SCHOLARLY PUBLICATIONS
School of Electrical Engineering
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Journal Name: Scientific Reports **IF: 3.9**

Title: Resilient math inspired EDA optimized fuzzy adaptive exponent controller for LFC improvement of an EV integrated microgrid

Author: Sahu P.C.; Sahoo B.; Swain S.C.; Tejani G.G.; Bassir D.

Details: Volume 15, Issue1, August 2025

Abstract: This study aims to stabilize the frequency of an electric vehicle-integrated AC microgrid in different electrical uncertainties. The recommended microgrid is built by incorporating different distributed generation (DG) oriented power plants. The DG system includes a wind power plant, solar PV plant, diesel generator, fuel cell and geothermal plant. The microgrid frequency goes on oscillating under the action of few uncertainties like dynamics in applied load, fluctuation in wind power and variability in solar power intensity. Further, the charging of electric vehicles extremely disturbs the grid frequency and causes frequency instability issues in the microgrid. The Fuzzy PI-D^{Æ} parameters are selected in optimum by incorporating an advanced Math inspired-Exponential distribution algorithm (Mi-EDA) in different operations. The potential of the optimal Fuzzy PI-D^{Æ} controller is compared with fractional ordered fuzzy PID (FO-FPID), Fuzzy PID and PID controllers in concern to the microgrid's frequency stabilization. The research findings conclude that, the anticipated Fuzzy PI-D^{Æ} approach promptly advances the settling time of frequency by 72.72% and 136.32% and 345.46% to that of FO-FPID, Fuzzy PID and PID controllers respectively. The optimal property of the recommended Mi-EDA technique is compared with the typical sine cosine algorithm (SCA), GA and PSO techniques for validating the potential of the technique.

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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.

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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