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Design Approach for a Power System Stabilizer (PSS) and for Power Quality Utilizing An Adaptive-Neuro Fuzzy Logic

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Abstract: It proposes a novel design approach for a Power System Stabilizer (PSS) utilizing an Adaptive-Neuro Fuzzy Logic (ANFL) system to effectively control low-frequency oscillations caused by the integration of large Electric Vehicle (EV) loads into the power grid. The increasing penetration of EVs poses significant challenges to the stability of power systems due to their intermittent charging and discharging patterns. The ANFL-based PSS combines the advantages of adaptive control techniques and fuzzy logic systems to provide a robust and adaptive solution. The ANFL system dynamically adjusts its parameters based on the real-time system conditions, enhancing the overall stability and control performance. The neuro-fuzzy inference mechanism integrates neural network techniques with fuzzy logic control, enabling the system to learn and adapt to changing operating conditions. The design process involves the identification of the power system's dynamic characteristics using system identification techniques. The obtained model is then used to train the ANFL system, which optimizes its parameters to achieve the desired control objectives. The ANFL-based PSS is implemented in real-time simulations, considering various EV load scenarios and operating conditions. The simulation results demonstrate the effectiveness of the proposed ANFL-based PSS in mitigating low-frequency oscillations caused by large EV loads. The adaptive nature of the ANFL system allows it to continuously adapt and improve its control response, ensuring stable and reliable operation of the power system. The ANFL- based PSS also exhibits robustness against uncertainties and disturbances, making it suitable for practical implementation in realworld power systems. The proposed ANFL-based PSS represents a significant advancement in power system stability control, particularly in the presence of large EV loads. By harnessing the capabilities of adaptive control and fuzzy logic, the PSS offers an intelligent and flexible solution that can effectively address the challenges posed by EV integration. The research findings contribute to the ongoing efforts to develop sustainable and resilient power systems capable of accommodating the growing demand for electric transportation

Keywords: Power System Stabilizer (PSS), Adaptive-Neuro Fuzzy Logic, Control System Design, Power System Stability, Fuzzy Logic Control

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