

Elham N Bifari, Laila M Nhari, Reda M El-Shishtawy, Abdullah M Asiri, Kenan Ozel, Abdullah Atilgan, **Abdullah Yildiz**
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Phenothiazine–imidazole-based dye containing furan π -linker for dye-sensitized solar cells

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ABSTRACT

In this research, a new organic dye, referred to as 6b, is developed by integrating phenothiazine and triphenylimidazole as dual donor components, along with a furan-based π -linker and a cyanoacrylic acid acceptor. This D-D- π -A configuration is designed to enhance light absorption, charge transfer, and anchoring on TiO₂ surfaces for effective dye-sensitized solar cell (DSSC) applications. The produced dye demonstrates a wide visible absorption range (220–570 nm), a high molar extinction coefficient ($\epsilon = 18,060 \text{ M}^{-1} \text{ cm}^{-1}$ at 468 nm), and well-aligned HOMO/LUMO levels that facilitate photoinduced charge separation. DSSCs constructed with three distinct electrolyte systems are evaluated. The device utilizing the MPN + BM-Gu electrolyte achieves the highest power conversion efficiency (PCE) of 7.44%, mainly due to improved dye regeneration and ionic mobility. Studies using electrochemical impedance spectroscopy (EIS) and carrier dynamics indicate favorable interfacial characteristics and effective charge transport. These findings affirm the potential of dye 6b as a promising sensitizer for high-performance DSSCs.

Zakaria Benlalia, Toufik Mzili, Mustapha Hankar, Mourad Mzili, Nebojsa Bacanin, Momina Shaheen, *Musaria Karim Mahmood* Most Cited AI Research (2024-2025): A Cross-Sector Review



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Research Article

Enhancing Wireless Sensor Network Lifetime through Fuzzy-Based Execution of the LEACH Protocol

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ABSTRACT

Introduction Wireless Sensor Networks Wireless Sensor Networks (WSNs) consist of a number of physically disperse sensor nodes which use wireless communication to do sensing and retrieving information from the physical world. In a network of battery driven and energy limited nodes, the network lifetime is an important concern. Driven by the above mechanism, as a cluster of nodes is frustrated, the function of the entire network drops dramatically or even becomes inefficient. Low-Energy Adaptive Clustering Hierarchy (LEACH) LEACH is one of the most well-known energy-efficient clustering protocols for making wireless sensor networks more sustainable by grouping nodes and moderating the group head. However, in LEACH protocol, the operation of cluster head is selected randomly, which might lead to the waste of energy in the node. Here, this paper proposes an enhanced LEACH that integrates fuzzy logic-based decision-making with cluster head selection. The fuzzy-centric LEACH versions improve significantly in terms of energy consumption and network lifetime through the involvement of some parameters such as residual energy, distance to BS, and the density of sensor nodes. Simulation results confirms that the proposed fuzzy implementation of LEACH outperforms the existing classical variant and gives a feasible solution for WSN deployment environment.

Mehmet Zahid Erel

Fuel-cell electric vehicle integrated shunt active power filter with advanced control algorithm for energy management and harmonic suppression



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Fuel-cell electric vehicle integrated shunt active power filter with advanced control algorithm for energy management and harmonic suppression

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ABSTRACT

Fuel Cell Electric Vehicles (FCEVs) offer high energy density, zero emissions, and fast refueling, making them ideal for sustainable transport. However, power converters and charging stations introduce nonlinear currents that distort waveforms and reduce power quality (PQ). Shunt Active Power Filters (SAPFs) have emerged as effective solutions to these challenges. This study presents a sliding mode control (SMC) strategy with phase-decoupled Kalman filtering for improved harmonic suppression, power factor correction, and DC-link voltage regulation under varying load and grid conditions. The Kalman filter, based on a simplified converter model, enhances noise immunity and enables independent SMCs with fixed switching frequency. A saturation-based SMC is used for robust DC-link voltage control. The proposed control reduces grid current THD to 1.53 % under 10 % voltage sag and maintains 4.23 % under distorted grid conditions, complying with IEEE-519 standards. Power factor improves to near unity (0.989–1). DC-link voltage ripple is limited to $\Delta V = 2$ V, with fast response time under 50 ms and minimal overshoot. Additionally, the SAPF supports 3 kW of active power, easing the grid burden. Simulations confirm the strategy's effectiveness in improving FCEV performance, addressing power quality and efficiency issues.