Invitation to Submit

Communications and Protocols Used in Industrial Automation
Guest Editor: Carlo Olivieri
Deadline: 15 November 2023

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Guest Editors: Yuhang Ye, Nadia Kanwal, Brian Lee and Mohammad Samar Ansari
Deadline: 30 November 2023

The Hybrid AC-DC Power System Coordinated Control and Operation Technology
Guest Editors: Baohong Li, Zheren Zhang and Qin Jiang
Deadline: 31 December 2023

Advances in Power Converter Design, Control and Applications
Guest Editor: Pedro J. Villegas
Deadline: 15 January 2024

Advances in Power System Dynamics, Stability, Control and Dispatch with Large-Scale Renewable Energy Penetrated
Guest Editors: Gao Qiu, Youbo Liu, Mao Yang and Yuxiong Huang
Deadline: 31 January 2024

Advances in Design, Diagnosis, and Fault Tolerant Strategies for Electric Machines and Drives
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Selected Papers

DOI:10.3390/electronics11030412

Performance of 5G Trials for Industrial Automation

Authors: Junaid Ansari, Christian Andersson, Peter de Bruin, János Farkas, Leefke Grosjean, Joachim Sachs, Johan Torsner, Balázs Varga, Davit Harutyunyan, Niels König and Robert H. Schmitt

Abstract: Wireless- and 5G-enabled industrial automation is expected to include a plethora of different applications with a wide variety of requirements. In this article, evaluations are undertaken for the deployment of 5G in realistic industrial production environments with realistic deployment settings. Both deployments using commercial 5G systems and a 5G prototype system including pre-commercial and standard compliant URLLC functionality have been investigated. Systematic latency and reliability measurements were performed, over the air and in live networks, for different packet sizes, different devices, and networks with different capabilities (at different sites) to characterize the expected performance. The results indicate that today's 5G latency performance significantly depends on packet size, transmission direction (uplink or downlink), and network configuration as well as on the end device's design and capabilities. Our over-the-air measurements also empirically show that 5G technology and future networks have the capability of providing one-way latency of around 1 ms in both uplink and downlink for the various packet sizes tested. It is concluded that the requirements for very low latencies can be achieved with high reliability guarantees, as required in some of the most stringent industrial IoT applications.

DOI:10.3390/electronics11081251

A Risk Curtailment Strategy for Solar PV-Battery Integrated Competitive Power System

Authors: Arup Das, Subhojit Dawn, Sadhan Gope, Taha Selim Ustun

Abstract: Power system networks are becoming more complex and decentralized with the foreword of deregulation in the global power sector. In this scenario, an independent system operator (ISO) is responsible for determining the appropriate actions to deliver stable and quality power to the customers connected to the network at the lowest cost without violating the system security limits. Violations of any security limit may result in system risk. The unstable and non-reliable system always has some drawbacks and is not desirable from the consumer's point of view. A deregulated power market always keeps the consumer on the advantage side by giving stable, reliable, and less costly power. By using risk assessment tools, we identify the fault conditions and we try to minimize the risk by various uses of sequential programming methods. In this paper, a novel power system risk analysis and congestion management approach are introduced with considering meta-heuristic algorithms i.e., Slime Mould Algorithm (SMA) and Artificial Bee Colony Algorithm (ABC) in renewable energy integrated electricity market. The proposed power system risk analysis is constructed with the help of two risk valuation tools named Conditional-Value-at-risk (CVaR) and Value-at-risk (VaR). The higher negative value of VaR and CVaR represents the higher risk system and lower negative value or towards a positive value of VaR and CVaR denotes the less risk or stable system. The projected method has been experienced on the IEEE 14-bus test system and IEEE 30-bus test system to examine the usefulness of the meta-heuristic algorithm in system risk analysis under the deregulated environment. The importance of renewable energy integration in system risk curtailment has also been depicted in this work: basically, to measure the system's risk, hence enhancing the system's reliability and societal welfare. As a result, it will benefit both supply and demand-side participants.

DOI:10.3390/electronics11071125

A Systematic Guide for Predicting Remaining Useful Life with Machine Learning

Authors: Tarek Berghout and Mohamed Benbouzid

Abstract: Prognosis and health management (PHM) are mandatory tasks for real-time monitoring of damage propagation and aging of operating systems during working conditions. More definitely, PHM simplifies conditional maintenance planning by assessing the actual state of health (SoH) through the level of aging indicators. In fact, an accurate estimate of SoH helps determine remaining useful life (RUL), which is the period between the present and the end of a system's useful life. Traditional residue-based modeling approaches that rely on the interpretation of appropriate physical laws to simulate operating behaviors fail as the complexity of systems increases. Therefore, machine learning (ML) becomes an unquestionable alternative that employs the behavior of historical data to mimic a large number of SoHs under varying working conditions. In this context, the objective of this paper is twofold. First, to provide an overview of recent developments of RUL prediction while reviewing recent ML tools used for RUL prediction in different critical systems. Second, and more importantly, to ensure that the RUL prediction process from data acquisition to model building and evaluation is straightforward. This paper also provides step-by-step guidelines to help determine the appropriate solution for any specific type of driven data. This guide is followed by a classification of different types of ML tools to cover all the discussed cases. Ultimately, this review-based study uses these guidelines to determine learning model limitations, reconstruction challenges, and future prospects.

DOI:10.3390/electronics11081268

Evaluation of Production of Digital Twins Based on Blockchain Technology

Authors: Nada A. Nabeeh, Mohamed Abdel-Basset, Abduallah Gamal and Victor Chang

Abstract: A blockchain, as a form of distributed ledger technology, represents the unanimity of replication, synchronization, and sharing of data among various geographical sites. Blockchains have demonstrated impressive and effective applications throughout many aspects of the business. Blockchain technology can lead to the advent of the construction of Digital Twins (DTs). DTs involve the real representation of physical devices digitally as a virtual representation of both elements and dynamics prior to the building and deployment of actual devices. DT products can be built using blockchain-based technology in order to achieve sustainability. The technology of DT is one of the emerging novel technologies of Industry 4.0, along with artificial intelligence (AI) and the Internet of Things (IoT). Therefore, the present study adopts intelligent decision-making techniques to conduct a biased analysis of the drivers, barriers, and risks involved in applying blockchain technologies to the sustainable production of DTs. The proposed model illustrates the use of neutrosophic theory to handle the uncertain conditions of real-life situations and the indeterminate cases evolved in decision-makers' judgments and perspectives. In addition, the model applies the analysis of Multi-criteria Decision Making (MCDM) methods through the use of ordered weighted averaging (OWA) and the Technique of Order Preference Similarity to the Ideal Solution (TOPSIS) to achieve optimal rankings for DT production providers based on consistent weighted decision-maker's judgments in order to maintain and to assure sustainability. An empirical study is applied to the uncertain environment to aid decision-makers in achieving ideal decisions for DT providers with respect to various DT challenges, promoting sustainability and determining the best service providers. The Monte Carlo simulation method is used to illustrate, predict, and forecast the importance of the weights of decision-makers' judgments as well as the direct impact on the sustainability of DT production.