus* leaf extract that acted as an efficient stabilizer and capping agent of the NPs. The as-prepared ZnO is then calcined at 400ºC, 500ºC and 600ºC in order to gain better crystalline ZnO NPs. More than 70 components including alcohol, keton, steroid, terpinoid, carotinoide were present in the leaf extract which was confirmed by Gas Chromatography Mass Spectrometer (GC-MS) analysis. The X-ray Diffraction (XRD) analysis of calcined samples showed that the particles were crystalline with hexagonal and monoclinic structure and the crystallite size was found to be about (33.58-25.8)nm for ZnO. The surface morphology of the NPs was investigated by Scanning Electron Microscopy and Field Emission Scanning Electron Microscopy (FESEM) which showed that NPs were spherical in shape with uniform size distribution. Elemental analysis of the NPs was carried out with Energy Dispersive X-ray (EDX) Spectroscopy and it indicated the elemental signature of the presence of Zinc, oxygen, carbon in the ZnO NPs and Copper, Oxygen, carbon in the CuO NPs. The Fourier Transform Infrared Spectroscopy (FTIR) analysis showed that the capping agents of the NPs contained the functional groups alcohol, alkene, kitone, terpinoied, organic acid. The thermal stability of ZnO NPs was investigated using Differential Scanning Calorimetry (DSC) and Thermo Gravimetric Analysis (TGA). DSC showed one exothermic peaks. The heat enthalpy of ZnO NPs is 2326 j/g and 242.7 μVs/mg respectively. The percentage of weight loss was of about 10% for ZnO as found from TGA. The ZnO NPs were super paramagnetic in nature with zero coercivity and zero reminance magnetization which was observed using a Vibrating Sample Magnetometer (VSM). The average crystallite size was determined by Scherer formula which showed that the crystallite size of calcined ZnO NPs decreased with the increase in calcinations temperature. But the crystallite size increase with calcinations temperature, which supported the results of XRD and VSM.

Key words: Nanoparticles, *Catharanthus Roseus* leaf extract**,** XRD, GC-MS, SEM,FESEM, FT-IR, EDX,VSM,TGA.

Sensing of High-K Biomolecules using L-shaped Tunnel FET

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ABSTRACT:

This paper investigates detection of various neutral biomolecules having high dielectric constant using L-shaped Tunnel Field Effect Transistors (TFETs) in wet environment. This scheme relies on entire removal of vertical oxide arm of L-shaped device in which the biomolecules are captured by the receptors attached to the oxide-semiconductor interface. The dielectric constant of the biomolecules influences current-voltage characteristics of the device. The transfer characteristics of the device are obtained using well calibrated SILVACO ATLAS device simulator. Our findings show that carrier in–line tunneling with gate field enables the opportunity to detect the presence of a biomolecule such as pyridine with a maximum voltage sensitivity of 1.3 V in watery medium. Obtained results suggest that the proposed sensor operates with high or comparable sensitivity for sensing biomolecules relative to earlier findings in the literature.

Keywords: Tunnel FET, L-Shaped Tunnel FET, wet environment, biosensor, voltage sensitivity.

Design and Analysis of Cyl GAA-TFET based Cross-coupled Voltage Doubler Circuit

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ABSTRACT:

In this work, a cross-coupled voltage doubler based on Cyl GAA-nTFET with improved reliability is proposed for IoT applications. Device circuit Co-design investigations have been made in terms of DC/analog characteristics such as ION, IOFF, SS, and circuit parameters such as Power efficiency, output voltage, and energy consumption using 3D TCAD mixed-mode simulation. Further, the proposed circuit nullifies the reverse leakage current due to the arrangement of two non-overlapping clock signals with the tunnel transistors based on hetero-material. The proposed co-design used the merits of low bandgap material like Ge, which is used as a material in the source region with low spacer width of 15 nm, reduces the depletion of the fringing field over the source gate edge, leads to high ION. Whereas, drain underlap increases the drain channel resistance, and significantly reduces leakage current (IOFF). Moreover, the proposed device is well calibrated and investigates the effects of trap charges while analyzed the TAT model on the device. This co-design approach promotes the power efficiency of up to 95.4% implemented on a 30 nm technology node.

Index Terms—TFET, Circuit simulation, Voltage doubler, Internet of Things.

Unified Analytical Model for Charge Density and Plasmonic waves in the Quaternary AlInGaN/AlN/GaN Heterostructures

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ABSTRACT:

A new analytical model for calculating sheet charge density and plasma frequency of Terahertz waves in quaternary AlInGaN/AlN/GaN HEMTs is presented. The analytical results show good match with the existing experimental data in the literature. We infer that due to the higher electron concentration accumulation in quaternary alloys, as compared to ternary alloys such as AlGaN, the introduced plasmon oscillations have higher frequency by almost an order. Our model gives an insight in exploring the quaternary alloy based HEMTs for future THz applications.

Keywords: Terahertz, Analytical model Gallium nitride, Quaternary alloy, 2DEG, Plasma frequency

Superior Performance of Gate Workfunction and Gate Dielectric Engineered Trapezoidal FinFET in the presence of Trap Charges

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ABSTRACT:

In this paper, an analytical model has been developed to study the impact of dual material gate design and gate dielectric engineering on Trapezoidal FinFET for achieving improved device performance even in the presence of trap charges. In order to study the characteristics, Poisson's equation has been solved by employing suitable boundary conditions. It is demonstrated that the device offers improved reliability in presence of trap charges and exhibits excellent immunity to short channel effects.

Keywords: Dual material gate, High-k, Trapezoidal FinFET, Trap charges, Reliability

A 2.45 GHz Low Noise Figure CMOS-Based LNA Using Constant g_m Biasing Technique

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ABSTRACT:

In this paper the first active block of the RF receiver system, i.e., a Low Noise Amplifier (LNA) working at ISM band of frequency 2.45 GHz is demonstrated. Proposed topology of the low noise amplifier is a cascaded type LNA which uses a constant transconductance biasing circuit to reduce the variations of the gain and noise figure of LNA while the cascaded stage increases its gain to a higher level. The proposed LNA topology is realized on 180-nm CMOS technology. The simulation results of our proposed LNA topology was able to deliver gain (S_{21}) of 24.64 dB while maintaining a very low value of NF, i.e., 1.723 dB. Good input and output impedance matching have been done with S11 of −32.82 dB and S_{22} of −6.526 dB and the tradeoff between various parameters has been done in a way to achieve high gain and low noise figure. The proposed circuit exhibits unconditional stability over all ranges of frequency and not only at the operating frequency of LNA The demonstrated LNA circuit operates at very low power consumption of 4.68 mW.

Index Terms—Input matching, low-noise amplifier (LNA), noise figure (NF), constant gm biasing, S-parameters.

Radiation Tolerant Memory Cell for Aerospace applications

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ABSTRACT:

Radiation-induced single-event upsets (SEUs), or soft errors, cause significant threat to the reliability of nanoscale memories. In this paper we have proposed a 10-T radiation hardened SRAM cell with exceptionally high radiation tolerance. The proposed cell has significantly better performance in terms of radiation robustness as compared to other existing radiation hardened SRAM cells. Comparisons of several hardened memory cells in terms of access time (read access time and write access time), stability (read static noise margin, write margin and hold static noise margin), power consumption (read power, write power and hold power) and layout area is done. From these comparisons it can be concluded that the proposed cell has better or comparable performance for all the parameters, except for write access time (TWA). The write access time is longer for the proposed cell as compared to other comparison cells. Furthermore, the effect of supply voltage variation has also been studied by calculating and comparing all the parameters at different supply voltages. Monte Carlo simulations are also used for some of the parameters to evaluate the effects of process, voltage, and temperature (PVT) variations.

Keywords: Variability; SRAM; RSNM; Standby Power.

Design and analysis of Asymmetric Cantilever type Shunt switch for L band applications

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ABSTRACT:

This paper exhibits design and simulations of an Asymmetric cantilever type RF-MEMS switch with a uniform and non-uniform meanders. The Electromechanical and Electro-magnetic analysis are performed by using COMSOL multi-physics and HFSS software. Here, the aim of the paper is to maintained the low pull-in voltage and enhance the isolation of the switch. The single and non-uniform meanders type of switches are shows good results, By comparing two switches, the non-uniform meander type switch shows better performance. The dielectric material is an important factor for getting good capacitance of the switch. The switch capacitance in the upper and lower states is 5.42 fF, 8.26 fF, and 3.68 pF, 6.43 pF. The switching time analysis of switch is obtained as 3 µs 9 µs. The beam materials also impact to reduce the pull-in voltage, the obtained voltages are 6.3 V and 4.3 V. The switch has good S-parameters, such as return and insertion losses of proposed switch -36.24 dB, -48. dB and -0.032 dB -0.051 dB. The isolation was raised as -40 dB and -46 dB at 1 to 5 GHz frequency. So, the switch is suitable for low-frequency range L band, military and radar applications.

***Keywords*:** RF MEMS Switch, Actuation voltage, S-Parameters

Current Mirror with Diode-Connected Keeper based Linear and Sensitive NBTI Monitoring Circuits

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ABSTRACT:

As the technology is scaling down and with a decrease in oxide thickness, the effect of NBTI is a major reliability concern in semiconductor industries. NBTI is an aging phenomenon which degrades the performance of the circuit with time. In this paper, we first analyze the effect of NBTI on 6T SRAM performance after the stress time of 10 years. The simulation results show that the write margin is increased by 3.356% whereas Hold SNM, read SNM, and standby leakage current is reduced by 6.53%, 23.86% and 13.42% respectively. We also present a current mirror with diode connected keeper based NBTI monitoring sensor using NMOS transistors only. Continuous monitoring of the NBTI effect without any bias generator or control circuit is a key feature of the proposed sensor circuit. The sensitivity of the sensor is 40 µV/nA and the linearity of the sensor is up to the practical range of leakage current of the SRAM cell.

Index Terms—Negative Bias Temperature Instability(NBTI), Standby Leakage current, Static Noise Margin(SNM), SRAM cells, Reliability, Aging, Threshold voltage degradation.

Technique to Design Robust Nanoscale Soft-Error Tolerant 9T SRAM Cell for Ultralow Power Applications

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ABSTRACT:

The proposed cell provides 1.25×/1.96×lower read current I_{READ} variability compared with WREN9T/SENTV9T. The proposed cell achieves 4.23×higher noise tolerance capability (i.e., read static noise margin (RSNM) during read operation compared with CONV6T due to the fact that it employs read decoupled operation. Moreover, SBL9T consumes lower standby power during hold state and dynamic power in the active state as compared with SENTV9T, WREN9T and CONV6T. SBL9T also exhibits 10.01×/8.65×/11.47× narrower spread in standby power compared with CONV6T/ WREN9T/ SENTV9T. The dynamic power spread shows a similar trend with SBL9T providing 1.97×/1.02× narrower spread in dynamic power compared with WREN9T/ SENTV9T. These benefits, however, are achieved by the SBL9T at the cost of 1.28×/0.71×/1.01× longer read delay compared with CONV6T/WREN9T/SENTV9T.

Keywords— Bit-interleaving, half select issue, read delay, write delay, read stability, write-ability, variability, standby power.

Fin Aspect Ratio Optimization of Novel Junctionless Gate Stack Gate All Around (GS-GAA) FinFET for Analog/RF Applications

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ABSTRACT:

This work studies the effect of Fin aspect ratio (AR) variation with constant conducting channel area on Analog/RF performance of novel Junctionless Gate Stack Gate All Around (GS-GAA) FinFET. Several important electrostatic, analog, and RF parameters have been explored with the help of the SILVACO ATLAS 3D simulator. It has been observed that for the high Fin aspect ratio leakage current (I_{off}) of the device reduces by almost twenty times and consequently improves the switching speed and subthreshold characteristics of the device. Parameters like transconductance (g_m), device efficiency (TGF), cut-off frequency (f_T), and maximum oscillation frequency (f_{max}) also show notable improvement for the higher Fin aspect ratio. Thus, a high Fin aspect ratio improves the performance of the device and also provides better immunity to SCEs. The findings of this paper can help engineers to design 3-D devices according to their needs.

Keywords: Analog/RF performance, Fin Aspect Ratio (AR), Gate All Around (GAA) FinFET, Gate Stack (GS), Junctionless (JL), Short Channel Effects (SCEs).

Applications of PKL electricity for use in DC instruments

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ABSTRACT:

There are a lot of battery systems in the local market for use in DC appliances. The main aim of this research work for generating an innovative electricity device from PKL (Pathor Kuchi Leaf) to light the DC appliances like DC fan, DC lantern, DC energy bulb, DC LED bulb, laptops, TV, Radio, DC refrigerator and other DC appliances which needs DC electricity. Our innovative PKL electricity will operate those DC appliances. There is an electrochemistry which has a relationship between chemical reactions and electricity. The reaction of the electrochemistry is divided in to two parts: spontaneous and non- spontaneous system. The redox reactions for PKL electrochemical cell occur in PKL extract/solution/suspension which is spontaneous. The reactants and products of the PKL electrochemical cell exist charged ions/species. The reaction of the ions has been affected by the PKL extract. When the circuit of the PKL electrochemical cell is connected by an electrically conducting path then the voltage and current is produced spontaneously. This spontaneously created voltage and current of the PKL electrochemical Cell has been measured for practical applications of the DC appliances. The performances of this PKL electricity for DC appliances has been studied . This work may be the guide line of future electricity generation system for practical use in DC appliances.

Kew words: DC appliances, PKL electricity, PKL electrochemical cell, Redox reactions, Spontaneous reactions, Non- spontaneous reactions, Ions, Species.

High Switching Performance of Novel Heterogeneous Gate Dielectric – Heteromaterial Based Junctionless-TFET

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ABSTRACT :

This paper reports the effect of heterogeneous gate dielectric stack in a III-V compound semiconducting material based hetero-structrure junctionless tunnel field effect transistor, HD-HJLTFET for analog analysis. In our proposed device, low bandgap material, InAs is used in the source region and higher bandgap material, GaAs is used in the channel and drain region to implement the bandgap engineering at the source to channel interface. Further, a heterogenous gate dielectric has been introduced by replacing the conventional gate oxide under the control gate by high-k gate oxide and low-k gate oxide at the source and drain side, respectively. The selection of an appropriate high-k oxide for the hetero dielectric and length of the high-k oxide in our proposed device has been optimized using different dielectric materials in the high-k region. The results of hetero-dielectric HJLTFET (HDHJLTFET) are also compared with Mono-dielectric HJLTFET for Low-k HJLTFET (only SiO2 at Control Gate) and High-k HJLTFET (only HfO2 at Control Gate). The proposed device shows enhanced performance in terms of ION (~304% and ~15% higher), IOFF (~9% and ~13% lower) , ION/IOFF (~348% and ~36% higher), device efficiency (480% and ~195% higher), gm (~302% and ~14% higher), gm3 (~309% and ~12% lower), and Subthreshold swing (~16% and ~10% reduced) as compared to mono-dielectric devices, Low-k HJLTFET and High-k HJLTFET, respectively.

Keywords: Analog, Band-to-band tunneling, Heterodielectric, Polar gate, Mono-dielectric.

Electrical Performance of Gate Modulated TFET (GM-TFET) with Epitaxial Layer

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ABSTRACT

In this paper, the performance of epitaxial layer (ETL) based gate modulated (GM-TFET) is evaluated through 3D Technology Computer Aided Design (TCAD) device simulator. We have incorporated the vertical tunneling along with lateral tunneling to improve the device performance. The influence of ETL thickness (t_{epi}) and doping concentration of ETL (N_{epi}) on electrical parameters such as transfer characteristic, output performance, subthreshold swing (SS), and threshold voltage (V_T) is highlighted for ETL based GM-TFET. It is found that both t_{epi} and N_{epi} have significant impact on the electrical parameters of ETL based GM-TFET.

Keywords: Electrical Characteristics, Epitaxial layer, Gate Modulated TFET, TFET.

Design and Analysis of Electromechanical characteristics of Bi-metallic beam RF MEMS Switch for Fast Switching Time

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ABSTRACT

This paper deals with the design and study of a shunt type capacitive RF MEMS switch using bi – metallic beam as a suspended mem includes a vertically deforming beam which includes perforations and meanders. The significant accomplishments in this work are the pull in voltage that is minimized to 4.8 Vand fast switching time. The up capacitance of the switch is 300 fF, down state capacitance is 9.2pFthe obtained capacitance ratio is 0.3. The product utilized for CPW line is Gold (Au). The dielectric product utilized in between the beam and the CPW transmission line is Silicon Nitride (Si3N4). We achieved electromechanical analysis through COMSOL software.

Keywords: pull-in voltage, isolation loss, up capacitance, down capacitance, switching time, CPW transmission line, RF MEMS switch.

Application of IoT (Internet of things) and Big data technology in smart grid and renewable energy integration.

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ABSTRACT :

Rising demand for electricity and also the increasing demand for clean energy (renewable energy) is propelling traditional grids to move towards smart grids. Smart grid offers a bidirectional flow of energy from users to the grid and vice versa along with continuous monitoring, processing and generation of data. Consumers can purchase or/and sell electricity from/to the utility grid, also constant monitoring and calculations are required in a smart grid for which smart meters are required to be installed. There would also be a generation of enormous data in the system because of the presence of smart sensor systems. Hence, the requirement of good connectivity and fast data processing speed would also be required for continuous processing of data in smart grids. New technologies like IoT and Big data would be good options to be used in a smart grid system to incorporate and enhance data processing and data transfer capabilities. This paper presents the applications of IoT and big data technology in the field of a smart grid system. This paper presents a review of the smart grid system, IoT and Big data technology, their working and collaboration with each other

Keywords: IoT, Bigdata, smart grid, renewable energy.

Comparative study of Different Edge Detection Methods with Cellular Automata Based Approaches in Bio-Medical Image Processing

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ABSTRACT

In the domain of digital image processing, a number of methods for detecting edges have been proposed till now like Robert, Sobel, Prewitt, Canny, etc. All these methods have some benefits and some drawbacks. Edge detection can be done in more efficient way using the concept of Cellular Automata. Different rules for cellular automata are efficient to find out the edge of bio-medical images also. Outputs obtain on applying cellular automata are better in terms of computation time and clarity. As consequences the detected edges using Cellular Automata are clear and continual. The outcomes of edge detection of bio-medical images can be confirmed with graphical instances.

Keywords- Edge Detection, Cellular Automata, Cellular Edge Detection, Bio-Medical Image Processing

A Temporal Perspective to Event Logs for the Prediction of Process Completion Time

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ABSTRACT

Operational support is a domain in process mining used for business process monitoring. It involves the prediction of various aspects of a business process like the outcome of a case, the next activity to be performed, the sequence of execution of events, remaining time, the completion time of the process, etc. The information utilized for such an analysis is in the form of event logs, and the techniques used to focus mainly on discovering the patterns existing in the activity execution. Also, a majority of these techniques depend upon the features of the process. Some of these features are the sequence of activities, resources involved in the business process, etc. Currently, there is a lack of techniques that include temporal features like the trend and seasonality of a business process to understand and improve the process itself. This may cause temporal features to get ignored. The novelty of this research work is that it explores methods to utilize an event log as a time series as well as proposes a new imputation technique called ALN. The former enhances the analysis process for capturing the temporal properties of a business process, while the latter is used to fill in missing values in the time series. This work also compares different imputation techniques that ensure that the time series is evenly-spaced in nature in combination with various statistical techniques.

Keywords: Event logs, Time series forecasting, Process mining, Business intelligence

Novel InAlN/AlN/GaN Recessed T-Gate HEMT with Graded Back-Barrier for Wireless Applications

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ABSTRACT

In this paper, we have studied the linearity performance of the InAlN/AlN/GaN recessed T- gate HEMT with graded back barrier and compare with the without graded back barrier HEMT using silvaco TCAD simulator. Precisely a brief comparison has been done on the linear and nonlinear parameter of the proposed device with the conventional device. It has been observed that by changing the Al composition in the back barrier layer effectively improved the linearity parameters. All the linear and nonlinear parameters such as g_{m2}, g_{m3}, VIP_2, VIP_3, IIP_3, IMD_3, 1-dB compression point investigated. Simulated results confirmed that by grading the back barrier layer significantly improve the linearity characteristics of the device which are 3 times higher than the conventional device, proving its efficacy for wireless applications.

Keywords: InAlN/GaN heterostructure, AlGaN back-barrier, recess, linearity, polarization.

Reconfigurable Antennas for RFID/WLAN/WiMAX Applications using RF MEMS Switches

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ABSTRACT:

In this paper, we have designed and analyzed the performance of reconfigurable antennas for wireless communication applications using RF MEMS switches over the frequency range 0.5 GHz- 7.5 GHz. The proposed reconfigurable antenna is designed with three identical shunt capacitive RF MEMS switches with AlN as a dielectric material. The RF MEMS switch used for the design of reconfigurable microstrip patch antenna is offering good performance i.e., actuation voltage is 4.5 V, switching time is 45 µs. Based on the switching of the RF MEMS switches the antenna is resonating at 0.9 GHz, 1.5 GHz, 3.5 GHz, 5.4 GHz. So, the antenna designed is capable to serve in multiple applications like RFID, WLAN and WiMAX.

Keywords: Electrostatic Actuation, Material Analysis, Reconfigurable Antenna, RF MEMS Switches, Wireless Communication.

Design and Analysis of SIW based filter for Ka Band Applications

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ABSTRACT:

This paper presents a filter designed for the Ka Band using Substrate Integrated Waveguide(SIW). A 3 pole SIW filter is designed on a single layered Rogers RT/Duroid 6002 having dielectric constant ε_r= 2.94 and tanδ = 0.0012. The filter is operating between 26.5 GHz to 27.3 GHz with 3.0% fractional bandwidth. The simulation results of the Iris based SIW filter have shown that, the 700MHz passband is found to have an insertion loss of 1.8dB and return loss better than 20dB. Improvement in the stopband performance is achieved by exciting the adjacent side of the SIW which places the transmission zero to the upper side of the passband. The location of transmission zero can be varied changing the offset distance of input/output port to the cavity centre.

Keywords: Ka-Band, Band Pass filter, Substrate Integrated Waveguide (SIW), Iris.

Design of Circular Patch Antenna with GDS for Wireless Communications

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ABSTRACT:

A circular patch antenna with slit and complimented split ring resonator with defects on ground plane is proposed for wireless application. The antenna is designed with slit on the circular radiating patch with defects on the ground plane to produce the impedance matching and improve the gain. The proposed antenna is simulated using HFSS and CST simulation tools. The proposed antenna has resonates one frequency band. It operates at 8.5GHz in HFSS and 8.54GHz in CST simulators with return loss -26.39dB and -33.8dB respectively. The maximum gain is observed for HFSS and CST simulators of proposed antenna of 8.29dBi and 8.17dBi.

Keywords: circular patch antenna, CSRR, WiMAX application.

Strained $Si/Si_{1-y}C_y$ Superlattice based Quasi-Read Avalanche Transit-Time Devices for Terahertz Ultrafast Switches

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ABSTRACT:

Effects of selective Carbon (C) incorporation in Silicon (Si) Quasi-Read-Avalanche-Transit-Time (QRATT) devices are studied through indigenously developed non-linear Strain-corrected-Mixed-Quantum-Tunneling-Drift-Diffusion-Model (SMQTDDM). A superlattice of alternate thin films of strained-Si and comparatively thick layers of $Si_{0.99}C_{0.01}$ stressors constitutes the active region. Out-of-plane mobility enhancement occurs due to in-plane biaxial strain at $Si/Si_{0.99}C_{0.01}$ interfaces. Band offset between $Si/Si_{0.99}C_{0.01}$ results in high injection velocity. Combined effect of strain-engineering and band offset amounts to the application of periodic accelerating pulse along the active region. That subsequently reduces carrier transit-time and results in THz oscillation even in Si-ATT-diode. Remarkable RF performance (RF-power~$23.2 \times 10^8 W/m^2$ at 0.73THz) of exotic Si-QRATT-devices is reported for the first time. The simulation incorporates quantum-effects, process-induced-strain, parasitic-resistance, thermal-model and inter-sub-band-tunneling in the dispersion relation of the superlattice's Multiple-Quantum-Wells (MQWs) by combined solution of Schrodinger-Poisson equations. The theoretical analysis is aptly verified with experimental observations for in-house-fabricated Si-ATT-diodes. QRATT-device-based THz series-shunt switches are further explored.

Studies on Performances of Copper Oxide Nanoparticles from *Catharanthus Roseus* Leaf Extract

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ABSTRACT:

Copper Oxide nanoparticles (NPs) have been successfully synthesized through green synthesis route using Catharanthus roseus leaf extract that acted as an efficient stabilizer and capping agent of the NPs. The as- prepared CuO is then calcined at 400ºC, 500ºC and 600ºC in order to gain better crystalline CuO NPs. The X-ray Diffraction (XRD) analysis of calcined samples showed that the particles were crystalline with hexagonal and monoclinic structure and the crystallite size was found to be about (30.77-13.25)nm for CuO. The surface morphology of the NPs was investigated by Scanning Electron Microscopy and Field Emission Scanning Electron Microscopy (FESEM) which showed that NPs were spherical in shape with uniform size distribution. Elemental analysis of the NPs was carried out with Energy Dispersive X-ray (EDX) Spectroscopy and it indicated the elemental signature of the presence of Copper, Oxygen, carbon in the CuO NPs. The Fourier Transform Infrared Spectroscopy (FTIR) analysis showed that the capping agents of the NPs contained the functional groups alcohol, alkene, kitone, terpinoied, organic acid. The thermal stability of CuO NPs were investigated using Differential Scanning Calorimetry (DSC) and Thermo Gravimetric Analysis (TGA). DSC showed one exothermic peaks. The heat enthalpy of CuO NPs are 2326 j/g and 242.7 μVs/mg respectively. The percentage of weight loss was of about 13.33% for CuO as found from TGA. The CuO NPs were paramagnetic in nature with zero coercivity and zero reminance magnetization which was observed using a Vibrating Sample Magnetometer (VSM). The average crystallite size was determined by Scherer formula which showed that the crystallite size of calcined CuO NPs decrease with increase in calcinations temperature. But the crystallite size increase with calcinations temperature, which supported the results of XRD and VSM.

Key words: CuO Nanoparticles, *Catharanthus Roseus* leaf extract**,** XRD,GC-MS, SEM, FESEM, FTIR, EDX, DSC,VSM,TGA.

High Temperature Analysis of Negative Capacitance–Reconfigurable–FET Under the Impact of Ferroelectric Parameters Variation

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ABSTRACT

A dual-gate Negative Capacitance–Reconfigurable–FET (NC-R-FET) is a dynamic programmable device with ferroelectric gate-stack which is expected to achieve substantial improvement in drive current along with super steep switching characteristics. The performance of the device majorly depends on the ferroelectric parameters which are chosen carefully so as to achieve substantial amplification while ensuring hysteresis-free operation. However, any unintended variation caused in ferroelectric parameters greatly affects device performance. Thus, in the present paper, the influence of these unintended variations on the device performance of NC-R-FET is exhaustively studied over a broad temperature range.

Keywords: Ferroelectric Parameters, Hysteresis, Negative Capacitance, Reconfigurable, Temperature, Variation.

Radiation Immune SRAM Cell for Deep Space Applications

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ABSTRACT

Reliability of nanoscale memories is largely affected by Radiation-induced single-event upsets (SEUs), or soft error. In this paper we have proposed a 12T radiation hardened static access memory (SRAM) cell with exceptionally high radiation tolerance. The proposed cell shows significantly better performance in terms of radiation robustness as compared to other existing radiation hardened SRAM cells. The WARH12T cell exhibit 1.44x/1.47x/2.10x/8.75x/0.97x write ability or Write static noise margin(WSNM) and 1.04x/1.02x/1.04x/1.36x/1.28x higher read stability or Read static noise margin (RSNM) than that of RHBD-10T/RHD-12T/UTSC-12T/NS-10T/PS-10T cells respectively. In addition to this ,the cell has only 0.7x/0.73x/0.67x/0.62x/0.21x Read access time (TRA) and 0.5x/0.68x/0.64x/0.52x/0.51x write access time (TWA) than that of RHBD-10T/RHD-12T/UTSC-12T/NS-10T/PS-10T cells respectively. For all these improvements, it incurs a penalty of 1.61x/1.21x/1.25x/1.04x/2.93x in write power (WPWR) as compared to that of RHBD-10T/RHD-12T/UTSC-12T/NS-10T/PS-10T cells at V_{DD}=1.2V. Furthermore, the effect of supply voltage variation has been studied by calculating and comparing all the parameters at different supply voltages. To evaluate the effect of process, voltage, and temperature (PVT) variations, Monte Carlo simulations are also used for some of the parameters.

Keywords: WSNM; SRAM; RSNM; Write power.

Adsorption-based Chemical and Biological Microsensors: Improved Time Response Model Considering Bimodal Surface Affinity and Analyte Depletion

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ABSTRACT

We consider the time response of affinity-based chemical and biological microelectronic sensors. To this purpose we analyze non-uniform adsorption/desorption processes caused by different binding affinities of different binding sites. This non-uniformity may be caused by a non-uniform surface morphology, or uneven binding of functionalizing particles to the surface. We assume here that there are two types of adsorption sites on the sensing surface. This is denoted as bimodal surface affinity. Another mechanism that we take into account to improve the accuracy of our model is the adsorption-caused depletion of the analyte caused by the finite amount of analyte present in the closed reaction chamber. As a result we obtain a comprehensive mathematical model that can predict the behavior of general affinity-based sensors. Our main results include a closed-form analytical solution for the model of adsorption valid for applications with analyte concentrations sufficiently high to ensure that the depletion of the numbers of molecules in the gas phase due to the adsorption is negligible, a numerical solution of the general bimodal affinity adsorption model without any approximations and a comparative (quantitative and qualitative) analysis of the related influence of the analyte depletion on the bimodal affinity adsorption to the sensor response. The presented research could find wider applications outside the sensor field, for instance in prediction of the behavior of any micro- or nanosystem surrounded by a gas or liquid that can adsorb to its surfaces. The smaller the details of the device are, the stronger will be the influence of surface adsorption phenomena.

Keywords: Adsorption, Analyte depletion, Bimodal surface affinity, Chemical and biological sensors, Closed reaction chamber, Microelectronic sensors, Time response.

Optimisation of Solar Photovoltaic (PV) Parameters Using Meta-Heuristic Optimisation Approaches

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ABSTRACT:

This paper presents a critical analysis of the techniques used in various researches on the optimisation of photovoltaic (PV) parameters, which involves the use of different algorithms in order to extract and improve these parameters from the single diode model (SDM), double diode model (DDM) and three diode model (TDM) respectively. It will also equate the results of datasheet values from PV manufactures with experiment values obtained from PV module measurements. The meta-heuristics optimisation techniques to be considered include Genetic Algorithm (GA), Particle Swarm Optimisation (PSO), Harmony Search (HS), Flower Pollination Algorithm (FPA), Simulated Annealing (SA), Teaching Learning Based Optimisation (TLBO), and different hybrid solutions to improve the convergence speed, RMSE, and MAE

Keywords: Double Diode Model, Genetic Algorithms, Single Diode model, Parameter Extraction, photovoltaic cell models, Three Diode Model.

A Novel Hardware Architecture Design for Area Constrained Integral Image Generation for Face Detection Application

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ABSTRACT

Human face detection finds an important role in various Human-Computer Interaction (HCI) and computer vision applications. The seminal work of face detection proposed by Viola-Jones found popularity in the hardware implementation of these applications because of the inherent parallelism in the algorithm. It utilizes integral image computation as a preprocessing step to reduce the overall computation burden of Haar-like features. Although the calculation of the integral image consists of simple addition operations, the total number of operations increases with the increase in image resolution. Therefore, for resource-constrained real-time embedded applications, the computation and storage of integral values present several design challenges. This paper proposes an optimized hardware architecture of integral image computation for a resource constraint low-cost system. The proposed architecture utilizes the advantage of overlapping area in the sliding window used to find face features in the Viola-Jones face detector. We have simulated the proposed architecture using VIVADO® Design Suite 2018.2 for the ZC702 board. The proposed architecture achieves a significant reduction in the hardware resource utilization compared to the state-of-the-art integral image computation implementations.

Keywords: Face detection, integral image, pipelined architecture, parallel processing.

A Novel Trench FinFET as biosensor for early detection of Alzheimer's disease

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ABSTRACT:

In this work we propose and simulate a novel Trenched FinFET for the detection of biomolecules, which may be used as a basis for the diagnosis of Alzheimer's disease based on their protein marker protein (β-amyloid peptide/protein). The concentration of the β-amyloid peptide in the cerebrospinal fluid and on the brain and the spinal cord are a major indicator of the diseases progression, and by detecting the presence of β-amyloid peptides early on may provide earlier detection and management of Alzheimer's disease. The device is based on the changes in the dielectric properties of the trench in the presence of β-amyloid peptide. APTES ((3-Aminopropyl) triethoxysilane) is used to bind the β-amyloid peptide to the trench in the device. All comparisons regarding the change of the electrical behavior of the device have been made with air as a reference. A shift in the threshold voltage (V_{th}) is observed in the presence of the β-amyloid peptide and increases from 0.392 V to 0.616 V with the increase in its dielectric constant. Similarly, it is also found that the change in the Switching ratio (I_{on}/I_{off}) is also significant and follows an increasing trend from 26.74 to 1.46 x 10^4 with the dielectric constant. The saturation current of the device increases from 3.64 x 10^{-4}A to 4.98 x 10^{-4}A in the presence of β-amyloid peptide. Thus this device can be used as a potential biosensor for the detection of Alzheimer's disease

Keywords—Sensor, Biosensor, Sensitivity, FinFET, Dielectric constant

Impact of channel epilayer induced corner-effect on the sensing performance of a unique pTFET-based biosensor (epi-pTFET-biosensor) device in sub-100-nm gate length

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ABSTRACT

In this paper, for the first time, a unique pTFET-based biosensor device having a channel epilayer (epi-pTFETbiosensor) has been introduced and its performance in the sensing domain has been studied through a rigorous analysis based on five different sensitivity parameters, followed by the determination of detectability of the proposed device and an optimum length-window of the nanogap cavity for the successful detection of five different types of bio-molecules, viz. Apomyoglobin, Myoglobin, Protein-G, Ferricytochrome-C, and Ferrocytochrome-C. Interestingly, it has been found that, the undesired corner-effect, generally known for its detrimental impact on the subthreshold characteristics of the MOS-based structures, when generated by the presence of a corner due to the introduced epilayer, actually, comes to the aid of the proposed epi-pTFETbiosensor device by enhancing its detectability, compared to its equivalent conventional SOI pTFET sensor device by a great degree, yet maintaining significantly good sensitivity matrices throughout.

Keywords: biosensor, corner-effect, detectability, drive current sensitivity, epilayer, subthreshold swing sensitivity, threshold voltage sensitivity, threshold voltage shift, Tunnel FET,

Comparative study of InAlN and InGaN Super Back Barrier layer on p-Gate/AlGaN/GaN HEMT

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ABSTRACT

Attractive properties of GaN allows it to be used in power electronic devices in various space and defense applications like satellites and radars. In this paper, we have done comparative study of InAlN and InGaN back barrier with conventional GaN buffer in p-GaN/AlGaN/GaN HEMT. Carrier spilling in the channel is reduced which resulted in better 2DEG confinement in the channel. Maximum electric field in the channel is 1.17 MV/cm, that is one order higher than conventional GaN Buffer. The drain current is ~332mA/mm with back barriers due to enhanced electron concentration in the channel. Transfer characteristics and I_{ON}/I_{OFF} ratio are improved with back barrier. Higher I_{ON}/I_{OFF} ratio in InAlN back barrier makes it to be more power efficient and reliable p-GaN/AlGaN/GaN device than InGaN back barrier.

Keywords—HEMT, Back Barrier (BB), 2DEG, I_{ON}/I_{OFF} ratio

A Behavioral Control with Obstacle Avoidance for Co-operative type FPGA based Multi Robot

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ABSTRACT

This paper proposes the autonomous obstacle avoidance algorithm of cooperative type multi robot transportation with-in indoor environment. The Behavioral control between multi robots in transportation of loads with cooperative methods is challenge in real time scenario. The proposed algorithm is a novel approach and consists of 1) Behavioral control between multi robots with balanced formation and optimized communication method, 2) An obstacle avoidance of the multi robot. The leader follower approach is developed between group of FPGA based multi robot. The leadership swapping between robots are also developed to establish smart behavioral control of robots. The static and dynamic obstacle avoidance method is developed in lines of Bug2 algorithm for cooperative type FPGA based multi robots. In this paper, the proposed behavioral control with obstacle avoidance is coded in Verilog HDL and same is simulated using Xilinx ISE and Vivado tools. The equivalence hardware scheme is developed and synthesized for proposed algorithm using Xilinx FPGA , Zynq-7000 SoC ZC702.

Keywords: FPGA, Formation, Behavioral Control, Multi robots, Obstacle avoidance.

Design of Conformal F-Shaped Patch Antenna for Biomedical Applications

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ABSTRACT:

Design of conformal F-shaped patch antenna to work at ISM band for biomedical applications is presented. The proposed antenna is considered with polyimide substrate flexible material. The radiating element has proposed Fshaped with asymmetric CPW feeding. The simulation of the proposed antenna is tested in free space and in muscle tissue by considering the electrical properties of human body. The proposed antenna is operates at 2.4GHz in free space with return loss -14.96dB and 2.47GHz in muscle tissue with return loss -33.3dB. The specific absorption rate (SAR) of the proposed antenna shows less than 1.6W/Kg for both conditions. The radiation pattern of proposed antenna is also presented in this paper.

Keywords: Monopole F-shape antenna, Asymmetric CPW, ISM band application

A Study on Electrochemical Cell based on soil and living PKL tree

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ABSTRACT

Zn/Cu electrodes based electrochemical cell has been designed and developed using soil of a pot and living PKL (Pathor Kuchi Leaf) tree for electricity cultivation. The open circuit voltage (V_{oc}), short circuit current (I_{sc}), maximum power (P_{max}) and internal resistance (r_{in}) have been studied. Firstly, the Zn plate was placed in to the soil of the pot and the Cu plate was placed on to the living PKL tree. Secondly, the Cu plate was placed in to the soil of the pot and the Zn plate was placed on to the living PKL tree. Different soil pots and different living PKL trees have been used for getting open circuit voltage (Voc), short circuit current (I_{sc}), maximum power (P_{max}) and internal resistance (r_{in}) of the electrochemical cell. It is shown that the performance of the second condition is better than the first condition. This work is very new and innovative. This work can help to light the LED bulb.

Key words: Soil, Living PKL, Zn/Cu electrodes, Electrochemical Cell, Internal Resistance.

Fast Charging Method For Wireless Power Transfer Enabled Devices

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ABSTRACT:

The electric vehicles, EV, begin to be experimentational focal point for the ecological characteristics in not long past. As the core technology of the EVs, the battery mechanism controls the evolution of the EVs. The hybrid storage arsenal can expand the lifetime of the batteries by developing their operating context, and how to truncate the charging time. Using the wireless technology, the regulation of fast charging of the batteries is advocated.

Keywords— Maximum Power Transfer; Wireless Charging System; Fast charging; Wireless charging efficiency

Vigorous Deep Learning Model for Identifying Tomato Leaf Diseases

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ABSTRACT:

Identifying and detecting a plant disease is a prime challenge in the farming segment. Specifically, for tomato farming: Early Blight, Late Blight, Mosaic Virus, Target Spot, Yellow Leaf Curl Virus (YLCV), Bacterial Spot, Leaf mold, Septoria leaf spot and Two-spotted spider mite are nine general diseases that severely affect the yield. In this work, we propose a convolutional neural networks (CNNs) based Deep learning model for the tomato leaf diseases identification. In our study, we take the Tomato Leaf Disease Dataset (TLDD) consisting of 18160 images of the infected and the healthy tomato leaves from PlantVillage. We first selected the most appropriate and accurate DL models for disease identification experiments. Four popular models viz. SqueezeNet, ResNet50, InceptionV3 and DenseNet are chosen for the analysis. Lastly, using ImageAI library on Google Colaboratory (Colab), we have trained all four models on collected tomato-leaf-image dataset to identify the presence of above mentioned nine common tomato leaf diseases. Results from our experiments on comparative study of the selected deep learning models identify nine different tomato leaf diseases. Thus, we infer that the InceptionV3 model provides the highest accuracy of 99.64%. Our chosen model provides faster detection with higher accuracy as compared to the other models. In future work, we intend to modify the algorithm to develop our own model for disease identification for other crops as well.

Keywords: Deep learning, Convolutional neural network, Tomato Leaf Disease, ImageAI

Capacitive Analysis of a Novel 3 nm Truncated Fin FinFET

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ABSTRACT:

In this work, a novel *Truncated Fin* (TF) Junctionless (JL) bulk FinFET is compared over its 3 different oxide thicknesses which are solely compatible to its gate length. This paper is the analysis of high-performance switching characteristics of a (JL) FinFET at the scale of 3 nm gate length investigated on *Silvaco Atlas TCAD Tools*. Moreover, capacitance dependent parameters such as Transconductance, Frequency Product (TFP), Energy Delay Product (EDP) and Gain Bandwidth Product (GBP) are also analysed and found that, trade-offs between bandwidth and power are minimum at Tox=1 nm in TF-FinFET which ultimately dedicated to a noticeable reduction in parasitic capacitance (Cgg = Cgs + Cgd). This is because EDP and GBP also improve considerably and thus will reflect its effectiveness in RF amplifiers and receivers. As TFP and EDP of TF-FinFET at Tox=1 nm are only 38.4% and 43.5% of TFP and EDP respectively at Tox=0.4 nm. Hence device is most efficient at Tox=1 nm. Simulated results showed enhanced performance of TF-FinFET in terms of System-on-chip (SOC) Applications.

Keywords: Junctionless, Truncated fin (TF), FinFET, GaAs substrate, Parasitic capacitance.

Design, analysis and simulation of a piezoresistive microbridge and micro cantilever for MEMS pressure sensor in Continuous Glucose Monitoring

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ABSTRACT:

Advancement in healthcare has a rapid growth in engineering, the combination of medical and engineering is said to be Bio-Medical Engineering. Diabetes, it is due to the frequent urination, blurred vision, fatigue, irritability, extreme hunger, increased thirst, etc. In this paper, we have designed microbridge and micro cantilever using the FEM tool based on the non-linearity and sensitivity parameters. Micro cantilever obtained the sensitivity of 5.2e-6 with having the change in resistance 0.00011. It possesses a displacement of 1.04μm at an input voltage of 5V. While it is integrated with the electro-osmosis pressure sensor which estimates the changes in glucose concentration levels.

Keywords: Diabetes, piezoresistive, Microbridge, Micro cantilever, Electro-osmosis, BIO-MEMS.

Interface trap charge analysis of junctionless triple metal gate high-k gate all around nanowire FET based biotin biosensor for detection of cardiovascular diseases

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ABSTRACT

In this paper, a triple metal gate high-k gate all around junctionless nanowire field-effect transistor biotin biosensor has been developed to study the impact of different interface trap charges (ITCs) on device performance. All results were authenticated using ''atlas-3D'' device simulation tool. Interface trap charge effects on output characteristics such as transconductance, switching ratio, leakage current, and total current density with biotin biomolecule have been studied. Drain off-current ratio was considered as a sensing metric for biotin biomolecule detection with different interface trap charges (ITCs). Drain off-current results of biotin biomolecule are $3.12x10^{-12}$A, $2.10x10^{-13}$A and $4.07x10^{-16}$A for positive, neutral, and negative interface trap charges, respectively. Finally, we have found that a negative ITC has a positive impact on our proposed biotin biosensor performance than the positive ITCs, proving its efficacy for the detection of cardiovascular diseases.

Keywords: - Triple metal gate high-k gate all around, biotin-bio-sensor, junctionless- NWFET; Interface trap charge; atlas-3D,

Biography:

Dr. Shinichi Takagi

(Keynote Speaker of Micro2020)

Shinichi Takagi, University of Tokyo Shinichi Takagi received the B.S., M.S. and Ph.D. degrees in electronic engineering from the University of Tokyo. He joined the Toshiba Research and Development Center, Japan, in 1987, where he was engaged in the research on the device physics of Si MOSFETs. From 1993 to 1995, he was a Visiting Researcher at Stanford University, where he studied the strained-Si and SiGe devices. In 2003, he moved to the University of Tokyo, where he is currently working as a professor in the department of Electrical Engineering and Information Systems. He received 18 awards including IEEE Andrew S. Grove Award and IEEE Paul Rappaport Award.

Curriculum Vitae – Main points - 2020

Basic Data:

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Education: • University of Technology and Humanities in Radom (UTH Radom) / Faculty of Transport, Electrical Engineering and Computer Sciences / Scientific Postdoctoral Graduation (habilitation) • Warsaw University of Technology / Electrical Faculty / Department of Industry Power Electronics / Doctor of Philosophy (PhD) in Electrical Engineering • Warsaw University of Technology / faculty of Electronics / Master of Science (MSc) in Electronic Engineering

Research Areas:

• Power Electronics Converters in Drive Applications • Application of Power Converters in Renewable Sources and Battery Electric Vehicles • EMC Compatibility in Power Converters Systems • Hybrid power systems in electric industry drives • Energy Storages for BEV and Active Power Filters

Work Experience:

• Currently – after study up till now scientific worker and academic lecturer at Technology and Humanities University in Radom/Poland, now on professor position in faculty of Transportation, Electrical and Computer Sciences in Electric Drives and Power Electronics Devices Division. • Currently, about 70 scientific publications, 2 patents obtained, supervisor of 5 doctoral students in the discipline of Automatic Control, Electronics and Electrical Engineering. • Council of the UTH Doctoral School in Radom, - coordinator of the discipline of automation, electronics and electrical engineering • 2000-2010 – board member of ELPOL Ltd. – responsibilities: identifying and establishing new business, organising sales visits, preparing tenders & proposals and quotations, negotiating contracts & terms and conditions, reviewing cost and sales performance, providing product education and advice, attending trade. Medium and low voltage power distribution and electrical drives systems, power quality devices, active filters, ups and others power electronic devices. Involved in industry electrical projects: renewable sources in smart grid distribution systems, electric drives of long belt conveyors with regulated belt speed in surface lignite mines, drive motion systems of surface mining machines like: excavators and spreaders.

Computer skills: • Microsoft Office / MS Project / Autocad / Eplan / Matlab-Simulink / ANSYS - Simplorer / LaTex (TexStudio, JabRef)

Foreign languages: • English, Russian – good, german – basic.

BIOGRAPHICAL SKETCH OF HILLOL RAY

(Guest of Honor of Micro2020)

Hillol Ray, Poet Laureate, Author, Song Writer, and Multi-linguist, is a Civil-Structural - Environmental Engineer, and Manager of Drinking Water Supply (Underground Injection Control) Enforcement Program, with the U.S. Environmental Protection Agency (EPA) in Dallas, Texas. He received letters of personal compliments for his innovative thoughts and poems, from the former U.S. President Bill Clinton, former U.S. Vice President and Nobel Peace Laureate Al Gore, Jr., the U.S. EPA Administrator Lisa P. Jackson; the Cousteau Society President Madame Francine Cousteau (wife of world renowned oceanographer, Jacques Yves Cousteau) of Paris, France, and Mother Teresa of Kolkata, India. He was announced as the Brownbuiders of Note Hall of Fame in March/April and July/August 1978 and March/April 1979 by the Brown & Root, Inc. in Houston, Texas, USA. In 2006, he received the NFIA (National Federation of Indian American Associations) National Award from Long Beach, California, USA, in Liberal and Fine Arts. His biography has appeared in "500 Leaders of Science" and "International Directory of Distinguished Leadership" – both published by the American Biographical Institute (ABI) in North Carolina, and also in many other biographical books, published by the International Biographical Centre (IBC) from Cambridge, United Kingdom. He has been interviewed by and published on "China Campus" magazine from Beijing, China, as well as in many popular magazines/newspapers/webzines and TV and Radio stations in USA and abroad; inducted under the "Nobel Laureates and Famous Indian Americans in USA"; conferred "Diversity Poet" by the University of Michigan Medical School in Ann Arbor, Michigan, and "Inspirational Speaker" by the University of Wisconsin at Eau Claire, U.S.A. He received the Bronze Medal (2001) and Customer Service Award (2002) from U.S. EPA, Literary Award (2018) from BECAA (Bengal Engineering College Alumni Association of North America and Canada), Distinguished Service Award 2018 (Literary Accomplishments and Human Rights Activist) from Cultural Association of Bengal (CAB – New York); "Foreign Jewel – India's Pride Award (2015) from Moramer Katha Literary Organization (Midnapore, W. Bengal). He is listed in Marquis Who's Who in America, Marquis Who's Who in Science and Engineering, and Marquis Who's Who in the World. In 2018, He was presented with the Albert Nelson Marquis Lifetime Achievement Award from New Jersey, USA.

June 30, 2020
July 1, 2020 (Revised and Updated)

Micro2020, 25th - 26th July, 2020, Online Conference,
Virtual Venue: Delhi Technological University, Delhi, India.
Joint Organizer: Applied Computer Technology, Kolkata, India
List of invited Speakers/ Session Chairs

	**Prof. Shinichi Takagi,** Semiconductor electronics, Department of Electrical Engineering Graduate School of Engineering, The University of Tokyo, Japan. **Keynote Address:** Title: ***Prospects and challenges of advanced CMOS logic devices***
	**Dr. Mohd Faizul Bin Mohd Sabri** Associate Professor Department of Mechanical Engineering Faculty of Engineering University of Malaya, Kaula Lumpur, Malaysia,
	**Prof.(Dr.) Abhijit Biswas** General Chair, Micro2019 and Professor, Dept. of Radio Physics and Electronics University of Calcutta, Kolkata, India E-mail: abiswas5@rediffmail.com www.caluniv.ac.in
	**Dr hab. inż. Jerzy R. Szymański, University Professor** Department of Electric Drives and Industrial Electronics. Uniwersytet Technologiczno-Humanistyczny im.K.Pułaskiego w Radomiu, POLAND.
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