



Improved Power Quality with Active Shunt Power Filter Based on Optimized PI Controller and Flying Squirrel Search MPPT Technique Applied to the WECS

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Abstract: This paper aims to improve power quality issues following the IEEE 519 power quality standard recommendations. Indeed, the existing electrical distribution system employs highly nonlinear loads, which raises concerns about the quality of electrical energy. To solve these problems, an optimized PI controller and a bio-inspired MPPT controller are applied to a Wind Energy Conversion System (WECS) integrated with a Shunt Active Power Filter (SAPF). The MPPT controller is used for extracting maximum power from the WECS using the Flying Squirrel Search (FSS) algorithm. In order to overcome the problem of the dynamic performance of DC Link voltage that occurs when using the traditional PI control, an adaptive PI controller using the Sliding Mode Extremum-Seeking (SMES) algorithm is adopted. The SMES algorithm is utilized here to reduce a selected cost function that brings the required performance aspects. The dynamic performance of the SAPF is optimized using the direct power control technique. Simulation results are provided to confirm the effectiveness of the proposed controllers. They clearly demonstrate that the applied control algorithms are effective in eliminating harmonic currents and injecting the available active power of the wind turbine into the load and power grid.

Keywords: *SAPF; THD; WECS; MPPT controller; FSS algorithm; adaptive PI controller; SMES technique.*

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