SCHOLARLY PUBLICATIONS
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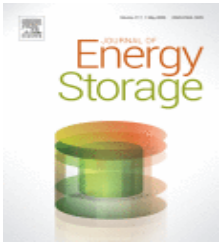
Journal Name: Journal of Energy Storage **IF: 8.9**

Title: Multi-criteria based multi-stage planning and management of home energy system considering V2H, H2G, H2 storage and degradation factor

Author: Sannigrahi S.; Ghatak S.R.; Acharjee P.

Details: Volume 117, May 2025

Abstract: Due to expanding electric vehicle (EV) penetration, urbanization, and population expansion, energy consumption in the residential sector has been steadily increasing, which has compelled Indian homes to adopt in-house renewable power generation. In this regard, proper design and management are of utmost importance for the optimum benefit of the homeowner. Accordingly, this study concentrates on the planning and operation of home energy system (HES) considering renewable sources, bi-directional EV, and Hydrogen (H_2) storage facilities to maximize the potential benefits for homeowner. A multi-stage planning model is adopted to enable homeowner to make gradual investments, resulting in cost-effective planning solutions. Moreover, practical aspects, like component degradation, time-varying energy costs, and home-to-grid capabilities, are considered to investigate their impact on HES operation. Besides, a unique approach based on the K-means clustering technique is adopted to explicitly characterize system uncertainties. Finally, a complete analysis of the techno-eco-environmental implications of HES is presented, which will undoubtedly encourage and assist Indian households to embrace HES in the near future.



URL: https://www.sciencedirect.com/science/article/pii/S2352152X25008217?via%3Dihub

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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

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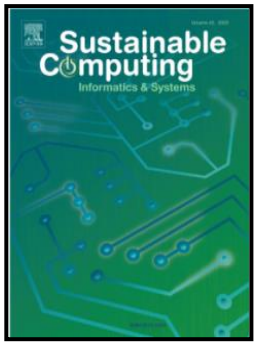
Journal Name: Sustainable Computing: Informatics and Systems **IF: 3.8**

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.



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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