

# Lecture Notes in Electrical Engineering

## Volume 745

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# WITS 2020

Proceedings of the 6th International  
Conference on Wireless Technologies,  
Embedded, and Intelligent Systems

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## **Brief Synopsis About WITS'2020 Book**

This book gathers together selected papers presented at the 6th International Conference on Wireless Technologies, Embedded and Intelligent Systems (**WITS 2020**).

**WITS** Conference is an event that brings together specialists from all over the world, covering multiple aspects of diverse topics such as wireless networking, embedded and intelligent systems, electronic and renewable energy to create an open space networking and exchange of information and knowledge and also to strengthen the synergy between researchers and experts from academia, research institutions and industry. During three days, presentations, discussions and side events will inspire new ideas and innovations that will support enhancing innovation.

The tremendous advances in wireless communications, embedded and intelligent systems, combined with rapid evolution in smart appliances and devices have generated new challenges and problems requiring solutions that rely on interactions between different network layers and applications in order to offer advanced mobile services. Moreover, a transformation of our energy system is already occurring due to the strong demand and acceptance of creating a carbon-free energy system, which underlines the need to develop a strategy for a renewable, sustainable and innovative energy future that enables societal, commercial and community prosperity.

This year, WITS Conference is being held from October 14 to 16, 2020. The conference received submission from many different countries all over the world.

This book results from more than 245 contributions of researchers from more than 14 countries worldwide. After a thorough peer-review process, the Program Committee has accepted 120 papers, which have undergone a selection stage to retain 104 papers for this LNEE volume. This achieves overall acceptance rate of 42.5%.

To put a conference of this magnitude together is not a small task. To that end, we would like to thank the Technical Program Chairs members, all the reviewers, Publicity and Communication Chairs and all members of the Organizing Committee for their assistance in making this conference a success. We would like to thank our distinguished speakers who have agreed to address the conference attendees.

We are very grateful to the keynote speakers who have accepted our invitation to come and share their work during the conference: **Prof. Adam. W. Skorek**, from Trois-Rivières University of Quebec (Canada); **Prof. Ruano António Eduardo De Barros** from Algarve University, Faro (Portugal); **Prof. Norma Alias** from Center for Sustainable Nanomaterials (Malaysia); **Prof. Mohamed Himdi** from the University of Rennes 1 (France); **Prof. Rachid Yazami** from KVI Holdings PTE LTD. (Singapore); **Prof. Ivashko Evgeny** from Russian Academy of Sciences, Moscow (Russia); and **Dr. Ahmed Boutejdar** from German Research Foundation DFG, Braunschweig-Bonn (Germany).

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# Invited Speakers

Pr. Adam. W. Skorek

Ph.D. Eng., Trois-Rivières University, Canada

«Artificial Intelligence and Brain Biofields HPC Simulations»

**Summary** Artificial intelligence (AI) is present in electrical, electronics and computer engineering for years. In particular, the biofields defined as electromagnetics and thermal fields in living matter are naturally related to AI studies and applications, including brain analysis with numerical modeling and simulations. Brain functionalities inspiring all developments in AI from theoretical investigations to machine learning, humanoid robots and brains interface device implementation. The brain biofield interactions with external excitations such as 5G telecommunications devices, transcranial magnetic stimulation and even other brain biofields are currently explored more as never before. A presentation from worldwide perspective of some modern research works with their result applications is completed by lecturer's experiences and guidelines for the future. Some practical examples and instructions for researchers, engineers and students are presented, stimulating the audience to various scientific as well as R&D activities in this so promising area.

Prof. Ruano António Eduardo De Barros

Universidade do Algarve, Faro, Portugal

«Computational Intelligence Techniques for Home Energy Management Systems»

**Summary** The consumption of energy has increased substantially in the building sector in the past years, fueled primarily by the growth in population, households and commercial floor space. For this reason, home energy management systems (HEMS) are becoming increasingly important to invert this continuously increasing trend.

Computational intelligence (CI) techniques play an important role in existing HEMS, and its use will be much more important in the future. This talk will discuss major applications of CI methods in HEMS, with an emphasis on the use of models for forecasting energy consumption and production, on non-invasive load monitoring (NILM) of electrical appliances and on real-time predictive control of HVAC systems.



Prof. Norma Alias

Associate Professor at Center for Sustainable Nanomaterials, Malaysia

«Machine Learning System for IoT Data Stream Connected to Freeze-DIC Machine Sensor Device in Drying Pineapple»

**Summary** By analyzing big data generated using IoT wireless technology, synchronizing digital, physical value streams, predictive analytics, the process of control, and monitoring the manufacturing machines become more predictability and interoperability. Big data analytics of machine learning systems is proposed for optimizing the DIC-freeze-drying operation of pineapple. The IoT sensor device connected to the DIC-freeze-drying machine will generate a huge volume and high-speed velocity data signals. Machine learning helps manufacturers enhance their production, eliminate production downtime, increase the quality of processes, and reduce financial risk.

Therefore, a DIC-freeze machine with machine learning focuses on the development of artificial intelligence and a method of data analysis. The aims of complex algorithms to automate the drying process are to predict the optimum level of time duration, pressure, and temperature for drying different species of pineapple by making insightful decisions. In addition, it is easy to get fake pineapple extracts and the large quantities of data produced by DNA sequencing. DNA could be sequenced by generating fragments via the hidden scheme. The fake issue can be detected based on the DNA sequencing database integrated with the properties of phytopharmacological characteristics, physical biology, and biometric properties of pineapple species. Some analytical methods of the complex model for data generation and machine learning are useful for the visualization, observation, and monitoring process to facilitate the data decision making. Multi-processor of distributed memory architectures of high-performance computing platform supports the large sparse simulation. Parallel performance measurements and numerical analysis are the indicators to investigate the drying process. DIC-freeze-drying with this adaptive manufacturing technology preserves the sensorial quality and nutritional compounds. In the case of high water content perishable, the treatment is usually accompanied by irreversible damage of cell structures and maintains the nutrient quality and deterioration of tissue porosity.

The working principles are to identify the factors influencing the customer's choice for a new product of dry pineapple. To optimize the DIC-freeze-drying treatment and to analyze the characteristics of potential customers for the premium drying pineapple product, this paper proposed big data analytics of synchronizing digital, physical value streams and predictive analytics. The freeze-drying machine with the elements of IoT data sensor and machine learning analysis will produce the highest quality of pineapple nutrient and will affect the socioeconomic factors of local drying pineapple industry.

Prof. Mohamed Himdi

Professor of University, IETR, University of Rennes 1, France

«Technologies of Optically Transparent Antennas from VHF/UHF to the Millimeter-Wave Band»

**Summary** The development of wireless communications and the increase of radio applications, such as UMTS, Bluetooth, GPS and WLAN, in dense urban areas are environmental challenges requiring innovative technological solutions. To restrict the visual impact of the associated antenna networks and to improve their location in the city, an attractive possibility is to develop optically transparent antennas. In this field area of interests, thin-film materials deposited on see-through substrates provide innovative solutions.

Such transparent antennas are usually fabricated from transparent conducting oxide (TCO) films, such as indium tin oxide (ITO), fluorine tin oxide (FTO) or multilayers such as TCO/metal/TCO deposited on glass substrates. However, these solutions imply a limitation in sheet resistance  $R_s$  and/or optical transparency,  $T$  values. To circumvent these restrictions, we have developed an original approach: the fabrication of mesh metal films which exhibit very low sheet resistance value:  $R_s = 0.05 \text{ ohm/sq}$  (to restrict the ohmic loss) combined with high thickness:  $6 \mu\text{m}$  (to limit the skin depth effect) and high transparency:  $T = 80\%$  in the visible light spectrum. This novel solution provides the best radiating efficiency at microwave frequency. In this communication, we report on ITO films, ITO/metal/ITO multilayers and silver/titanium films deposited on Corning glass substrates by R.F. sputtering and the fabrication of the mesh metal structures. We investigate the microwave performance of various transparent antennas made from such materials with different levels of transparency and sheet resistance values. Each transparent antenna performance is compared with that of a reference counterpart made from a continuous (opaque) metal film.

Many passive and active antenna examples will be presented and discussed during the communication.

Prof. Rachid Yazami

Founding Director KVI PTE LTD., Singapore

«The Role of Lithium-Ion Batteries in the Future Energy Transition»

**Summary** The main objective of the energy transition is reducing the greenhouse gas (GHG) emission due to hydrocarbon material combustion used in transportation, industry and housings and buildings so as to reduce the effects of climate change, such as global warming. Accordingly, tremendous efforts have been deployed to transit from the combustible sources of energy to clean and sustainable sources such as solar, wind, waves, hydroelectricity and geothermal, among others. As a result, the cost of solar panels both thermal and photovoltaic together with the cost of wind turbines has been dramatically reduced making clean energy economically viable as compared to fossil based one.

A serious limitation of clean energy sources is their intermittency, i.e., day/night and clouds for solar and level of wind for the turbines. Electric power companies are entitled to provide enough power to their customers 24/7. This is one area where lithium-ion batteries will play a major role in power time shifting and power peak shaving. Besides stationary energy storage, the other major applications of LIB are in mobile electronics and in electric vehicles.

Our research activity is currently focused on improving LIB performances in terms of life, safety and fast charging and will be shown in this presentation.

Prof. Ivashko Evgeny

Russian Academy of Sciences, Moscow, Russia

«Modern IT and IoT Technologies in Innovative Solutions for Aquaculture»

**Summary** Aquaculture (or aquafarming) is the farming cultivating freshwater and saltwater populations of fish (crustaceans, mollusks, aquatic plants, algae and other organisms) under controlled conditions.

The global aquaculture industry is an important source of fish; it recently exceeded in production world's wild fish catch and continues to grow rapidly. Such growth is met by conservatism of business processes and outdated technologies of the most of producers, which hinders further development. Therefore, it is expected that aquaculture will soon become a major consumer of innovations and modern information technologies. A number of innovative technologies are developing with the Aquaculture 4.0 (similar to Industry 4.0) and "precision aquaculture" approaches. They relate to artificial intelligence, machine learning, neural networks, pattern recognition, machine vision, big data, cloud/edge/fog computing, etc; they aimed to address the internal challenges of aquaculture in the domains of risk management, labor productivity, scalability and production growth.

The report is devoted to the most striking approaches and promising innovative solutions based on the modern IT and (I)IoT in aquaculture.

Dr. Ahmed Boutejdar

German Research Foundation DFG, Braunschweig-Bonn, Germany

«Design of Very Compact Planar Filters Using a New Hi-Lo and DGS Techniques for Radar Applications»

**Summary** In this work, a novel miniaturized microstrip low-pass filter using a double Hi-Lo and cross-defected ground structure resonators is presented. The Hi-Lo resonator is placed on the top layer of the structure, while the two identical cross-DGS resonators are etched in the ground plane. Each DGS shape consists of two cross-heads, which are connected with a channel slot. Both DGS resonators are electromagnetically coupled. The proposed filter has been designed simulated, optimized, and manufactured. The filter topology is simulated using HFSS simulator and measured using Agilent Field Fox NA, N9918A VNA. Both results of the proposed LPF show a sharp roll-off ( $\xi$ ) of 84dB/GHz and exhibit a very low insertion loss in the pass band of 0.4 dB from DC to 0.9 GHz, and it achieves a wide rejection bandwidth with overall 20 dB attenuation from 1.2 GHz up to 3.2 GHz. The compact low-pass structure occupies an area of  $(0.37\lambda_g \times 0.37\lambda_g)$  where  $\lambda_g = 94$  mm is the waveguide length at the cut-off frequency 1 GHz. The carried-out results confirm the effectiveness of the proposed method.

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