Enhancing Voltage Stability and Power Quality in PV-Integrated Grids Through Advanced SVC Control

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Abstract:

This study explores the integration of photovoltaic (PV) solar systems into existing power grids, a process that presents significant technical challenges due to the intermittent nature of solar energy and its impact on power output stability. These fluctuations can cause voltage instability, compromise power quality, and affect overall grid reliability. Furthermore, non-linear loads contribute to the generation of harmonics, exacerbating power quality issues. To mitigate these challenges, the research proposes the use of Static Var Compensators (SVCs) to enhance grid stability and improve power quality. SVCs offer rapid reactive power compensation, helping to maintain voltage levels during transient conditions. This paper introduces an innovative SVC approach that incorporates an Adaptive Neuro-Fuzzy Inference System (ANFIS) based control system with Pulse Width Modulation (PWM). The proposed method is rigorously validated through detailed simulations conducted in the MATLAB/SPS environment.

Keywords:

FACTS, ANN control, reactive power control, static VAR compensator, THD.