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Electrical, Electronics and Communications Engineering

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Section Information:

The "Electrical, Electronics and Communications Engineering" section is open to receive high-quality papers on either experimental or theoretical aspects reporting state-of-the-art technology and recent advancements in the field of electrical engineering (electric machines and drives, monitoring, control, power quality, microgrids, renewable energies harvesting), electronics engineering (antennas and radio propagation, electromagnetic compatibility, microwaves, radars and sonar navigation), and communication engineering (connected vehicles, IoT, networking technologies, wireless networks). The section also welcomes rudimentary and challenging studies.

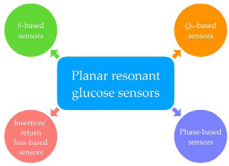
Section Electrical, Electronics and Communications Engineering

Featured Papers

DOI:10.3390/app11157018

Microwave Planar Resonant Solutions for Glucose Concentration Sensing: A Systematic Review

Authors: Carlos G. Juan, Benjamin Potelon, Cédric Quendo, Enrique Bronchalo

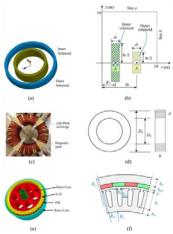


Abstract: The measurement of glucose concentration finds interesting potential applications in both industry and biomedical contexts. Among the proposed solutions, the use of microwave planar resonant sensors has led to remarkable scientific activity during the last years. These sensors rely on the changes in the dielectric properties of the medium due to variations in the glucose concentration. These devices show electrical responses dependent on the surrounding dielectric properties, and therefore the changes in their response can be related to variations in the glucose content. This work shows an up-to-date review of this sensing approach after more than one decade of research and development. The attempts involved are sorted by the sensing parameter, and the computation of a common relative sensitivity to glucose is proposed as general comparison tool. The manuscript also discusses the key points of each sensor category and the possible future lines and challenges of the sensing approach.

DOI:10.3390/app11041627

Machine Learning for Design Optimization of Electromagnetic Devices: Recent Developments and Future Directions

Authors: Yanbin Li, Gang Lei, Gerd Bramerdorfer, Sheng Peng, Xiaodong Sun, Jianguo Zhu

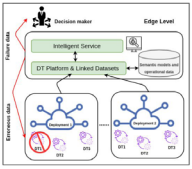


Abstract: This paper reviews the recent developments of design optimization methods for electromagnetic devices, with a focus on machine learning methods. First, the recent advances in multi-objective, multidisciplinary, multilevel, topology, fuzzy, and robust design optimization of electromagnetic devices are overviewed. Second, a review is presented to the performance prediction and design optimization of electromagnetic devices based on the machine learning algorithms, including artificial neural network, support vector machine, extreme learning machine, random forest, and deep learning. Last, to meet modern requirements of high manufacturing/production quality and lifetime reliability, several promising topics, including the application of cloud services and digital twin, are discussed as future directions for design optimization of electromagnetic devices.

DOI:10.3390/app11073186

Digital Twins Collaboration for Automatic Erratic Operational Data Detection in Industry 4.0

Authors: Radhya Sahal, Saeed H. Alsamhi, John G. Breslin, Kenneth N. Brown, Muhammad Intizar Ali

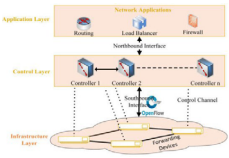


Abstract: Digital twin (DT) plays a pivotal role in the vision of Industry 4.0. The idea is that the real product and its virtual counterpart are twins that travel a parallel journey from design and development to production and service life. The intelligence that comes from DTs' operational data supports the interactions between the DTs to pave the way for the cyber-physical integration of smart manufacturing. This paper presents a conceptual framework for digital twins collaboration to provide an auto-detection of erratic operational data by utilizing operational data intelligence in the manufacturing systems. The proposed framework provide an interaction mechanism to understand the DT status, interact with other DTs, learn from each other DTs, and share common semantic knowledge. In addition, it can detect the anomalies and understand the overall picture and conditions of the operational environments. Furthermore, the proposed framework is described in the workflow model, which breaks down into four phases: information extraction, change detection, synchronization, and notification. A use case of Energy 4.0 fault diagnosis for wind turbines is described to present the use of the proposed framework and DTs collaboration to identify and diagnose the potential failure, e.g., malfunctioning nodes within the energy industry.

DOI:10.3390/app11156999

SDN-OpenFlow Topology Discovery: An Overview of Performance Issues

Authors: Raniyah Wazirali, Rami Ahmad, Suheib Alhiyari



Abstract: Software-defined networking (SDN) is an innovative architecture that separates the control plane from the data plane to simplify and speed up the management of large networks. This means the control logic has been moved from the network hardware level to the centralized control management level. Therefore, the use of the OpenFlow Discovery Protocol (OFDP) is one of the most common protocols used to discover the network topology in a data plane and then transmit it to the control plane for management. However, OFDP has various shortcomings in its performance such as exchanging too many messages between both levels (control and data), which in turn increases the load on the SDN-Controller. Additionally, since the application layer depends entirely on the network topologies plotted in the control plane, it is very important to obtain accurate network topology information from data plane. Therefore, after providing background on topology discovery protocols to the reader, we will concentrate on performance issues. The present study identifies and discuss the primary concerns involved in the complex query process, infrastructure, influencing factors, and challenges for the topology discovery process. Furthermore, this paper will present several recent studies that have overcome and enhanced these issues. In addition, open discussion and future work concerning these issues are also discussed.

DOI:10.3390/app11178117

From 5G to 6G Technology: Meets Energy, Internet-of-Things and Machine Learning: A Survey

Authors: Mohammed Najah Mahdi, Abdul Rahim Ahmad, Qais Saif Qassim, Hayder Natiq, Mohammed Ahmed Subhi, Moamin Mahmoud

Abstract: Due to the rapid development of the fifth-generation (5G) applications, and increased demand for even faster communication networks, we expected to witness the birth of a new 6G technology within the next ten years. Many references suggested that the 6G wireless network standard may arrive around 2030. Therefore, this paper presents a critical analysis of 5G wireless networks', significant technological limitations and reviews the anticipated challenges of the 6G communication networks. In this work, we have considered the applications of three of the highly demanding domains, namely: energy, Internet-of-Things (IoT) and machine learning. To this end, we present our vision on how the 6G communication networks should look like to support the applications of these domains. This work presents a thorough review of 370 papers on the application of energy, IoT and machine learning in 5G and 6G from three major libraries: Web of Science, ACM Digital Library, and IEEE Explore. The main contribution of this work is to provide a more comprehensive perspective, challenges, requirements, and context for potential work in the 6G communication standard.

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