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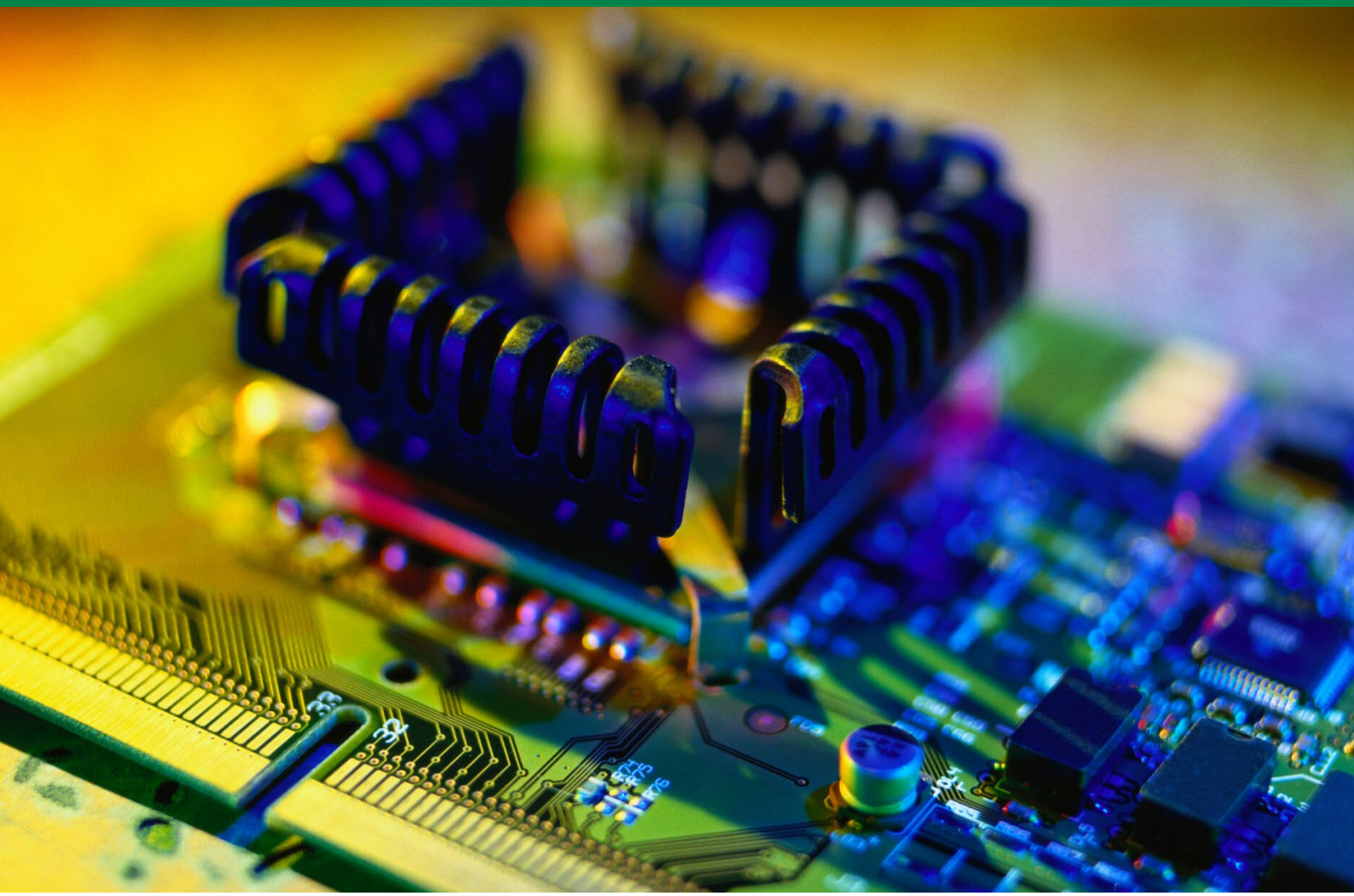
GSEEE2022

2nd Global Summit on Electronics & Electrical Engineering

November 14, 2022 **Virtual**



The Scientistt
Bangalore, Karnataka, India
Contact: +91 8977940575
Email: contact@thescientistt.com

FOREWORD

Dear Colleagues,

We are pleased to announce that the "2nd Global Summit on Electronics & Electrical Engineering (GSEEE2022)", which will be held on November 14, 2022 as virtual conference, is a premiere and one of the highest level international academic conferences in the field of electronics and electrical engineering.

The objective of GSEEE2022 is to provide a unique forum for discussion of the latest developments, refresh your knowledge and will offer plenty of networking opportunities, providing you a chance to meet and interact with leading researchers as well as most influential minds in the field of electronics and electrical engineering.

The conference offers a diverse scientific program covers the latest, cutting-edge developments which can change the course of science to benefit the human society. The conference consists of excellent plenary talks, keynote talks, technical sessions and workshops along with industry tech talks. Leading experts get together in this international forum to present their research and share knowledge.

The Young Researchers Forum provides a great opportunity for PhD students and young postdocs to meet up in a friendly, informal and international atmosphere to discuss and exchange ideas, to get feedback on their work from leading scientists in the field.

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Virtual Presentations

Ruihua Cheng

Department of Physics, Indiana University Purdue University Indianapolis (IUPUI), Indianapolis, IN 46202, USA

Study of Isothermal Spin State Switching in a Spin Crossover Molecular Thin Film

Abstract

Using optical characterization, it is evident that the spin state of the spin crossover molecular complex [Fe{H2B(pz)2}2(bipy)] (pz = tris (pyrazol-1-1y)-borohydride, bipy = 2,2'- bipyridine) depends on the ferroelectric polarization of an adjacent thin film of the polymer ferroelectric polyvinylidene fluoride-hexafluoropropylene (PVDF-HFP). The UV-Vis spectroscopy reveals that room temperature switching of [Fe{H2B(pz)2}2(bipy)] molecules in bilayers of PVDF-HFP/[Fe{H2B(pz)2}2(bipy)] as a function of ferroelectric polar polarization. The electric polarity dependence of bilayers of PVDF-HFP/[Fe{H2B(pz)2}2(bipy)] shows a strong dependence on the thickness of the PVDF-HFP layer. The PVDF-HFP/[Fe{H2B(pz)2}2(bipy)] interface may affect polarization retention in the PVDF-HFP thin film limit.

Biography

Ruihua Cheng is currently working at the Department of Physics of Indiana University-Purdue University-Indianapolis (IUPUI) as an associate professor. She received her Ph.D in Physics at University of Nebraska-Lincoln in 2002. Then she conducted her postdoctoral research in the magnetic thin film group of materials science division at Argonne National Laboratory. In 2005, she joined the Department of Physics at IUPUI. Her current research is focused on molecular magnetic materials characterization, particularly spin crossover molecular manipulation and their applications in molecular based devices.

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M. Wang[1,*], C.Wu[1], X.G. Yang[2], J. Zhou[2]

[1]College of Energy and Electrical Engineering, Hohai University, Nanjing, China
[2]Electric Power Research Institute of State Grid Shanghai Electric Power Company, Shanghai, China
*wangmin@hhu.edu.cn

Temperature Control Load Extraction and Characteristic Analysis Based on Time-dependent Intrinsic Correlation

Abstract

To balance the demand of users' electricity and the demand of power grid dispatching and to improve the ability of demand response of temperature-controlled load as well as to further master the operation rules of temperature-controlled load so that to prearrange the dispatching plan, a multi timescale dynamic correlation analysis model based on improved complete set of adaptive noise and time internal relatedness was proposed. By means of analyzing the dynamic association of load and environmental temperature time series under multi timescale, its complex variation relation within partial time period was seized, thus both peeling off the fluctuant component of temperature-controlled load off from the load curve and the estimation of the proportion of temperature-controlled load were implemented. The application method of the proposed model was illustrated by the analysis of computing examples, meanwhile the effectiveness of the proposed model was verified.
Keywords: Temperature-controlled load; Demand side response; Multi timescale; Empirical mode decomposition; Dynamic correlation

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Ming Zheng

School of Materials Science and Physics, China University of Mining and Technology, 1 Daxue Road, Xuzhou 221116, China
E-mail: zhengm@cumt.edu.cn

Multiferroic Heterostructures and Magnetoelectric Coupling Effects

Abstract

The integration of magnetic functional thin films (e.g., metals/alloys, ferrites, and manganites) with perovskite ferroelectrics offers an exciting opportunity to control magnetism by electric field (instead of magnetic field and electric current) through a strong magneto electric coupling effect, which is promising for developing dense, high-speed, ultralow-power tunable electronic and spintronic devices. Progress has been made toward electrically controlling nonvolatile tuning of magnetic states in these multiferroic heterostructures for information storage industry, which is usually attributed to ferroelectric polarization switching-induced interfacial charge effect. In this work, we propose a design principle that the electrically induced ferroelastic domain engineering in PMN-PT ferroelectric single-crystal substrates can be used to achieve robust nonvolatile tuning of magnetic and transport properties in elastically-coupled perovskite manganites and $SrRuO_3$ thin films in a reversible way. Such a nonvolatile and reversible response is striking, which stems from the intermediate lateral-polarization-induced stable strain state in the substrate during domain switching. Based on the piezoelectric response of the substrate, the quantitative determination of the resistance change and the lateral strain of the film can be obtained. These results demonstrate that lattice strain and physical properties of functional thin films epitaxially grown on PMN-PT substrates can be in situ, dynamically and reversibly modulated via ferroelectric poling, converse piezoelectric effect, polarization rotation, and ferro elastic effect. This method can be further extended to study the intrinsic strain effects of other functional thin films. Moreover, for manganite films the magnetically (optically) tunable strain effect, together with the strain-tunable magneto resistance (photo resistance) effect, demonstrates strong mutual coupling between the strain and the magnetic field (light), which is essentially mediated by the electronic phase separation. Our findings are instructive for realizing ferro elastically driven nonvolatile manipulation of lattice-coupled magnetic and electrical properties in hybrid correlated oxides/ferroelectric systems and designing next-generation reconfigurable, high-frequency, ultralow-power nonvolatile electronic devices.

Wei Liu*, Shuyuan Zhang, and Jie Zhang

School of Microelectronics, Northwestern Polytechnical University, Xi'an, 710072, China
*liuwei127@nwpu.edu.cn

Optimization on the Structures of InGaN Quantum Dots for the Red-Light Emitting Devices

Abstract

The structures of InGaN quantum dots used as the active region in the red-light emitting devices are studied and optimized. Especially, the influence of the position of InGaN quantum dots on the electroluminescence (EL) properties of red light-emitting diodes (LEDs) is carefully investigated. It is found that as the InGaN dots shifts from the P-region to the N-region, the LED's EL intensity decreases, and the spectrum red-shifts. By analyzing the EL spectra, energy band structures and carrier distribution, it is considered that, when the dots position moves away from the p-region, the injection barrier width of holes increases, while that of electrons decreases. Thus, the injection efficiency of electrons and holes is enhanced and weakened, respectively. Compared with electrons, the injection efficiency of holes with larger effective mass can be significantly reduced by a thicker barrier [1]. As a result, the hole concentration in InGaN dots is reduced more severely, leading to a reduction in the total amount of carriers. The decreased concentration of injected carriers may weaken the carrier screening effect to the polarization electrical field, thereby the polarization-induced quantum confined-Stark effect is enhanced [2,3]. As a consequence, it is suggested that for the red LED whose InGaN dot layer is far away from the p-region, the EL intensity is reduced and the peak wavelength becomes longer.

Keywords

InGaN, quantum dots, electroluminescence, red light, high-In-content.

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Lolit Manus Villanueva

Xavier University, Philippine

Future Wind Energy Forecasting using Radial Basis Function Neural Network

Abstract

With increasing demand in electrical power all throughout the world, one alternative is to harvest power from renewable sources of energy. Power from wind turbines can contribute to the deficiency of generated electrical power that can be used in off-grid local community operations and even supply household power requirements.

In Cagayan de Oro City, eight weather stations collect wind data for several years and this data is used to forecast future wind energy and thus, electrical power converted from the said wind energy. A Radial Basis Function Neural Network (RBFNN) is used to predict the three-year daily average electrical power that can be harvested from each of the eight weather stations.

The forecasted electrical power is used in determining which weather stations are feasible for constructing wind turbines. With a threshold average daily power of 500 watts, it is seen that only four out of the eight stations are recommended to build wind turbines on their sites.

Keywords

Radial Basis Function, Neural Network, Wind Energy, Forecasting, Renewable Energ

Rong Su

School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore, email: rsu@ntu.edu.sg

Distributed Cooperative Control and Optimization of Connected Automated Vehicles Platoon against Cut-in Behaviors of Social Drivers

Abstract

Connected automated vehicles (CAVs) have brought new opportunities to improve traffic throughput and reduce energy consumption. However, the uncertain lane-change behaviors (LCBs) of surrounding vehicles (SVs) as an uncontrollable factor significantly threaten the driving safety and the consistent movement of a group of platoon CAVs. How to ensure safe, efficient, and fuel economic platoon control poses a key challenge faced by researchers in complex traffic environments. In this talk, I will briefly describe a new dynamic platoon management and cooperative driving framework for a mixed traffic flow consisting of multiple CAVs and possible human-driven vehicles (HDVs) as the SVs on unsignalized roads. In the proposed framework, the leader CAV of the platoon provides a high-level automatic driving decision to the follower CAVs by developing an optimal trajectory estimation of the HDVs while distributed observers and tracking controllers are properly implemented by the follower CAVs. Specifically, the proposed framework consists of three stages. At the observation stage, the cruising information of all the SVs will be collected by the leader CAV through the Cellular- Vehicle-to-X (C-V2X) infrastructure, while an automatic decision-making driving assistance system (ADMDSS) is constructed to determine the driving states of the platoon. When the HDVs approach the communication range of the platoon, in the prediction stage, the trajectories of the HDVs as the target vehicles will be estimated and the reference trajectory planning for the leader CAV and the cooperative controller design for the follower CAVs will be respectively activated by using C-V2X infrastructure. More importantly, we consider two types of social driving behaviors (SDBs): courteous and rude, where the optimal trajectory estimation will be obtained based on the known social preferences of the SVs. While the HDVs deliver their social cut-in intentions (SCIIs) into the platoon CAVs, the ADMDSS will provide a high-level trajectory guidance to the platoon CAVs to adjust the time-varying space error among the CAVs while the problems of collision avoidance and energy composition will be solved at the lane change stage within a finite time by proposing a cooperative trajectory tracking optimization algorithm. Extensive simulation cases indicate the effectiveness of the proposed approaches.

Mohd Ridzuan Ahmad

Division of Control and Mechatronics Engineering, Faculty of Electrical Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.
mdridzuan@utm.my

An Integrated Microfluidic-Dual Microneedle for Characterization of Single Red Blood Cell Membrane Capacitance

Abstract

This work presents an integrated dual microneedles-microfluidic impedance flow cytometry device for cell detection based on impedance measurements. Single-cell detection plays a significant role in biomedical diagnostics such as early cancer cell detection and pathogenic bacteria cells in the blood. The growing need for straightforward and low-cost microfluidic device fabrication led to the invention of numerous microfluidic-based impedance flow cytometry (IFC) techniques. However, the current impedance flow cytometry is associated with limitations in terms of design complexity, not being reusable, and high cost for fabrication. The state-of-the-art method for impedance flow cytometry detection utilizes an embedded electrode in the microfluidic to measure the electrical impedance of the presence of cells at the sensing area. Nonetheless, this method requires an expensive and complicated electrode fabrication process. Furthermore, the reuse of the fabricated electrode also requires an intensive and tedious cleaning process. Due to that, we present a microfluidic device with integrated dual microneedles. The two microneedles are placed at the half-height of the microchannel for cell detection and electrical measurement. A commercially available Tungsten needle was utilized for the microneedles. The microneedles are easily removed from the disposable PDMS (Polydimethylsiloxane) microchannel and can be reused with a simple cleaning process, such as washing by ultrasonic cleaning. The polystyrene (PS) microbeads with three different sizes (5μm, 7μm, and 10μm) and red blood cells (RBC) were utilized to perform the single-cell detection of this IFC device. Through the experiments, the PS microbeads and RBC were distinguished based on cell size at seven frequency measurements (10 kHz, 50 kHz, 100 kHz, 500 kHz, 800 kHz, 1 MHz, and 2 MHz). The electrical properties of RBC, such as specific capacitance membrane (Csmem) were extracted by fitting the experiments measurement result with the equivalent circuit model of this IPC device. In conclusion, although this device was low-cost, it preserves the core functionality of the sensor, which is capable of detecting passing cells at the sensing area. We believe our work will be beneficial to enabling technology, particularly in the point of care diagnosis tools.

Keywords

Microfluidics, Single Cell Analysis, Non-Invasive Diagnosis

Debarati Dey Roy

B.P.Poddar Institute of Management & Technology, India

Quantum Molecular Effects in Nano scale Devices

Abstract

At the edge of micro to nano interface, creates a high impact towards the modern society. Captivating quick progress in microelectronics technology reaches towards a promising and exponentially developing field recently, which is indeed responsible for engineering of micro and nano-scale devices and systems. In the last few years, in the area of micro electronic technologies, an exponentially sharp peak has observed. This area is also enriched with device fabrication, characterization, as well as its analytical modelling and simulation. Research and development wings have come up with their scientific findings and technological developments, which are relevant to nano-scale devices. This seemed as a promising field that is required primarily to complete the necessities from IC industries. Engineering of alternate materials with novel structures plays an important role to the path of innovative novel nano- scale device modelling. This reflects their crucial contribution to advance performance of applications in micro and nano dimension circuits in association with micro-systems. In addition to this, there has been an amazing enhancement in the shrinking of micro -mechanical devices, which is abbreviated as micro-electro-mechanical systems (MEMS) or Nano-electro- mechanical systems (NEMS). Moreover, bio-inspired Nano scale device modelling also steals the attention of researchers now-a-days. Micromechanical actuators and bio-sensors are the vital portions of MEMS technology. During last few years, there has been numerous advancements and achievements have observed for nano-scale devices that increase the thrust for the researchers. This increasing number of applications for MEMS actuators and sensors presenting thrilling new challenges and openings for researchers and scientists. Thus, it is time to organize a special section to represent and share the huge amount of collected knowledge in this rapidly growing field.

Ioannis Giannoulakis

Project Manager Director, EIGHT BELLS LTD, Cyprus - Greece

5G Solutions for Smart Energy Grids

Abstract

Fifth Generation (5G) networks will be an important ingredient for the development of smart grid technologies, allowing the grid to adapt better to the dynamics of renewable energy and distributed generation. As renewable resources such as solar and wind power are gaining pace with a dynamic to become prevalent in a few years from now, the power grid will require integrated monitoring and control, as well as integration with substation automation in order to control differing power flows and to plan for stand-by capacity that supplements energy generation. Smart grid capabilities promise to control easier bi-directional power flows and to monitor, control, and support distributed energy resources. The 5G mobile networks are expected to integrate previously unconnected devices to smart grids for accurate monitoring and improved forecasting of their energy needs. Managing energy demand will become more efficient, requiring less investments, as the smart grid will be able to balance easier the energy load, to reduce electricity peaks, and ultimately, to reduce energy costs. Large cities will be able to plan their energy infrastructure based on collected data, spending less resources and reducing the ‘downtime’. Likewise, from the perspective of power supply, 5G is expected to enable better efficiency, observability and controllability of the power system, especially at the distribution side. Energy suppliers will be able to collect and store power grid related data at much faster rates, ensuring secure and stable power supply, while risk mitigation and fault management will become simple and more straight forward. The Smart5Grid example provides an open environment to third parties for experimentation, which will be able to support development, testing, and validation of 5G Network Applications specialized for the Energy Vertical.

David Moss

Director, Optical Sciences Centre, Swinburne University of Technology, Melbourne, Australia
E-mail: dmoss@swin.edu.au

Ultra-high Bandwidth Applications of Integrated Kerr Optical Frequency Microcombs

Abstract

This talk will focus on our work on ultrahigh bandwidth applications of Kerr microcombs to optical neural networks, optical data transmission and microwave photonics. Convolutional neural networks (CNNs) are a powerful category of artificial neural networks that can extract the hierarchical features of raw data to greatly reduce the network complexity and enhance the accuracy for machine learning tasks such as computer vision, speech recognition, playing board games and medical diagnosis. Optical neural networks can dramatically accelerate the computing speed to overcome the inherent bandwidth bottleneck of electronics. We use a new and powerful class of micro-comb called soliton crystals that exhibit robust operation and stable generation as well as a high intrinsic efficiency with an extremely low spacing of 48.9 GHz. We demonstrate a universal optical vector convolutional accelerator operating at 11 Tera-OPS/s (TOPS) on 250,000 pixel images. We use the same hardware to form a deep optical CNN, achieving successful recognition of full 10 digits. We also report world record high data transmission over standard optical fiber from a single optical source, at 44.2 Terabits/s over the C-band. We achieve error free transmission across 75 km of standard optical fiber in the lab and over a field trial with a metropolitan optical fiber network. Our work demonstrates the ability of optical soliton crystal micro-combs to exceed other approaches in performance for the most demanding practical optical communications applications.

Biography and Research Interests

David J. Moss is Director of the Optical Sciences Centre at Swinburne University of Technology in Melbourne, Australia, since 2016. He was with RMIT University in Melbourne, 2014-16, the University of Sydney 2004 - 14 and JDS Uniphase in Ottawa Canada from 1998-2003. From 1994-98 he was a Senior Research Fellow with the Optical Fiber Technology Centre at Sydney University prior to which he was a visiting Scientist with Hitachi Central Research Laboratories in Tokyo, Japan,1992-94. From 1988-92 was with the National Research Council of Canada in Ottawa. He received his PhD from the University of Toronto in Physics and BSc from the University of Waterloo. He won the 2011 Australian Museum Eureka Science Prize and Google Australia Prize for Innovation in Computer Science. He is a Fellow of the IEEE Photonics Society, the OSA (now the Optica Society) and the SPIE. His research interests include optical microcombs, integrated nonlinear optics, quantum optics, microwave photonics, optical neural networks, optical networks and transmission, 2D materials including graphene oxide for nonlinear optics, optical signal processing, nanophotonics, and biomedical photonics for cancer diagnosis and therapy.

K. Blankenbach

Pforzheim University, Display Lab, Tiefenbronner Str. 65, 75175 Pforzheim, Germany
kb@displaylabor.de

New Electronic Design for Smart Embedded Automotive RGB LEDs

Abstract
Automotive interior lighting has become a major part of the customer experience. In consequence, thousands of RGB LEDs will provide outstanding visual effects incl. safety functions and daylight legibility. This raise the requirements from today's night lighting significantly. The limitations of today's single RGB LED systems with LIN bus are that data transmission is too slow and calibration & compensation of temperature drift not effective. Therefore, a new approach was designed and engineered toward mass production: ISELED as intelligent smart embedded LED system optimized for advanced automotive interior lighting.

The ISELED system integrates in a single package RGB LEDs, current driver, temperature sensor, calibration data and a high speed bi-directional data interface. To achieve high optical quality of direct-lit light guides, the calibration of individual LEDs must be performed before integration. This is done here at the end-of-line test via measurement of the intensity and wavelength. Individual currents are calculated and stored in the OTP. The data interface is capable of daisy chaining of up to 4,079 smart LEDs with real time animations. Read-out of individual LED currents enable the easy implementation of safety features for e.g. visualization of manual or autonomous mode.
Keywords: RGB LED, current driver, temperature, embedded connectivity, optoelectronics

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S. Lumetti[1,*], P.Malagò[1],P.-A. Stürmer[1], M. Moridi[1], and M.Ortner[1]

[1]Silicon Austria Labs GmbH, Europastraße 12, 9524 Villach / St. Magdalen, Austria
*stefano.lumetti@silicon-austria.com

AMR Sensor Design for Magnetic Tactile Sensing Applications

Abstract

Here, we discuss the design of anisotropic magneto resistive (AMR) sensor arrays aimed at the detection and 3D reconstruction of the motion of a permanent magnet for tactile sensing applications. The proposed tactile sensor structure consists of an array of AMR sensors located at the bottom and of a permanent magnet on top, embedded within a flexible membrane and therefore capable of moving relative to the AMR sensors as a result of an external tactile solicitation. The AMR sensor arrays are made of barber-pole-biased Permalloy (Ni80Fe20) stripes arranged in four Wheatstone bridges. Micromagnetic simulations based on finite-difference methods (MuMax3) [2] have been performed to compute the AMR sensor response, whereas the Magpylib Python package [3] has been exploited to simulate the magnetic field generated by the permanent magnet. Analytical models have been developed to infer the magnet motion based on the output of the AMR sensors. The proposed magnetic sensor design allows to reconstruct the 3D motion of the permanent magnet – and therefore to ultimately infer the 3D force acting on the tactile sensor – via a purely planar arrangement of monolithically microfabricated AMR sensors, despite the latter being sensitive only to the in-plane magnetic field component.

The novel tactile sensor design proposed in this work holds potential for the realization of a large plethora of easy-to-fabricate and low-cost microscale sensors suitable for probing a wide variety of observables (e.g., acceleration, pressure, flow, etc.) and for integration into MEMS devices.

Keywords

AMR sensors, tactile sensing, Permalloy, micromagnetic simulations

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Biography

Stefano Lumetti studied physics at the University of Modena and Reggio Emilia (Italy), where in 2018 he also completed his PhD in Physics and Nanosciences with a research activity focused on the fabrication and characterization of magnetic single-molecule transistors with graphene electrodes for spintronic applications. He also spent two years at the Néel Institute (Grenoble, France) as a visiting PhD student. In 2019 he joined Silicon Austria Labs GmbH, where he is currently employed as a senior scientist with focus on the experimental development of magnetic sensor systems and the microfabrication of MEMS and magneto resistive devices.

Juan José Encinas C

Ricardo Palma University, Peru
Email: encinas_2010@hotmail.com
Tel: 921 671 455

Impact of Mechatronics on Industrial Biotechnology

Abstract

This research was carried out to determine the impact of mechatronics in the health sector, since currently mechatronics has an impact in multiple areas of the industry, but lately especially in biotechnology. Its development was valued, from the perspective of different researchers, which has allowed its insertion in this sector. This development benefits both patients and physicians, as they have revolutionized the field of medical equipment and devices. Biotechnology has applications in important industrial areas such as: health care, the development of new approaches for the treatment of diseases; agriculture with the development of improved crops and food. Robotics and digital image and signal processing were also found to have a greater impact on medicine. Likewise, an analysis of the mechatronics applied to this science was made, which showed that the surgical and therapeutic areas are the most favored and are nourished by innovative techniques, which are more reliable and less invasive for the patient.

Biography

He was born in Lima, Peru. He is a Mechatronic Engineer. Session Chair and participant of the 4th North American Industrial Engineering and Operations Management Conference-IEOM 2019 in Toronto, Canada. He received a certificate for attendance and presentation at the 2nd International Conference on Automation Engineering and Intelligent Manufacturing-ICIMA 2018 in Penang, Malaysia. He participated in the X International Symposium on Innovation and Technology-ISIT 2019 in Cusco, Peru. Member of the steering and technical committee of the ISIT. He participated as part of the Peru Section of the IEEE in the XXVI International Congress of Electronics, Electricity, Engineering and Computing-INTERCON 2019 in Lima, Peru. He with experience in research, development and innovation in the fields of mechatronics, medical robotics, telemedicine, aerospace engineering and bioengineering. Researcher in programming by IPCEM agents. Lecturer and Consultant in Mechatronic, Spatial and Biomedical Technologies. He is also a consultant in information and communication technologies in the Peruvian government sector.

Bruno Cesar Barreto de Figueiredo

State University of Roraima, Brazil

Investigating Robustness In Electrical Networks Using Complex Networks

Abstract

Our lecture proposes to review the most relevant works that have investigated robustness in power grids using Complex Networks (CN) concepts. We will discuss two different approaches. The first is based on topological concepts which use metrics such as mean path length, clustering coefficient, efficiency, and betweenness centrality, among many others. The second is the hybrid approach that consists of introducing (into the CN framework) some concepts from Electrical Engineering (EE) in the effort of enhancing the topological approach and uses novel, more efficient electrical metrics such as electrical betweenness, net-ability, and others.

There is a controversy between the CN community that argues that the topological approach does not aim to focus on the detailed operation but to discover the unexpected emergence of collective behavior, while part of the EE community asserts that this leads to an excessive simplification. We will bring to a discussion which of these approaches can provide better insights into real power grids.

We intend to talk about this open debate once it seems to be no predominant structure (scale-free, small-world) in high-voltage transmission power grids, the vast majority of power grids studied so far. Most of them have in common that they are vulnerable to targeted attacks on the most connected nodes and robust to random failure.

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