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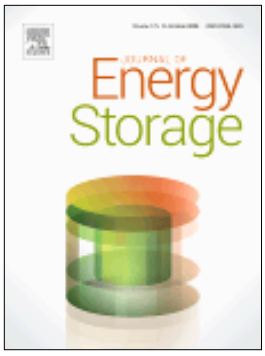
**Journal Name: Journal of Energy Storage** **IF: 10.7**

**Title:** Optimal bio-inspired fuzzy adaptive control strategy for frequency and power control of a battery-integrated AC microgrid

**Author**: Das M.C.; Swain S.C.; Sahu P.C.; Bhatta S.K.; Bassir D.; Tejani G.

**Details:** Volume-179, November 2026

**Abstract:** This research manuscript presents a resilient fuzzy adaptive exponent control (FAEC) strategy for managing power distribution among distributed generation (DG) units in an islanded AC microgrid under various loading conditions. The microgrid is basically a hybrid type and incorporates several DGs like wind generator, solar PV system, diesel generator, micro-turbine, thermo-electric system and fuel-cell for the generation of desired electricity. The energy storage systems, such as battery systems and super capacitors, are also integrated with the microgrid system. Since the microgrid incorporates several inertia-less DGs, the system may face huge frequency instability issues under load dynamics. Further, the intrinsic nature of wind fluctuation and solar intensity deviation creates power generation issues in the microgrid system, especially in islanding operations. The typical islanding mode of operation needs more attention in dynamic load scenarios. In different load dynamic situations, the output power management of each individual DG is important for the reliable operation of the microgrid. As per the new load demand, the individual DG unit cordially takes up the additional demand without fluctuating the system frequency. This needs an effective secondary control mechanism to sort out the additional load demand smoothly. In this regard, the study has recommended a fuzzy adaptive exponent controller for energy management of the microgrid system. The controller offers it's best effort at the optimal parametric situation. In optimal design concern, the study has anticipated a novel Botox optimization algorithm (BOA) for tuning the gains of the FAEC controller. To justify novelty, the optimal performance of the FAEC controller is compared with basic fuzzy PID and PID controllers. The recommended FAEC approach is able to stabilize the zone1 power (ΔPZ1) faster through 105.24% and > 500% as compared to the fuzzy-PID controller and the conventional PID controller respectively. Further, the optimization and supremacy behaviour of the anticipated BOA approach is evaluated statistically, over gradient search algorithm (GSA), standard SCA and PSO algorithms.




**URL:** https://www.sciencedirect.com/science/article/pii/S2352152X2603344X?via%3Dihub

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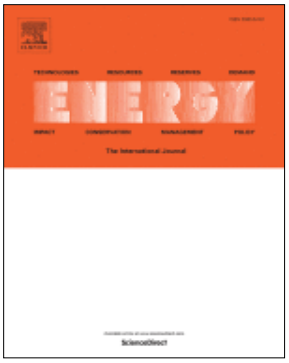
**Journal Name: Energy** **IF: 10.1**

**Title:** A preference-aware reinforcement learning framework for cost-effective and comfort-driven coordinated building energy management

**Author**: Wang J.; Bai W.; Mishra D.K.; Ganivada P.; Lipu M.S.H.; Muttaqi K.; Sutanto D.; Ma Z.

**Details:** Volume-363, 30th October, 2026

**Abstract:** Building energy consumption accounts for up to 40% of global energy use, contributing substantially to greenhouse gas emissions. Although demand-side management (DSM) and intelligent control systems have been extensively studied for residential buildings, smart buildings still face critical challenges due to their complex energy consumption profiles and lack of flexible, multi-energy management frameworks. This paper presents a novel multi-objective coordinated energy management system (EMS) that integrates a preference-aware reinforcement-learning framework to balance energy cost and indoor thermal comfort by dynamically coordinating multiple building systems, including heating, ventilation, and air conditioning (HVAC), energy storage systems (ESS), and hydrogen storage tanks (HST). To support day-ahead operation under uncertain renewable generation, the proposed EMS incorporates an AI-based extreme learning machine (ELM) model enhanced by a historical data correlation evaluation (HDCE) method, which improves the accuracy of short-term photovoltaic (PV) generation predictions. Simulation results show that the proposed framework can achieve approximately 13.4% energy cost reduction while maintaining nearly negligible user discomfort. In addition, the integrated PV forecasting module achieves a prediction error of 3.33%, which provides reliable renewable input for the coordinated EMS.




**URL:** https://www.sciencedirect.com/science/article/pii/S0360544226023510?via%3Dihub

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**Journal Name: Energy Reports** **IF: 6.6**

**Title:** A data-driven Kalman filter-integrated deep learning framework for optimized fault detection in lithium-ion batteries

**Author**: Chatterjee S.; Deka B.; Debdas S.; Debdas S.; Kumar P.

**Details:** Volume-16, December 2026

**Abstract:** Electric vehicles (EVs) and energy storage systems are prone to critical safety hazards associated with lithium-ion battery failures. The current fault detection tools have a fundamental trade-off: Model-based approaches cannot support aging-dependent dynamics, whereas deep learning methods generate too many false alarms and cannot estimate uncertainty of the predictions. To overcome these shortcomings, this paper proposes a novel hybrid framework integrating Adaptive Data-Driven Kalman Filtering (ADKF) with Transformer-based deep learning. The key innovation is a two-way, continuous feedback loop between the filter and the network. This is different from the earlier hybrid methods where the filter and the network work side by side without sharing the information, or the filter was used to prepare the network data in one direction only. The proposed transformer model learns adaptive state-space models from operational data, continuously refining the ADKF's predictions, while the ADKF simultaneously feeds its innovation sequence back to the transformer, providing optimal Bayesian filtering that reduces noise-induced false positives and quantifies prediction uncertainty, which is the principal shortcoming of transformer-only models. This two-way feedback loop is what allows the proposed transformer-based deep learning model to learn state-transition and observation mappings directly from data, supplying the Kalman filter with accurate, adaptive process models that evolve with battery aging rather than requiring manual re-tuning. When transformers detect faults, they can automatically adjust Kalman filter parameters, maintaining estimation accuracy during both normal and faulty operations. The proposed framework addresses five critical fault categories: two SOC-related anomaly types (drift, imbalance), SOH degradation (capacitor degradation), temperature faults (thermal anomalies), coupled multi-parameter faults, and sensor integrity issues.




**URL:** https://www.sciencedirect.com/science/article/pii/S2352484726006529?via%3Dihub

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**Journal Name: Scientific Reports** **IF: 4.9**

**Title:** Electro-thermal benchmarking of low-order lithium-ion battery equivalent circuit models under constant-current and dynamic loading

**Author**: Mishra S.; Swain S.C.; Mayaluri Z.L.; Sahoo P.K.; Samantaray A.K.

**Details:** Volume16, Issue-1, December 2026

**Abstract:** Low-order equivalent circuit models (ECMs) are widely used in battery management systems (BMSs) because they balance accuracy with computational efficiency. Here we present a harmonised electro–thermal benchmark to evaluate voltage accuracy, heat-generation consistency, and temperature prediction under both constant-current and dynamic loading conditions. Three low-order model structures are assessed: the internal-resistance (Rint) model, the first-order Thevenin (1RC) model, and a compact hybrid electro–thermal 1RC model that incorporates bounded electrical adaptation and a two-node thermal network. Model parameters are identified using standard open-circuit-voltage and pulse-based experiments, while thermal parameters are obtained independently from heating–cooling tests and held fixed during validation. Performance is evaluated using commercial 18650 lithium-ion cells across ambient temperatures of 0C,25C and 40C under both laboratory and drive-cycle-inspired load profiles. The results show that increasing electrical model fidelity substantially improves voltage tracking under dynamic conditions and leads to more consistent heat-generation pathways when coupled to a fixed thermal model. Under the strict hold-out profile inspired by the Worldwide Harmonized Light Vehicles Test Cycle (WLTC) at 25C, the hybrid electro–thermal 1RC model delivers a voltage root mean square error (RMSE) of mV, a surface-temperature RMSE of C, and a heat-generation consistency mismatch of (mean ± SD across cells). These results provide quantitative guidance for selecting compact electro–thermal battery models for real-time applications under dynamic operation.

**URL:** https://www.nature.com/articles/s41598-026-44025-2

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**Journal Name: Scientific Reports** **IF: 4.9**

**Title:** Adaptive long short term memory-PI based control for load frequency regulation in electric vehicle integrated two area power systems

**Author**: Das S.K.; Swain S.C.; Nayak B.; Dash R.; Osumanu F.; Mohapatra B.; Al Bustanji S.; Rubanenko O.

**Details:** Volume-16, Issue-1, December 2026

**Abstract:** The growing penetration of electric vehicles (EVs) and renewable energy sources has introduced significant nonlinear and stochastic disturbances in modern power systems, posing major challenges to conventional load frequency control (LFC) strategies. To address these issues, a Long Short-Term Memory-based Proportional Integral (LSTM-PI) controller is proposed to enable adaptive frequency regulation in a two-area EV-integrated system. The LSTM network dynamically tunes the proportional and integral gains in response to temporal variations in frequency and tie-line states. The learning module is trained using an Integral of Time weighted Absolute Error (ITAE) objective. Practical non-linearities such as governor deadband, generation-rate constraints, valve saturation, and EV state-of-charge limits are incorporated into both the training dataset and the online control evaluation. A constrained Model Predictive Control (CMPC-PI) is developed as a modern benchmark to compare the proposed technique under identical sampling rates and actuator limits. The proposed method shows better performance under dynamic conditions. Statistical performance analysis has been carried out through 30 runs of Monte Carlo analysis with a mean of 95% confidence intervals. Stability analysis under time-varying gains is supported by a bounded-gain Lyapunov Framework and a delay-margin analysis that addresses sensing and actuation delays. The result analysis confirms that the LSTM-PI controller provides a scalable intelligent solution for modern EV-integrated smart grid frequency regulation. The proposed intelligent adaptive controller provides a scalable, low-complexity, and stability-assured solution for robust load-frequency regulation in nonlinear, EV-integrated smart power grids.

**URL:** https://www.nature.com/articles/s41598-026-49840-1

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**Journal Name: Journal of Engineering Research (Kuwait)** **IF: 4.0**

**Title:** Frequency stabilization of deregulated hybrid power systems using improved firefly optimized controller and FACTS device

**Author**: Samal M.; Panigrahi C.K.; Gupta D.K.; Mohapatra B.K.; Parija B.; Pati R.K.

**Details:** 29th September, 2026

**Abstract:** This paper focuses on the Load Frequency Control (LFC) of hybrid power systems integrated with wind power plants in a deregulated environment. To boost system performance, an Improved Firefly Algorithm (IFA)-based cascaded FOPID-FI controller has been presented. Improved Firefly Algorithm (IFA) was designed for multi-source hybrid power systems in a deregulated regime. The proposed IFA combines Firefly Algorithm and Particle Swarm Optimization to enhance controller tuning. Its robustness is validated under poolco and bilateral transactions, random load disturbances, parameter variations, and FACTS-assisted renewable energy integration. MATLAB/SIMULINK was used to test the proposed controller's efficiency with GENCOs and DISCOs under poolco and bilateral power transactions. Using FACTS Controller, the present work regulates frequency in a deregulated power system with RES. The effectiveness of the proposed technique is analyzed using random step load changes and parametric variations.




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