SCHOLARLY PUBLICATIONS
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Journal Name: IEEE Journal of Emerging and Selected Topics in Power Electronics **IF: 4.9**

Title: Investigation of an Extendable Multisource Switched-Capacitor Multilevel Inverter with Reduced Device Count

Author: Roy T.; Nandi S.; Patel R.; Misra B.; Nayak B.

Details: Volume 13, Issue 3, June 2025

Abstract: The article introduces a novel 17-level switched-capacitor multilevel inverter (SCMLI) that eliminates the need for an H-bridge circuit while significantly reducing the number of components involved. This innovative structure relies on two symmetric non-isolated sources and a capacitor leg (CL) composed of four capacitors arranged in series. Furthermore, an extended version of this 17-level structure has been devised, allowing for the incorporation of varying numbers of sources and capacitors. Notably, this extended configuration achieves the same number of output voltage levels as comparable structures but with a reduced requirement for switches, drivers, capacitors, and sources. In addition, the proposed structure requires to conduct only two semiconductor devices to charge capacitors directly from dc sources, enhancing capacitor voltage profiles. Also, by conducting just three switches to achieve the highest voltage level, it reduces parasitic voltage drops and increases the boosting factor. To incorporate modularity and enable the generation of higher output voltage levels, the article explores a cascaded configuration of the proposed extended SCMLI. This configuration is analyzed for both symmetric and asymmetric dc source arrangements. The article provides comprehensive insights into the construction of the circuit, its operating principles, voltage stress analysis, the procedure for selecting capacitors, inrush current analysis, and detailed power losses analysis for the proposed inverter. Finally, the performance of the proposed 17-level SCMLI is validated through experimentation on a laboratory prototype, demonstrating its efficacy under various load conditions. The proposed inverter achieves 94.4% efficiency at an output power of 213 W, with a total harmonic distortion (THD) of 6.21% in the output voltage.

URL: https://ieeexplore.ieee.org/document/10818462

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Journal Name: Energy Report **IF: 4.7**

Title: An exclusive survey on robust controllers and novel optimization techniques for AGC of power system

Author: Sahu P.C.; Mohapatra S.; Bhatta S.K.; Tejani G.G.; Mousavirad S.J.

Details: Volume 13, June 2025

Abstract: This review paper addresses several robust controllers and optimization procedures for developing automatic generation control (AGC) in an electrical supply system under various electrical disturbances. Since, the electrical power system is completely dynamic and non-linear in nature, frequent control over power generation is required as per the new scheduled demand. The action that promptly oversees the electricity generation as per the new scheduled demand is referred as AGC. The AGC action mostly relies over several robust controllers for creating secondary control loop in the system. These controllers sense the error signals of the power system effectively and takes remedial immediately to assure stability in the system. The error signals are the deviation in network frequency (ΔF) and diversion in inter-area power (ΔP_{tie}), which mutually referred as the area control error (ACE). The mismatch between net electricity generation and active gross loading is the main cause of the ACE in power system. The several control schemes like, conventional PID, Fraction value ordered PID (FO-PID), Fuzzy-PID, Fuzzy- TID, Fuzzy ruled sliding mode control (F-SMC) strategy, Type-II Fuzzy controllers etc. are demonstrated to improve AGC of the power system. The proposed controllers offer improved efficiency at their optimum state. So, optimization techniques need to be incorporated in the AGC scenario to optimal design several proposed controllers. Finally, this review article has synthesized few simulation-based case studies to validate the efficacy of the proposed controller and suggested optimization techniques. Robustness of the proposed controllers are also examined through several sensitivity studies.

URL: https://www.sciencedirect.com/science/article/pii/S2352484725001581?via%3Dihub

SCHOLARLY PUBLICATIONS
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Journal Name: Scientific Reports **IF: 3.8**

Title: A novel TID + IDN controller tuned with coatis optimization algorithm under deregulated hybrid power system

Author: Dei G.; Gupta D.K.; Sahu B.K.; Bajaj M.; Blazek V.; Prokop L.

Details: Volume 15, Issue 1, December, 2025

Abstract: Implementing a suitable load frequency controller to maintain the power balance equation for a multi-area system with many power generating units poses a challenge to a power system engineer. Incorporation of renewable energy sources along with non-renewable units is another challenge while maintaining the stability of the system. Hence a robust intelligent controller is an essential requirement to achieve the objective of automatic load frequency control. This article introduces a novel and efficient controller designed for a three-control area within a deregulated multi-source energy system. The three areas include diverse power generation sources: Area 1 integrates thermal units, hydro units, and solar thermal power plants. In Area 2, there is a combination of distributed solar technology (DST) with thermal and hydro units. Area 3 incorporates a geothermal power plant alongside thermal and hydro unit. The proposed controller is a parallel combination of the tilted integral derivative controller (TID) and the integral derivative with a first-order filter effect (IDN). The controller's parameters are optimized using an advanced Coatis Optimization Algorithm (COA). High effective efficiency and absence of control parameters are the key advantages of Coatis Optimization Algorithm. In summary, this paper presents an innovative TID + IDN controller optimized using a novel Coatis Optimization Algorithm within a three-area hybrid system operating in a deregulated context. Considering the poolco transaction and implementing the COA optimized TID + IDN controller with an error margin of 0.02%, the value of the objective function, ITAE for the transient responses is 0.1233. This value is less than the value obtained in other controllers optimized with different optimization techniques. In case of poolco transaction, the settling time of deviation of frequency in area-1, deviation of frequency in area-2, and deviation of frequency in area-3 are 8.129, 3.72, and 2.254 respectively. As compared to other controllers, the transient parameters are better in case of this proposed controller.

URL: https://www.nature.com/articles/s41598-025-89237-0

SCHOLARLY PUBLICATIONS
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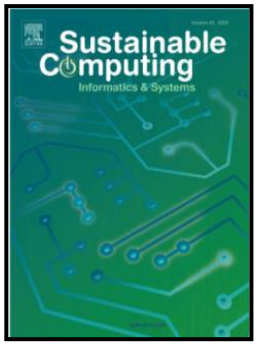
Journal Name: Sustainable Computing: Informatics and Systems **IF: 3.8**

Title: Simulation and real-time implementation of a combined control strategy-based shunt active power filter in microgrid

Author: Barik P.K.; Shankar G.; Sahoo P.K.; Samal S.

Details: Volume 46, June, 2025

Abstract: Renewable energy is rapidly being employed in power networks to meet energy demands, changing the traditional power distribution system into a microgrid (MG)-based system. Additionally, nonlinear loads in the MG system have a tendency to produce undesirable power quality (PQ) problems that need to be properly addressed. In the present work, the MG system is designed using solar PV, wind energy, and fuel cell-based distributed generations, and the PQ concerns of the MG system are addressed in the presence of a combined control technique-based shunt active power filter (SAPF). The combined control technique used for the generation of compensating current of SAPF consists of a negative feedback phase locked loop (NFPLL) based modified synchronous reference frame (MSRF) technique for improving the synchronization performance of SAPF, fuzzy inverted error deviation (FIED) based dc-link voltage controller and adaptive fuzzy hysteresis current controller (AFHCC) based switching pulse generation. The conventional MSRF method, HCC methodology, and fuzzy logic controller (FLC) approach are used by the majority of SAPFs to generate the compensating current for SAPF, but these methods do not completely eliminate harmonics. Hence, in this work, a FIED based control approach is used to improve the performance of SAPF by controlling the V_{DC}under load changing condition. Apart from FIED technique, NFPLL based MSRF technique is used for quickly and accurately extracts the reference signal during load perturbations and AFHCC scheme is used for switching pulse generation. The suggested combined control strategy (NFPLL-MSRF-FIED-AFHCC) is first evaluated on the MATLAB/Simulink environment and then validated on the OPAL-RT 4510 real-time digital simulator platform. The simulation and real-time outcomes show that the proposed technique works effectively in different scenarios.



URL: https://www.sciencedirect.com/science/article/pii/S221053792500023X?via%3Dihub

SCHOLARLY PUBLICATIONS
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Journal Name: IEEE Access **IF: 3.6**

Title: An Improved IoT Based Hybrid Predictive Load Forecasting Model for a Greenhouse Integrated With Demand Side Management

Author: Biswal S.R.; Choudhury T.R.; Panda B.; Mishra S.

Details: Volume 13, June 2025

Abstract: Greenhouse farming enhances agricultural productivity but remains highly energy-intensive, requiring advanced energy management strategies to ensure sustainability. Traditional load forecasting and demand-side management (DSM) methods often fall short in adapting to the dynamic and highly variable environmental conditions within greenhouses. This study hypothesizes that combining hybrid machine learning models with IoT-based DSM can optimize energy consumption while maintaining critical microclimatic conditions for crop growth. A hybrid predictive model integrating Extreme Gradient Boosting (XGBoost) for static feature learning and Long Short-Term Memory (LSTM) for sequential pattern recognition is proposed, coupled with a priority-based DSM framework deployed on a Raspberry Pi IoT platform. The model was trained and tested using one year of real-world greenhouse data, achieving a Mean Absolute Percentage Error (MAPE) of 5.3%, reducing grid energy dependency by 7.1%, and lowering the average electricity cost by 17.3%. These results demonstrate that the proposed system offers a scalable, economically viable, and sustainable solution for intelligent energy management in greenhouse environments, significantly advancing the integration of AI and DSM technologies in controlled agriculture. Furthermore, this work contributes directly to Sustainable Development Goals (SDGs) 2, 7, and 12 by promoting food security, increasing renewable energy utilization, and enhancing responsible resource consumption in greenhouse farming.

URL: https://ieeexplore.ieee.org/document/11036172

SCHOLARLY PUBLICATIONS
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Journal Name: IEEE Access **IF: 3.6**

Title: Smart Power Systems Transformation: Advanced Fault Detection with Edge Computing and Signal Processing in LV Networks with EV Charging Stations

Author: Chakraborty P.; Sinha P.; Debdas S.; Paul K.; Saiprakash C.; Manoj V.; Ustun T.S.; Onen A.

Details: Volume 13, July 2025

Abstract: This research presents a novel framework for improving fault detection and grid resilience in modern power systems by leveraging edge computing, optimized infrastructure placement, and advanced signal processing. At the core of the approach is an innovative time-frequency analysis method that enhances fault discrimination, even in noisy environments. By strategically positioning smart meters and Electric Vehicle (EV) charging stations, the framework improves fault detection efficiency and overall system reliability. The Adaptive SBCT index dynamically fine-tunes fault identification, ensuring a more responsive power grid. Additionally, Kernel Principal Component Analysis (KPCA) streamlines data processing without compromising critical information, enhancing real-time performance. Extensive simulations and case studies validate the framework's effectiveness across diverse low-voltage networks, demonstrating its potential to minimize power outages, reduce maintenance costs, and strengthen grid reliability. Future directions include large-scale real-world deployment and integration with renewable energy sources to further enhance system sustainability and scalability.

URL: https://ieeexplore.ieee.org/document/11071546

SCHOLARLY PUBLICATIONS
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Journal Name: IEEE Access **IF: 3.4**

Title: Cyber-Resilient Detection of Power Quality Events With NSCT and PCA-SVM

Author: Chatterjee S.; Sinha P.; Gatla R.K.; Kumar D.G.; Rao D.S.N.M.; Paul K.; Ustun T.S.; Onen A.

Details: Volume: 13, Article, 2025

Abstract: The increasing reliance on smart grids, coupled with the integration of renewable energy and growing cyber-physical interactions, has heightened the vulnerability of power systems to both power quality (PQ) disturbances and cyber-attacks. This paper presents an innovative detection framework that combines Nonsubsampled Contourlet Transform (NSCT) with Principal Component Analysis (PCA) and Support Vector Machine (SVM) classification to accurately detect and classify PQ disturbances under the influence of cyber threats, such as False Data Injection (FDI) and Denial of Service (DoS) attacks. The proposed methodology leverages NSCT's multiscale decomposition capabilities to extract fine-grained signal features, while PCA optimizes feature selection for enhanced computational efficiency. Comprehensive experiments conducted on synthetic and real-world datasets validate the framework's effectiveness, demonstrating superior detection accuracy, robustness to noise, and resilience against cyber-attacks. The proposed NSCT-PCA- SVM approach represents a significant step forward in ensuring secure and reliable smart grid operations.

URL: https://ieeexplore.ieee.org/document/10971426